

ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST
ALONG THE EASTERN SHORELINE OF PUGET SOUND
AT THE FAUNTLEROY SOUTH GEODUCK TRACT (#09050)

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 six 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 is along the eastern shoreline of Puget Sound, between the city of Des Moines and West Seattle, and is described below.

Proposed Harvest Dates: 2022-2023

Tract name: Fauntleroy South geoduck tract (Tract #09050)

Description: (Figure 1, Tract vicinity map)

The Fauntleroy South geoduck tract is a subtidal area with a proposed harvest area of approximately 85 acres (Table 1) along the eastern shoreline of Puget Sound in the South Puget Sound Geoduck Management Region. The southern boundary of the tract is north of and adjacent to the Seahurst geoduck tract and extends northerly along the shoreline for approximately 2.4 miles (Figure 1). The commercial tract area lies between the -18 ft. and the -70 ft. (MLLW) water depth contours. This geoduck tract was most recently surveyed in 2016 by the Puyallup Tribe and a supplemental survey of the tract north of and adjacent to the Fauntleroy South tract (Fauntleroy North) was done in 2022 by WDFW.

The tract harvest area is bounded by a line projected southerly from a Control Point (CP) on the -18 foot (MLLW) water depth contour in the northeasterly portion of the tract at 47°31.019' N. latitude, 122°23.968' W. longitude (CP 1), south along the -18 foot (MLLW) water depth contour to a point at 47°29.384' N. latitude, 122°22.135' W. longitude (CP 2); then west to a point on the -70 foot (MLLW) water depth contour at 47°29.343' N. latitude, 122°22.216' W. longitude (CP 3); then northerly along the -70 foot (MLLW) water depth contour to a point at 47°31.019' N. latitude, 122°24.029' W. longitude (CP 4); then easterly to the point of origin (Figure 2).

This estimate of the tract boundary is made using Geographic Information System (GIS) data layers that were generated from NOAA soundings. All contours are corrected to mean lower low water (MLLW). The shoreline data is from DNR, digitized at 1:24,000 scale in 1999. The -70 ft. (MLLW) water depth contour is used for the deep water

boundary, and the shallow water boundary is defined by the -18 ft. contour (MLLW). The latitude and longitude positions are reported in decimal minutes to the closest thousandth of a minute. Corner latitude and longitude positions are 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 any geoduck harvest. 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. The most common sediments where geoducks are harvested are sand with varying amounts of mud and/or gravel. The specific sediment type of a 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 known 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 weak in the vicinity of the Fauntleroy South tract. Currents reach a projected maximum flood velocity of 0.8 knots per hour and maximum ebb velocity of 0.6 knots (Tides and Currents software; station #1746; approach, Quartermaster Harbor entrance).

In the 2016 Puyallup Tribe survey, the subsurface substrates were only noted on one transect and that was recorded as sub dominantly mud. However, based on the surveys of the nearby Fauntleroy North and Seahurst tracts, it is expected that sand is also the dominant substrate on this tract.

Water Quality:

Water quality is considered acceptable for shellfish harvest at the Fauntleroy South geoduck tract, and the tract is classified by the Washington Department of Health (DOH) as “Approved”. DNR will verify the health status of the Fauntleroy South tract prior to any geoduck harvest.

The following data on water quality have been provided by the Washington Department of Ecology (DOE) for the Puget Sound Main Basin - East Passage SW of Three Tree Point (EAP001) at 47.4167° North latitude; 122.3800° West longitude. The DOE latitude and longitude positions are reported by DOE in decimal degrees. For 2010 (most recently completed data year available) at water depths between 10 to 15 meters, the mean reported dissolved oxygen concentration is 8.5 mg/l with a range from 6.8 to 11.5 mg/l. The mean salinity at this station was 29.5 ppt with a range from 28.8 to 30.2 ppt. The

mean water temperature at this station was 10.3°C with a range from 8.8 to 13.2°C.

Biota:

Geoduck:

The Fauntleroy South geoduck tract is approximately 85 acres. The abundance of geoducks in this harvest area is moderate with a current average density estimate of 0.14 geoducks/sq.ft. This area currently contains an estimated 1,962,410 pounds of geoducks (Table 1). This biomass estimate is made using 2016 Puyallup Tribe geoduck transect and dig sample data. The commercial quality of geoducks sampled was not noted, nor were geoduck dig stations rated for digging difficulty (Table 2).

The density from the 2016 pre-fishing survey ranged from 0.01 geoducks/sq.ft. on transect 9 to 0.33 geoducks/sq.ft. on transect 21 (Figure 3; Table 3). Transect locations and pre-fishing geoduck counts, corrected with siphon “show factors,” are listed in Table 5. The geoducks at the Fauntleroy South tract, averaging 3.80 pounds, are significantly larger than the average weight for Puget Sound of 2.1 pounds. The lowest average whole weight is 2.95 pounds at station #4 and the highest average whole weight is 4.73 pounds at station #1 (Table 5).

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 mean lower low water - 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 primarily 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 Fauntleroy South 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. The bottoms are relatively flat and composed of soft sediments, which provide few attachments for macroalgae that are often associated with many fish species. The 2017 supplemental survey at the Seahurst tract immediately to the south and the 2022 Supplemental survey at the Fauntleroy North tract immediately to the north are being used as a proxy to describe the fish expected to be in the vicinity of this tract. The fish observed were various species of flatfish, sculpins, eelpout, perch and ratfish (Table 6).

