ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST
ALONG THE WESTERN SHORELINE OF BAINBRIDGE ISLAND
AT THE MANZANITA GEODUCK TRACT (#07000)

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 continued harvest along the western shoreline of Bainbridge Island is described below.

Proposed Harvest Year(s): 2023- 2024

Tract name: Manzanita geoduck tract (Tract #07000)

Description: (Figure 1, Tract Vicinity map)

The Manzanita geoduck tract is a subtidal area of approximately 306 acres (Table 1) along the western shoreline of Bainbridge Island in Port Orchard in the Central Puget Sound Geoduck Management Region. The tract is adjacent to and shares a common boundary with the Agate Pass/Sandy Hook tract (#06800) to the north, the Point Bolin (#06900) tract to the northwest, and the Battle Point North tract (#07050) to the south. The Manzanita tract was formerly the northern portion of the Battle Point North tract (#07050), prior to a 2008 biological survey.

The Manzanita tract is bounded by a line projected southerly along the -25 foot (MLLW) water depth contour from a control point (CP) in the northeastern portion of the tract at 47°41.471' N. latitude, 122°34.058' W. longitude (CP 1) to a point at 47°40.889' N. latitude, 122°33.986' W. longitude (CP 2); then westerly to a point at 47°40.871' N. latitude, 122°34.838' W. longitude (CP 3); then northerly to a point at 47°41.093' N. latitude, 122°34.844' W. longitude (CP 4); then northeasterly to a point at 47°41.543' N. latitude, 122°34.592' W. longitude (CP 5); then northerly to a point on the -25 foot (MLLW) water depth contour at 47°41.663' N. latitude, 122°34.574' W. longitude (CP 6); then along the -25 foot (MLLW) water depth contour to a point at 47°41.729' N. latitude, 122°34.466' W. longitude (CP 7); then southeasterly 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 WDFW geoduck survey data (2008 survey). All contours are corrected to MLLW. Contour GIS layers from Dale Gombert (WDFW) were generated from NOAA soundings. Shoreline data was from DNR, digitized at 1:24000 scale in 1999. Estimates of average mid-channel lines were used for the deep-water boundary, and the -25 ft. (MLLW) water depth contour was used for the shallow boundary, due to herring spawning habitat in the vicinity of the tract. Eelgrass was found at a maximum water depth of -17 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 harvesting episodes.

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 typically sand 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. In Puget Sound, at Agate Passage adjacent to this tract, currents reach a predicted maximum flood velocity of 7.2 knots and maximum ebb velocity of 6.0 knots (Tides and Currents software; station #1641; Agate Passage, south end).

The surface substrates within this tract are primarily mixtures of sand and mud, with sand predominant on 30 transects and mud predominant on 43 transects (total transects = 81). Current velocities tend to diminish from north to south in the northern portion of Agate Passage/Port Orchard. The northern portion of the tract (transects 35-37 and 75-78) and nearshore transects (1-7, 15-20) tend to have predominantly sand substrate (Figure 3, Transect map). The southern portions of the tract, and mid-channel portions in the southern section of the tract (transects 10-14, 43-74, 79-81), tend to have lower current velocities and have predominantly mud substrate.

Water Quality:

Water quality is good at the Manzanita geoduck tract. Water mixing at this tract is affected by the convergence of currents from Agate and Rich Passages, 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 Manzanita geoduck tract is approximately 306 acres. The abundance of geoducks on this tract is low, with a current estimated average density of 0.04 geoducks/sq.ft. This tract currently contains an estimated 1,652,340 pounds of geoducks (Table 1). On all 13 dig stations, geoducks are considered commercial quality (Table 2). Digging difficulty ranged from “easy” to “very difficult” to dig. The factors which influenced “very difficult” ratings (dig stations 9 and 50) included deep depth of geoducks in the substrate, compact mud, shell layer, and high turbidity (low visibility).

The average density range from the 2008 pre-fishing survey was 0.008 geoducks/sq.ft. at station #73 to 0.383 geoducks/sq.ft. at station #8 (Table 3). The geoducks at the Manzanita tract are large for Puget Sound, averaging 2.90 pounds, while the average geoduck in Puget Sound is 2.1 pounds. The lowest average whole weight is 2.21 pounds per geoduck at dig stations #27 and #56 and the highest average whole weight is 4.01 pounds per geoduck at dig station #17 (Table 4). Station locations, and geoduck counts corrected with siphon “show factors”, are listed in Table 5.

The Manzanita geoduck tract was first surveyed in 1968 by WDFW as part of the Port Orchard tract. The tract was surveyed again in 1994 and 1995 by WDFW and was named the Battle Point North tract. A third survey of 306 acres (81 transects) was done by WDFW in 2008 and included the northern portion of Battle Point North. The portion of the tract surveyed in 2008 was renamed “Manzanita” and the remaining area to the south (about 417 acres) retained the name Battle Point North and it was renumbered as tract

#07050. The results of the 2008 survey and subsequent harvests (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 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 to geoduck's low rate of natural recruitment. WDFW has studied the regeneration rate of geoducks on certain tracts throughout the Salish Sea. 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 Manzanita 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. The fish observed during the survey at the Manzanita tract (Table 6) were various flatfish including starry flounder, rock sole, sand dab, and C-O sole; sculpins; lingcod; cabezon; poachers; and skate egg cases.

WDFW marine fish managers were asked of their concerns of any possible impacts on groundfish and baitfish that geoduck fishing would have. 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 has been observed along this tract to a maximum depth of -17 ft. (MLLW) during a 1992 eelgrass survey. The nearshore tract boundary will be along the -25 ft. (MLLW) water depth contour to provide year-round protection to Pacific herring spawning habitat and to provide a vertical buffer between eelgrass beds and geoduck harvest.

