ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST
ALONG THE NORTHERN SHORELINE OF KITSAP PENINSULA
AT THE FOULWEATHER EAST GEODUCK TRACT (#04950)

Commercial geoduck harvest is jointly managed by the Washington Departments of Fish and Wildlife (WDFW) and Natural Resources (DNR) and is coordinated with treaty tribes through harvest management plans. Harvest is conducted by divers from subtidal beds between the -18 foot and -70 foot water depth contours (corrected to mean lower low water, hereafter MLLW). Harvest is rotated throughout Puget Sound in seven geoduck management regions. The fishery, its management, and its environmental impacts are presented in the Puget Sound Commercial Geoduck Fishery Management Plan (DNR & WDFW, 2008) and the Final Supplemental Environmental Impact Statement (WDFW & DNR, 2001). The proposed harvest along the northern shoreline of Kitsap Peninsula is described below.

Proposed Harvest Year(s): 2024- 2025

Tract name: Foulweather East geoduck tract (Tract #04950)

Description: (Figure 1, Tract Vicinity map)

The Foulweather East geoduck tract is a subtidal area of approximately 214 acres (Table 1) along the northern shoreline of Kitsap Peninsula, approximately a quarter mile southeast of Foulweather Bluff in the Northern Central Puget Sound Geoduck Management Region.

The Foulweather East tract is bounded by a line projected northwesterly along the -24 foot (MLLW) water depth contour from a control point (CP) in the northwestern portion of the tract at 47°56.254’ N latitude, 122°35.995’ W longitude (CP 1); to a point at 47°55.282’ N latitude, 122°33.846’ W longitude (CP 2); then northerly to a point on the -70 foot (MLLW) water depth contour at 47°55.455’ N latitude, 122°33.846’ W longitude (CP 3); then northwesterly along the -70 foot (MLLW) water depth contour to a point at 47°56.254’ N latitude, 122°35.773’ W longitude (CP 4); then westerly to the point of origin (Figure 2, Control Points map). These latitude and longitude positions are in WGS84 datum.

This estimate of the tract boundary was made using GIS and the Swinomish Tribe geoduck survey data. All contours are corrected to mean lower low water (MLLW). Contour GIS layers from James McArdle (Swinomish Tribe) were generated from 2005 UW Puget Sound DEM. Shoreline data was from DNR, digitized at 1:24000 scale in 1999. The -70 ft. (MLLW) water depth contour was used for the deep water boundary, and the -24 ft. (MLLW) water depth contour was used for the shallow boundary, due to eelgrass being documented at a maximum water depth of -22 ft. (MLLW) in the vicinity

of the tract. The latitude and longitude positions are reported in WGS84 datum, degrees decimal minutes to the closest thousandths of a minute. Corner latitude and longitude positions were generated using GIS, and have not been field verified to determine consistency with area estimates, landmark alignments, or water depth contours.

The delineation of the tract boundary will be field verified by DNR prior to state monitored geoduck harvests. Any variance to the stated boundary will be coordinated between WDFW and DNR prior to geoduck harvest.

Substrate:

Geoducks are found in a wide variety of sediments ranging from soft mud to gravel, and are most commonly harvested in sandy sediments with varying amounts of mud and/or gravel. The specific sediment type of a geoduck bed is primarily determined by water current velocity. Coarse sediments are generally found in areas of fast currents and finer (muddier) sediments in areas of weak currents. The major impact of harvest will be the creation of small holes where the geoducks are removed. The holes fill in within a few days to several weeks and have no long-term effects. The substrate holes refill in areas with strong water currents much faster than in areas with weak water currents. Water currents tend to be moderate and variable in the vicinity of the Foulweather East tract. In Puget Sound, just south of this tract at Apple Cove Point, currents reach a predicted maximum flood velocity of 1.1 knots and maximum ebb velocity of 1.3 knots (Tides and Currents software; station #1621; Apple Cove Point).

The surface substrate within this tract is primarily sand, which was noted as predominant on 58 of the 64 transects. Other substrates noted in order of frequency of occurrence were mud, pea gravel, shell, gravel, cobble and boulder..

Water Quality:

Water quality is good at the Foulweather East geoduck tract. Water mixing at this tract is affected by the convergence of currents from Admiralty Inlet and the main basin of Puget Sound, which prevents stratification (water layering) and brings deeper nutrient-rich waters to the surface. As a result, the marine waters in this area are well oxygenated and productive. The following data on water quality have been provided by the Washington Department of Ecology (DOE) for Puget Sound at the Port Madison station (PMA001). For 2012 (most recently completed data year available), between water depths of 18 and 70 feet, the mean reported dissolved oxygen concentration was 9.3 milligrams per liter (mg/l) with a range between 6.7 mg/l and 14.2 mg/l. The mean salinity at this station was 28.9 parts per thousand (ppt) with a range between 26.4 ppt and 30.0 ppt. The mean water temperature at this station was 50.9° F with a range between 45.3° F and 60.9° F. This geoduck tract has been classified by the Washington Department of Health as Approved.

Biota:

Geoduck:

The Foulweather East geoduck tract is approximately 214 acres, which includes the area recently approved by DOH on the east side of the tract, pending agreement ofby co-managers. The abundance of geoducks on this tract is high, with a current estimated average density of 0.211 geoducks/sq.ft. This tract currently contains an estimated 3,962,375 pounds of geoducks (Table 1). On all 9 dig stations, geoducks are considered commercial quality (Table 2). Digging difficulty ranged from “easy” to “difficult” to dig. The factors which influenced a “difficult” rating included compact substrates, gravel, shell and turbidity.

The average density from the pre-fishing survey was 0.221 geoducks/sq.ft., ranging from 0.000 geoducks/sq.ft. on transect #54 to 0.747 geoducks/sq.ft. on transect #12 (Table 3). Transect locations and geoduck counts corrected with siphon “show factors” are listed in Table 4. The geoducks at the Foulweather East tract have an average weight of 2.02 pounds, while the average geoduck in Puget Sound is 2.42 pounds. The lowest average whole weight was 0.97 pounds per geoduck at dig station #38 and the highest average whole weight was 3.03 pounds per geoduck at dig station #16 (Table 5).

The Foulweather East geoduck tract was surveyed in 2015 by the Swinomish Tribe. The results of the 2015 survey (Table 1) are used in the preparation of this Environmental Assessment.

Geoducks are managed for long term sustainable harvest. No more than 2.7% of the fishable stocks are harvested (total fishing mortality) each year in each management region throughout Puget Sound. The fishable portion of the total Puget Sound population includes geoducks that are found in water deeper than -18 feet and shallower than -70 feet (corrected to MLLW). Other geoducks which are not harvestable are found inshore and offshore of the harvest areas. Observations in south Puget Sound show that major geoduck populations continue to depths of 360 feet. Additional geoducks exist in polluted areas and are also unavailable for harvest, but continue to spawn and contribute to the total population.

The low rate of harvest is due to geoduck's low rate of natural recruitment. WDFW has studied the regeneration rate of geoducks on certain tracts throughout Puget Sound. The estimated average time to regenerate a tract to its original density, after removal of 65 percent of the geoducks, is 55 years. The recovery time for the Foulweather East tract is unknown. The research to empirically analyze tract recovery rates is continuing.

Fish:

Geoduck beds are generally devoid of rocky outcroppings and other relief features that attract and support many fish species, such as rockfish and lingcod. On geoduck tracts, the bathymetry is typically relatively flat and the substrate is typically composed of soft sediments, which provide few attachments for macroalgae associated with rockfish and lingcod. Dogfish shark were the only fish reported during the survey at the Foulweather East tract (Table 6).