WDFW marine fish managers were asked of their concerns of any possible impacts geoduck fishing would have 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 groundfish 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. There are no Pacific herring spawning grounds along the shoreline in the vicinity of the Fauntleroy South tract. As a precautionary measure, the Fauntleroy South nearshore tract boundary will be along the -18 ft. (MLLW) water depth contour to provide year-round protection and a vertical buffer (at least 2 vertical feet) between potential herring spawning habitat (eelgrass beds) and geoduck harvest.

Surf smelt spawning habitat has been identified along the shoreline of the Fauntleroy South geoduck tract (Figure 4). Surf smelt deposit adhesive, semitransparent eggs on beaches that have a specific mixture of coarse sand and pea gravel. Inside Puget Sound, surf smelt spawning is thought to be associated with freshwater seepage, where the water keeps the spawning gravel moist. Eggs are deposited near the water's edge in water a few inches deep, around the time of the high water slack. There is vertical separation between surf smelt spawning (slack high tide) and geoduck harvest activity (-18 ft. to -70 ft., MLLW).

Sand lance spawning areas have been documented along the shoreline of the Fauntleroy South geoduck tract (Figure 4). Sand lance populations are widespread within Puget Sound, the Strait of Juan de Fuca and the coastal estuaries of Washington. They are commonly noted in the eastern Strait of Juan de Fuca and Admiralty Inlet. However, WDFW plankton surveys and ongoing exploratory spawning habitat surveys suggest that there are very few if any bays and inlets in the Puget Sound basin that will not be found to support sand lance spawning activity. Spawning of sand lance occurs at tidal elevations ranging from +5 feet to about the mean higher high water line. After deposition, sand lance eggs may be scattered over a wider range of the intertidal zone by wave action. The

incubation period is about four weeks. Sand lances are an important part of the trophic link between zooplanktons and larger predators in the local marine food webs. Like all forage fish, sand lance are a significant component in the diet of many economically important resources in Washington. On average, 35 percent of juvenile salmon diets are comprised of sand lance. Sand lance are particularly important to juvenile Chinook salmon, where 60 percent of their diet is comprised of sand lance. Other economically important species, such as Pacific cod (*Gadus macrocephalus*), Pacific hake (*Merluccius productus*) and dogfish (*Squalus acanthias*) feed heavily on juvenile and adult sand lance. There is vertical separation between sand lance spawning (+5 feet to mean higher high water) and geoduck harvest activity (-18 ft. to -70 ft., MLLW). Due to vertical separation, geoduck fishing on the Fauntleroy South tract should have no detrimental impacts on 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.

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. In NOAA’s 2011 5-Year Review, it was reported that for all but a few demographically independent populations of steelhead in Puget Sound, estimates of mean population growth rates obtained from observed spawner or red counts are declining, typically 3 to 10% annually. 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 is a winter run of steelhead in the Green-Duwamish watershed that is rated “healthy.” This rating was made because spawner escapements have generally varied within a range of +/- 25% of the escapement goal of 2000 wild spawners. Spawning for this stock generally occurs between early March to mid-June. This is a native stock with wild production. The horizontal separation between the tributaries that support a steelhead run and the Fauntleroy South tract supports a conclusion that geoduck harvest will likely have no impact on steelhead populations.

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 ESA. 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 and within Hood Canal. The timing for summer run chum spawning is late August to late October. Out-migration of juveniles has been observed in Hood Canal during February and March, though out-migration may be as late as mid-April. Recent recovery and supplementation efforts have reversed the trend of decline in Hood Canal summer run chum salmon stocks. Total escapement for Hood Canal summer run chum salmon has reached historic high levels and risk of extinction has decreased for all stocks (Adicks, K. *et al.*, 2007). The Fauntleroy South 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 Fauntleroy South geoduck tract, which support 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 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 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 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 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 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).

Three Chinook salmon runs have been identified in the Puyallup River. The status of the Spring run of Chinook salmon in the Puyallup River is extinct (NMFS, Appendix E, TM-35, Chinook Status Review). The status of the natural Summer/Fall run of Chinook salmon in the Puyallup River is undetermined with a 5-year geometric mean for total estimated escapement at 2,518 fish (NMFS, Appendix E, TM-35, Chinook Status Review). The Fall run of Chinook salmon in the Puyallup River is a mixed or composite production of special concern with an unknown origin and run size (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 -18 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. Geoduck harvest should have no impact on salmon 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” [pdf] (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 Fauntleroy South geoduck tract is outside of the critical habitat range of green sturgeon and geoduck harvest at this location will have no adverse effects on ESA recovery efforts for green sturgeon populations.

Invertebrates:

The 2017 Supplemental survey at the Seahurst tract immediately to the south and the 2022 Supplemental survey at the Fauntleroy North tract immediately to the north are being used as a proxy to describe the invertebrates expected to be in the vicinity of this tract. The most common and obvious groups include anemones, cnidarians, ascidians, mollusks, crustaceans, echinoderms, and various species of marine worms (Table 6).

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. Dungeness crab are likely to be found on this tract in low to moderate numbers. Dungeness crab were observed on 3 of the 57 total supplemental survey transects (900 sq. ft./transect), or 5% of these transects done in this area.

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 -360 ft. (MLLW) water depth contour (Figure 5). Dr. Dave Armstrong at 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 along this tract is approximately 582 acres. There are about 517,039 harvestable geoducks in the entire 85 acre tract harvest area, from the 2016 pre-fishing survey estimate. With a harvest of 65 percent, the total number harvested would be 336,075 geoducks. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so $336,075 \times 1.18 = 396,569$ square feet of substrate. This equals about 9.1 acres. This is about 1.6 percent of the total available crab habitat in the vicinity of this tract. Based on the low amount of disturbance, plus the lack of effects observed at the Thorndyke Bay study, we conclude that any effects on Dungeness crab populations will be very minor, if they occur at all.