There are Pacific herring spawning grounds along the western shoreline of Bainbridge Island in the vicinity of the Manzanita tract (2008 Washington State Baitfish Stock Status Report; and this Environmental Assessment, Figure 4 - Fish Spawning Areas Near the

Manzanita Tract #07000). Along the shorelines of Port Orchard and Agate Passage, herring spawning has been documented during the period of January 1 through April 15. The state geoduck harvest strategy at the Manzanita tract is to conduct harvest outside of the peak herring spawning period of January 1 through April 15 or harvest deeper than -35 ft. (MLLW) during this period. Surf smelt spawning has also been identified in the vicinity of the Manzanita tract. Surf smelt deposit adhesive, semi-transparent 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 substantial vertical separation between surf smelt spawning (slack high tide) and geoduck harvest activity (-18 ft. to -70 ft., MLLW). Geoduck fishing on the Manzanita tract, under the harvest conditions of this Environmental Assessment, should have no detrimental impacts on Pacific herring or surf smelt 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 and 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 may occur as late as mid-April. The Manzanita 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 Manzanita 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 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 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).

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, 2+ feet vertically from the 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.

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 western shoreline of Bainbridge Island that support steelhead stocks. The horizontal separation between tributaries that support steelhead runs and the Manzanita 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 Manzanita 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:

Marine invertebrates, which are frequently found on geoduck beds, were also observed on this tract (Table 6). The most common and obvious of these include: [1] mollusks (geoducks, horse clams, truncated mya clams, false geoducks, heart cockles, horse mussels, jingleshell oysters, piddocks, spiney scallops, unidentified hardshell clams, moon snails, moon snail egg cases, octopus, and nudibranchs - rosey tritonia, armina, dendronotus, and unspecified nudibranch); [2] echinoderms (sunflower sea stars, sand stars, short-spined stars, blood stars, leather stars, sun stars, and rose stars), [3] cnidarians (sea pens, sea whips, burrowing anemones, striped anemones, and plumed anemones); [4] arthropods (Dungeness crabs, red rock crabs, graceful crabs, hermit crabs, decorator crabs, ghost shrimp, mysids, unspecified shrimp, and unspecified arthropods); and [5] annelid worms (chaetopterid, sabellid, and terebellid). 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 were observed on 16 out of 81 transects during the 2008 biological survey of the Manzanita tract. Dungeness crab present on the tract may experience peak molt in mid-April, based on data from the Kingston area (Cain, 10/15/01).

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 (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 334 acres. There were about 1,614,000 harvestable geoducks in the entire 306 acre tract, from the 2008 pre-fishing survey estimate. With a harvest of 65 percent, the total number harvested would be about 1,049,006 geoducks. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so 1,049,006 x 1.18 = 1,237,828 square feet of substrate. This equals approximately 28.42 acres, which is about 8.5 percent of the total available crab habitat in the vicinity of this tract. Based on low 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. Aquatic algae observed during the pre-fishing geoduck survey (Table 7) include:

> Laminarian algae, Desmarestia algae, small red algae, and other unspecified small algae.

John Boettner and Tim Flint, of 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 and that the existing conditions in the fishery SEIS are sufficient to protect fish and wildlife habitat and natural resources. An eelgrass survey was done on this tract May 6 and 7, 1992, by WDFW divers swimming the entire shoreward boundary of the tract.Eelgrass was documented at a maximum depth of -17 ft. (MLLW). The shoreward boundary of this tract will be no shallower than the -25 ft. (MLLW) water depth contour, which 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 Bainbridge Island and rare reports of humpback whales near Bainbridge 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. 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 are primarily designated as "rural" and "semi-rural" shoreline environmental designation

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 and compressors may not exceed 50 dB measured 200 yards from the noise source, which is 5 dBA below the state noise standard.

Fishing:

The waters around this tract are not prime sport fishing areas, however, 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 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:

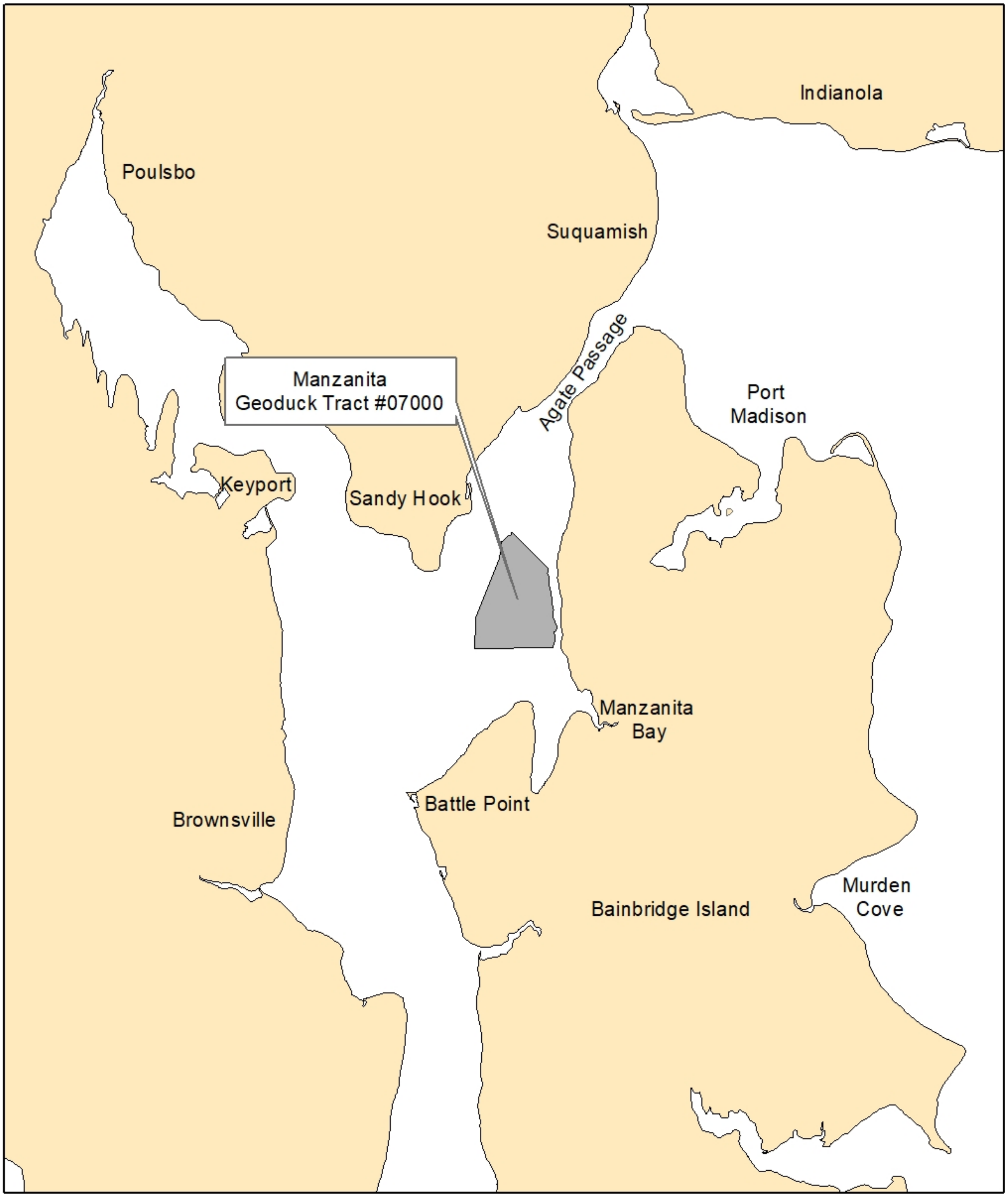
The Manzanita area is used by recreational and commercial vessels traveling in Central Puget Sound and through Agate Passage and Port Orchard. Geoduck harvesting at this site should not result in any significant navigational conflicts. The Washington Department of Natural Resources will notify the boating community prior to harvest.