WDFW marine fish managers were asked of their concerns regarding possible impacts of geoduck fishing on groundfish and baitfish. Greg Bargmann of WDFW stated that geoduck fishing would have no long-term detrimental impacts and may have some short term benefits to flatfish populations by increasing the availability of food. Dan Penttila of the WDFW Fish Management Program recommended that eelgrass beds within the harvest tract should be preserved for any spawning herring. Eelgrass was observed along this tract to a maximum depth of -22 ft. (MLLW) during the Swinomish Tribe's 2015 eelgrass survey. The nearshore tract boundary will be along the -24 ft. (MLLW) water depth contour to provide a vertical buffer between eelgrass beds and geoduck harvest.

There are no Pacific herring, surf smelt or sand lance spawning grounds near the Foulweather East tract (Figure 4). Geoduck fishing on the Foulweather East tract, under the harvest conditions of this Environmental Assessment, should have no detrimental impacts on Pacific herring, surf smelt or sand lance spawning.

NOAA Fisheries Service announced on April 27, 2010, that it was listing canary and yelloweye rockfish as "threatened" and bocaccio as "endangered" under ESA (federal Endangered Species Act). The listings became effective on July 27, 2010. Historic high levels of fishing and water quality are cited as reasons that these rockfish populations are in peril and have been slow to recover. On January 23, 2017; canary rockfish were delisted based on newly obtained samples and genetic analysis (Federal Register 82 FR 7711). Geoduck fishery managers are tracking this process and will take actions necessary to reduce the risk of "take" of any listed rockfish species that could potentially result from geoduck harvest activity.

Two salmon populations, Puget Sound Chinook salmon and Hood Canal summer run chum salmon, were listed by the National Marine Fisheries Service on March 16, 1999, as threatened species under the federal Endangered Species Act. Critical habitat for summer-run chum salmon populations includes all marine, estuarine, and river reaches accessible to the listed chum salmon between Dungeness Bay and Hood Canal, as well as within Hood Canal. The timing for summer-run chum spawning is early September to mid-October. Out-migration of juveniles has been observed in Hood Canal during February and March, though out-migration may occur as late as mid-April. The Foulweather East tract is outside of the critical habitat range for Hood Canal summer-run

chum salmon.

Critical habitat for Puget Sound Chinook salmon includes all marine, estuarine and river reaches accessible to listed Chinook salmon in Puget Sound. WDFW recognizes 27 distinct stocks of Chinook salmon; 8 spring-run, 4 summer-run, and 15 summer/fall and fall-run stocks. The existence of an additional five spring-run stocks is in dispute. The majority of Puget Sound Chinook salmon emigrate to the ocean as subyearlings.

Major tributaries in the general vicinity of the Foulweather East geoduck tract supporting Chinook salmon runs, are the Duwamish Waterway/Green River basin and the Lake Washington basin (mouth at Shilshole Bay; with Cedar River, Issaquah Creek, and north Lake Washington tributaries and sub-basins). Three viable runs of Chinook salmon have been identified in the Duwamish Waterway/Green River basin. The status of the spring-run of Chinook salmon in the Duwamish Waterway/Green River basin is extinct. The status of the natural summer/fall run of Chinook salmon in the Duwamish Waterway/Green River basin is of mixed native and non-native origin; a composite of wild, cultured, or unknown/unresolved production; and healthy with a 5-year geometric mean for total estimated escapement at 4,889 fish. The timing of the Duwamish River run is uncertain and has a 5-year geometric mean for total estimated escapement at 5,216 fish. The status of the summer/fall run in Newaukum Creek is of mixed native and non-native origin; wild production; and healthy (NMFS, Appendix E, TM-35, Chinook Status Review).

The production of the Lake Washington summer/fall run of Chinook salmon is natural with a 5-year geometric mean for total estimated escapement at 557 fish. The status of the natural Cedar River summer/fall run of Chinook salmon is of native origin; wild production; with a 5-year geometric mean for total estimated escapement at 377 fish. The status of the mixed summer/fall run of Chinook salmon in Issaquah Creek is of non-native origin; a composite of wild, cultured, or unknown/unresolved production; and healthy. The status of the natural summer/fall run of Chinook salmon in the North Lake Washington tributaries is native origin; wild production; with a 5-year geometric mean for total estimated escapement at 145 fish (NMFS, Appendix E, TM-35, Chinook Status Review).

The geographic separation (horizontal) of this tract from known spawning tributaries and vertical separation of geoduck harvest (deeper and seaward of the -24 ft. MLLW contour) from juvenile salmon rearing areas and migration corridors (upper few meters of the water column) reduces or eliminates potential impacts to salmon populations. Charles Simenstad of the University of Washington School of Fisheries stated that the exclusionary principle of not allowing leasing/harvesting in water shallower than -18 ft. MLLW, the 2+ ft. vertically from elevation of the lower eelgrass margin, and within any regions of documented herring or forage fish spawning should, under most conditions, remove the influences of harvest-induced sediment plumes from migrating salmon.

Therefore, geoduck harvest should have no impact on salmon populations.

On May 7, 2007, NOAA Fisheries Service announced listing of Puget Sound steelhead as "threatened" under ESA. This listing includes more than 50 stocks of summer- and winter-run steelhead. Steelhead share many of the same waters as Puget Sound Chinook salmon, which are already protected by ESA, and will benefit from shared conservation strategies. There are no identified streams or rivers in the vicinity of the Foulweather East tract that support steelhead stocks. The horizontal separation between tributaries that support steelhead runs and the Foulweather East tract will assure that geoduck harvest will likely have no impact on steelhead populations.

Green sturgeon have undergone ESA review in recent years, due to depressed populations. NOAA Fisheries Service produced an updated status review on February 22, 2005, and reaffirmed that the northern green sturgeon Distinct Population Segment (DPS) warranted listing as a Species of Concern, however proposed that the southern DPS should be listed as Threatened under the ESA. NMFS published a final rule on April 7, 2006, listing the southern DPS as threatened (71 FR 17757), which took effect June 6, 2006. The green sturgeon critical habitat proposed for designation includes the outer coast of Washington within 110 meters (m) depth (including Willapa Bay and Grays Harbor) to Cape Flattery and the Strait of Juan de Fuca to its United States boundary. Puget Sound proper has been excluded from this critical habitat designation. The Foulweather East geoduck tract is outside of the critical habitat range of green sturgeon; therefore geoduck harvest at this location will have no adverse effects on ESA recovery efforts for green sturgeon populations.

Invertebrates:

The marine invertebrates observed on this tract are listed in Table 6. The most common and obvious of these include: [1] mollusks (geoducks, horse clams, horse mussel, piddock, *Mya truncata*, and octopus); [2] echinoderms (sea cucumbers); and [3] worms. Geoduck harvest has not been shown to have long-term adverse effects on these invertebrates. Geoduck harvest can depress some local populations of benthic invertebrates; however most of these populations recover within one year.

WDFW and DNR have studied the effects of geoduck harvest on the population of Dungeness crab at Thorndyke Bay in Hood Canal. The results of 4.6 years of study have shown no adverse effects on crab populations due to geoduck fishing. To determine the potential impacts to Dungeness crab, the percentage of substrate disturbed during fishing was calculated and compared to the entire crab habitat within the tract and shoreward of the tract to the +1 ft. level and seaward out to -330 ft. (MLLW) water depth contour. The -360 ft. (MLLW) water depth contour was used as a proxy for the -330 ft. (MLLW) water depth contour as an accurate -330 ft. (MLLW) water depth contour was not available at the time this document was prepared (Figure 5, Potential Dungeness Crab Habitat Map).