Algae:

Large, attached 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. Soft sediment substrates, as is generally found on geoduck tracts, provide poor attachment and anchorage for large algae. The 2017 Supplemental survey at the Seahurst tract immediately to the south and the 2022 Supplemental survey at the Fauntleroy North tract immediately to the north are being used as a proxy to describe the algae expected to be in the vicinity of this tract. These include: red algae, foliose green algae (*Ulva* spp.), diatoms, brown algae (*Laminaria* spp. *Costaria* spp., and *Desmarestia* spp.) (Table 7).

John Boettner and Tim Flint, from the WDFW Habitat Division, have stated that as long as geoduck fishing was restricted seaward of the eelgrass beds they have no concerns about the fishing. This was confirmed by WDFW Habitat Division who stated that the existing conditions in the fishery SEIS are sufficient to protect fish and wildlife habitat and natural resources. The shallow boundary of geoduck harvest is set at least two

vertical feet seaward of the deepest occurrence of eelgrass, to protect all eelgrass along the tract from harvest activities. An eelgrass survey was conducted at the Fauntleroy South geoduck tract in 2022 by the Puyallup Tribe. It was reported that no eelgrass was observed deeper than -16 ft. (MLLW). The shoreward boundary of this tract will be no shallower than the -18 ft. water depth contour (MLLW), which should provide sufficient buffer for any 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 Bainbridge Island and rare reports of humpback whales near Vashon Island. 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>). Handpick 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, dabbling ducks, black brant, mergansers, buffleheads, cormorants, gulls, and terns. Blue heron, bald eagles, and osprey 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 shoreline waters seaward of the Ordinary High Water mark are designated as “Aquatic Shoreline” throughout King County. Upland properties immediately adjacent to the Fauntleroy South tract are designated as “Incorporated” shoreline area (Final King County Comprehensive Plan, 2013).

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:

The waters in the vicinity of this geoduck tract (in Marine Area 11) are not prime sport fishing areas, however, some recreational salmon fishing for blackmouth, silver and pink salmon could occur seasonally in proximity to this tract. Sport fishing is open year-round for surfperch. Rockfish fishing is closed. Lingcod can only be taken May 1-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 South Puget 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.

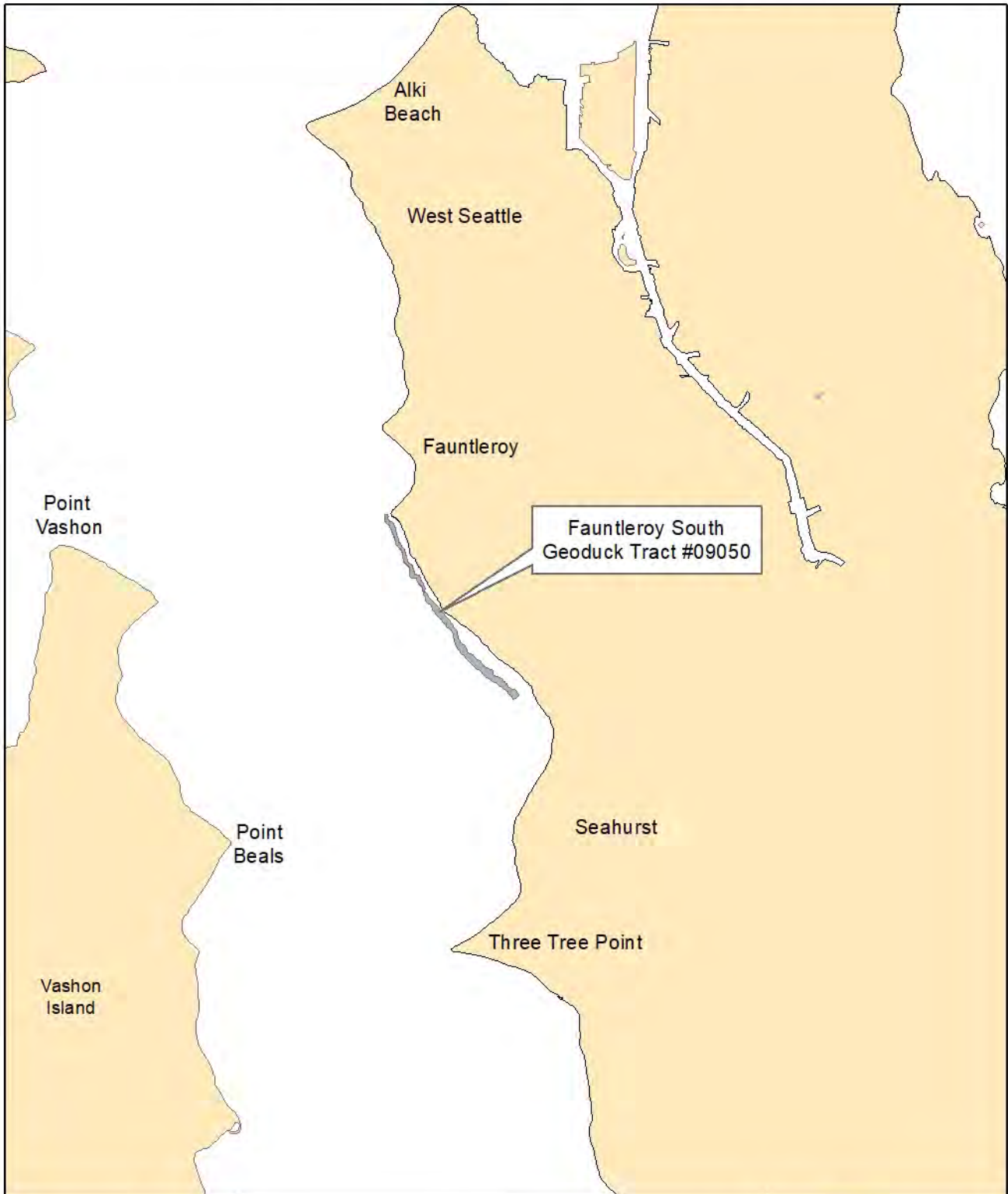
Navigation:

