Chapter 3
Description of Activities

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Chapter 3. Description of Activities

Washington DNR's goal in developing the Aquatic Lands Habitat Conservation Plan is to provide a programmatic process for managing state-owned aquatic lands that meets both the applicable requirements of the Endangered Species Act, and DNR's duty to manage the lands in a way that achieves a balance of public benefits. This includes ensuring that there is no appreciable reduction in the likelihood of the survival or recovery of a covered species in the wild where incidental take or habitat degradation results from specific activities authorized by Washington DNR. The habitat conservation plan provides a programmatic method for habitat management on state-owned aquatic lands that supports the recovery of species, thereby reducing the risk of extinction.

Three general categories of authorized activities are included in the habitat conservation plan: shellfish aquaculture, log booming and storage, and overwater structures. Each category has an associated array of operations, as well as a geographic distribution of occurrence. This chapter provides brief descriptions of the activities that Washington DNR is requesting under an incidental take permit. The activities are described as they currently exist and operate prior to the implementation of the habitat conservation plan. For a description of the changes that would be made to the design and operation of these activities as a result of the implementation of the habitat conservation plan, see Chapter 5. A more detailed discussion of the current designs and operations of all of the activities authorized on state-owned aquatic lands may be found in the Potential Covered Activities Technical Paper (Washington DNR, 2005b).

3.1 Washington DNR's authority

The Washington State Legislature has delegated to Washington DNR proprietary authority over the state's aquatic lands. Washington DNR's management of aquatic lands is guided generally by the state constitution and by Title 79 (Public Lands) of the Revised Code of Washington (RCW), as well as by regulations promulgated by the Board of Natural Resources. State-owned aquatic lands are also subject to other statutes and regulations governing the management of all real property in Washington State. Specific authorities related to state-owned aquatic lands are listed in Table 3.1.

Table 3.1 Summary of statutory authority specifically associated with state-owned aquatic lands.

Chapter	Title	Content
RCW 79.105	Aquatic lands—General	Sets basic definitions and authorities for managing state-owned aquatic lands. Gives Washington DNR authority to sell, lease, and exchange certain aquatic lands, as well as the authority to sell valuable materials (*e.g.* sediment and geoducks) from those aquatic lands.
RCW 79.110	Aquatic lands—Easements and rights of way	Sets Washington DNR's authority to grant easements and rights-of-way for specific activities on and over the state's aquatic lands.
RCW 79.115	Aquatic lands—Harbor areas	Stipulates that harbor areas are to be established by the Board of Natural Resources. Harbor areas are to be reserved for navigation and commerce and for facilities that promote navigation and commerce (*e.g.* docks and wharves).
RCW 79.120	Aquatic lands—Waterways and streets	Stipulates that Washington DNR must plat waterways at the same time it establishes harbor areas. Waterways are generally reserved from sale or lease so they can remain free as public highways for watercraft.
RCW 79.125	Aquatic lands – Tidelands and shorelands	Sets Washington DNR's authority to lease tidelands and shorelands for a variety of uses. Also stipulates that Washington DNR may exchange these lands if such an exchange is in the public interest and of benefit to the state and prohibits sale of tidelands and first class shorelands except to public entities.
RCW 79.130	Aquatic lands—Beds of navigable waters	Sets Washington DNR's authority to lease (for up to 55 years) beds of navigable waters that lie waterward of the extreme low tide mark. Washington DNR may not, however, lease or grant authority for anyone to use aquatic lands that lie waterward of outer harbor lines.
RCW 79.135	Aquatic lands—Oysters, geoducks, shellfish, and other aquaculture uses	In coordination with the Washington Department of Fish and Wildlife and Washington Department of Health, sets Washington DNR's authority to lease lands for shellfish harvesting and aquaculture. The Washington Department of Fish and Wildlife regulates commercial shellfish growers and their harvesting, while the Washington Department of Health monitors beaches and shellfish tracts for pollution and other issues that affect human health. Also confirms Washington DNR's authority to sell geoducks as valuable materials and enter into agreements with the purchasers on the terms and conditions deemed necessary.
RCW 79.100	Derelict vessels	Gives Washington DNR and other public authorities certain powers to abate hazards posed by derelict vessels.
WAC 332-30	Aquatic land management	Defines rules for Washington DNR's land management.

Note: RCW = Revised Code of Washington; WAC = Washington Administrative Code

3.2 Shellfish aquaculture

The Washington Administrative Code (WAC) defines aquaculture as ". . . the culture and/or farming of food fish, shellfish, and other aquatic plants and animals in fresh water, brackish water, or salt water areas . . . ." (WAC 332-30-106). Washington DNR authorizes the use of state-owned intertidal and shallow subtidal lands in fulfillment of its duties to provide public benefits through the use of renewable resources and to foster uses of aquatic environments (RCW 79.105.030 and .050).

For the purposes of the habitat conservation plan, shellfish aquaculture includes the operations, facilities, and structures associated with the commercial planting and harvesting of shellfish that Washington DNR authorizes on state-owned aquatic lands. The harvesting of wildstock shellfish is not covered. Finfish aquaculture is a separate activity that is not covered by this habitat conservation plan.

3.2.1 Rationale for inclusion of shellfish aquaculture in the habitat conservation plan

Washington DNR selected shellfish aquaculture as a covered activity for the following reasons:

- The opportunity to improve ecosystem functions and support recovery of species. A condition of the incidental take permit under Section 10 requires improvements to habitat over the term of the agreement. The incidental take statement under Nationwide Permit 48, on the other hand, does not require improvements to habitat. The ability of Washington DNR to set limits or requirements for pesticide application on state-owned aquatic lands allows for greater protection of aquatic species and habitat. Pest management has the potential to result in take. One pesticide in particular, carbaryl, was determined by NOAA Fisheries to ". . . jeopardize the continued existence of [some] endangered or threatened species" (National Marine Fisheries Service, 2009b).
- Washington DNR retains a high degree of control over where shellfish aquaculture occurs on state-owned aquatic lands.
- Washington DNR is able to influence (through terms in an agreement) the methods used in shellfish aquaculture.
- All shellfish aquaculture activities occur (sometimes for continuous distances) in the intertidal and shallow sub-tidal areas, which are critical habitat for spawning, foraging, cover, and migration of covered species.

The requirements of the habitat conservation plan will be used for siting shellfish aquaculture operations and related facilities, designing structures and sites, operating and maintaining structures, and removing abandoned structures at the termination of a lease.

3.2.2 Legal framework for shellfish aquaculture

Washington DNR's authority

Section 79.105.050 of the Revised Code of Washington (WAC) obligates Washington DNR to ". . . Foster the commercial and recreational use of the aquatic environment for production of food, fiber, income, and public enjoyment from state-owned aquatic lands. . . ." The statute also states that ". . . the department may develop and improve production and harvesting of seaweeds and sea life attached to or growing on aquatic lands or contained in aquaculture containers . . . ."

In accordance with Washington Administrative Code, aquaculture is considered a water-dependent use, and, as such, it is a preferred use of state-owned aquatic lands (WAC 332-30-100). Table 3.1 lists the general authorities that apply to state-owned lands, while Table 3.2 lists authorities that are specifically related to aquaculture.

Table 3.2 Washington DNR's authority specifically related to shellfish aquaculture.

Law/Rule	Title	Content
RCW 79.105	Aquatic lands—General	Describes the general provisions; the use, sale, and lease provisions; the leasing and rental rates; and other management provisions for aquatic lands.
RCW 79.135	Aquatic lands—Oysters, geoducks, shellfish, other aquacultural uses, and marine aquatic plants	Describes the general provisions and laws for leasing aquatic lands for shellfish cultivation and other aquaculture.
WAC 332-30-106	Definitions	Defines aquaculture as the culture and/or farming of food fish, shellfish, and other aquatic plants and animals in fresh water, brackish water, or salt water areas. Aquaculture practices may include, but are not limited to, hatching, seeding or planting, cultivating, feeding, raising, harvesting of planted crops or of natural crops so as to maintain an optimum yield, and processing of aquatic plants or animals.
WAC 332-30-122	Aquatic land use authorization	Stipulates general requirements for authorizations; considerations for application review, rents, and fees; criteria for structures and improvements; and insurance, bonds, and security requirements.
WAC 332-30-128	Rent review	Stipulates rights of Washington DNR and lessees related to rents, and provides a process for requesting a rent review.

Law/Rule	Title	Content
WAC 332-30-157	Commercial clam harvesting	States conditions, boundaries, and methods by which commercial clam harvesting can occur under lease.

Note: RCW = Revised Code of Washington; WAC = Washington Administrative Code

Leases for shellfish aquaculture

Washington DNR authorizes shellfish aquaculture using a standardized lease agreement specific to the culture of oysters, clams, and mussels. Agreement terms, as recorded in Washington DNR's financial management database (NaturE), ranged from 3 to 39 years, with 10-year terms being most common, followed by 20-year terms, and then 15-year terms.

Regulatory oversight of shellfish aquaculture

The U.S. Army Corps of Engineers regulates shellfish aquaculture under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Table 3.3 outlines the regulatory entities involved, as well as their legal authority.

In 2007, the U.S. Army Corps of Engineers issued Nationwide Permit 48 for existing shellfish aquaculture sites. Nationwide Permit 48 was reissued in March 2012. This permit does not cover the use of pesticides or shellfish aquaculture operations established after the revision of the permit in March 2012. As part of their permitting process for actions that may affect a federally listed species or its designated critical habitat, the U.S. Army Corps of Engineers is required to initiate Endangered Species Act consultation with NOAA Fisheries and the U.S. Fish and Wildlife Service.

In 2009, the Seattle District of the U.S. Army Corps of Engineers initiated programmatic consultation with NOAA Fisheries and the U.S. Fish and Wildlife Service regarding Nationwide Permit 48. The biological assessment prepared for Nationwide Permit 48 in Washington State assessed impacts from an environmental baseline that included existing shellfish aquaculture. The biological opinions issued in 2009 by the U.S. Fish and Wildlife Service and NOAA Fisheries for the activities addressed under Nationwide Permit 48 in Washington State did identify adverse effects on listed species, but determined that the effects of shellfish aquaculture activities would not cause take, jeopardize listed species, or result in adverse modification of designated critical habitat (National Marine Fisheries Service, 2009a; United States Fish and Wildlife Service, 2009). The U.S. Army Corps of Engineers reinitiated consultation with the U.S. Fish and Wildlife Service in 2010 to address effects from methods of geoduck farming and harvesting and changes to bull trout critical habitat. This consultation resulted in a determination of no adverse modification (United States Fish and Wildlife Service, 2009). The U.S. Army Corps of Engineers must evaluate all nationwide permits every five years.

Nationwide Permit 48 authorizes existing commercial shellfish aquaculture activities. It also authorizes commercial shellfish aquaculture activities in new areas, provided that those activities have received a valid agreement from a state or local government agency and do not directly affect more than 1/2-acre of submerged aquatic vegetation beds (for example, eelgrass). Nationwide permits are re-authorized every five years. Standard or individual permits administered by the U.S. Army Corps of Engineers cover actions that do not meet the conditions of Nationwide Permit 48, but also typically expire within 10 years of issuance. For existing shellfish aquaculture, the U.S. Army Corps of Engineers has programmatic Endangered Species Act coverage until March 18,

2017, and not for the anticipated term of the habitat conservation plan. New operations require individual Endangered Species Act coordination.