Dr. Dave Armstrong of the University of Washington has determined that Dungeness crab utilize Puget Sound bottoms from the +1 ft. level out to the -330 ft. level. The entire crab habitat within and along this tract is approximately 1,446 acres. There were about 2,055,669 harvestable geoducks in the entire 214 acre tract, from the 2015 pre-fishing survey estimate. With a harvest of 65 percent, the total number harvested would be about 1,336,185 geoducks. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so 1,336,185 x 1.18 = 1,576,698 square feet of substrate, or approximately 36 acres. This is about 2.5 percent of the total available crab habitat in the vicinity of this tract with the potential for disturbance from geoduck harvest. Based on zero observations of Dungeness crab on this tract during the pre-fishing survey, the moderate amount of disturbance of potential crab habitat in the vicinity of the tract, and the lack of effects observed at the Thorndyke Bay study, we conclude that any effects on Dungeness crab will be very minor, if they occur at all.

Aquatic Algae:

Large attached aquatic algae are not generally found in geoduck beds in large quantities. Light restriction often limits algal growth to areas shallower than where most geoduck harvest occurs. Diatoms and unspecified small red algae were the only algae observed on this tract (Table 7).

John Boettner and Tim Flint, from the WDFW Habitat Division, have stated that if geoduck fishing is restricted to seaward of the eelgrass beds, they have no concerns about the fishing and that the existing conditions in the fishery SEIS are sufficient to protect fish and wildlife habitat and natural resources. The -24 ft. (MLLW) water depth boundary of this tract should provide sufficient buffer to avoid any harvest impacts to eelgrass beds in the vicinity of the tract.

Marine Mammals:

Several species of marine mammals, including seals, sea lions, and river otters may be observed in the vicinity of this geoduck tract. There have also been sporadic reports of gray whales feeding near the eastern shoreline of the Kitsap Peninsula and rare reports of humpback whales near the eastern shoreline of the Kitsap Peninsula. Killer whales may also be observed in the vicinity of this tract, particularly between November and March. The Southern Resident stock of killer whales resides mainly in the San Juan Islands throughout spring and summer, but incursions south into Puget Sound occur more frequently during winter months (Brent Norberg, NOAA, pers. comm. 5/15/06). The Southern Resident stock of killer whales was listed as “endangered” under the federal Endangered Species Act (ESA) by the National Marine Fisheries Service on November 15, 2005. This is in addition to the designation of this stock in May 2003 as “depleted” under the Marine Mammal Protection Act. More information and a draft conservation plan for this stock can be found at the NOAA website

(https://www.fisheries.noaa.gov/action/listing-southern-resident-killer-whale-under-esa). Hand pick shellfish fisheries, like geoduck harvesting, are considered Category III under the Marine Mammal Authorization Program for Commercial Fisheries. This means that there is a "rare or remote" likelihood of marine mammal "take," (Brent Norberg, NOAA, pers. comm. 5/15/06). Precautions should be taken by commercial divers when marine mammals are in the area, to be aware of marine mammal movements and behavior to eliminate the remote risk of entanglement with diver hoses and lines.

Birds:

A variety of marine birds are common in Puget Sound and the general vicinity of this tract. The most significant of these are guillemots, murres, murrelets, grebes, loons, scoters, dabbing ducks, black brant, mergansers, buffleheads, cormorants, gulls, and terns. Blue herons, bald eagles, and ospreys are also regularly observed. Geoduck harvest does not appear to have any significant effect on these birds or their use of the waters where harvest occurs. A study by DNR and the WDFW was conducted at northern Hood Canal to learn the effects of geoduck fishing on bald eagles (Watson et al., 1995). A significant conclusion of this study is that commercial geoduck clam harvest is unlikely to have any adverse impacts on bald eagle productivity.

Other uses:

Adjacent Upland Use:

The upland properties adjacent to the tract have been given the environmental designation as a "rural" shoreline.

To minimize possible disturbance to adjacent residents, harvest vessels are not allowed shoreward of the 200 yards seaward of the ordinary high tide line (OHT). Harvest is allowed only during daylight hours and no harvest is allowed on Saturday, Sunday, or state holidays.

The only visual effect of harvest is the presence of the harvest vessels on the tract. These boats (normally 35-40 feet long) are anchored during harvest and divers conduct all harvest out of sight. Noise from boats, compressors and pumps may not exceed 50 dB measured 200 yards from the noise source, which is 5 dBA below the state noise standard.

Fishing:

Some recreational salmon fishing for blackmouth and silvers could occur seasonally in

proximity to this geoduck bed. Sport fishing is open year-round for surfperch. Rockfish fishing is closed in this area. January 1 to March 31 fishing is catch and release and fly fishing only. Lingcod can only be taken May 1 to June 15 by hook and line or May 21 to June 15 by spearfishing. The WDFW Sport Fishing Rules pamphlet describes additional seasons, size limits, daily limits, specific closed areas, and additional rules for salmon and other marine fish species. The fishing which does occur should not create any problems for the geoduck harvesting effort in the area.

Geoduck fishing on this tract is managed in coordination with the North Central Sound treaty tribes through state/tribal geoduck harvest management plans. The non-Indian geoduck fishery should not be in conflict with any concurrent tribal fisheries.

Navigation:

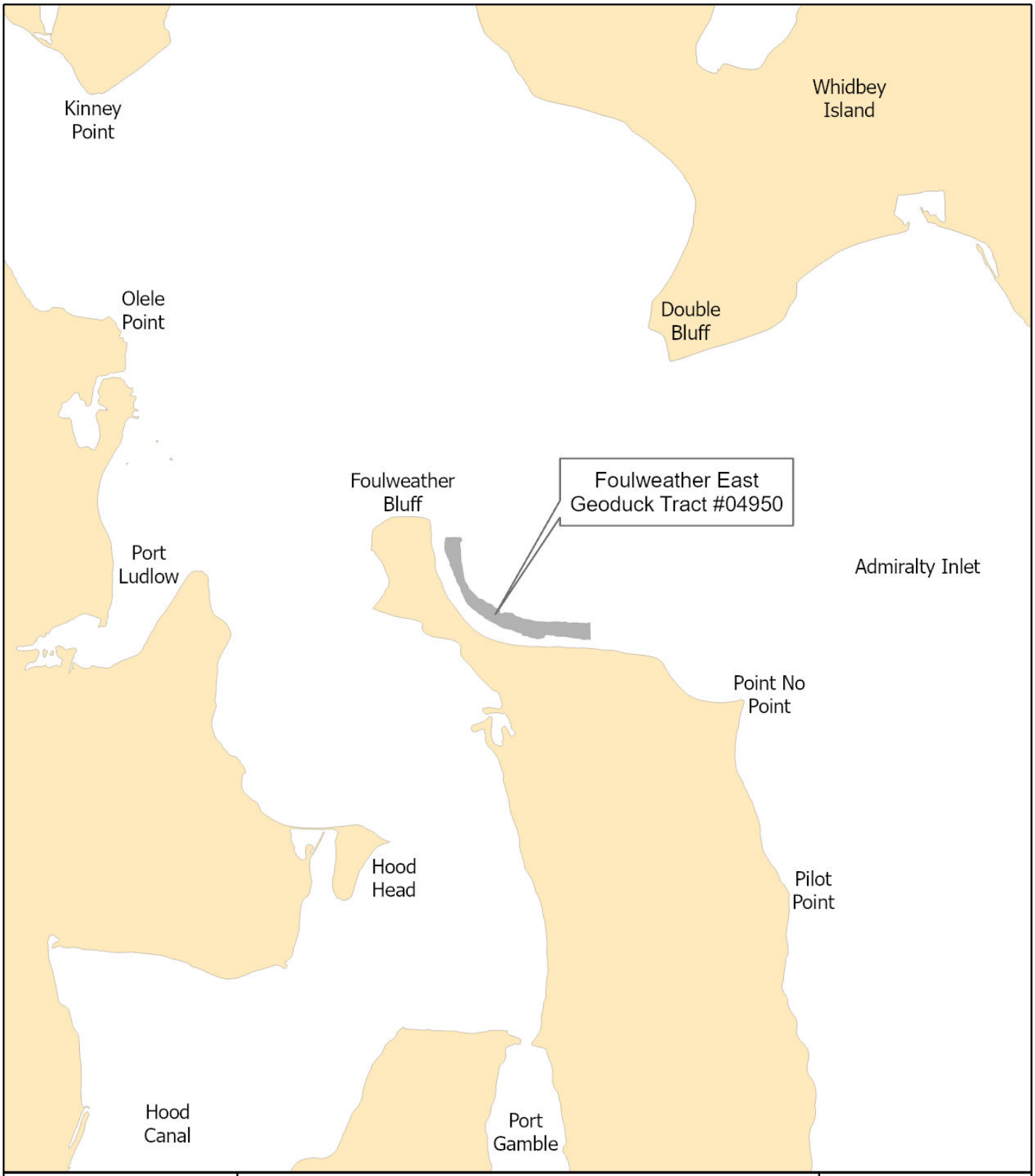
The Foulweather Bluff area is used by recreational and commercial vessels traveling Hood Canal and Central Puget Sound. Geoduck harvesting at this site should not result in any significant navigational conflicts. The Washington Department of Natural Resources will notify the local boating community prior to any harvest.