The Fauntleroy South area is used by recreational and commercial vessels traveling in South 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:

The proposed commercial geoduck harvest is for one tract along the eastern shoreline of Puget Sound. The tract was recently surveyed in 2016 by the Puyallup and the biomass estimate for the 85 acre harvest area is 1,962,410 pounds. The commercial tract is classified by DOH as "Approved." The anticipated environmental impacts of this harvest are within the range of conditions discussed in the 2001 Final Supplemental Environmental Impact Statement. To reduce the possible impacts to forage fish and eelgrass, the harvest will be seaward of the -18 ft. water depth contour (MLLW) along the tract. No significant impacts are expected from this harvest.

Figure 1. Vicinity Map, Fauntleroy South Commercial Geoduck Tract #09050



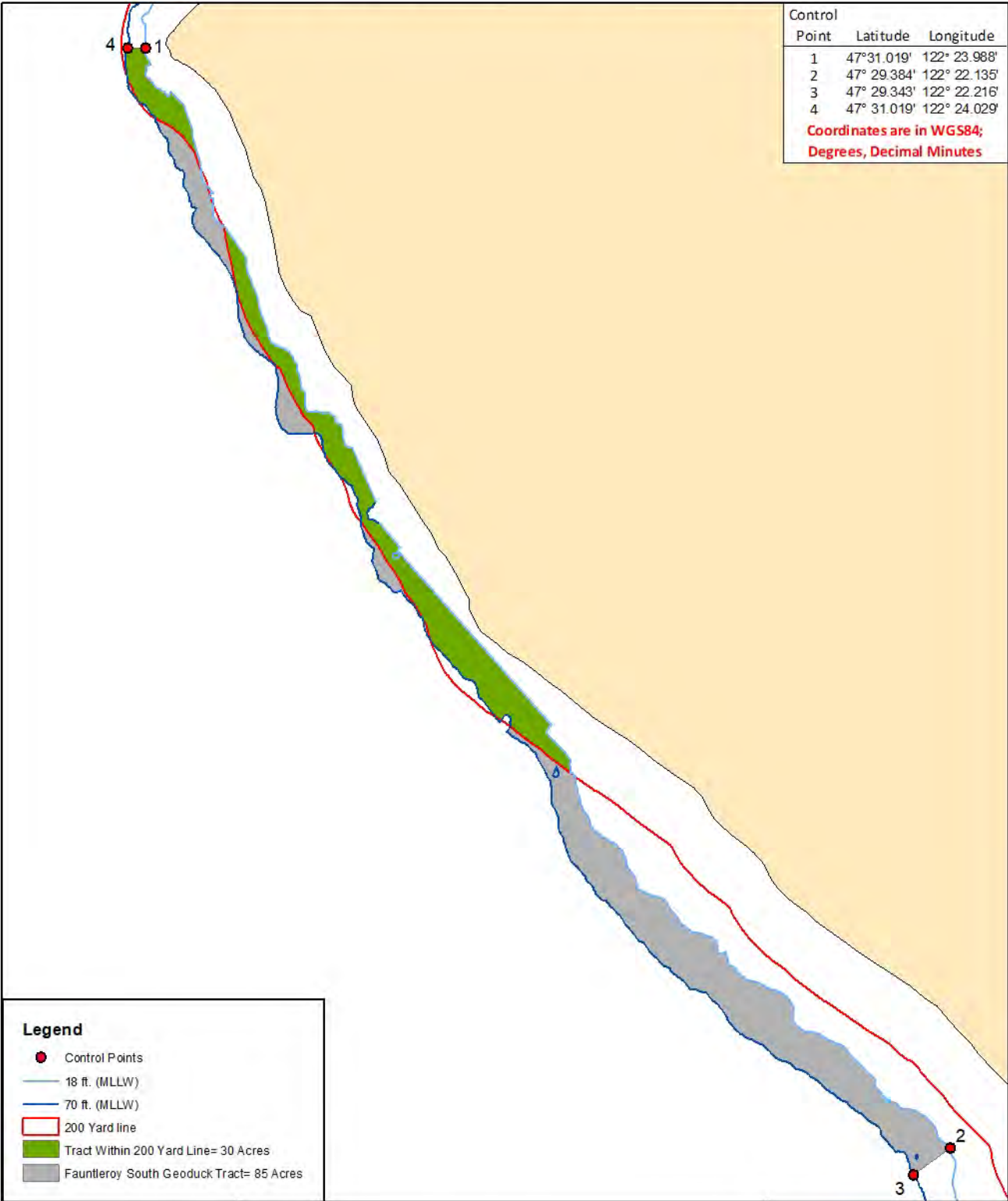
1:100,000
1 inch = 1.58 miles


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.