Table 3.3 Regulatory oversight of shellfish aquaculture.

Agency	Permit, Approval, or Regulatory Requirement	Permit, Approval, or Regulatory Requirement Needed
Local city or county planning office	Shoreline substantial development permit, Shoreline conditional use permit, Shoreline variance permit. Some jurisdictions do not require shoreline permits for shellfish aquaculture.	All development/activities either within 200 feet of the shorelines of the state and above a set value, or meeting other criteria.
NOAA Fisheries	Marine Mammal Protection Act Marine Mammal Take Authorization	All projects affecting marine mammals.
U.S. Army Corps of Engineers	Rivers and Harbors Act Section 10 Permit	Construction in navigable waters. Nationwide Permit 48 available to existing aquaculture sites.
Environmental Protection Agency	Clean Water Act Section 404 Permit	Discharge of dredged or fill materials in navigable waters.
US Food and Drug Administration	Federal Food, Drug, and Cosmetic Act	Consumer protection of seafood.
Washington State Department of Ecology	Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) Permit	Regulates point and non-point sources of pollutants.
	Clean Water Act Section 401 Water Quality Certification	For all projects requiring a Section 401 permit, the state assesses whether the discharge being authorized will or will not violate state water quality standards.
	Shoreline Management Act	All development/activities within 200 feet of the shorelines of the state.
Washington Department of Fish and Wildlife	Commercial shellfish licenses	Licenses commercial shellfish harvesters. Through this licensing scheme, regulates the amount, methods, and location of harvest.
	Aquatic farm registrations	Requires registration for *aquatic farms*: Registration regulates the cultivation of aquatic *products* (*i.e.* shellfish) and requires detailed reports from aquatic farmers.
Washington State Department of Health	Shellfish growing area monitoring	Monitoring of shellfish beds for risks associated with human health.

Scope of shellfish aquaculture

The incidental take permit will cover existing and future shellfish aquaculture activities that are authorized by Washington DNR and approved. Existing agreements will be included at the time of renewal or amendment, and future agreements will be included at the time of signature.

3.2.3 Shellfish aquaculture: activity description

General description

Shellfish aquaculture techniques vary based on the species being grown, local site conditions, and the desired marketable product. For the purposes of this habitat conservation plan, a distinction is made between ground-based techniques and floating techniques. Existing ground-based aquaculture occurs in both the intertidal and subtidal areas and involves growing shellfish directly on or in the substrate (bottom culture), either in bags laid on racks or directly on the substrate (bag culture), or on longlines staked into the ground to raise the shellfish above the substrate (longline culture). Floating aquaculture involves placing shellfish in trays, baskets, or nets suspended from floats, rafts, or longlines so that they hang in the water column and remain suspended above the substrate during low tides.

Timing

Shellfish seeding occurs from early spring to late summer. Growth to maturity can take two to four years, depending on local conditions and the growing method. Because harvest is tailored to meet market demand, harvesting can occur at any time of the year.

Ground-based culture activities generally occur when tides are low enough to expose the culture bed. The lowest low tides (minus tides) typically occur for several days twice each lunar month, at the full moon and again at the new moon. These tides occur near midnight in December, near noon in June, and at corresponding intermediate times in the other months. In order to capitalize on the minus tides, some culture activities occur day and night (whenever the minus tides occur). During culture activities, workers or mechanical harvesters may be on the bed for three to six hours before tidelands re-flood an area.

Species cultured

Although the predominant shellfish species cultured on state-owned aquatic lands is the Pacific oyster (*Crassostrea gigas*), Washington DNR also leases land for culture of Manila clams (*Venerupis philippinarum*), littleneck clams (*Protothaca staminea*), butter clams (*Saxidomus gigantea*), Kumamoto oysters (*Crassostrea sikamea*), European flat oysters (*Ostrea edulis*), Olympia oysters (*Ostrea lurida*), Puget Sound blue mussels (*Mytilus trossulus*), and Mediterranean mussels (*Mytilus galloprovincialis*). Of the species cultured, only four are native: Olympia oysters, littleneck clams, butter clams, and Puget Sound blue mussels. Washington DNR has 11 total sites proposed for geoduck aquaculture located in Jefferson, Mason, Pierce and Thurston counties. Washington DNR anticipates entering into agreements for the culture of geoducks (*Panopea abrupta*) with existing applicants once all environmental review and permitting processes are complete.

Seed set

Methods for setting seed vary. Aquatic farmers use hatchery-produced seed for Mediterranean mussels, geoduck clams, and all other clam species. For Puget Sound blue mussels, aquatic farmers use natural seed set from older beds. Oysters are grown from both natural and hatchery seed.

Natural seed set is collected on bags of fragmented shell (cultch) or gravel and placed in the intertidal zone prior to the spawning season. The bags are laid directly onto the ground or placed on racks set on the ground. Once the shellfish larvae have set on the hard substrate and become spat, they are kept there until they reach a suitable size for planting (generally 0.6 to 1 centimeter or 0.2 to 0.4 inches). Hundreds to thousands of cultch bags are required to sustain commercial inventories.

Figure 3.1 Oyster bottom culture in Grays Harbor. Photo: Washington DNR

Hatcheries can be on-site or off-site. In hatcheries, adult shellfish are induced to spawn and the larvae are raised until they set and become spat. Oyster larvae are released into tanks to settle on the cultch, which is then removed and used as seed. Oyster seed can be sold as spat attached to cultch in mesh bags, or as spat attached to shell threaded on longlines. Clam larvae are allowed to set on screens. Clam seed is often sold by the bag. Mussel spat is sold on longlines. The spat of any shellfish species may be held in the middle to lower intertidal area for up to several months until they reach a suitable size for planting.

Spat size can also be increased by using a secondary nursery, or floating upweller system (FLUPSY), to take advantage of naturally occurring algal food sources. Floating upweller systems are generally located in water deeper than 6 meters (20 feet) to eliminate variations in food supplies associated with tidal movements and to minimize impacts on aquatic vegetation. Shellfish spat are placed in bins, which are lowered into a floating frame called a silo and suspended in the seawater. Several bins are placed in a row on either side of a centrally enclosed channel that ends at a paddlewheel or pump that circulates the water past the shellfish. The water flow is constant, so the spat feed constantly. Once the juvenile shellfish reach a suitable size, they are transplanted to a grow-out site.

With few exceptions, an aquaculture leaseholder will not be allowed to transfer or import shellfish marine organisms, shellfish aquaculture products, or shellfish aquaculture equipment, unless the leaseholder has first obtained a permit through the Washington Department of Fish and Wildlife. To reduce the introduction of disease or pests into Washington state waters, permits may be approved with conditions, or denied—depending on the possible risk factors. (WAC 220-72-076)

Types of culture proposed for coverage

Ground-based culture

Bottom culture

Bottom culture involves growing clams or oysters (or both) directly on or in the substrate of intertidal areas, typically between tidal elevation +0.6 and -0.6 meters (+ 2 and -2 feet; Figure 3.1).

Site preparation

Oyster beds are typically laid out in the intertidal areas, as allowed by sloughs or channels, to capitalize on natural nutrient flow patterns. Prior to planting a new crop of oysters, workers prepare the beds by removing remaining shellfish, built-up mud, organic debris, rocks, and predators, such as native sea stars (Asteroidea),the native moon snail (*Polinices lewisii*), and the two introduced snails—the eastern oyster drill (*Urosalpinx cinerea*) and the Japanese oyster drill (*Ocinebrellus inornatus*). Grading of the site is done either by hand, or with a hydraulic dredge. Beds may also be harrowed. The harrow is a skidder with tines towed along the substrate by a boat when the bed is submerged.

For clam culture, the substrate may be enhanced by using a pump and high pressure hose to spray crushed shell, washed gravel, or a combination of the two (called frosting) from the deck of a barge when the bed is submerged. Several passes are made over the bed when applying the material to ensure even distribution. Some of these activities can be repeated on a plot several times a year.

Seeding

After the bed is prepared, it is seeded with shellfish spat. Seeding methods vary by species and by site-specific factors, such as predator occurrence and weather conditions. Some oyster beds are seeded by spraying spat attached to cultch from the deck of barges when the bed is submerged, or evenly dispersing them by hand during minus tides. In other cases, lessees rely solely on the natural set of oyster seed onto existing beds.

Seeding may occur at any time during the year to meet a particular shellfish grower's needs. Seeded cultch or larger natural catch seed is normally planted onto an oyster bed anytime between February and October. Oyster shell for natural recruitment is normally placed when natural recruitment conditions are optimal (July and August).

Older clam beds are often seeded through natural seed set, but some beds require seeding of hatchery spat. After each growing season, clam beds are typically surveyed during low tides to assess seed survival and distribution and to estimate future harvest yield. If additional clam seed is required, it can be spread by hand onto exposed substrate at low tide, during an incoming tide when the water is approximately 10 centimeters (4 inches) deep, or during an outgoing tide when the water is approximately 0.6 to 1 meter (2 to 3 feet) deep. Seed can also be spread from a boat at high tide. Anti-predator netting is spread over the bed after seeding to exclude crabs, moon snails, and diving ducks. Clam growers may remove the predator netting over the clam beds a few days to a few weeks later, when the clams have burrowed into the substrate sufficiently to avoid most predators.

Grow-out

During oyster grow-out, oyster beds undergo periodic raking by hand or by mechanical harrowing to maintain the even distribution of oysters on the plot and avoid reduction in size through overcrowding. Oysters may also be dredged up and moved to an area of higher food resources to improve growth rates. In areas where the substrate is soft, the oysters may sink into the mud either due to their own weight, or as a result of bioturbation[1] by ghost shrimp (*Neotrypaea californiensis*) or blue mud shrimp (*Upogebia pugettensis*). Oysters must stay on the surface to survive, so such beds are harrowed periodically to pull the oysters back to the surface. Harrowing may be done at any time of the year, depending on the needs of the crop, but most often occurs between February and May. Clams are allowed to bury themselves and are left buried to grow out for 1.5 to 4 years.

Harvest

The harvest of bottom cultured oysters is done by hand or mechanically. Hand harvest occurs during minus tides, with workers either picking the oysters by hand, or loosening them with rakes. Crews deposit the oysters in bushel-sized containers (Figure 3.2) that are periodically emptied into larger containers (15 to 20 bushels) equipped with ropes and buoys to allow them to be lifted with a boom crane onto the deck of a barge at high tide. Smaller containers are sometimes placed or dumped on the decks of grounded scows[2] for retrieval at high tide or are carried off the beach at low tide. Single oysters are often hand harvested into mesh bags or baskets to minimize handling and damage to shells.

Figure 3.2 Hand harvest of bottom cultured oysters in Grays Harbor. Photo: Washington DNR

Mechanical harvest by a dredge harvester or a hydraulic harvester occurs when beds are submerged. Dredge harvest boats use a boom crane or hydraulic winch to lower a bag dredge onto the bed. Bag dredges have a leading edge (blade) consisting of a steel frame with teeth and a steel mesh collection bag attached to the frame. The dredge is towed across the surface of the substrate, loosening and pulling up the shellfish and guiding them into the bag. The bag is then lifted onto the boat deck, emptied and redeployed (Figure 3.3). Generally, two bag dredges are deployed by each boat, one off each side.