Summary:

Commercial geoduck harvest is proposed for one tract along the northern shoreline of the Kitsap Peninsula. The tract was recently surveyed in 2015 by the Swinomish Tribe and the current biomass estimate for the 214-acre harvest area is 3,962,375 pounds. This commercial tract is presently classified by DOH as “Approved” for shellfish harvest. An eelgrass survey was completed, and eelgrass was observed to a maximum depth of -22 ft. (MLLW). The shoreward boundary of the tract will be set at -24 ft. (MLLW) or deeper to provide a buffer between eelgrass, potential forage fish spawning habitat and geoduck harvest. The anticipated environmental impacts of this harvest are within the range of conditions discussed in the 2001 Final Supplemental Environmental Impact Statement. No significant impacts are expected from this harvest.

File: 240214_Foulweather East_EA_04950.doc

Figure 1. Vicinity Map, Foulweather East Commercial Geoduck Tract #04950



N
W E
S

1:100,000

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.5 1 2 3 Miles

Washington Department of FISH and WILDLIFE

Map Date: February 14, 2024
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 2. Control Points Map, Foulweather East Commercial Geoduck Tract #04950

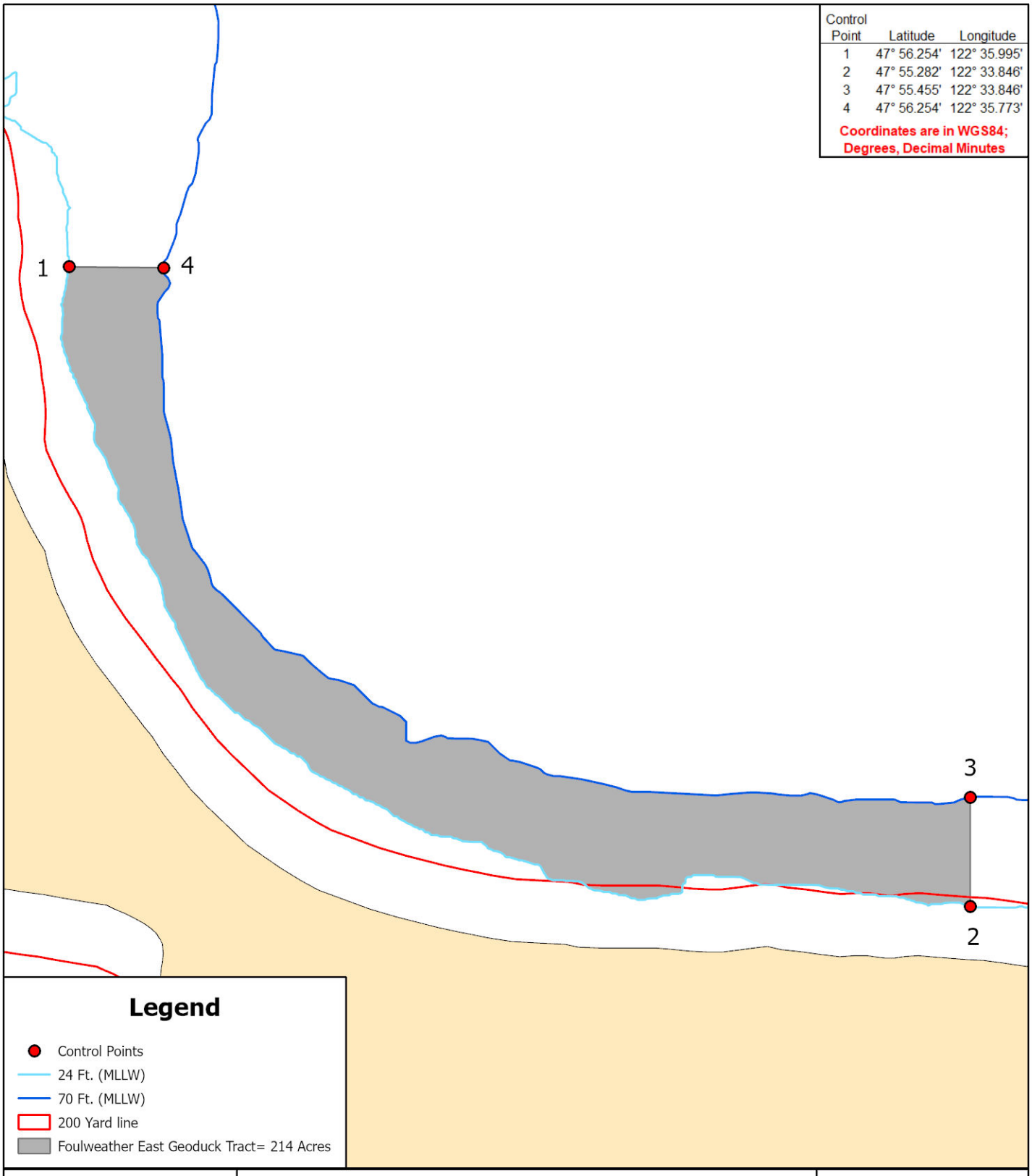


Figure 3. Transect and Dig Station Map, Foulweather East Commercial Geoduck Tract #04950