Summary:

Commercial geoduck harvest is proposed for one tract along the western shoreline of Bainbridge Island. The tract was recently surveyed in 2008 by WDFW and the current biomass estimate for the 306 acre harvest area is 1,652,340 pounds. Geoduck harvest on this tract is on-going and a total of 3,031,117 pounds have been reported since the 2008 biological survey. The 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 -17 ft. (MLLW). The shoreward boundary of the tract will be set at -25 ft. (MLLW) or deeper to provide a buffer between 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: 230216_Manzanita _EA_07000.doc

Figure 1. Vicinity Map, Manzanita Commercial Geoduck Tract #07000



N
W E
S

1:80,000

1 inch = 1.26 miles

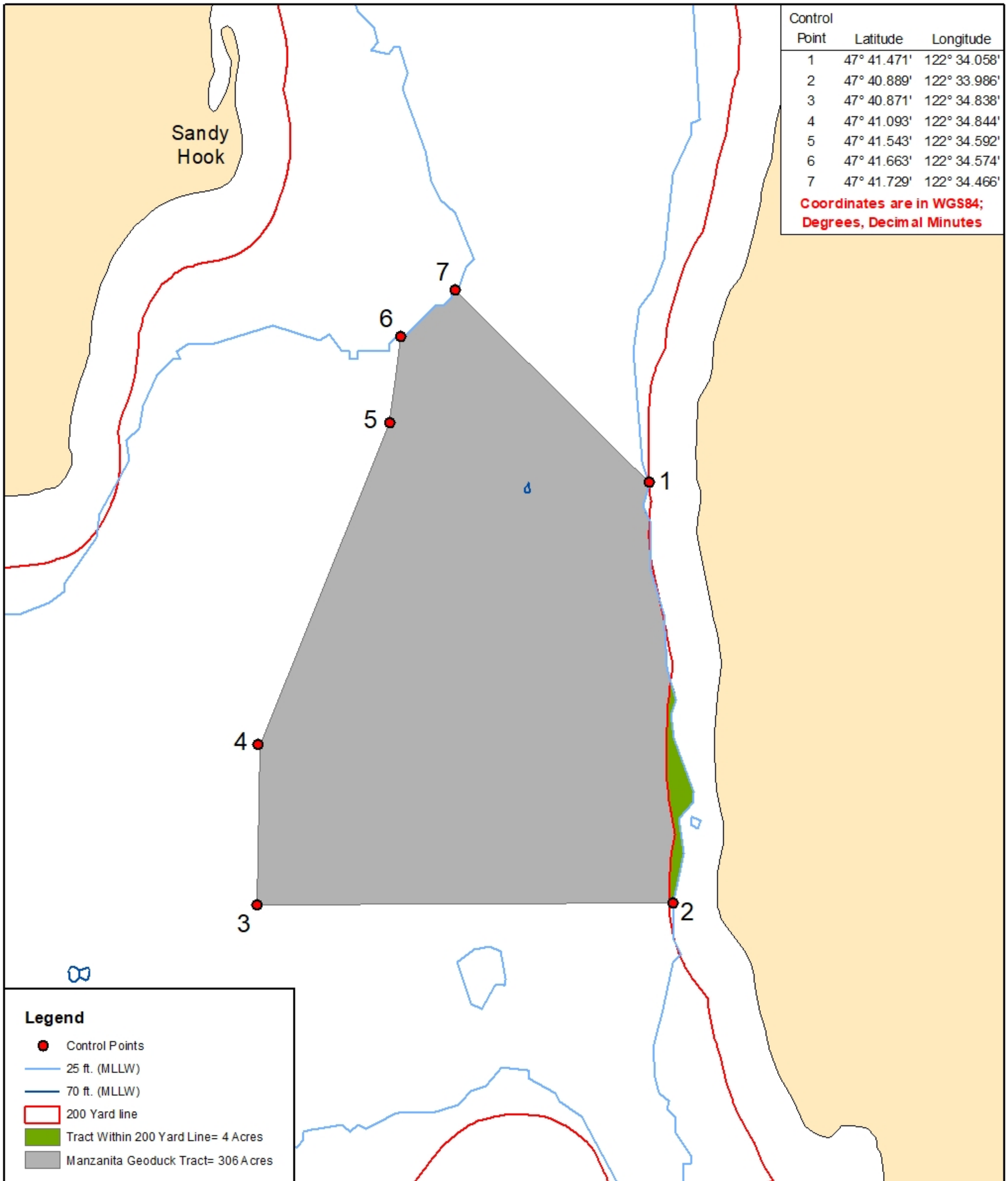
Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.425 0.85 1.7 2.55 Miles