[1] The displacement and mixing of sediment particles by benthic animals and plants.

[2] A flat-bottomed boat with a blunt bow that can navigate in shallow waters and can be beached for loading and unloading.

Hydraulic harvesters, or escalator dredges, consist of a generator, operating controls, and hydraulic apparatus mounted on a floating barge or platform that is towed through the water. The hydraulic apparatus contains a conveyor belt system and an arm with a water jet and rollers extending below the water surface to the substrate. Hydraulic harvesters are used to harvest large quantities of oysters and are most appropriate for harvesting larger oysters. Smaller oysters and oysters less than three years old, as well as residual shells, are screened out mechanically and returned to the bottom.

Mechanical harvest often takes place in the fall, winter, and early spring, when the minus tides occur at night, but it can take place year round. Mechanical harvest typically occurs two to four hours per day and three to four days per week. Hand harvesting occurs in spring, summer, and early fall, when the minus tides occur during the day.

Clams are usually hand harvested during low tide using a clam rake. Depending on the level of productivity of the beds, multiple ages of clams may be in the ground, and undersized clams are left in beds for future harvests. Market-size clams are put in buckets, bagged, tagged, and transported to processing plants. Harvesting may occur annually, or as infrequently as once every four years.

Clams can also be mechanically harvested using a specialized piece of equipment called a clam harvester that rakes up the clams with spinning, circular rakes and sieves out the gravel. Clam harvesters can be as large as a boat and float on the water over the clam beds at high tides, or they can be as small as a rototiller and be pushed over the clam beds at low tides.

Figure 3.3 Mechanical harvest of bottom cultured oysters in Willapa Bay. Photo: Washington DNR

Bag culture

In ground-based bag culture, shellfish are contained within semi-rigid mesh bags placed directly onto the ground (Figure 3.4) or laid on rebar racks designed to hold four bags at a time (Figure 3.5). Shellfish grown in bags are protected from predators. Clams and oysters are grown with this method. Juvenile oysters are put into spat bags, which are then put into the mesh bags. Larger oysters are put directly in the mesh bags. Clam seed is placed into the bags and sediment is allowed to penetrate the bags and cover the clam seed.

Figure 3.4 Shellfish bags on the substrate in Totten Inlet. Photo: Washington DNR

Site preparation

Beds are prepared during low tides by removing organic debris, rocks, and predators (such as sea stars, moon snails, and two species of oyster drills). In some cases, operators broadcast crushed oyster shells, gravel, or a combination of the two onto the site to harden the ground (frosting). The growing plot may be marked with stakes. Some operators install longlines and polyvinyl chloride (PVC) pipe or metal stakes on the bed to secure the bags. Alternatively, trenches 5 to 10 centimeters (2 to 4 inches) deep can be dug to provide a more secure foundation for the bags.

Seeding

Seed is placed in reusable, semi-rigid plastic mesh bags closed with plastic ties or galvanized metal rings. Bags are typically 0.6 by 1 meter (2 by 3 feet) in size and have mesh openings measuring 0.3 to 2.5 centimeters (0.1 to 1 inch). Substrate consisting of pea gravel and shell fragments may be added to the bags. Oyster bags laid directly on the substrate may be anchored with metal stakes or attached to a line that is anchored to the substrate. Clam bags are placed in shallow trenches and allowed to work into the substrate.

Figure 3.5 Shellfish bags on racks in Grays Harbor. Photo: Washington DNR

Grow-out

The shellfish are allowed to grow out in the bags. The bags are checked periodically during low tides to ensure that they remain secured to the bottom and may be turned as often as every two weeks to control fouling of the upper mesh surface and to optimize growth. Oysters may be periodically redistributed among bags to reduce their density, and bags of progressively larger mesh size may be substituted.

Harvest

Oyster and clam bags are harvested by hand. Bags can be loaded into a boat when beds are submerged by hooking them with a rake and pulling them on board. Alternatively, during low tides, a wheelbarrow can be used to transport the bags to shore.

Longline culture

In longline culture, oysters are grown in clusters on rope lines suspended one meter (3 feet) or less off the bottom between upright stakes of PVC or metal pipe (Figure 3.6). The longlines keep the oysters from sinking into soft substrates and protect them from benthic pests and predators.

Site preparation

Prior to planting (or replanting) oyster longlines, operators use hand tools to level off areas where silt has built up and remove from the lines any remaining oysters from the previous harvest. They prepare the site by removing organic debris, rocks, sand dollars (Clypeasteroida), and predators, such as sea stars, moon snails, and two species of oyster drill. If the longline pipes or stakes were removed to make it easier to clean and level the site, they are reinstalled. These actions are performed by hand during low tides.

Seeding

Polypropylene or nylon lines are extended between the pipes or stakes, and a piece of seeded oyster cultch is attached roughly every 0.3 meters (1 foot).

Grow-out

The oysters are grown out over two to three years. The longline system is checked periodically during low tides to ensure that the lines remain secured to the pipes and that the pipes remain in place.

Figure 3.6 Oyster longline culture in Grays Harbor. Photo: Washington DNR

Harvest

Longline-cultured oysters are harvested by hand or mechanically. Hand harvest entails cutting the clusters of oysters off the lines at low tide and placing them in harvest tubs. Large tubs are equipped with buoys for retrieval at a higher tide by a vessel equipped with a boom crane or hydraulic hoist. Small tubs are carried off the bed by hand.

With mechanical harvesting, buoys are attached at intervals along the lines at low tide. On a high tide, the buoys are hooked to a special reel mounted on a vessel that pulls the lines off the pipes and reels them onto the boat. Once on the boat, the oyster clusters are cut from the lines.

Geoduck aquaculture

In 2003, the Washington State Legislature directed Washington DNR to develop a pilot project to assess the feasibility of conducting geoduck aquaculture on state-owned aquatic lands. In 2005, a report responding to this direction was presented by Washington DNR to the legislature. The report recommended limited leasing for the activity, requested a statute revision regarding the sale of geoduck aquaculture product, and requested funding for further research. The legislature accepted the recommendation to move forward on geoduck aquaculture leasing and revised the statute; however, funding was not granted for further research.

Washington DNR went ahead with the program and, in June 2006, advertised an initial request for offers to lease state-owned aquatic lands for geoduck aquaculture. A second competitive bidding process was advertised in October 2007. Proponents submitted applications describing how they

proposed to conduct operations; Washington DNR scored the applications and selected potential lessees.

Washington DNR originally intended to lease 10 hectares (25 acres) of state-owned aquatic lands per year for 10 years, up to a maximum of 101 hectares (250 acres) under lease at any one time. However, the 2007 Legislature directed Washington DNR to lease no more than 6 hectares (15 acres) per year for this activity through 2013. All present sites under consideration for authorized geoduck aquaculture on state-owned aquatic lands were selected using the following criteria:

A preference for no adjacent residential development.

- A preference for high bank.
- Suitable substrate sediment.
- Absence of eelgrass.
- Low natural stock densities of shellfish.
- Low recreational or tribal shellfish use.
- More than 61 meters (200 feet) from wild geoduck tracts.
- Approved or potential to be approved for health certification.

Washington DNR has 11 total sites proposed for geoduck aquaculture located in Jefferson, Mason, Pierce and Thurston counties. Washington DNR anticipates entering into agreements for the culture of geoducks (*Panopea abrupta*) with existing applicants once all environmental review and permitting processes are complete.

Site preparation

Geoduck aquaculture generally takes place between -0.6 and + 0.6 meters (-0.0 and +2.0 feet) mean lower low water (MLLW). Bed preparation may include removing organic debris, rocks, mussel mats, and other marine species that would compete with the geoducks. Anti-predator PVC tubes are then inserted into the substrate. The tubes are generally 22 centimeters (8.5 inches) long and 10 to 15 centimeters (4 to 6 inches) in diameter. They are worked 15 centimeters (6 inches) into the substrate during low tide, leaving 7 to 8 centimeters (2.5 to 3 inches) of the tube above the surface of the substrate. Insertion of the tubes is done by stomping them in by foot or with a hydraulic tube planter that uses a jet of water powered by a gasoline engine to ease the insertion process (Davis, 2004). The tubes are placed 31 to 46 centimeters (12 to 18 inches) apart in rows for a typical density of 40,000 tubes per 0.4 hectare (1 acre). (Figure 3.7)

Seeding

Geoduck seed obtained from a hatchery is often acclimated to local site conditions prior to planting. Once the geoduck spat has acclimated, seeding into the PVC tubes takes place by manually placing two to four seed geoducks in each tube for a typical density of 80,000 to 160,000 geoduck seeds per 0.4 hectare (1 acre). Once the seeds have been placed in the tubes, the top of each tube is covered with a small piece of netting secured in place with a rubber band. Alternatively, the entire bed may be covered with large pieces of anti-predator canopy nets anchored at the edges. In some cases, the individual coverings and the canopy nets are both applied.

Grow-out

The tubes and netting remain in place for six months to three years (the duration is based on pressure from predator species) to allow the young clams to burrow into the substrate to a depth adequate to evade predators. The tubes and netting are then removed. Netting that becomes fouled prior to removal may be replaced with new netting.

Figure 3.7 Geoduck farm in Zangle Cove. Photo: Washington DNR

The geoducks are left to grow to a marketable size (about 2 pounds) for an additional four to seven years. By the time they are harvested, they may be as far as 1 meter (3 feet) down in the substrate.

Harvest

Geoducks are harvested either at low tide by harvesters on the beach, or at high tide by divers. Individual geoducks are extracted by loosening the substrate around each clam using pressurized seawater (about 20 gallons per minute delivered at about 40 pounds per square inch) via a water jet (a hose fitted with a nozzle). (Figure 3.8)

Water pumps powered by gasoline engines are used to operate the pressurized water hose. These water pumps are located in boats near the area under harvest. The water intakes are fitted with screens to prevent fish from getting trapped, and pumps are often encased to dampen the noise. Harvesters create temporary depressions of varying depths and harvest in an up-slope direction to allow the water from the pressure hose to flow away behind them (Davis, 2004).

Floating culture

In floating culture, mussels are grown on longlines suspended from rafts (Figure 3.9), and oysters are grown on longlines suspended from rafts or placed in trays, baskets, or nets suspended from floats or rafts so that they hang below the surface of the water.

Figure 3.8 Geoduck harvest in Totten Inlet. Photo: Washington DNR

Mussel and oyster rafts are generally constructed of floating steel frames with wood poles (pole rafts) or ropes (rope rafts) laid in rows across the top of the frame. The poles or ropes are hung at approximately 40-centimeter (16-inch) intervals with 6-meter (20-foot) long ropes with shellfish attached. Rafts generally range in size from 10 meters (33 feet) square (rope rafts) to 12 meters (39 feet) square (pole rafts) and are typically clustered together in groups of two or three. A single pole raft can support 660 longlines, and a single rope raft can support 480 longlines. Anti-predator nets are hung around the edges of both types of raft to exclude diving ducks. These nets are continually in place.