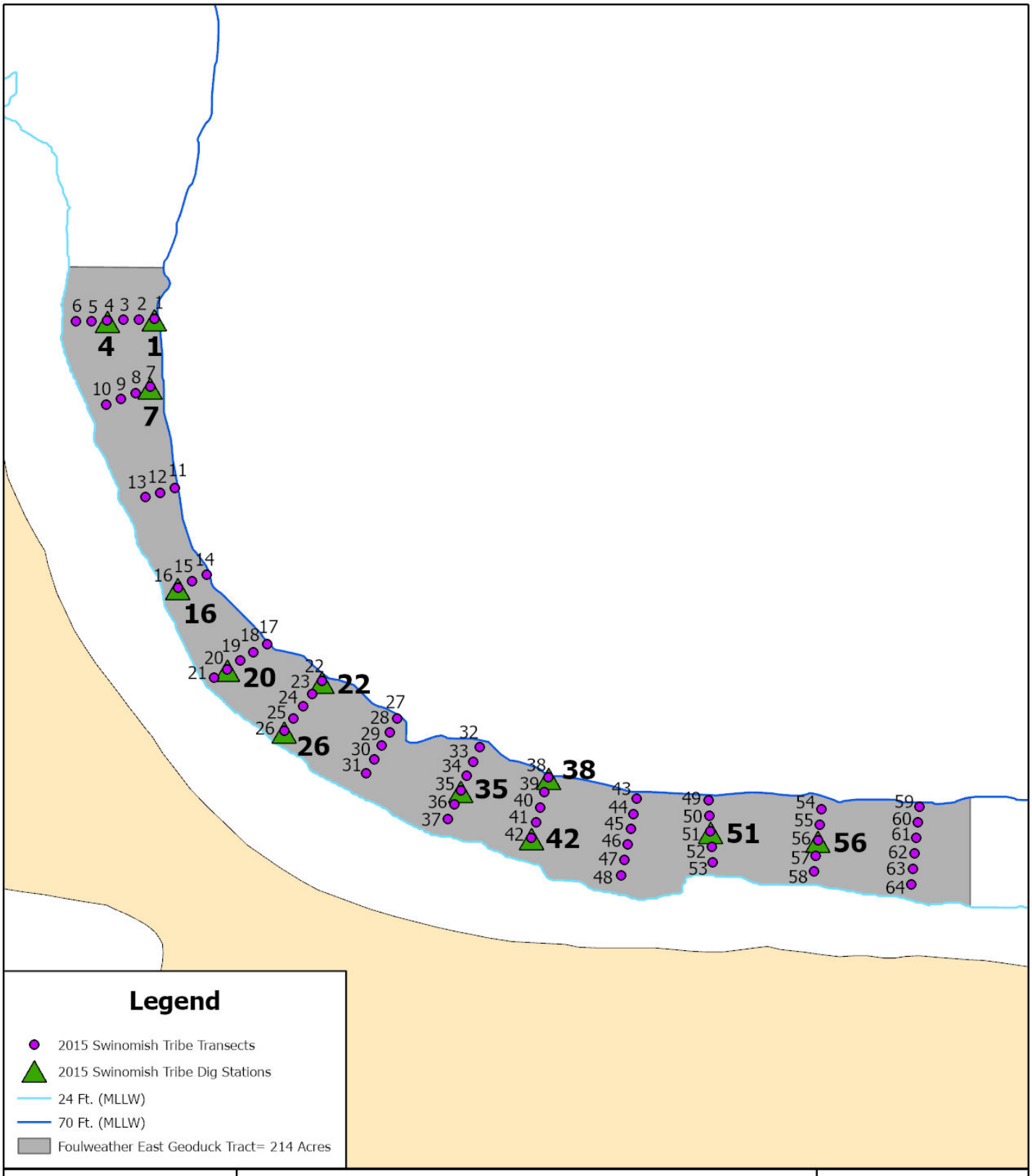


Figure 4. Fish Spawning Areas Near the Foulweather East Commercial Geoduck Tract #04950

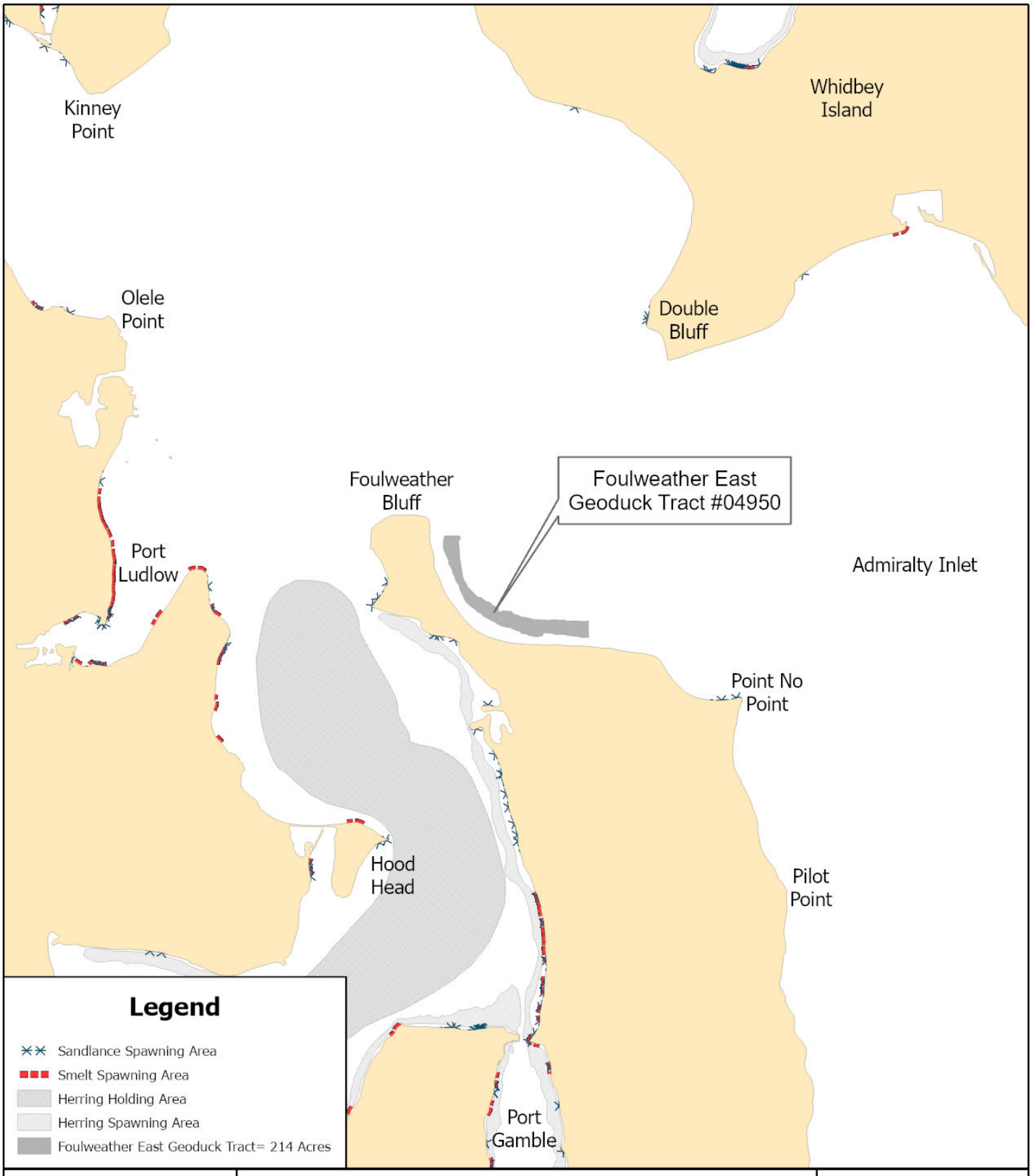
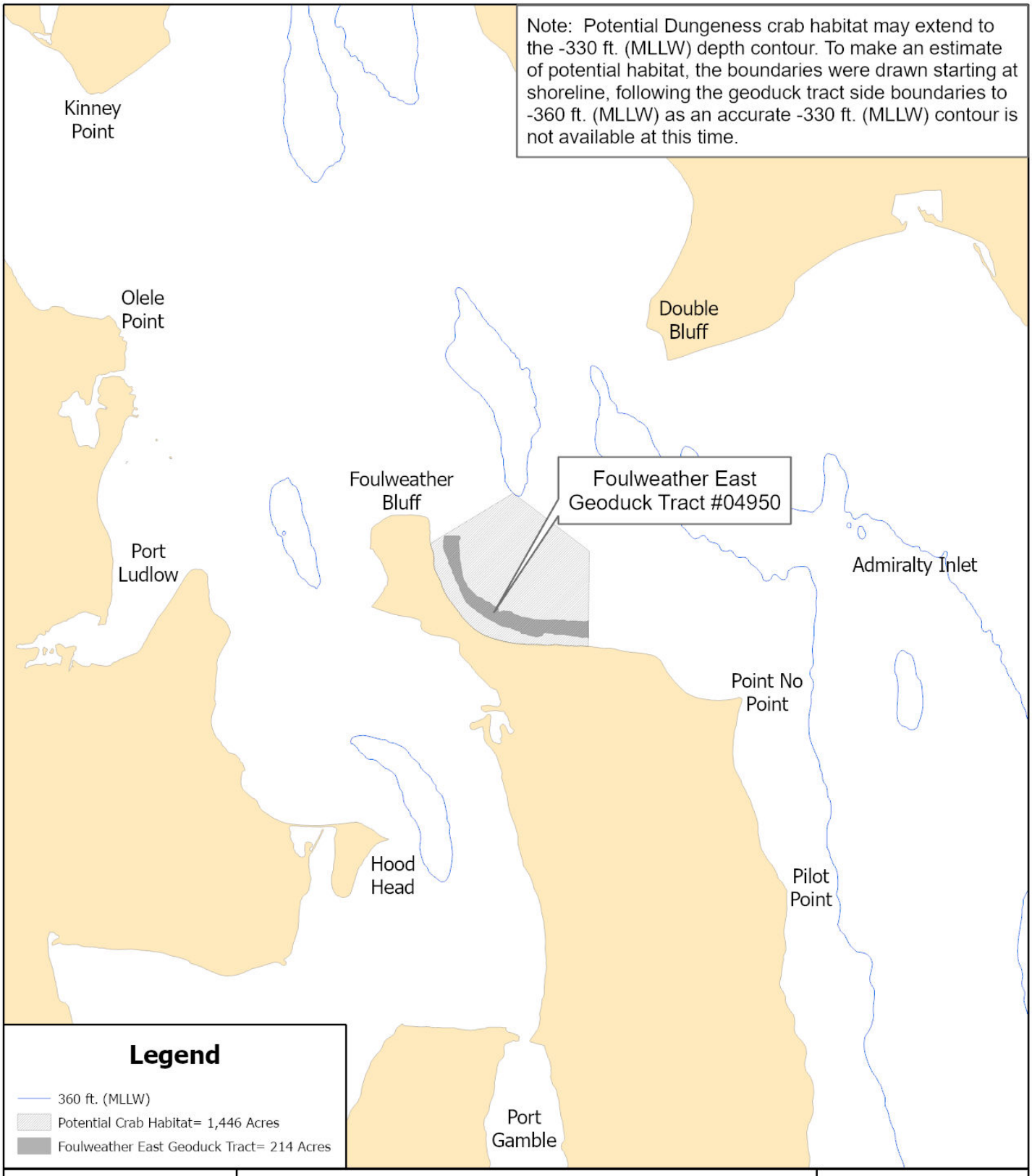