Washington Department of FISH and WILDLIFE

Map Date: April 4, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 2. Control Points Map, Manzanita Commercial Geoduck Tract #07000



Control Point	Latitude	Longitude
1	47° 41.471'	122° 34.058'
2	47° 40.889'	122° 33.986'
3	47° 40.871'	122° 34.838'
4	47° 41.093'	122° 34.844'
5	47° 41.543'	122° 34.592'
6	47° 41.663'	122° 34.574'
7	47° 41.729'	122° 34.466'

Coordinates are in WGS84; Degrees, Decimal Minutes

1:15,000

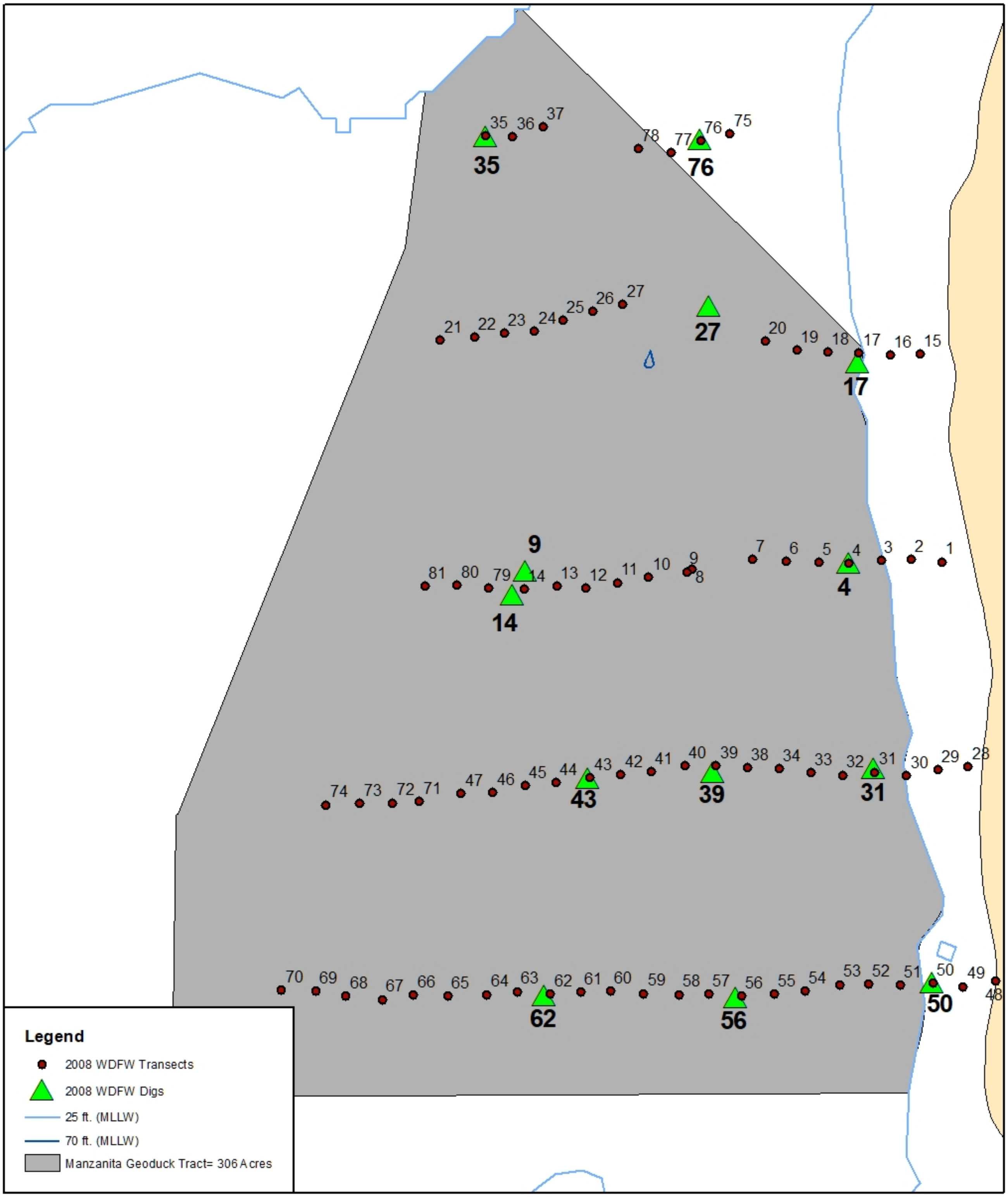
1 inch = 0.24 miles

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.