Figure 3.9 Floating mussel culture on Penn Cove. Photo: Washington DNR

Site preparation
Prior to reseeding the rafts, mussel growers clean and repair them. This is done in late March and early April, just before mussel spawning begins. Mussel growers who will be

using natural seed set hang coiled 6-meter (20-foot) long seed collector lines from the mussel rafts at intervals of approximately 40 centimeters (16 inches).

Seeding
On mussel rafts that use natural seed set, mussel larvae set on the coiled longlines in May and grow to a visible size by August. At that point, the coiled lines are uncoiled for grow-out. Mussel growers who use hatchery seed acquire the seed on longlines encased in tubular cotton or plastic mesh "socks" to hold the spat onto the longline. The sock rots away, but not until the mussel spat have adhered to the longline. The encased longlines are hung from the ropes or poles at intervals of approximately 40 centimeters (16 inches). Oyster growers who use hatchery seed for trays, baskets, and net grow-out methods acquire the seed on cultch; for longline rafts, they acquire the seed on longlines encased in socks or as cultch strung on longlines.

Grow-out
Approximately three weeks after setting out new longlines, round disks that are 20 centimeters (8 inches) in diameter are added to each longline at 40-centimeter (16-inch) intervals to help prevent shellfish from falling off. Anti-predator netting below the water excludes diving ducks and marine mammals. Mussels are grown for approximately one year and are harvested when they have reached a shell length of 5 to 6 centimeters (2 to 2.5 inches). Oysters are harvested after 15 to 18 months and sold as specialty oysters, due to their small size, or are transferred to growth plots in bottom culture areas for another growing season.

Harvest
Oyster and mussel rafts are harvested either by pulling in the longlines using a boat equipped with a hoist and winch, or by maneuvering a sink float underneath the raft, cutting the longlines, and allowing them to fall onto the sink float.

3.2.4 Activities interrelated with shellfish aquaculture

Pesticide use

Carbaryl (Sevin™) has been used for more than 30 years to control ghost and blue mud shrimp populations in areas of oyster cultivation in Willapa Bay and Grays Harbor (Dumbauld et al., 2001; Feldman et al., 2000). Carbaryl is applied by spraying it as a soluble powder onto the intertidal area during low tides. Spraying is done by helicopter or by hand. Carbaryl is a neurotoxin that targets insects, crabs, and shrimp and causes paralysis and death. It breaks down into 1-napthol, which is toxic to fish and mollusks (Stonick, 1999). The use of carbaryl is regulated by the Washington State Department of Ecology through a National Pollutant Discharge Elimination System (NPDES) permit that is issued directly to the Willapa Bay/Grays Harbor Oyster Growers Association. The current NPDES permit contains the provision that no more than 243 hectares (600 acres) in Willapa Bay and no more than 81 hectares (200 acres) in Grays Harbor will be treated with carbaryl in any given year.

In 2009, NOAA Fisheries found that carbaryl application caused jeopardy to species listed as threatened under the Endangered Species Act (National Marine Fisheries Service, 2009b). In addition, the use of carbaryl was scheduled to be phased out by the end of 2012 as a result of a

litigated settlement agreement. The NPDES permit from the Department of Ecology to apply carbaryl does not consider the 2009 NOAA findings regarding the potential for impacts to ESA listed species and continues to be valid.

Removal of fouling material

Fouling occurs when invertebrates or algae attach themselves to shellfish or equipment. Fouling can seriously affect the growth and survival of shellfish by blocking water flow. The main fouling organisms include sponges, tunicates, mussels, algae, and barnacles. These organisms are most commonly removed by scraping or scrubbing the bags and equipment with sea water on site. Alternatively, the fouled equipment is sometimes moved upland to dry out, and the fouling is then removed.

Supporting structures

Some aquaculture sites also include supporting structures, such as docks, mooring buoys, bulkheads, bank armoring, and nearshore buildings associated with the transfer and processing of shellfish. These supporting structures are discussed in Section 3 (Overwater Structures) of this chapter.

Vessels and vehicles

Barges, scows, and other vessels are used in support of harvest operations to access beds from the water and to collect and transport the harvested shellfish. All-terrain vehicles (ATVs) may be used to access sites during low tides.

3.2.5 Spatial extent of shellfish aquaculture

In March 2013, Washington DNR had a combined total of 111 agreements and applications for shellfish aquaculture in 10 counties (Table 3.4), encumbering approximately 834.07 hectares (2,059.17 acres) of state-owned aquatic lands. These activities occur in the Northwest Coast and Puget Trough ecoregions. In order to predict how this activity might expand in the future, current agreement numbers from Washington DNR and population projections from the Washington State Department of Commerce were used to calculate an estimate in each ecoregion where the activity is currently present. By 2040, for shellfish aquaculture, Washington DNR estimates an additional eight new agreements in the Northwest Coast ecoregion and seven new agreements in the Puget Trough ecoregion.

Table 3.4 Shellfish aquaculture agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Northwest Coast	Clallam	6
	Grays Harbor	16
	Jefferson	16
	Pacific	48
Puget Trough	Island	1
	Kitsap	1
	Mason	16
	San Juan	6
	Whatcom	1
Total Agreements		**111**

Ground-based culture

Clams

As of March 2013, Washington DNR is managing 16 shellfish aquaculture agreements for clams encumbering 38 hectares (94 acres) of state-owned aquatic lands. These activities occur in the Northwest Coast and Puget Trough ecoregions including Willapa Bay, Hood Canal, South Puget Sound, and Strait of Juan de Fuca waterbodies (Table 3.5).

Table 3.5 Clam agreements (ground-based) by ecoregion and waterbody.

Ecoregion	Waterbody	Number of Agreements	Hectares (Acres) Encumbered
Northwest Coast	Willapa Bay	1	11ha (27ac)
Puget Trough	Hood Canal	6	21ha (52ac)
	South Puget Sound	4	2ha (6ac)
	Strait of Juan de Fuca	5	4ha (9ac)

Oysters

As of March 2013, DNR is managing 81 ground-based culture agreements for oysters encumbering 736 hectares (1,816 acres) of state-owned aquatic lands. These activities occur in the Northwest Coast and Puget Trough ecoregions including Grays Harbor, Willapa Bay, Hood Canal, South Puget Sound, San Juan, and Strait of Juan de Fuca waterbodies (Table 3.6).

Table 3.6 Oyster agreements (ground-based) by ecoregion and waterbody.

Ecoregion	Waterbody	Number of Agreements	Hectares (Acres) Encumbered
Northwest Coast	Grays Harbor	16	188ha (463ac)
	Willapa Bay	46	430ha (1,063ac)
Puget Trough	Hood Canal	9	70ha (174ac)
	South Puget Sound	5	3ha (8ac)
	San Juan	2	5ha (11ac)
	Strait of Juan de Fuca	3	40ha (98ac)

Geoduck aquaculture

Washington DNR has 11 total sites proposed for geoduck aquaculture located in Jefferson, Mason, Pierce and Thurston counties. Washington DNR anticipates entering into agreements for the culture of geoducks (*Panopea abrupta*) with existing applicants once all environmental review and permitting processes are complete.

Table 3.7 Geoduck applications by ecoregion and waterbody.

Ecoregion	Waterbody	Number of Agreements	Hectares (Acres) Encumbered
Puget Trough	Hood Canal	3	unknown
	South Puget Sound	8	unknown

Floating culture

Mussels

As of March 2013, there were 8 shellfish aquaculture agreements for mussels encumbering 34 hectares (85 acres) of state-owned aquatic lands. These activities occur only in the Puget Trough ecoregion including Hood Canal, South Puget Sound, and San Juan waterbodies (Table 3.8).

Table 3.8 Mussel agreements by ecoregion and waterbody.

Ecoregion	Waterbody	Number of Agreements	Hectares (Acres) Encumbered
Puget Trough	Hood Canal	1	2ha (6ac)
	South Puget Sound	5	28ha (70ac)
	San Juan	2	4ha (9ac)

Oysters

As of March 2013, DNR was managing six floating-culture agreements for oysters encumbering 26.07 hectares (64.17 acres) of state-owned aquatic lands. These activities occur in the Northwest Coast and Puget Trough ecoregions including Willapa Bay, Hood Canal, South Puget Sound, and San Juan waterbodies (Table 3.9).

Table 3.9 Oyster agreements (floating) by ecoregion and waterbody.

Ecoregion	Waterbody	Number of Agreements	Hectares (Acres) Encumbered
Northwest Coast	Willapa Bay	1	13ha (31ac)
Puget Trough	Hood Canal	1	4ha (10ac)
	South Puget Sound	2	0.07ha (0.17ac)
	San Juan	2	9ha (23ac)

3.3 Log booming and storage

Section 79.105.060 of the Revised Code of Washington (RCW) defines log booming as "… placing logs into and taking them out of the water, assembling and disassembling log rafts before or after their movement in water-borne commerce . . . ." The definition includes water-based sorting and temporary holding of the logs. The same section also defines log storage as ". . . the water storage of logs in rafts or otherwise prepared for shipment in water-borne commerce . . . ." Log booming is also defined as a water-dependent use (WAC 332-30-145(7)) and, as a result, is a preferred use of state-owned aquatic lands.

The use of aquatic lands for these activities occurs as part of larger commercial logging operations. Because the two activities are closely related, Washington DNR frequently combines them into a single agreement.

3.3.1 Rationale for inclusion in the habitat conservation plan

Log booming and storage was selected as a covered activity for the following reasons:

- There are no federal permitting requirements for existing sites, which means no oversight via Endangered Species Act Section 7 consultation. Installation of new log booms will require a permit from the U.S. Army Corps of Engineers, which triggers Endangered Species Act Section 7 consultation, but this does not cover the lifespan of the operation or agreement.
- The potential for impacts is associated with loss of benthic habitats due to effects of shading, debris piles, water quality impairment, and dredge activities. Washington DNR retains a high degree of control over where log booming and storage occurs on the landscape.
- Washington DNR has the ability to influence log booming and storage operations through terms in an agreement.

3.3.2 Legal framework for log booming and storage

Washington DNR's authority

Log booming is defined as a water-dependent use and is therefore a preferred use of state-owned aquatic lands (WAC 332-30-145). The general authorities are listed in Table 3.1; Table 3.10 lists authorities that apply specifically to log booming and storage.

Table 3.10 Washington DNR's authority specifically related to log booming and storage.

Law/Rule	Title	Content
RCW 79.105.060(9),(10)	Definitions	Defines log storage and booming.
RCW 79.105.250	Log storage rents	Specifies log storage rents.
RCW 79.125.220	Second-class tidelands or shorelands—Lease for booming purposes	Defines the circumstances under which Washington DNR can lease second-class tidelands or shorelands for booming purposes and the duties and liabilities imposed on lessees.
RCW 79.125.410; RCW 79.130.010(2)	First-class unplatted tidelands and shorelands—Lease preference right to upland owners—Lease for booming purposes	Describes when first-class tidelands may be leased to the abutting upland owner and when they may be leased to others for booming purposes. In case the abutting tidelands or shorelands or the abutting uplands are not improved or occupied for residential or commercial purposes, Washington DNR may lease the beds to any person for a period not exceeding ten years for booming purposes
WAC 332-30-145	Booming, rafting, and storage of logs	Defines the requirements for log booming and storage activities authorized by Washington DNR.