Figure 5. Dungeness Crab Habitat Map, Foulweather East Commercial Geoduck Tract #04950



EXPLANATION OF SURVEY DATA TABLES

The geoduck survey data for each tract is reported in seven computer-generated tables. These tables contain specific information gathered from transect and dig samples and diver observations. The following is an explanation of the headings and codes used in these tables.

Tract Summary

This table is a general summary of survey information for the geoduck tract including estimates of *Tract Size* in acres, average geoduck *Density* in animals per sq.ft., *Total Tract Biomass* in pounds with statistical confidence, and *Total Number of Geoducks*. Mass estimators are reported in average values for *Whole Weight* and *Siphon Weight* in pounds. Geoduck siphon weights are also reported in *Siphon Weight as a percentage of Whole Weight.* Biomass estimates are adjusted for any harvest that may occur subsequent to the pre-fishing survey.

Digging Difficulty

This table presents a station-by-station evaluation of the factors contributing to the difficulty of digging geoduck samples with a 5/8" inside nozzle diameter water jet. Codes for the overall subjective summary of the digging difficulty are given in the *Difficulty* column. An explanation of the codes for the dig difficulty follows:

Code	Degree of Difficulty	Description
0	Very Easy	Sediment conducive to quick harvest.
1	Easy	Significant barrier in substrate to inhibit digging.
2 or	Some difficulty	Substrate may be compact or contain gravel, shell clay; most geoducks still easy to dig.
3	Difficult	Most geoducks were difficult to dig, but most attempts were successful.
4	Very Difficult	It was laborious to dig each geoduck. Unable to dig some geoducks.
5	Impossible	Divers could not remove geoducks from the substrate.

Abundance refers to the relative geoduck abundance; a zero (0) indicates that geoducks were very sparse, a one (1) indicates that they were moderately abundant and a two (2) indicates that they were very abundant. *Depth* refers to the depth that the geoducks were found in the substrate. A zero (0) indicates that they were shallow, a one (1) indicates that they were moderately deep and a two (2) indicates that they were very deep. The columns labeled *Compact*, *Gravel*, *Shell*, *Turbidity* and *Algae* refer to factors that contribute to digging difficulty by interfering with the digging process. A zero (0) in one of these columns indicates that the factor was not a problem, a one (1) indicates that the

factor caused moderate difficulty and a two (2) indicates that the factor caused a significant amount of difficulty when digging. *Compact* refers to the compact or sticky nature of a muddy substrate. *Gravel* and *Shell* refer to the difficulty caused by these substrate types. *Turbidity* refers to the turbidity within the water near the dig hole caused by the digging activity. High turbidity makes it difficult to find the geoduck siphon shows. The difficulty of digging associated with turbidity varies with the amount of tidal current present. Therefore, the turbidity rating refers only to the conditions occurring when the sample was collected. *Algae* refers to algal cover, which also makes it difficult for the diver to find geoduck siphon shows. Because algal cover varies seasonally, this value only applies to the conditions when the sample was collected. The *Commercial* column gives a subjective assessment of whether or not it would be feasible to harvest geoducks on a commercial basis at the given station.

Transect Water Depths, Geoduck Densities and Substrate Observations

This table reports findings for each transect. *Start Depth* and *End Depth* (corrected to MLLW) are given for each transect. *Geoduck Density* is reported as the average number of geoducks per square foot for each 900 square foot transect. *Substrate Type* and *Substrate Rating* refer to evaluations of the substrate surface. A two (2) rating indicates that the substrate type is predominant. A one (1) rating indicates the substrate type was present.

Geoduck Weights and Proportion Over 2 Pounds

This table summarizes the size and quality of the geoducks at each of the stations where dig samples were collected. Weight values for any geoduck dig samples that were damaged during sampling to the extent that water loss occurred, are excluded from calculations. The *Number Dug* column lists the number of geoducks collected. The *Avg. Whole Weight (lbs.)* column gives the average sample weight of whole geoduck clams for each dig station. The *Avg. Siphon Weight (lbs.)* column gives the average weight of the siphons of the geoducks for each dig station. The percentage of geoducks greater than two pounds is given in the *% Greater than 2 lbs.* column.

Transect - Corrected Geoduck Count and Position Table

This table reports the diver *Corrected Count*, the geoduck siphon *Show Factor* used to correct the count, and the *Latitude/Longitude* position of the start point of each survey transect. Raw (observed) siphon counts are “corrected” by dividing diver observed counts for each transect with a siphon “show” factor (See WDFW Tech. Report FPT00-01 for explanation of show factor) to estimate the sample population density. Transect positions are reported in degrees and decimal minutes to the thousandth of a minute, datum WGS84.