0 0.075 0.15 0.3 0.45 Miles

Map Date: February 23, 2022
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 3. Transect and Dig Station Map, Manzanita Commercial Geoduck Tract #07000



N
W E
S

1:8,500

1 inch = 0.13 miles

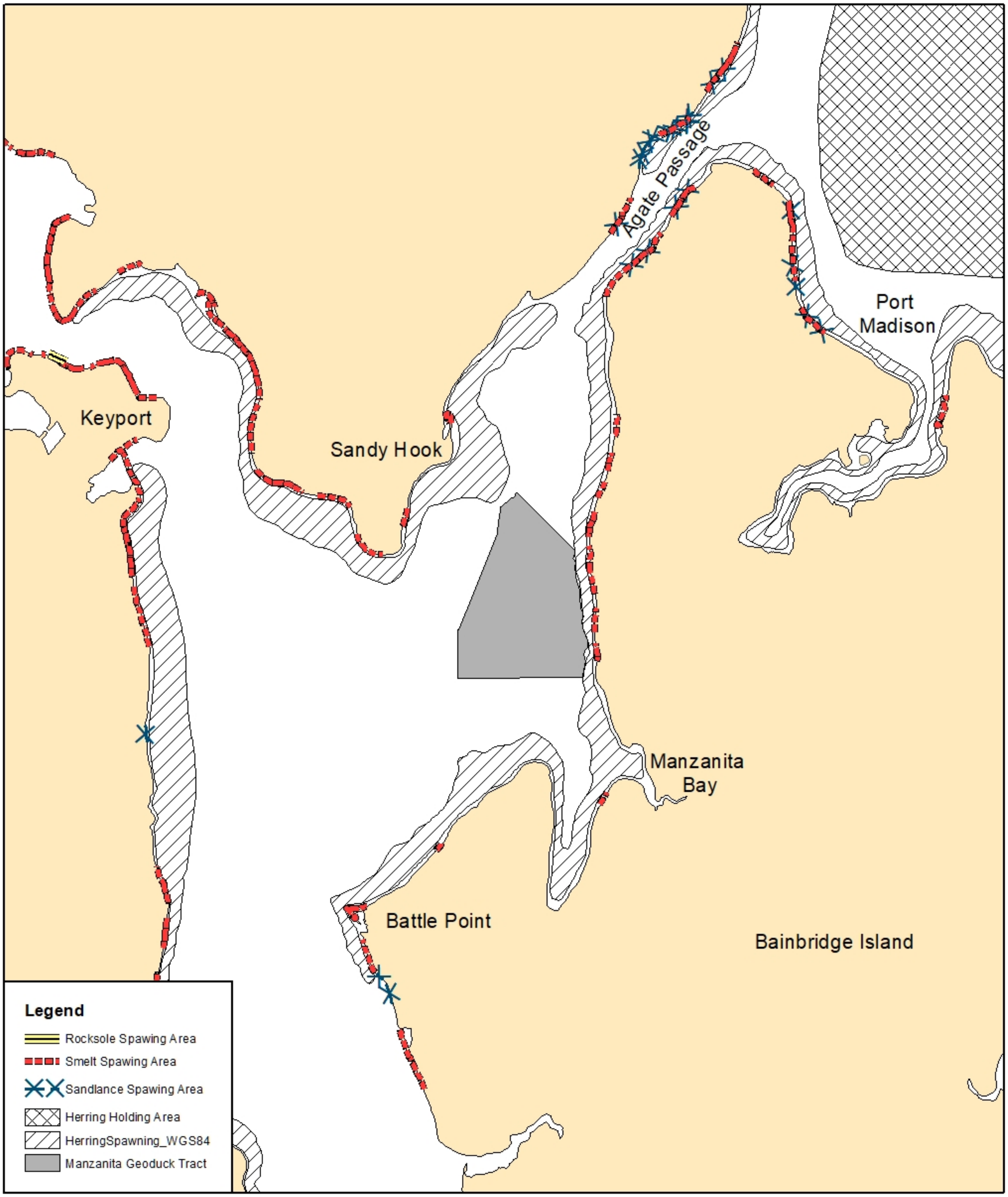
Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.045 0.09 0.18 0.27 Miles

Washington Department of FISH and WILDLIFE

Map Date: April 16, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 4. Fish Spawning Areas Near the Manzanita Commercial Geoduck Tract #07000



N W E S

1:50,000

1 inch = 0.79 miles

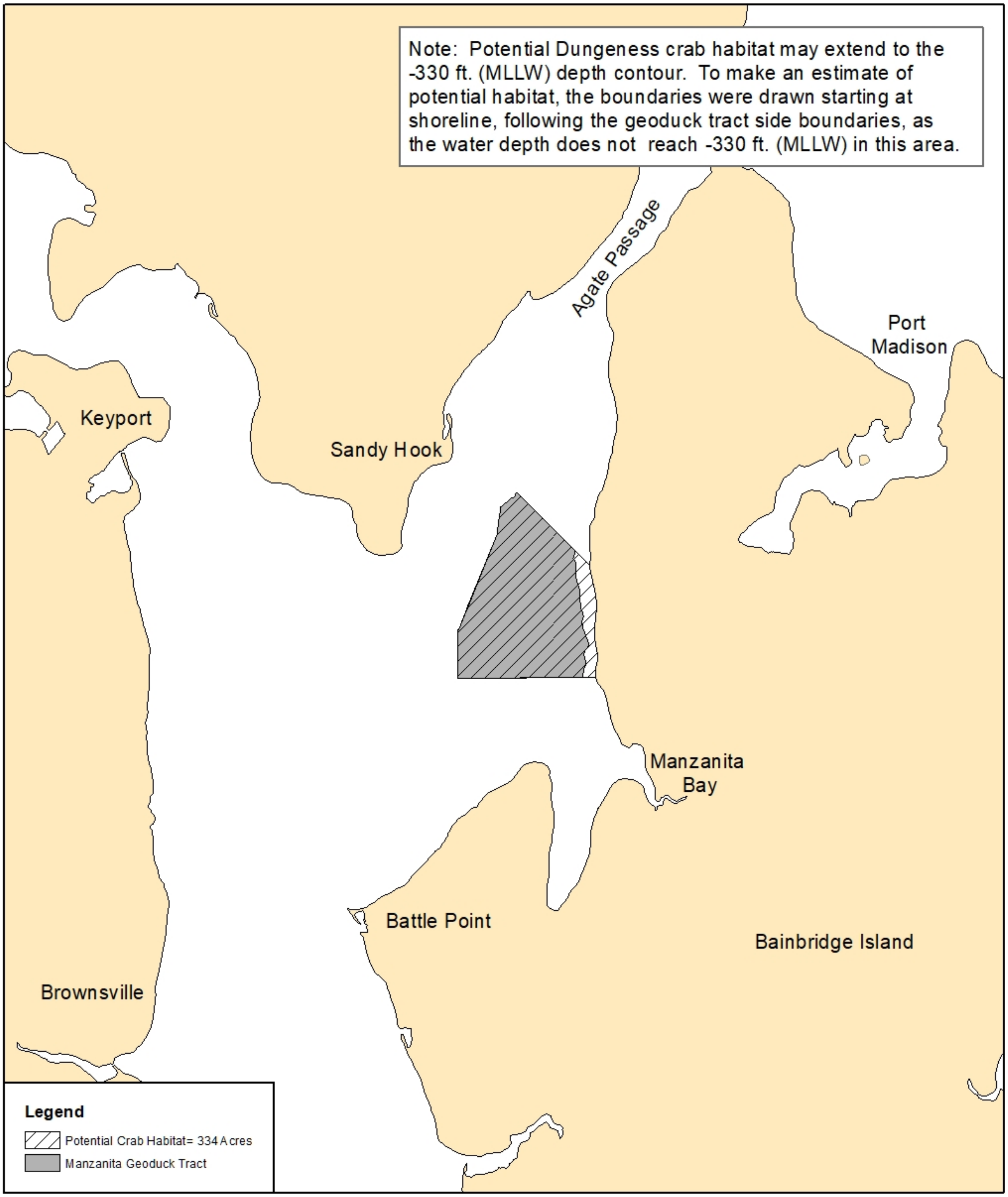
Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.25 0.5 1 1.5 Miles