Note: RCW = Revised Code of Washington; WAC = Washington Administrative Code

Leases for log booming and storage

Log booming and storage is authorized through a lease specific to the activity. Terms of agreement—as recorded in Washington DNR's financial management database (NaturE)—ranged from 5 to 100-plus years, with 10-year terms being the most frequent, followed by 15-year terms, and then 30-year terms.

Regulatory oversight of log booming and storage

Regulatory oversight for existing log booming and storage sites on state-owned aquatic lands is limited to those actions associated with spills and clean-up of debris and contamination, with new in-water structures required to obtain regulatory permits for construction (Table 3.11).

Table 3.11. Regulatory oversight of log booming and storage.

Agency	Permit, Approval, or Regulatory Requirement	Permit, Approval, or Regulatory Requirement Needed
Local city or county planning office	Shoreline substantial development permit, shoreline conditional use permit, shoreline variance permit	All development/activities either within 200 feet of the shorelines of the state and above a set value, or meeting other criteria.
U.S. Coast Guard	Regulation of navigation under 14 U.S. Code §§ 1 et seq.	Location of rafts in or near navigational channels.
U.S. Army Corps of Engineers	Regulation of navigation under 14 U.S. Code §§ 1 et seq.	Location of rafts in or near navigational channels.
The Environmental Protection Agency	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Consent Decree	Contaminated sediment cleanup and remediation activities under federal jurisdiction.
Washington State Department of Ecology	Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) Permit	Point and non-point sources of pollutants that discharge into waters of the state from log handling both in the water, and in the log handling area of the site (runoff).
	Model Toxics Control Act (MTCA) Policy Advisory Committee	Cleanup for contaminated sediments.
	Shoreline Management Act	All development and activities within 200 feet of the shorelines of the state.
Washington Department of Fish and Wildlife	Washington Hydraulic Code Hydraulic Project Approval (HPA)	Construction or other work that affects the bed or flow of waters of the state.

Scope of log booming and storage

For the purposes of this habitat conservation plan, log booming and storage includes the operations, facilities, and structures associated with in-water handling, sorting, and storage of commercial timber logs that Washington DNR authorizes on state-owned aquatic lands. The scope of covered log booming and storage activities includes agreements in existence at the time that the incidental take permit is signed and all future log booming and storage agreements that are signed during the term of the permit. Existing agreements will be included at the time of renewal or amendment, and future log booming and storage agreements will be included at the time of

signature. The transportation of logs by using a tug boat or other vessel to tow rafts of log bundles, flat log rafts, or barges loaded with logs is not in Washington DNR's jurisdiction and is not included as part of the covered activity.

3.3.3 Log booming and storage: activity description

Log booming

Log booming involves placing individual logs or secured bundles of logs into the water or removing them from the water using heavy machinery, sorting them, and assembling rafts for in-water transport or in-water storage. Companies that lease state-owned aquatic lands for this activity may have log shipments arriving on trucks at an upland facility or delivered by ships or barges. Logs arriving on land are placed into the leased area from shore at designated transfer sites using ground-based machinery (Figure 3.11). This loader has its engine situated on the back of the unit, which lowers the risk that the machine will pollute the water with fuel when the front end enters the water to pick up or remove log bundles. Logs that are brought into the leased area by water on barges are transferred into the water using cranes or hoists mounted on the barges.

Figure 3.11. Loading logs at Port Angeles Harbor. Photo: Washington DNR

Many log booming facilities bundle logs prior to putting them in the water. Logs can be bundled prior to transport on trucks, or they can be transported loose and then bundled on land prior to in-water storage. Other facilities bundle logs in the water. Log bundles are held with wire, cable, or metal bands (Figure 3.12).

The number of logs in a bundle ranges from three to dozens and depends on the diameter of the logs. An average bundle size is 35 logs, assuming logs are approximately 20 centimeters (8 inches) in diameter. An average bundle is 2 meters (6 feet) in diameter and about 12 meters (39 feet) long. A log raft is made up of anywhere from 20 to 70 bundles, or 700 to 2,450 total logs.

Figure 3.12 Boomed logs on Hylebos Waterway. Photo: Washington DNR

Log storage

Log storage refers to temporarily holding logs, log bundles, or log rafts in designated areas either after sorting and raft assembly and prior to transportation, or after transportation and prior to removal for processing (Figure 3.13). The volume of logs in a storage area at any one time varies and is influenced by the timing of log deliveries, changes in timber market conditions, the size of the overall operation, and other economic factors, but there are generally some logs being stored at all times. Individual log bundles may remain in a storage area for three months to a year.

Storage times are shorter in saltwater if there is a known presence of shipworms (*Bankia setacea*), or teredos (*Teredos spp*.), at the site. Shipworms, or teredos, are worm-like, wood-boring bivalves that ingest submerged, untreated wood. Their presence varies according to local environmental conditions, such as dissolved oxygen levels and salinity. Where teredos are thought to occur, the logs are generally not stored longer than a few weeks.

Figure 3.13. Log storage on Hylebos Waterway. Photo: Washington DNR

Containment booms are used to hold stored logs. They are made of floating logs chained or cabled to each other and chained to pilings or to an anchor at either end (Figure 3.14). Within a configuration of pilings in a leased area, the containment booms are used to create sections that allow for sorting of log shipments by species, receiver, or purchaser. Most containment booms are not anchored to the bottom, so the configuration can be easily changed as needed.

State-owned aquatic lands that are leased for log storage are generally in the vicinity of shipping ports and lumber processing plants, but this is not always the case. For example, there are authorized sites in the vicinity of timber harvest areas to facilitate in-water holding and sorting before transport to a mill or other destination.

Figure 3.14. Containment boom on Commencement Bay. Photo: Washington DNR

3.3.4 Log booming and storage: interrelated activities

Supporting structures

Log booming and storage activities may require docks for the vessels that are used to manipulate and transfer logs, ramps to aid in the delivery of logs to the water, and pilings, dolphins[3], floats, and buoys for securing the logs in the storage area. Existing, permanent pilings and dolphins can be made of treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)) or untreated wood, steel, or concrete. Shoreline modifications can

[3] Dolphins typically consist of a number of piles driven into the seabed or riverbed and connected above the water level to provide a platform or fixing point.

include breakwaters and bulkheads. These supporting structures are discussed in Section 3 (Overwater Structures) of this chapter.

Vessels

Log booming and storage requires the use of tugboats to assemble and move the log rafts. In Washington, two kinds of tugboats are used:

- Harbor tugs that assemble the log rafts for towing to a processing facility (Figure 3.15).
- Log broncs that manipulate, sort, and position the logs and log bundles for assembly into rafts. Their use is limited by low tides.

Figure 3.15. Harbor tugs in Swinomish Channel. Photo: Washington DNR

3.3.5 Spatial extent of log booming and storage

In March 2013, Washington DNR had a combined total of 29 agreements and applications for log booming and storage in 13 counties, encumbering approximately 192.41 hectares (475.46 acres) of state-owned aquatic lands (Table 3.12). Agreements ranged in size from one-fifth of an acre to about 115.6 acres (Table 3.13). These activities occur in the North Cascades, Northwest Coast, Okanogan, and Puget Trough ecoregions. By 2040, for log booming and storage, DNR estimates one new agreement in the North Cascades ecoregion, no new agreements in the Northwest Coast or Okanogan ecoregions, and an additional six new agreements in the Puget Trough ecoregion.

Table 3.12. Log booming and storage agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
North Cascades	Skagit	2
Northwest Coast	Clallam	1
	Grays Harbor	3
Okanogan	Okanogan	1
	Clark	3
	Cowlitz	4
	King	1
Puget Trough	Kitsap	1
	Mason	4
	Pierce	2
	San Juan	3
	Snohomish	2
	Thurston	2
	Total Agreements	**29**

Table 3.13. Size of log booming and storage sites.

Size Hectares (Acres)	Number of Sites
< 4 (< 10)	10
4 to 7.9 (10 to 19)	6
8 to 11.9 (20 to 29)	2
12 to 15.9 (30 to 39)	2
16 to 19.9 (40 to 49)	2
20 to 27.9 (50 to 69)	3
28 to 31.9 (70 to 79)	0
32 to 40 > (80 to 99)	4

3.4 Overwater structures

Washington DNR authorizes the use of state-owned aquatic lands for a variety of over- and in-water structures used for recreation, industry, or habitation. This activity group includes:

- Boat ramps, launches, hoists, and lifts
- Docks and wharves
- Floating homes
- Marinas
- Mooring buoys
- Nearshore buildings
- Rafts
- Shipyards and terminals

3.4.1 Rationale for inclusion of overwater structures in the habitat conservation plan

Overwater structures were selected as a covered activity for the following reasons:

- The limited federal permitting requirements for ongoing operations covering the lifespan of the operation.
- The potential for incidental take from habitat loss or alteration associated with the structures and associated operations.
- The high degree of control that Washington DNR retains over where overwater structures occur on state-owned aquatic lands.
- The ability of Washington DNR to include in the terms of an agreement requirements regarding the operation and maintenance of facilities and structures.

While adequate coverage for impacts associated with construction and removal of structures exists through Section 7 consultations in the U.S. Army Corps of Engineers' permitting process, inclusion in the habitat conservation plan allows Washington DNR to avoid or minimize impacts associated with ongoing operations and maintenance of the structures. It also allows Washington DNR to reduce the effects of the structures themselves on all covered species when the lessee performs required maintenance or the lease is up for renewal. The requirements of the incidental take permit will be used for:

- Siting and design of new overwater structures to avoid or minimize the potential for incidental take of covered species.
- Minimizing take associated with existing structures.
- Removing abandoned structures and facilities at the termination of an agreement.

3.4.2 Legal framework for overwater structures

Washington DNR's authority

With the exceptions of floating homes and nearshore buildings, overwater structures are water-dependent and are therefore considered preferred uses of state-owned aquatic lands. Water-dependent use means a use that cannot logically exist in any location but on the water. Examples include, but are not limited to, waterborne commerce; terminal and transfer facilities; ferry terminals; watercraft sales in conjunction with other water dependent uses; watercraft construction, repair, and maintenance; moorage and launching facilities; aquaculture; log booming; and public fishing piers and parks (WAC 332-30-106 (75)). The general authorities are listed in Table 3.1; Table 3.14 lists authorities that apply specifically to overwater structures.

Table 3.14. Washington DNR's authority specifically related to overwater structures.

Law/Rule	Title	Content
RCW 79.105.060 (6), (11), (21), (24), (25)	Definitions	Defines *improvements* as anything considered a fixture placed within or upon or attached to aquatic lands that has changed the value of the land; defines a *terminal* as "a point of interchange between land and water carriers, such as a pier, wharf, or group of such, equipped with facilities for care and handling of cargo and/or passengers." Also defines *water-dependent, non-water dependent* and *water-oriented* uses.
RCW 79.105.200–.230, .260-.360; RCW 79.115–.130; RCW 79.125.400-460; RCW 79.130.010.	General aquatic statutes	Proscribes the manner and type of authorizations for aquatic lands, including preference rights, persons with a right to lease, and limitations on leasing for specific locations.
RCW 79.105.210	Aquatic lands—Preservation and enhancement of water-dependent uses—Leasing authority	Directs Washington DNR to place a high priority on water-dependent uses, such as navigation.
RCW 79.105.430	Private recreational docks—Mooring buoys	Specifies that residential owners of uplands adjoining state-owned aquatic lands may qualify for a recreational mooring buoy or dock (or both) free of charge and defines the criteria for such uses.