Most Common and Obvious Animals Observed

This table summarizes the animals, other than geoducks, that were observed during the geoduck survey, and reports the total number of transects on which they were present (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only animals that can be readily seen by divers at or near the surface of the substrate are noted. The *Group* designation allows for the organization of similar species together in the table. Whenever possible, the scientific name of the animal is listed in *Taxonomer*, and a generally accepted *Common Name* is also listed. Many variables may make it difficult for divers to notice other animals on the tract, including but not limited to poor visibility, diver skill, animals fleeing the divers, animal size, or cryptic appearance or behavior (in crevasses or under rocks).

Most Common and Obvious Algae Observed

This table summarizes marine algae observed during the geoduck survey, and reports the total number of transects on which they were seen (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only for macro algae, with the exception of diatoms. At high densities diatoms form a "layer" on or above the substrate surface that is readily visible and obvious to divers. Other types of phytoplankton are not sampled and are rarely noted. Whenever possible, the scientific name or a general taxonomic grouping of each plant is listed in *Taxonomer*.

Last Updated: April 14, 2020
S:\FP\FishMgmt\Geoduck\EnvironmentalAssessmentReports\Forms\EAcodesexplanation_7tables.doc

Table 1. GEODUCK TRACT SUMMARY

Foulweather East geoduck tract #04950.

Tract Name	Foulweather East
Tract Number	04950
Tract Size (acres)[a]	214
Density of geoducks/sq.ft[b]	0.211
Total Tract Biomass (lbs.)[b]	3,962,375
Total Number of Geoducks on Tract[b]	1,965,581
Confidence Interval (%)	22.78%
Mean Geoduck Whole Weight (lbs.)	2.02
Mean Geoduck Siphon Weight (lbs.)[c]	N/A
Siphon Weight as a % of Whole Weight[c]	N/A
Number of 900 sq.ft. Transect Stations	64
Number of Geoducks Weighed	167

[a.] Tract area is between the -24 ft. and -70 ft. (MLLW) water depth contours. This tract area includes the recently approved area at the east end of the tract pending agreement by co-managers.

[b.] Biomass is based on the 2015 Swinomish Tribe Pre-fishing survey biomass of 4,143,982 lbs. minus harvest of 181,607 through February 12, 2024

[c.] Siphon weights were not taken

Generation Date: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs

Table 2. DIGGING DIFFICULTY TABLE

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

Dig Date	Dig Station	Difficulty (0-5)	Abundance (0-2)	Depth (0-2)	Compact (0-2)	Gravel (0-2)	Shell (0-2)	Turbidity (0-2)	Algae (0-2)	Commercial (Y/N)
7/23/2015	1	4	1	0	0	2	1	-	-	Y
7/23/2015	4	2	1	1	0	1	1	-	-	Y
7/23/2015	7	2	2	1	1	0	1	-	-	Y
7/23/2015	16	1	1	1	0	0	1	1	-	Y
7/24/2015	20	4	1	0	0	2	1	2	-	Y
7/24/2015	22	4	2	1	0	1	2	1	-	Y
7/24/2015	26	2	1	1	0	1	1	2	-	Y
7/24/2015	35	3	2	1	0	2	1	1	-	Y
11/3/2015	38	4	2	0	2	2	0	0	-	Y
11/3/2015	42	4	2	1	2	2	0	0	-	Y*
11/3/2015	51	2	2	1	1	0	0	0	-	Y
11/3/2015	56	2	2	2	0	1	0	0	-	Y

*It was noted that digging was hard on this station, taking 40 minutes to dig 10 geoducks.

Table 3. TRANSECT WATER DEPTHS, GEODUCK DENSITIES, AND SUBSTRATE OBSERVATIONS

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

Survey Date	Transect	Start Depth (ft.) [a]	End Depth (ft.) [a]	Geoduck Density (no. / sq.ft.) [b]	Substrate [c]						
					mud	sand	peagravel	gravel	shell	cobble	boulder
7/21/2015	1	67	62	0.1644		2			1		
7/21/2015	2	62	55	0.3615		2			1		
7/21/2015	3	55	49	0.2430		2					
7/21/2015	4	49	43	0.0889		2					
7/21/2015	5	43	35	0.1096		2					
7/21/2015	6	35	24	0.0563		2					
7/21/2015	7	61	52	0.5393		2					
7/21/2015	8	52	43	0.2652		2					
7/21/2015	9	43	36	0.1511		2					
7/21/2015	10	36	26	0.1615		2					
7/20/2015	11	65	55	0.7081		2					
7/20/2015	12	55	46	0.7467		2					
7/20/2015	13	46	40	0.1985		2					
7/22/2015	14	67	60	0.6652	1	2					
7/22/2015	15	60	41	0.4726	1	2					
7/22/2015	16	41	24	0.0830	1	2					
7/21/2015	17	70	60	0.3852	1	2					
7/21/2015	18	60	52	0.4622	1	2					
7/21/2015	19	52	43	0.3585	1	2					
7/21/2015	20	43	34	0.2267	1	2					
7/21/2015	21	34	27	0.0356	2	1					
7/22/2015	22	66	59	0.6044		2					
7/22/2015	23	59	50	0.5170		2					
7/22/2015	24	50	41	0.4741		2					
7/22/2015	25	41	34	0.2593		2					
7/22/2015	26	34	29	0.0341		2					
7/22/2015	27	70	65	0.4444	1	2					
7/22/2015	28	65	59	0.4785	1	2					
7/22/2015	29	59	46	0.5244	1	2					
7/22/2015	30	46	38	0.4696	1	2					
7/22/2015	31	38	29	0.0519	1	2					
7/22/2015	32	70	64	0.2104		2	1				
7/22/2015	33	64	54	0.1748		2	1			1	1
7/22/2015	34	54	44	0.2178		2	1				
7/22/2015	35	44	36	0.1496		2					
7/22/2015	36	36	33	0.0578		2					
7/22/2015	37	33	24	0.0044	2						
7/22/2015	38	69	59	0.1511		2		1	1		
7/22/2015	39	59	54	0.2948		2					
7/22/2015	40	54	49	0.4341		2	1				
7/22/2015	41	49	45	0.3141		2	1				
7/22/2015	42	45	37	0.2089		2					
7/22/2015	43	65	53	0.1215		2					
7/22/2015	44	53	43	0.0459		2					
7/22/2015	45	43	37	0.0148		2					
7/22/2015	46	37	37	0.1156		2					
7/22/2015	47	37	35	0.1333		2					
7/22/2015	48	35	29	0.0948		2					
7/23/2015	49	71	62	0.2578		2	1		1		
7/23/2015	50	62	51	0.1526		2	1		1		

Table 3. Continued

Survey Date	Transect	Start Depth (ft.) [a]	End Depth (ft.) [a]	Geoduck Density (no. / sq.ft.) [b]	Substrate [c]						
					mud	sand	peagravel	gravel	shell	cobble	boulder
7/23/2015	51	51	42	0.1644		2	1				
7/23/2015	52	42	35	0.0237		2	1				
7/23/2015	53	35	26	0.0089		2	1				
7/23/2015	54	63	54	0.0000			2			1	
7/23/2015	55	54	46	0.0844				2		1	
7/23/2015	56	46	43	0.0652		1		2		1	
7/23/2015	57	43	36	0.0252		2					1
7/23/2015	58	36	24	0.0222		2					1
7/23/2015	59	69	62	0.0222		1		2			
7/23/2015	60	61	55	0.0237		2					
7/23/2015	61	55	47	0.0637		2					
7/23/2015	62	47	36	0.0667		2					
7/23/2015	63	36	31	0.0193		2					
7/23/2015	64	31	27	0.0163		2					