Washington Department of FISH and WILDLIFE

Map Date: April 4, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 5. Dungeness Crab Habitat Map, Manzanita Commercial Geoduck Tract #07000



1:50,000

1 inch = 0.79 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.

Washington Department of FISH and WILDLIFE

Map Date: April 4, 2018
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:

Code	Degree of Difficulty	Description
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

Manzanita geoduck tract # 07000.

Tract Name	Manzanita
Tract Number	07000
Tract Size (acres) [a]	306
Density of geoducks/sq.ft. [b]	0.04
Total Tract Biomass (lbs.) [b]	1,652,340
Total Number of Geoducks on Tract [b]	569,374
Confidence Interval (%)	17.7%
Mean Geoduck Whole Weight (lbs.)	2.90
Mean Geoduck Siphon Weight (lbs.)	0.58
Siphon Weight as a % of Whole Weight	20%
Number of 900 sq.ft. Transect Stations	81
Number of Geoducks Weighed	119

[a.] Tract area is between the -25 ft. and the -70 ft. (MLLW) water depth contours.

[b.] Biomass is based on the 2008 WDFW pre-fishing geoduck survey biomass of 4,683,457 pounds minus harvest of 3,031,117 pounds through February 16, 2023

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Table 2. DIGGING DIFFICULTY TABLE

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

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)
4	2	1	1	1	0	2	1	0	Y
9	4	1	2	2	0	2	1	0	Y
14	2	1	1	0	0	0	1	0	Y
17	0	2	0	0	0	0	0	0	Y
27	3	2	2	1	2	1	1	0	Y
31	3	1	1	1	1	2	1	0	Y
35	3	1	2	1	0	2	1	0	Y
39	1	1	1	1	1	0	1	0	Y
43	1	1	1	1	0	0	2	0	Y
50	4	0	1	1	0	1	2	0	Y
56	2	1	0	1	0	0	2	0	Y
62	1	1	1	1	0	0	2	0	Y
76	1	2	2	0	0	0	0	0	Y

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

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

Transect	Start Depth (ft.) [a]	End Depth (ft.) [a]	Geoduck Density (no. / sq.ft.) [b]	Substrate [c] mud	sand	peagravel	gravel	shell
1	25	36	0.1605	1	2			
2	36	48	0.1584	1	2			
3	47	56	0.1893	1	2			
4	56	56	0.1914	1	2			
5	56	58	0.2469	1	2			
6	58	56	0.2716	1	2			
7	57	56	0.1556	1	2			
8	56	56	0.3826	1	2			
9	56	56	0.2887	1	1			
10	56	56	0.2474	2	1			
11	56	54	0.1993	2				
12	54	53	0.1168	2				
13	52	52	0.0641	2				
14	52	51	0.0641	2				
15	25	38	0.2245	1	2			
16	38	47	0.2176		2			
17	47	55	0.3139		2			
18	55	56	0.2543		2			
19	56	58	0.1741		2			
20	57	61	0.2245		2			
21	50	51	0.0370	2				
22	51	51	0.0162	2				
23	51	51	0.0185	2				
24	51	51	0.0462	1	1			
25	51	49	0.2148	1	2			
26	49	49	0.2657	1	2			
27	49	53	0.2541		2			
28	25	39	0.0162	1	2			
29	39	48	0.1432	1	1			
30	47	51	0.1848	1	1			
31	51	52	0.1871	1	1			
32	52	51	0.2610	1	1			
33	51	50	0.2980	1	1			1
34	50	49	0.3326	1	1			
35	30	29	0.1432		2			
36	28	29	0.1271		2			
37	29	30	0.1779		2			
38	51	51	0.1831		2			
39	51	51	0.1689	1	2			
40	51	52	0.1989	1	2			
41	52	52	0.1452	1	2			
42	52	52	0.1389	1	2			
43	52	52	0.0852	2				
44	51	52	0.0584	2				
45	52	50	0.0395	2				