Map Date: September 20, 2022
Map Author: O. Working
File: Data\Ocean\Geoduck


Figure 2. Control Points Map, Fauntleroy South Commercial Geoduck Tract #09050




 1:16,500
 1 inch = 0.26 miles

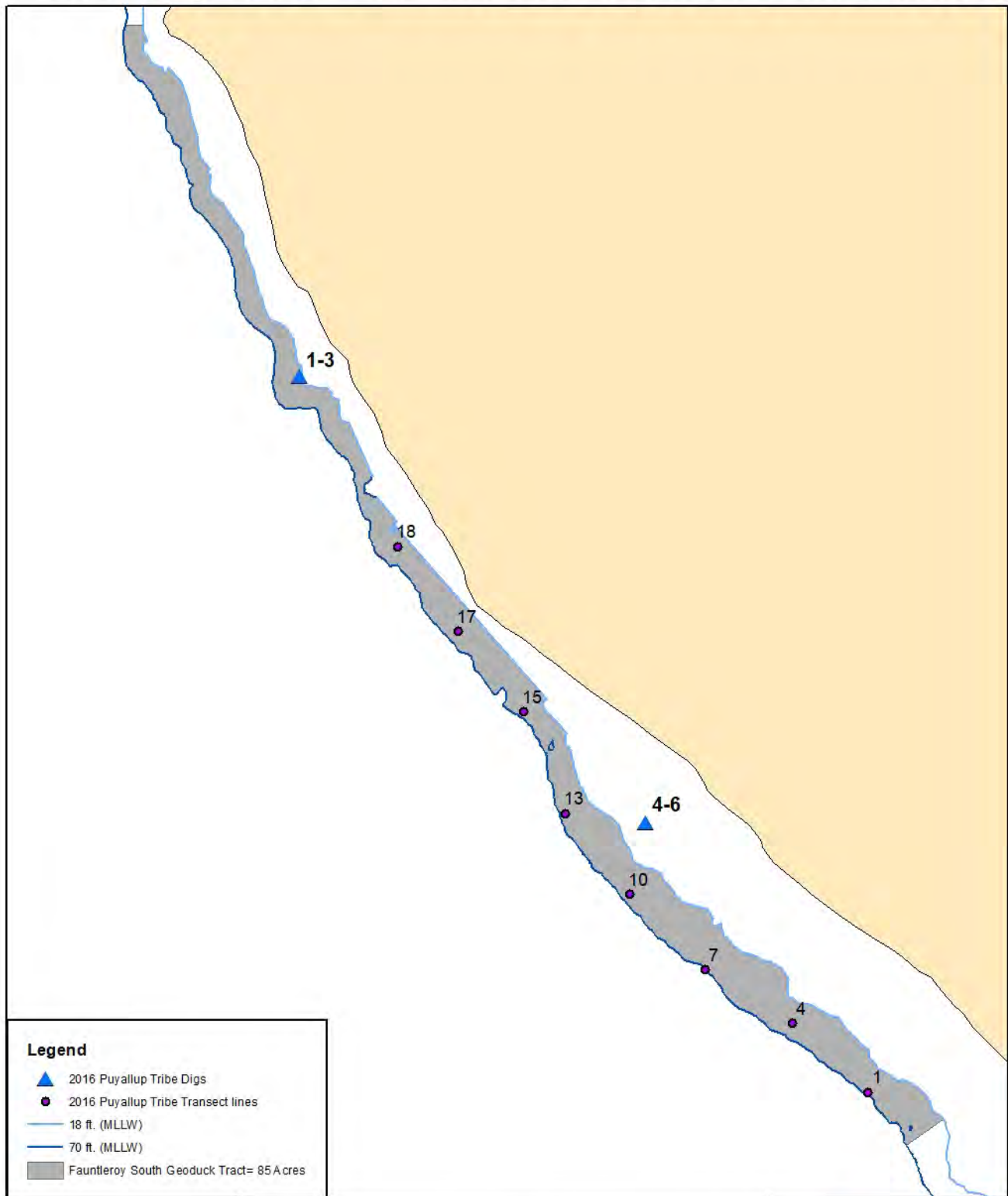
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 Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created
 09-20-99. Contours are from NOAA soundings.

0 0.075 0.15 0.3 0.45
 Miles


 Washington
 Department of
FISH and WILDLIFE

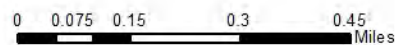
Map Date: September 20, 2022
 Map Author: O. Working
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Figure 3. Transect and Dig Station Map, Fautleroy South Commercial Geoduck Tract #09050