[a.] All depths are corrected to mean lower low water (MLLW)

[b.] Densities were calculated using the default 0.75 show factor

[c.] Substrate ratings: 1 = present; 2 = predominant; blank = not observed

Generated On: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs

Table 4. TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

Survey Date	Transect	Corrected Count	Show Factor	Latitude [a]		Longitude [a]	
7/21/2015	1	148	0.75	47°	56.176	122°	35.791
7/21/2015	2	325	0.75	47°	56.174	122°	35.828
7/21/2015	3	219	0.75	47°	56.173	122°	35.864
7/21/2015	4	80	0.75	47°	56.171	122°	35.901
7/21/2015	5	99	0.75	47°	56.170	122°	35.938
7/21/2015	6	51	0.75	47°	56.168	122°	35.974
7/21/2015	7	485	0.75	47°	56.068	122°	35.797
7/21/2015	8	239	0.75	47°	56.058	122°	35.831
7/21/2015	9	136	0.75	47°	56.048	122°	35.864
7/21/2015	10	145	0.75	47°	56.039	122°	35.898
7/20/2015	11	637	0.75	47°	55.910	122°	35.732
7/20/2015	12	672	0.75	47°	55.902	122°	35.766
7/20/2015	13	179	0.75	47°	55.894	122°	35.801
7/22/2015	14	599	0.75	47°	55.774	122°	35.653
7/22/2015	15	425	0.75	47°	55.763	122°	35.686
7/22/2015	16	75	0.75	47°	55.753	122°	35.719
7/21/2015	17	347	0.75	47°	55.668	122°	35.507
7/21/2015	18	416	0.75	47°	55.654	122°	35.537
7/21/2015	19	323	0.75	47°	55.640	122°	35.567
7/21/2015	20	204	0.75	47°	55.626	122°	35.598
7/21/2015	21	32	0.75	47°	55.613	122°	35.628
7/22/2015	22	544	0.75	47°	55.611	122°	35.375
7/22/2015	23	465	0.75	47°	55.591	122°	35.397
7/22/2015	24	427	0.75	47°	55.571	122°	35.418
7/22/2015	25	233	0.75	47°	55.551	122°	35.439
7/22/2015	26	31	0.75	47°	55.531	122°	35.461
7/22/2015	27	400	0.75	47°	55.556	122°	35.196
7/22/2015	28	431	0.75	47°	55.534	122°	35.213
7/22/2015	29	472	0.75	47°	55.512	122°	35.231
7/22/2015	30	423	0.75	47°	55.490	122°	35.248
7/22/2015	31	47	0.75	47°	55.468	122°	35.265
7/22/2015	32	189	0.75	47°	55.513	122°	35.001
7/22/2015	33	157	0.75	47°	55.491	122°	35.015
7/22/2015	34	196	0.75	47°	55.468	122°	35.029
7/22/2015	35	135	0.75	47°	55.445	122°	35.043
7/22/2015	36	52	0.75	47°	55.422	122°	35.057
7/22/2015	37	4	0.75	47°	55.399	122°	35.071
7/22/2015	38	136	0.75	47°	55.469	122°	34.837
7/22/2015	39	265	0.75	47°	55.445	122°	34.846
7/22/2015	40	391	0.75	47°	55.421	122°	34.855
7/22/2015	41	283	0.75	47°	55.397	122°	34.864
7/22/2015	42	188	0.75	47°	55.373	122°	34.874
7/22/2015	43	109	0.75	47°	55.439	122°	34.629
7/22/2015	44	41	0.75	47°	55.415	122°	34.635
7/22/2015	45	13	0.75	47°	55.391	122°	34.642
7/22/2015	46	104	0.75	47°	55.366	122°	34.648
7/22/2015	47	120	0.75	47°	55.342	122°	34.655

Table 4. Continued

Survey Date	Transect	Corrected Count	Show Factor	Latitude [a]		Longitude [a]	
7/22/2015	48	85	0.75	47°	55.318	122°	34.661
7/23/2015	49	232	0.75	47°	55.440	122°	34.461
7/23/2015	50	137	0.75	47°	55.415	122°	34.457
7/23/2015	51	148	0.75	47°	55.391	122°	34.454
7/23/2015	52	21	0.75	47°	55.366	122°	34.450
7/23/2015	53	8	0.75	47°	55.341	122°	34.446
7/23/2015	54	0	0.75	47°	55.430	122°	34.195
7/23/2015	55	76	0.75	47°	55.405	122°	34.198
7/23/2015	56	59	0.75	47°	55.381	122°	34.201
7/23/2015	57	23	0.75	47°	55.356	122°	34.205
7/23/2015	58	20	0.75	47°	55.332	122°	34.208
7/23/2015	59	20	0.75	47°	55.438	122°	33.965
7/23/2015	60	21	0.75	47°	55.414	122°	33.968
7/23/2015	61	57	0.75	47°	55.389	122°	33.971
7/23/2015	62	60	0.75	47°	55.365	122°	33.974
7/23/2015	63	17	0.75	47°	55.340	122°	33.977
7/23/2015	64	15	0.75	47°	55.315	122°	33.980

[a.] Latitude and longitude are in degrees and decimal minutes and WGS84 datum

Generated On: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs

Table 5. GEODUCK SIZE AND QUALITY

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

Dig Date	Dig Station	Number Dug	Avg. Whole Weight (lbs.)	Avg. Siphon Weight (lbs.)[a]	% of geoducks on station greater than 2 lbs.
7/23/2015	1	19	1.38	-	21%
7/23/2015	4	17	1.92	-	47%
7/23/2015	7	17	2.09	-	53%
7/23/2015	16	13	3.03	-	100%
7/24/2015	20	10	1.90	-	50%
7/24/2015	22	16	1.46	-	6%
7/24/2015	26	14	2.52	-	86%
7/24/2015	35	19	2.01	-	37%
11/3/2015	38	8	0.97	-	0%
11/3/2015	42	13	2.50	-	85%
11/3/2015	51	10	2.16	-	60%
11/3/2015	56	11	2.28	-	82%

[a.] Siphon weights not taken

Generated On: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs

Table 6. MOST COMMON AND OBVIOUS ANIMALS OBSERVED

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

# of Transects where Observed	Group	Common Name	Taxonomer
2	BIVALVE	HEART COCKLE	*Clinocardium nuttalli*
11	BIVALVE	HORSE CLAM	*Tresus* spp.
17	BIVALVE	HORSE MUSSEL	*Modiolus rectus*
3	BIVALVE	PIDDOCK	*Unspecified Pholadidae*
3	BIVALVE	TRUNCATED MYA	*Mya truncata*
13	CUCUMBER	SEA CUCUMBER	*Parastichopus californicus*
1	FISH	DOGFISH SHARK	*Squalus acanthias*
2	OCTOPUS	OCTOPUS	*Enteroctopus* sp.
19	WORM	ROOTS	Chaetopterid polychaete tubes
4	WORM	TUBE WORM	Unspecified serpulid

Generated On: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs

Table 7. MOST COMMON AND OBVIOUS ALGAE OBSERVED

Foulweather East geoduck tract #04950, 2015 Swinomish Tribe pre-fishing survey.

# of Transects where observed	Taxonomer
1	Diatoms
3	Small red algae

Generated On: February 14, 2024
Generated By: O. Working, WDFW
File: S\FP\FishMgmt\Geoduck\EAs