Table 3. Continued

Transect	Start Depth (ft.) [a]	End Depth (ft.) [a]	Geoduck Density (no. / sq.ft.) [b]	Substrate [c] mud	sand	peagravel	gravel	shell
46	50	51	0.0442	2				
47	51	50	0.0442	2				
48	25	38	0.0205	2	1			
49	38	42	0.0331	2				
50	41	43	0.0552	2				
51	43	45	0.0584	2				
52	45	45	0.0963	2				
53	44	46	0.1199	2				
54	46	47	0.0915	2				
55	47	48	0.0900	2				
56	49	50	0.0968	2	1			
57	51	51	0.0891	2	1			
58	51	50	0.0999	2	1			
59	50	51	0.1153	2	1			
60	51	52	0.0768	2	1			
61	52	51	0.0599	2	1			
62	51	51	0.0676	2	1			
63	52	51	0.0415	2	1			
64	51	52	0.0338	2	1			
65	50	49	0.0123	2				
66	49	49	0.0369	2				
67	49	49	0.0246	2				
68	49	49	0.0261	2				
69	49	49	0.0215	2				
70	49	41	0.0184	2				
71	50	49	0.0277	2				
72	49	49	0.0200	2				
73	49	49	0.0077	2				
74	49	49	0.0123	2				
75	62	55	0.0583	1	2			
76	55	44	0.0796	1	2			
77	44	37	0.0753	1	2			
78	37	33	0.0966	1	2			
79	52	52	0.0213	2				
80	52	51	0.0242	2				
81	51	51	0.0142	2				

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

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Table 4. GEODUCK SIZE AND QUALITY

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

Dig Station	Number Dug	Avg. Whole Weight (lbs.)	Avg. Siphon Weight (lbs.)	% of geoducks on station greater than 2 lbs.
4	11	3.12	0.78	73%
9	12	2.58	0.44	83%
14	10	3.61	0.58	100%
17	10	4.01	0.85	100%
27[a]	10	2.21	0.49	80%
31[a]	10	2.68	0.66	80%
35	10	2.90	0.61	90%
39	12	2.90	0.38	83%
43	10	3.00	0.57	90%
50	8	2.60	0.59	88%
56	11	2.21	0.42	55%
62	10	2.65	0.50	90%
76	11	3.58	0.85	82%

Seven randomly selected geoduck samples were eliminated from dig station 27 to reduce the sample size from 17 to 10. Four randomly selected geoduck samples were eliminated from dig station 31 to reduce the sample size from 14 to 10. These samples were eliminated to reduce bias from "over-weighting" one sample over another

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Table 5. TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

Transect	Corrected Count	Show Factor [a]	Latitude [b]	Longitude [b]
1	144	0.54	47° 41.306	122° 33.961
2	143	0.54	47° 41.307	122° 33.997
3	170	0.54	47° 41.306	122° 34.032
4	172	0.54	47° 41.303	122° 34.069
5	222	0.54	47° 41.303	122° 34.104
6	244	0.54	47° 41.303	122° 34.142
7	140	0.75	47° 41.304	122° 34.181
8	344	0.49	47° 41.295	122° 34.251
9	260	0.49	47° 41.293	122° 34.257
10	223	0.49	47° 41.288	122° 34.301
11	179	0.49	47° 41.283	122° 34.337
12	105	0.49	47° 41.278	122° 34.374
13	58	0.49	47° 41.279	122° 34.407
14	58	0.49	47° 41.276	122° 34.445
15	202	0.49	47° 41.468	122° 33.993
16	196	0.49	47° 41.467	122° 34.028
17	282	0.49	47° 41.468	122° 34.064
18	229	0.49	47° 41.468	122° 34.100
19	157	0.49	47° 41.469	122° 34.136
20	202	0.49	47° 41.475	122° 34.173
21	33	0.48	47° 41.469	122° 34.550
22	15	0.48	47° 41.472	122° 34.510
23	17	0.48	47° 41.476	122° 34.476
24	42	0.48	47° 41.478	122° 34.441
25	193	0.48	47° 41.487	122° 34.408
26	239	0.48	47° 41.495	122° 34.374
27	229	0.48	47° 41.501	122° 34.339
28	15	0.48	47° 41.146	122° 33.925
29	129	0.48	47° 41.143	122° 33.960
30	166	0.48	47° 41.138	122° 33.996
31	168	0.48	47° 41.140	122° 34.033
32	235	0.48	47° 41.137	122° 34.070
33	268	0.48	47° 41.138	122° 34.107
34	299	0.48	47° 41.141	122° 34.144
35	129	0.48	47° 41.630	122° 34.503
36	114	0.48	47° 41.630	122° 34.472
37	160	0.48	47° 41.638	122° 34.437
38	165	0.70	47° 41.141	122° 34.181
39	152	0.70	47° 41.142	122° 34.217
40	179	0.70	47° 41.141	122° 34.253
41	131	0.70	47° 41.136	122° 34.292
42	125	0.70	47° 41.133	122° 34.327
43	77	0.70	47° 41.130	122° 34.363
44	53	0.70	47° 41.125	122° 34.402
45	36	0.70	47° 41.122	122° 34.438
46	40	0.70	47° 41.116	122° 34.475
47	40	0.70	47° 41.115	122° 34.512