Law/Rule	Title	Content
WAC 332-30-106 (10), (11), (15), (23) (25), (38) (43) (44) (45) (62) (75) (77)	Definitions	Defines concepts concerning overwater structures.
WAC 332-30-115	Harbor area use classes	Discusses overwater structures relative to constitutionally required uses in harbor areas.
WAC 332-30-122	Aquatic land use authorization	Describes requirements and means of securing authorizations.
WAC 332-30-139	Marinas and moorages	Sets design criteria for moorage facilities on state-owned aquatic lands.
WAC 332-30-144	Private recreational docks	Defines the conditions and limitations applying to private recreational docks on state-owned aquatic lands.
WAC 332-30-148	Swim rafts and mooring buoys	Specifies the size, number, placement, location, and design of mooring buoys.
WAC 332-30-171	Residential use on state-owned aquatic lands	Addresses residential uses of state-owned aquatic lands, including floating houses, moorage facilities, and vessels.

Note: RCW = Revised Code of Washington; WAC = Washington Administrative Code

Leases for overwater structures

Washington DNR authorizes overwater structures using three standardized contracts: a commercial agreement (boat ramps, commercial mooring buoys, docks, rafts, marinas, nearshore buildings, shipyards, and terminals); a floating home agreement; and a mooring buoy license for recreational mooring buoys not adjacent to the licensee's property. Recreational mooring buoys that are adjacent to a resident's upland parcel are also subject to a registration process. Agreement terms—as one year to more than 100 years, with 5-year terms being most common for mooring buoy licenses. The most common terms for other uses are either 12 or 30 years.

Regulatory oversight of overwater structures

In addition to the regulations and requirements of Washington DNR, overwater structures on state-owned aquatic lands are subject to the regulations of several federal, state, and local government agencies (Table 3.15).

Table 3.15 Regulatory oversight of overwater structures.

Agency	Permit, Approval, or Regulatory Requirement	Permit, Approval, Process or Regulatory Requirement Needed
Local city or county planning office	Shoreline substantial development permit, shoreline conditional use permit, shoreline variance permit	All development/activities either within 200 feet of the shorelines of the state and above a set value, or meeting other criteria.
	Floodplain development permit	Filling or grading within the 100-year floodplain.
NOAA Fisheries	Endangered Species Act Section 10 (Incidental Take Permit)	All projects affecting threatened or endangered species that have either federal funding or permits.
	Marine Mammal Protection Act Marine Mammal Take Authorization	All projects affecting marine mammals.
U.S. Army Corps of Engineers	Rivers and Harbors Act; Nationwide Permit	Locating a structure, excavating, or discharging dredged or fill material; transporting dredged material or ocean dumping.
	Rivers and Harbors Act Section 10 Permit	Construction in navigable waters.
Environmental Protection Agency	Clean Water Act Section 404 Permit; Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Consent Decree	Contaminated sediment cleanup and remediation activities under federal jurisdiction.
U.S. Fish and Wildlife Service	Endangered Species Act Section 10 Incidental Take Permit	All projects affecting threatened or endangered species that have either federal funding or permits.
Washington State Department of Ecology	Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permit	Point source and non-point discharges of pollutants into waters of the state.
	Coastal Zone Management Act (CZMA) Consistency Determination	Approval for activities requiring a federal permit, undertaken by a federal agency, or using federal funding—the state indicates whether the project is consistent with the state's CZMA.

Agency	Permit, Approval, or Regulatory Requirement	Permit, Approval, Process or Regulatory Requirement Needed
	Clean Water Act Section 401 Water Quality Certification	For all projects requiring a Section 401 permit, Ecology reviews the project to determine if the work will meet state water quality standards.
	Oil and Hazardous Substance Spill and Prevention and Response	Zero-spill strategy to prevent any oil or hazardous substance from entering the state's waters.
	Shoreline Management Act	All development/activities within 200 feet of the shorelines of the state.
Washington Department of Fish and Wildlife	Washington Hydraulic Code Hydraulic Project Approval (HPA)	Construction or other work that affects the bed or flow of waters of the state.

Scope of the overwater structures

For the purposes of the habitat conservation plan, overwater structures include the operations, facilities, and structures associated with recreation, industry, or habitation that Washington DNR authorizes on state-owned aquatic lands. The scope of the overwater-structures activity includes overwater-structure agreements in existence at the time that the incidental take permit is signed and all future overwater-structure agreements that are signed during the term of the permit. Existing agreements will be included at the time of renewal or amendment, and future overwater structure agreements will be included at the time of signature.

3.4.3 Overwater structures: activity description

Overwater structures are defined as structures associated with recreation, industry, or habitation that are built over, under, or floating on the water. The group is broken into two categories: **single-element structures** (meaning those with only one associated structure) and **multiple-element structures** that contain a complex of interrelated structures at a single facility. Activities associated with overwater structures typically occur year-round, although use of recreational facilities is heavier in the summer. While a majority of the structures are permanent, structures such as mooring buoys, floating docks, or rafts may be removed in the winter.

Although agreements for overwater structures vary in duration, the structures themselves may remain indefinitely. This is particularly true for multiple-element structures, because these structures are often valuable enough to remain in place through multiple lease terms and business operators.

Single-element structures

Single-element structures are those with no other associated structures or uses. They may be attached directly to the shore (docks and wharves; boat ramps, launches, hoists, lifts and rails; and

nearshore buildings), or they may lack a direct connection to the shore (mooring buoys, rafts, and floating homes).

Boat ramps, launches, hoists, lifts, and rails

Boat ramps, launches, hoists, boat lifts, and rails can be associated with recreational boating and single family homes. These activities—when associated with vessel repair, storage, or sales—are authorized as part of a marina, shipyard, or terminal. A boat ramp or launch is a sloping incline or short egress that extends into the water to provide for the launching and retrieval of boats (Figure 3.15) and is typically built abutting a road or parking area. The area immediately waterward of the ramp or launch has often been dredged, and a layer of soft sediment (such as sand) is occasionally placed in this area. The boat ramp or launch itself is usually a concrete slab resting on the substrate. In most cases, one or more docks for temporary moorage are associated with these structures. If a boat hoist or lift is also present, the term boat launch would be more appropriate than boat ramp.

Figure 3.15 Boat ramp on the Snake River. Photo: Washington DNR

Because boat ramps and launches are usually associated with vehicles that deliver the vessel to the water, their width is largely governed by the width of access roads. Their length is determined by potential changes in water level, the slope of the shoreline, and the displacement volume of the vessel, and therefore varies with location.

Boat hoists and lifts are equipment for moving vessels into and out of the water or storing boats above the water. They consist of a structure to support the boat and a mechanical or manual system for raising or lowering the boat (Figure 3.16). The overwater footprint of a hoist depends on the size of the vessel it is designed to move, with smaller hoists found in marinas and larger hoists found in shipyards and terminals. They may be attached to pilings or a dock, installed in a boathouse, or moored separately. In general, boat lifts are for smaller vessels, and boat hoists are for larger vessels.

Marine rails are another type of boat launching facility, similar in function and purpose to a boat ramp. Marine rails are typically a pair of rails set parallel and running into the water, with a winch at the top. A boat is winched into or out of the water and the rails guide the boat. Generally, either a boat ramp or marine rails are found at a facility, but not both.


Figure 3.16 (a) Recreational boat lift on Long Lake and (b) commercial boat hoist on Lake Washington. Photo: Washington DNR

Docks and wharves

Docks and wharves support industrial activities, commercial shipping, recreational boating, vessel fueling, moorage, and vessel repair. Structures in this category are typically attached to shore via fixed piers or gangways that are perpendicular to shore and have a T or L shape, with a portion of the structure parallel to shore.

These structures are either platforms raised above the water, or platforms floating on the water (Figure 3.17). They generally extend to water depths sufficient for berthing one or more vessels, but are occasionally located where moored vessels and even the floating dock itself can ground out at low water. Raised docks are supported by pilings driven into the substrate and are often located in water bodies with little or no regular fluctuation in water level. Floating docks, often called floats, are usually located where water levels change frequently. They are supported by floatation devices and are usually attached to pilings by means of movable wooden collars or chains that wrap around the pilings. Raised docks may also have skirting covering the open space between the decking and the water. Skirting is used to limit access to areas under the dock, to prevent flotsam from accumulating under the dock, for safety purposes, or for esthetic reasons. Skirting may be made of treated (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)) or untreated wood, metal, plastic, or a combination of materials. Skirting is frequently used on docks in lakes, but is rarely used on docks on other water bodies.

Figure 3.17 Dock with a float, pier, and gangway on the Cowlitz River. Photo: Washington DNR

Wharves are very similar to docks, but because the associated vessels tie up to load or unload cargo and passengers, wharves are always raised above the water on pilings, are attached directly to shore, and include no floating docks. Additional terminology applied to docks and wharves includes:

- Piers—Raised platforms attached to shore and supported by pilings driven into the substrate. These structures are usually connected to a floating dock by a gangway, but do not provide moorage.
- Gangway or walkway—A ramp that connects a dock to piers or to the shore. Gangways and walkways may be made of treated (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)) or untreated wood, metal, plastic, or a combination of these materials. As with decking, they may be grated or solid.

Floating Homes

Floating homes are structures that serve primarily as residences and are typically not designed for navigation (WAC 332-30-106 (23)) . (Figure 3.18) While the floating homes themselves are not attached to shore, they are usually permanently moored to pilings, with a gangway or dock providing access to the home from the shoreline. Floating homes may include ancillary structures for storage, work, or mooring small boats. These ancillary structures are described separately under the sections on those structures. Floating homes are made from a variety of materials, but are typically wooden buildings supported by platforms, rafts, or barges made of some combination of treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), steel, plastic, and foam (to provide floatation).

Figure 3.18 Floating homes on Lake Union. Photo: Washington DNR

Mooring Buoys

Washington's laws subdivide mooring buoys into two categories: commercial and recreational (RCW 79.105.430). Commercial buoys are typically used for temporary moorage of a vessel that is awaiting transit or is loading or offloading cargo. Recreational buoys are used as semi-permanent moorage for recreational vessels. Unlike other agreements, agreements for mooring buoys do not include ingress or egress, and the encumbrance is based on the square acreage of the swing of the vessel.[4]

A mooring buoy typically consists of an anchoring system (anchor and anchor line) and a float marking the location of the anchoring system, with a fitting to receive a vessel's mooring chain or hawser. Mooring buoy floats are generally made of plastic and filled with foam. Mooring buoys placed on state-owned aquatic lands include single buoys associated with a private residence, commercial buoys used for barge moorage, and buoy fields for temporary moorage near marinas, harbors, and parks.

Nearshore buildings

A nearshore building is any building built partly over or near the water (Figure 3.19). Nearshore buildings support commercial uses (for example, boat rentals and supplies, offices, restaurants, and boat houses) and residential uses. These buildings are often wood-clad and require frequent exterior maintenance due to their proximity to water. Their foundations are built on filled tidelands and supported on pilings over the water. Associated structures often include a deck or dock that extends waterward from the building. In lacustrine (lake-related) systems, boathouses are generally permanent structures built partially on the uplands and are therefore also considered to be nearshore buildings (Figure 3.20).