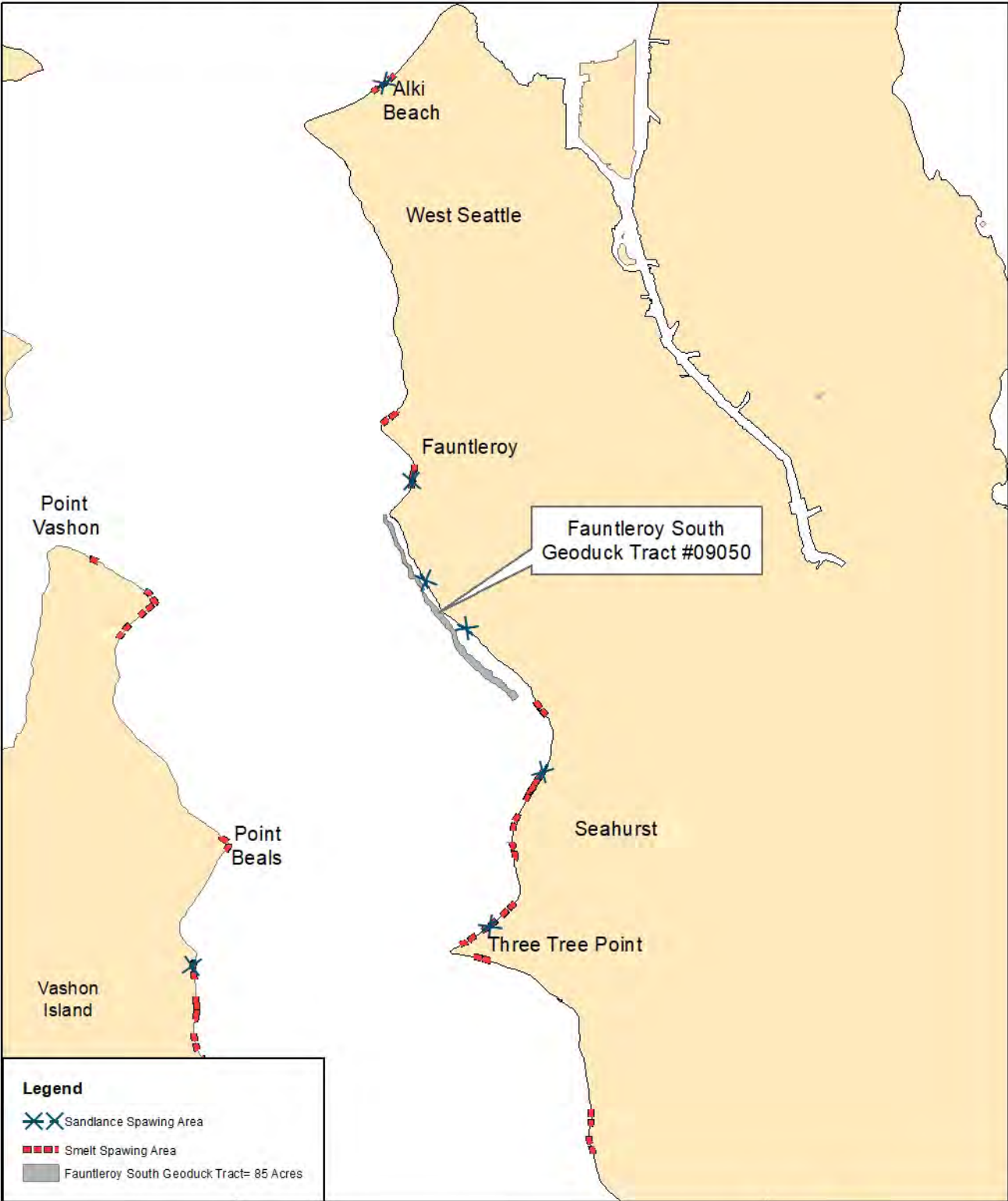
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Map Date: September 20, 2022
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File: Data\Ocean\Geoduck

Figure 4. Fish Spawning Areas Near the Fautleroy South Commercial Geoduck Tract #09050



Legend

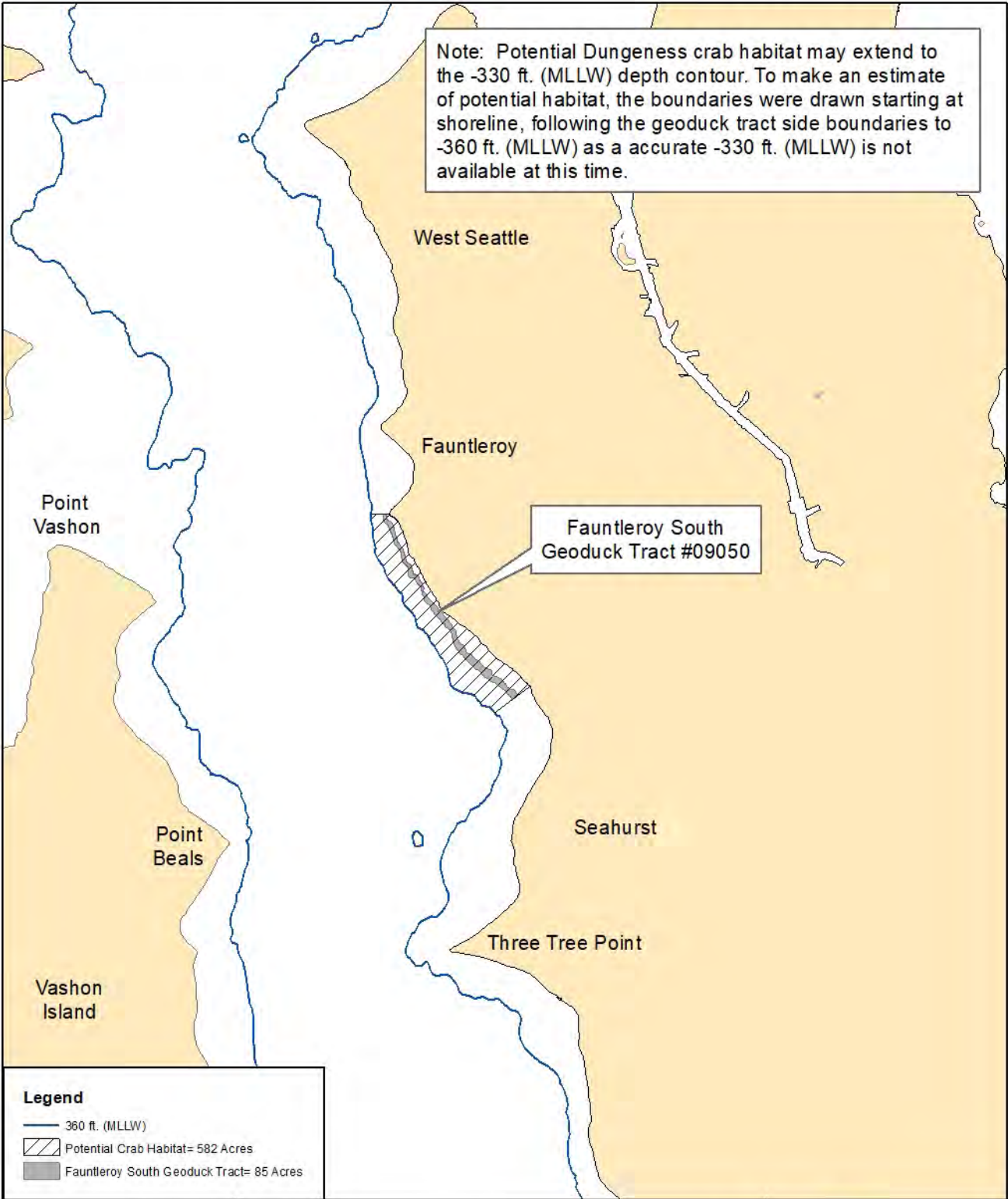
- Sandlance Spawning Area
- Smelt Spawning Area
- Fautleroy South Geoduck Tract= 85 Acres