Table 5. Continued

Transect	Corrected Count	Show Factor [a]	Latitude [b]	Longitude [b]
48	18	0.70	47° 40.979	122° 33.886
49	30	0.70	47° 40.974	122° 33.924
50	50	0.70	47° 40.976	122° 33.959
51	53	0.70	47° 40.974	122° 33.997
52	87	0.70	47° 40.974	122° 34.034
53	108	0.70	47° 40.973	122° 34.067
54	82	0.70	47° 40.967	122° 34.107
55	81	0.70	47° 40.964	122° 34.143
56	87	0.72	47° 40.962	122° 34.181
57	80	0.72	47° 40.963	122° 34.219
58	90	0.72	47° 40.962	122° 34.253
59	104	0.72	47° 40.962	122° 34.294
60	69	0.72	47° 40.963	122° 34.333
61	54	0.72	47° 40.962	122° 34.367
62	61	0.72	47° 40.960	122° 34.402
63	37	0.72	47° 40.961	122° 34.441
64	30	0.72	47° 40.958	122° 34.476
65	11	0.72	47° 40.956	122° 34.521
66	33	0.72	47° 40.956	122° 34.561
67	22	0.72	47° 40.952	122° 34.597
68	24	0.72	47° 40.954	122° 34.639
69	19	0.72	47° 40.957	122° 34.674
70	17	0.72	47° 40.957	122° 34.714
71	25	0.72	47° 41.108	122° 34.560
72	18	0.72	47° 41.106	122° 34.591
73	7	0.72	47° 41.105	122° 34.629
74	11	0.72	47° 41.103	122° 34.668
75	52	0.78	47° 41.637	122° 34.220
76	72	0.78	47° 41.631	122° 34.254
77	68	0.78	47° 41.621	122° 34.288
78	87	0.78	47° 41.623	122° 34.326
79	19	0.78	47° 41.276	122° 34.486
80	22	0.78	47° 41.278	122° 34.523
81	13	0.78	47° 41.276	122° 34.560

[a.] Show factor was used to correct combined geoduck counts
[b.] Latitude and longitude are in degrees and decimal minutes (NAD 27)

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Table 6. MOST COMMON AND OBVIOUS ANIMALS OBSERVED

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

# of Transects where Observed	Group	Common Name	Taxonomer
44	ANEMONE	BURROWING ANEMONE	*Pachycerianthus fimbriatus*
16	ANEMONE	PLUMED ANEMONE	*Metridium spp.*
3	ANEMONE	STRIPED ANEMONE	*Urticina spp.*
10	BIVALVE	HARDSHELL CLAMS	*Veneridae spp.*
2	BIVALVE	TRUNCATED MYA	*Mya truncata*
3	BIVALVE	FALSE GEODUCK	*Panomya spp.*
6	BIVALVE	HEART COCKLE	*Clinocardium nuttalli*
1	BIVALVE	HORSE MUSSEL	*Modiolus rectus*
1	BIVALVE	JINGLESHELL OYSTER	*Pododesmus macrochisma*
1	BIVALVE	PIDDOCK	*Unspecified Pholadidae*
1	BIVALVE	SPINY SCALLOP	*Chlamys hastata*
1	CEPHALOPOD	OCTOPUS	*Octopus or Enteroctopus spp.*
62	CNIDARIA	SEA WHIP	*Stylatula elongata*
60	CNIDARIA	SEA PEN	*Ptilosarcus gurneyi*
18	CRAB	DECORATOR CRAB	*Oregonia gracilis*
44	CRAB	HORSE CLAM	*Tresus spp.*
36	CRAB	HERMIT CRAB	Unspecified hermit crab
16	CRAB	DUNGENESS CRAB	*Cancer magister*
22	CRAB	RED ROCK CRAB	*Cancer productus*
34	CRAB	GRACEFUL CRAB	*Cancer gracilis*
3	CUCUMBER	SEA CUCUMBER	*Parastichopus californicus*
4	FISH	FISH	Unspecified Fish
11	FISH	STARRY FLOUNDER	*Platichthys stellatus*
11	FISH		*Citharichthys spp.*
56	FISH	FLATFISH	Unspecified flatfish
1	FISH	ROCK SOLE	*Lepidopsetta bilineata*
8	FISH	SCULPIN	Unspecified Cottidae
1	FISH	C-O SOLE	*Pleuronichthys coenosus*
1	FISH	LINGCOD	*Ophiodon elongatus*
1	FISH	CABEZON	*Scorpaenichthys marmoratus*
6	FISH	POACHER	Unspecified Agonidae
8	FISH EGGS	SKATE EGG CASE	*Raja spp. egg case*
15	GASTROPOD	MOON SNAIL EGGS	*Polinices lewisii egg case*
1	GASTROPOD	MOON SNAIL	*Polinices lewisii*
23	MISC	MYSIDS	Unspecified mysid
9	NUDIBRANCH	ROSY TRITONIA	*Tritonia diomedea*
16	NUDIBRANCH	ARMINA	*Armina californica*
1	NUDIBRANCH	DENDRONOTUS	*Dendronotus spp.*
9	NUDIBRANCH	NUDIBRANCH	Unspecified nudibranch
38	SEA STAR	SUNFLOWER STAR	*Pycnopodia helianthoides*
18	SEA STAR	SAND STAR	*Luidia foliolata*
68	SEA STAR	SHORT-SPINED STAR	*Pisaster brevispinus*
1	SEA STAR	SPINY STAR	*Hippasteria spinosa*
1	SEA STAR	BLOOD STAR	*Henricia leviuscula*
13	SEA STAR	LEATHER STAR	*Dermasterias imbricata*

Table 6. Continued

# of Transects where Observed	Group	Common Name	Taxonomer
54	SEA STAR	SUN STAR	*Solaster spp.*
8	SEA STAR	ROSE STAR	*Crossaster papposus*
30	SHRIMP	GHOST SHRIMP	Unspecified ghost shrimp
37	SHRIMP	SHRIMP	Unspecified shrimp
8	WORM	WORM	Unspecified Annelid worm
24	WORM	TEREBELLID TUBE WORM	*Terebellid spp.*
29	WORM	SABELLID TUBE WORM	*Sabellid spp.*
30	WORM	ROOTS	*Chaetopterid polychaete tubes*

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Table 7. MOST COMMON AND OBVIOUS ALGAE OBSERVED

Manzanita geoduck tract # 07000, 2008 WDFW pre-fishing survey.

# of Transects where observed	Taxonomer
5	Unspecified small mixed algae
37	Unspecified small red algae
58	*Laminaria spp.*
11	*Desmarestia spp.*

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