[4] Vessel swing = (Square root [Anchor Line Length^2] – [Water Depth at Extreme Low Tide]^2) + Mooring Line Length + Vessel Length.

Figure 3.19 Nearshore building on Elliott Bay. Photo: Washington DNR

Figure 3.20 Boathouse on Long Lake. Photo: Washington DNR

Rafts

Rafts are floating platforms that are not attached to shore and are used for recreational purposes (Figure 3.21). While the existing decking is typically treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), the floatation is constructed of wood, steel, plastic, concrete, rubber tires, or foam that is either encapsulated to contain debris, or un-encapsulated. Rafts are anchored to the substrate or a dock and sometimes ground out at low water.

Figure 3.21. Rafts on Summit Lake. Photo: Washington DNR

Multiple-element structures

Multiple-element structures are a complex of interrelated structures at a single facility, such as a marina, shipyard, or terminal. In addition to structures such as docks and piers, marinas, shipyards, and terminals may also include components such as fueling facilities, utility cables and pipelines, erosion control structures (for example, bulkheads and breakwaters), covered moorage, and outfalls.

Marinas

Marinas typically include a series of connected docks and vary substantially in overall size (Figure 3.22). Marinas may include other overwater structures and interrelated activities that support boating activities, including boat ramps, launches, hoists, floating homes, mooring buoys, nearshore buildings, covered moorage, stormwater outfalls, treated water outfalls, sewage pump-out stations, fueling facilities, bulkheads, breakwaters, bank armoring, utility cables and pipelines, and dry docks.

Marina docks are mostly floats arranged in a variety of configurations and are attached to piers by gangways. They also typically have slips of varying sizes to provide moorage for different sized vessels. These slips can either be leased long term from the marina or used for transient or guest moorage.

Figure 3.22. Marina on Budd Inlet. Photo: Washington DNR

Some marinas provide covered moorage (Figure 3.23a) or floating boathouses (Figure 3.23b) that cover the docks with roofs so that both the dock and associated slips are sheltered. The existing roof and the supports may be made of treated (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)) or untreated wood, metal, plastic, or a combination of materials. Roofs may incorporate skylights, smoke and heat vents, and lights, and there may be walls or curtains around the perimeter.

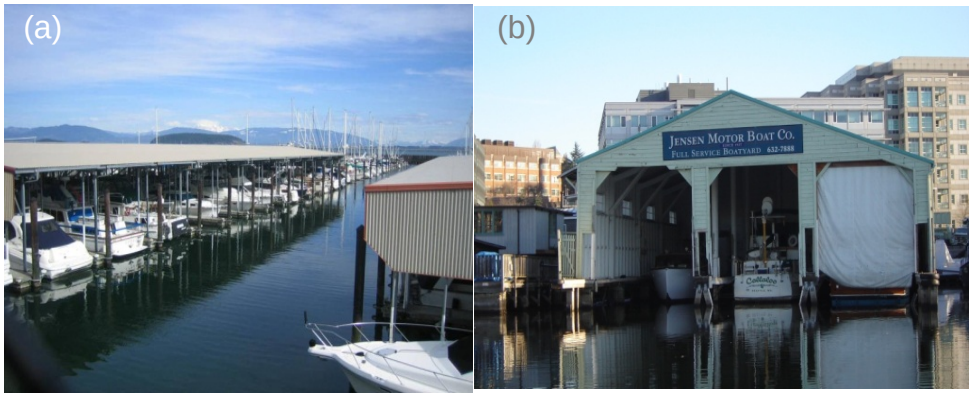

Figure 3.23. Covered moorage on Fidalgo Bay (a) and Lake Union (b). Photo: Washington DNR

Shipyards and Terminals

Shipyards are defined as facilities for the maintenance and repair of vessels, and terminals are defined as facilities that are either used exclusively for the transfer of cargo between boats and land, or include both cargo transfer and recreational moorage (Figure 3.24). The two types of facilities are combined in this sub-group due to similarities in both function and associated structures.

Figure 3.24. Terminal on Fidalgo Bay. Photo: Washington DNR

As with marinas, shipyards and terminals may include boathouses, boat hoists, cranes, nearshore buildings, fueling facilities, dry docks, outfalls, and utility cables and pipelines. Both the physical configuration and the number of elements at a shipyard or terminal are specific to the type of watercraft involved, the location of the facility, and the type of activity conducted at the site.

Docks associated with shipyards and terminals are generally raised above the water on pilings and are wider than recreational or marina docks. These docks may be capable of accommodating commercial vehicles, cranes, and other mechanical equipment that assist with loading and unloading operations. Docks that extend into deeper water for the mooring large vessels can be greater than 120 meters (394 feet) in length.

Shipyards and terminals can be generally categorized as the following types of operations:

- Repair and maintenance facilities that service commercial or pleasure boats (or both).
- Transfer facilities that load and unload products from large container ships, moving the products and materials to and from adjacent terrestrial distribution points. Transfer facilities authorized by Washington DNR include those used for the transfer of petroleum products (oil, gasoline, natural gas, and propane), alumina, agricultural commodities, sand, and gravel. While the facilities for processing are rarely located on or over submerged habitats, they may be located on adjacent, filled, state-owned aquatic lands or private parcels.
- Refinery facilities used for processing raw materials. Washington DNR currently leases land to both oil and aluminum refineries. While the facilities for processing are rarely located on or over submerged habitats, they usually include transfer facilities.
- Seafood processing terminals for unloading and processing fish and shellfish and lumber processing terminals associated with log booming and storage sites.
- Ferry terminals.[5]

[5] The ferry terminals in Washington that are run by the Washington State Department of Transportation are considered a transportation activity and are not covered by the habitat conservation plan. Ferry terminals that are not run by the Washington State Department of Transportation have a lease with Washington DNR and are covered by the habitat conservation plan.

General structural components

Although each type of overwater structure has unique structural components, there are also common components. These common features include pilings, dolphins, decking, floatation, anchoring systems, breakwaters, and bank armoring.

Anchoring systems

Anchoring systems attach overwater structures to the substrate. The systems comprise both anchors and anchor lines:

- Anchors may be either embedded into the substrate or placed on the surface of the substrate. They must have sufficient weight or connection to the substrate to hold the structure in place. Anchors may be made of metal, concrete, rock, or other heavy materials.
- Anchor lines are generally made of nylon, polypropylene, elastic, metal chains, or a combination of materials. For example, the anchor lines of mooring buoys may consist of a length of high-strength nylon rope, with a length of metal chain on the end nearest the buoy to keep the line from floating to the surface during slack water and to provide additional stability to the anchor.

Breakwaters and bank armoring

Breakwaters, bank armoring, bulkheads, and seawalls are used to control erosion or attenuate wave action as part of multiple-element structures. Fixed structures are generally constructed of riprap, gabions, pilings, concrete, rock, plastic, logs, or some combination of these materials (Figure 3.25). Existing floating breakwaters are anchored to pilings or the substrate and may be made of treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), abandoned vessels, concrete, or logs. Waveboards are another type of floating breakwater and consist of a floating wall of boards.

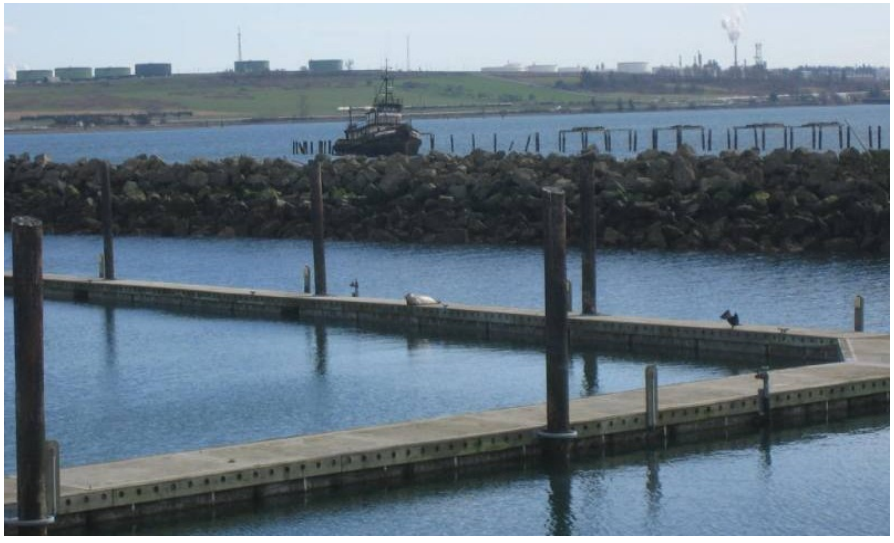

Figure 3.25 Fixed breakwater on Fidalgo Bay. Photo: Washington DNR

Figure 3.26. Partially grated walkway on Gig Harbor. Photo: Washington DNR

Decking

Decking refers to the flat surface of an overwater structure used for walking or sitting (Figure 3.26). Existing decking may be made of treated (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)) or untreated wood, metal, plastic, fiberglass, concrete, wood-plastic composites, or a combination of these materials and can be either grated or solid. Although grating may be used in place of solid decking to increase light transmission underneath the structure, the amount of open space in the grating may vary.

Dolphins

Dolphins are groups of two or more pilings bound together into a single unit. They are used for mooring boats, protecting docks or the shoreline, and guiding boats. The existing pilings may be bound with rope or metal bands, and the pilings may be made of concrete, steel, reinforced plastic, treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), or untreated wood, such as cedar. Dolphins can include bumpers or fenders made of recycled tires, rubber, plastic, rope, or timber.

Flotation

Buoyant floatation structures are used to help keep decking above the water (Figure 3.27). The materials used to construct them vary with the type of dock and decking. For docks with concrete decking, the floatation devices consist of a foam core encased in concrete. Other types of floatation include sealed plastic tubs filled with foam, foam enclosed in a coating of elastomer, foam that is not enclosed, or tires filled with foam. The casings that enclose foam are frequently black, but some permits issued by the U.S. Army Corps of Engineers specify that floatation be encased in white plastic tubs to increase the reflection of light and minimize overall shading effects.

Figure 3.27. Flotation made of foam-filled white plastic tubs on the Skagit River. Photo: Washington DNR

Pilings

Pilings are long, thin structures standing vertically out of the water (Figure 3.28). They are used as structural components of a facility or to mark boundaries. Existing pilings may be made of concrete, steel, reinforced plastic, treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), or untreated wood, such as cedar.

Figure 3.28. Steel pilings on the Willapa River. Photo: Washington DNR

3.4.4 Overwater structures: interrelated activities

Pump-outs

Pump-outs are facilities used to empty vessels' holding tanks of sewage and gray water. Pump-outs often consist of a vacuum pump located on a dock, which pumps the waste upland to a storage tank or treatment facility. Some facilities provide pump-out services that are mounted on small vessels (Figure 3.29). The waste collected by both vessel- and dock-mounted services is discharged into the adjacent upland treatment facility or hauled away to a site that can handle the wastewater.