1:100,000
1 inch = 1.58 miles

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.

Map Date: September 20, 2022
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 5. Dungeness Crab Habitat Map, Fautleroy South Commercial Geoduck Tract #09050



1:100,000
1 inch = 1.58 miles

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.

Map Date: September 20, 2022
Map Author: O. Working
File: Data\Ocean\Geoduck

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:

<u>Code</u>	<u>Degree of Difficulty</u>	<u>Description</u>
0	Very Easy	Sediment conducive to quick harvest.
1	Easy	Significant barrier in substrate to inhibit digging.
2	Some difficulty	Substrate may be compact or contain gravel, shell or 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*.

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Table 1. GEODUCK TRACT SUMMARY

Fauntleroy South geoduck tract # 09050.

Tract Name	Fauntleroy South
Tract Number	09050
Tract Size (acres) ^a	85
Density of geoducks/sq.ft ^b	0.140
Total Tract Biomass (lbs.) ^b	1,962,410
Total Number of Geoducks on Tract ^b	517,039
Confidence Interval (%)	25.40%
Mean Geoduck Whole Weight (lbs.)	3.80
Mean Geoduck Siphon Weight (lbs.)	N/A
Siphon Weight as a % of Whole Weight	N/A
Number of 900 sq.ft. Transect Stations	23
Number of Geoducks Weighed	61

^a. Tract area is between the -18 ft. and -70 ft. (MLLW) water depth contours

^b. Biomass is based on the 2016 Puyallup Tribe Pre-fishing Survey

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Table 2: DIGGING DIFFICULTY TABLE

Fauntleroy South geoduck tract #09050, 2016 Puyallup 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)
9/15/2016	1	No dig station ratings reported								
9/15/2016	2									
9/15/2016	3									
9/15/2016	4									
9/15/2016	5									
9/15/2016	6									

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

Fauntleroy South geoduck tract #09050, 2016 Puyallup Tribe pre-fishing survey.

Survey Date	Transect	Start Depth (ft.) ^a	End Depth (ft.) ^a	Geoduck Density (no. / sq.ft.) ^b	Substrate ^c mud
5/20/2016	1	70	52	0.1089	1*
5/20/2016	2	52	36	0.1189	*No other substrate ratings were reported
5/20/2016	3	36	19	0.0344	
5/20/2016	4	68	57	0.1222	
5/20/2016	5	57	43	0.2256	
5/20/2016	6	43	20	0.0733	
5/25/2016	7	64	49	0.2189	
5/25/2016	8	49	35	0.1711	
5/25/2016	9	35	22	0.0678	
5/25/2016	10	70	51	0.2411	
5/25/2016	11	51	35	0.1189	
5/25/2016	12	35	19	0.0811	
5/26/2016	13	63	38	0.2289	
5/26/2016	14	38	19	0.1156	
5/26/2016	15	64	43	0.1267	
5/26/2016	16	43	36	0.0067	
5/26/2016	17	69	23	0.1589	
5/26/2016	18	69	23	0.1989	
6/2/2016	19	70	20	0.0067	
6/2/2016	20	70	19	0.0556	
6/2/2016	21	66	29	0.3256	
6/2/2016	22	29	56	0.1400	
6/2/2016	23	65	29	0.2633	

- ^a. All depths are corrected to mean lower low water (MLLW)
- ^b. Densities were calculated using a 1.0 show factor
- ^c. Substrate ratings: 1 = present; 2 = predominant; blank = not observed

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Table 4: TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Fauntleroy South geoduck tract #09050, 2016 Puyallup Tribe pre-fishing survey.

Survey Date	Transect	Corrected Count	Show Factor	Latitude ^a	Longitude ^a
5/20/2016	1	98	1.000	47° 29.4230'	122° 22.3054'
5/20/2016	2	107	1.000		
5/20/2016	3	31	1.000		
5/20/2016	4	110	1.000	47° 29.5246'	122° 22.4802'
5/20/2016	5	203	1.000		
5/20/2016	6	66	1.000		
5/25/2016	7	197	1.000	47° 29.6038'	122° 22.6787'
5/25/2016	8	154	1.000		
5/25/2016	9	61	1.000		
5/25/2016	10	217	1.000	47° 29.7159'	122° 22.8516'
5/25/2016	11	107	1.000		
5/25/2016	12	73	1.000		
5/26/2016	13	206	1.000	47° 29.8359'	122° 22.9997'
5/26/2016	14	104	1.000		
5/26/2016	15	114	1.000	47° 29.9889'	122° 23.0996'
5/26/2016	16	6	1.000		
5/26/2016	17	143	1.000	47° 30.1093'	122° 23.2502'
5/26/2016	18	179	1.000	47° 30.2355'	122° 23.3903'
6/2/2016	19	6	1.000		
6/2/2016	20	50	1.000		
6/2/2016	21	293	1.000		
6/2/2016	22	126	1.000		
6/2/2016	23	237	1.000		

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

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Table 5: GEODUCK SIZE AND QUALITY

Fauntleroy South geoduck tract #09050, 2016 Puyallup Tribe pre-fishing survey.

Dig Date	Dig Station	Number Dug	Avg. Whole Weight (lbs.)	Avg. Siphon Weight (lbs.)	% of geoducks on station greater than 2 lbs.
9/15/2016	1	11	3.19	N/A	100%
9/15/2016	2	10	4.19	N/A	100%
9/15/2016	3	10	4.27	N/A	100%
9/15/2016	4	10	2.95	N/A	100%
9/15/2016	5	10	3.50	N/A	100%
9/15/2016	6	10	4.73	N/A	100%

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Table 6: MOST COMMON AND OBVIOUS ANIMALS OBSERVED

These data were collected on the Fauntleroy North and Seahurst tracts and are being used as a proxy for the flora and fauna on the Fauntleroy South geoduck tract #09050

# of Transects where Observed	Group	Common Name	Taxonomer
57	ANEMONE	PLUMED ANEMONE	<i>Metridium spp.</i>
18	ASCIDIAN	SESSILE TUNICATE	Unspecified Tunicate
32	BIVALVE	HORSE CLAM	<i>Tresus spp.</i>
1	BIVALVE	HORSE MUSSEL	<i>Modiolus rectus</i>
55	CNIDARIA	SEA PEN	<i>Ptilosarcus gurneyi</i>
4	CNIDARIA	SEA WHIP	<i>Stylatula elongata</i>
5	CRAB	DECORATOR CRAB	<i>Oregonia gracilis</i>
3	CRAB	DUNGENESS CRAB	<i>Cancer magister</i>
41	CRAB	GRACEFUL CRAB	<i>Cancer gracilis</i>
45	CRAB	HERMIT CRAB	Unspecified hermit crab
15	CRAB	RED ROCK CRAB	<i>Cancer productus</i>
12	CUCUMBER	SEA CUCUMBER	<i>Parastichopus californicus</i>
1	FISH	BIG SKATE	<i>Raja binoculata</i>
2	FISH	BROWN ROCKFISH	<i>Sebastes auriculatus</i>
4	FISH	C-O SOLE	<i>Pleuronichthys coenosus</i>
1	FISH	EELPOUT	Unspecified Zoarcidae
1	FISH	ENGLISH SOLE	<i>Parophrys vetulus</i>
20	FISH	FLATFISH	Unspecified flatfish
2	FISH	PERCH	Unspecified Embiotocidae
2	FISH	RATFISH	<i>Hydrolagus colliei</i>
42	FISH	SANDDAB	<i>Citharichthys spp.</i>
41	FISH	SCULPIN	Unspecified Cottidae
2	GASTROPOD	NASSA SNAILS	<i>Nassarius spp.</i>
8	MISC	SPONGE	Unspecified Porifera
18	NUDIBRANCH	ARMINA	<i>Armina californica</i>
2	NUDIBRANCH	DENDRONOTUS	<i>Dendronotus spp.</i>
1	NUDIBRANCH	DIAMONDBACK TRITONIA	<i>Tritonia festiva</i>
1	NUDIBRANCH	HERMISSENDA	<i>Hermisenda crassicornis</i>
12	SEA STAR	FALSE OCHRE STAR	<i>Evasterias troschelli</i>
8	SEA STAR	LEATHER STAR	<i>Dermasterias imbricata</i>
4	SEA STAR	SHORT-SPINED STAR	<i>Pisaster brevispinus</i>
1	SEA STAR	SPINY STAR	<i>Hippasteria spinosa</i>
2	SEA STAR	SUN STAR	<i>Solaster spp.</i>
10	SEA STAR	SUNFLOWER STAR	<i>Pycnopodia helianthoides</i>
7	SEA STAR	VERMILLION STAR	<i>Mediaster aequalis</i>
5	SHRIMP	SHRIMP	Unspecified shrimp
41	WORM	ROOTS	Chaetopterid polychaete tubes
38	WORM	SABELLID TUBE WORM	<i>Sabellid spp.</i>
3	WORM	TEREBELLID TUBE WORM	<i>Terebellid spp.</i>

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Table 7: MOST COMMON AND OBVIOUS ALGAE OBSERVED

These data were collected on the Fautleroy North and Seahurst tracts and are being used as a proxy for the flora and fauna on the Fautleroy South geoduck tract #09050

# of Transects where observed	Taxonomer
1	<i>Costaria costada</i>
2	<i>Desmarestia spp.</i>
15	Diatoms
28	<i>Laminaria spp.</i>
9	Large red algae
36	Small red algae
46	<i>Ulva spp.</i>

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