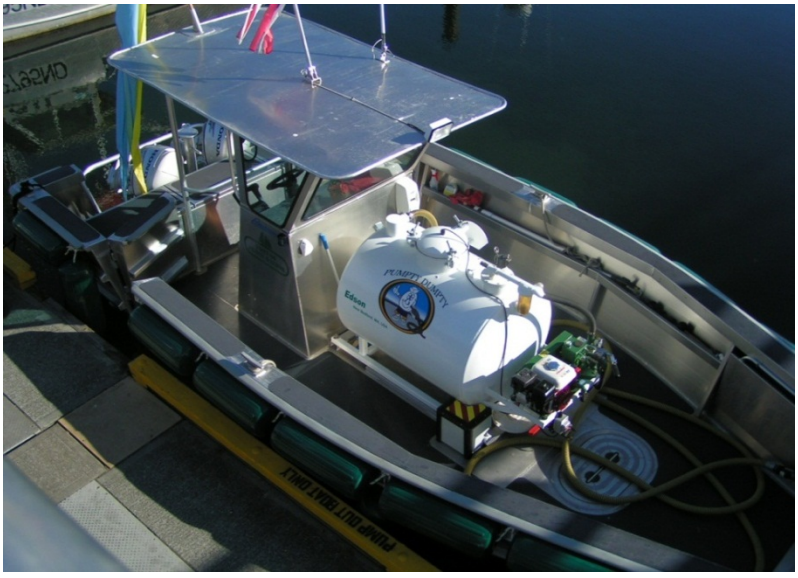

Figure 3.29. Vessel-mounted pump-out system in Friday Harbor. Photo: D. Roberts

Fueling facilities

Fueling facilities transfer engine and motor fuel to vessels and are part of multiple-element structures. Fueling facilities include a nearshore building on the dock and fuel pumps—attached by pipelines to upland storage tanks—that pump marine grade gasoline and diesel (Figure 3.30).

Figure 3.30. Fuel dock in Gig Harbor. Photo: Washington DNR

Utilities

Utilities associated with multiple-element structures include power and telecommunication cables, as well as pipelines that transport wastewater, oil, gas, and drinking water. Utilities may be attached to a structure (such as a dock), laid on or buried in the substrate within the leasehold, or, occasionally, suspended in the water column underneath the structure (Figure 3.31). Submerged lines and cables are typically buried when crossing *littoral* or intertidal zones and lie on top of the substrate in *limnetic* or subtidal zones, with or without ballast material. Erosion control structures, such as bank armoring, may be associated with utilities in areas where they connect to terrestrial environments or in areas of high current or wave energy.

Figure 3.31. Utility lines on a dock in Gig Harbor. Photo: Washington DNR

Outfalls

Outfalls are open pipes that discharge liquids to the aquatic environment (Figure 3.32). Multiple-element structures often include storm water outfalls that discharge runoff from the upland portion of the facility. The outfall, with the associated pipeline and structures (such as bank stabilization), may be made of concrete, metal, or high density polyethylene (HDPE) and may range from 0.15 to more than 2 meters (6 inches to more than 6 feet) in diameter.

Figure 3.32. Outfall on the Columbia River. Photo: Washington DNR

Dry docks

A dry dock is a structure used for building, repairing, or deconstructing vessels (Figure 3.33). In general, dry docks are used for vessels that are too large to be moved upland. Existing dry docks may be constructed of concrete, treated wood (creosote, ammoniacal copper zinc arsenate (ACZA), and chromated copper arsenate (CCA Type C)), untreated wood, metal, or a combination of materials. They may be floating, or they may rest on the substrate. They may include marine rails and boat hoists to facilitate moving vessels into and out of the dry dock. Dry docks can trap fishes when they are raised or removed from the water.

Figure 3.33. Floating dry dock on Lake Washington. Photo: Washington DNR

Vessels

Most overwater structures provide access to, and moorage, storage, construction, and repair of, vessels. Vessels may be made of wood, metal, composite material, or fiberglass.

Maintenance

Maintenance of overwater structures can include cleaning, removal of fouling organisms, painting, and in-water and above-water construction.

3.4.5 Spatial extent of overwater structures

In March 2013, Washington DNR had a combined total of 1,872 agreements and applications for overwater structures in 30 counties, and all ecoregions, encumbering approximately 9,862 hectares (24,370 acres) of state-owned aquatic lands (Table 3.16).

Table 3.16. Overwater structures agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Blue Mountains	Asotin	4
Canadian Rockies	Pend Oreille	8
Columbia Plateau	Benton	3
	Douglas	11
	Franklin	1
	Grant	1
	Yakima	4
East Cascades	Chelan	28
	Kittitas	2
North Cascades	Skagit	76
Northwest Coast	Clallam	37
	Grays Harbor	17
	Jefferson	96
	Pacific	39
	Wahkiakum	9
Okanogan	Okanogan	9
	Spokane	3
Puget Trough	Clark	23
	Cowlitz	27
	Island	39
	King	244

Ecoregion	County(s)	Number of Agreements
	Kitsap	254
	Lewis	8
	Mason	43
	Pierce	150
	San Juan	631
	Snohomish	30
	Thurston	42
	Whatcom	30
West Cascades	Skamania	3
	Total Agreements	**1872**

Single-element structures

Boat ramps, launches, hoists, lifts, and rails

In March 2013, Washington DNR had a combined total of 57 agreements and applications for boat ramps, launches, hoists, lifts, and rails in 23 counties, encumbering approximately 10 hectares (24 acres) of state-owned aquatic lands (Table 3.17). The lease terms of 10 of those agreements are longer than the term of the incidental take permit and will not be covered by the habitat conservation plan. These activities were found in the Blue Mountains, Canadian Rockies, Columbia Plateau, East Cascades, North Cascades, Northwest Coast, Okanogan, Puget Trough, and West Cascades ecoregions. Washington DNR estimates that by 2040 there will be no new agreements for boat ramps, launches, hoists, and lifts in the Blue Mountains, Canadian Rockies, East Cascades, Okanogan, and West Cascades ecoregions. The agency anticipates one additional agreement for these activities in the Columbia Plateau and Northwest Coast ecoregions, and two new agreements in the North Cascades ecoregion. And seven new agreements in the Puget Trough ecoregion.

Table 3.17. Boat ramp, launch, hoists, lift, and rails agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Blue Mountains	Asotin	2
Canadian Rockies	Pend Oreille	1
Columbia Plateau	Douglas	1
	Yakima	2
East Cascades	Chelan	1
	Kittitas	1
North Cascades	Skagit	7
	Clallam	6

Ecoregion	County(s)	Number of Agreements
Northwest Coast	Grays Harbor	3
	Jefferson	2
Okanogan	Okanogan	2
Puget Trough	Cowlitz	3
	Island	2
	King	4
	Kitsap	1
	Lewis	3
	Mason	1
	Pierce	2
	San Juan	2
	Snohomish	6
	Thurston	1
	Whatcom	3
West Cascades	Skamania	1
	Total Agreements	**57**

Docks and wharves

In March 2013, Washington DNR had a combined total of 188 agreements and applications for docks and wharves in 25 counties, encumbering approximately 8,508 hectares (21,025 acres) of state-owned aquatic lands (Table 3.18). The lease terms of 12 of those agreements are longer than the term of the incidental take permit and will not be covered by the habitat conservation plan. These activities were found in the Blue Mountains, Canadian Rockies, Columbia Plateau, East Cascades, North Cascades, Northwest Coast, Okanogan, and Puget Trough ecoregions. Washington DNR estimates that by 2040, there will be no new agreements for docks and wharves in the Blue Mountains and Canadian Rockies ecoregions. The agency expects one additional agreement for these activities in the Columbia Plateau, East Cascades, and Okanogan ecoregions; two new agreements in the Northwest Coast ecoregion; seven new agreements in the North Cascades ecoregion, and 33 new agreements in the Puget Trough ecoregion.

Table 3.18. Dock and wharf agreements, by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Blue Mountains	Asotin	1
Canadian Rockies	Pend Oreille	5
Columbia Plateau	Benton	1
	Douglas	1
East Cascades	Chelan	6

Ecoregion	County(s)	Number of Agreements
North Cascades	Skagit	21
Northwest Coast	Clallam	5
	Grays Harbor	4
	Jefferson	4
	Pacific	5
	Wahkiakum	1
Okanogan	Okanogan	1
	Spokane	2
Puget Trough	Clark	4
	Cowlitz	2
	Island	5
	King	29
	Kitsap	6
	Lewis	2
	Mason	4
	Pierce	17
	San Juan	38
	Snohomish	11
	Thurston	3
	Whatcom	10
Total Agreements		**188**

Floating homes

In March 2013, Washington DNR had a combined total of 57 agreements and applications for floating homes in four counties, encumbering approximately 20 hectares (50 acres) of state-owned aquatic lands (Table 3.19). These activities were found in the Northwest Coast and Puget Trough ecoregions. Washington DNR estimates that by 2040 there will be one new agreement for floating homes in the Northwest Coast ecoregion and seven new agreements in the Puget Trough ecoregion.

Table 3.19. Floating home agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Northwest Coast	Pacific	25
Puget Trough	Clark	1
	Cowlitz	4
	King	27
Total Agreements		**57**

Mooring buoys

In March 2013, Washington DNR had a combined total of 1,058 agreements and applications for mooring buoys in 17 counties, encumbering approximately 424 hectares (1,047 acres) of state-owned aquatic lands (Table 3.20). The lease terms of 18 of those agreements are longer than the term of the incidental take permit and will not be covered by the habitat conservation plan. These activities were found in the Blue Mountains, Columbia Plateau, East Cascades, North Cascades, Northwest Coast, Okanogan, and Puget Trough ecoregions. Washington DNR estimates no new agreements for mooring buoys by 2040 in the Blue Mountains and Okanogan ecoregions. The agency expects there will be two new agreements for this activity in the Columbia Plateau and East Cascades ecoregions, four new agreements in the North Cascades ecoregion, 12 new agreements in the Northwest Coast ecoregion, and 235 new agreements in the Puget Trough ecoregion.

Table 3.20 Mooring buoy agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Blue Mountains	Asotin	1
Columbia Plateau	Douglas	8
	Yakima	1
East Cascades	Chelan	12
North Cascades	Skagit	11
Northwest Coast	Clallam	5
	Jefferson	80
Okanogan	Okanogan	1
Puget Trough	Island	28
	King	35
	Kitsap	209
	Mason	27
	Pierce	59
	San Juan	545
	Snohomish	3
	Thurston	29
	Whatcom	4
	Total Agreements	**1058**

Nearshore buildings

In March 2013, Washington DNR had a combined total of 33 agreements and applications for nearshore buildings in nine counties, encumbering approximately 172 hectares (424 acres) of state-owned aquatic lands (Table 3.21). These activities were found in the North Cascades, Northwest Coast, Puget Trough, and West Cascades ecoregions. Washington DNR estimates that by 2040 there will be one new agreement for nearshore buildings in the Northwest Coast ecoregion, three new agreements in the North Cascades ecoregion, and five new agreements in the Puget Trough ecoregion.

Table 3.21 Nearshore building agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
North Cascades	Skagit	8
Northwest Coast	Clallam	3
	Jefferson	1
Puget Trough	Clark	2
	King	14
	Kitsap	2
	Lewis	1
	San Juan	1
	Snohomish	1
	Total Agreements	**33**

Rafts

In March 2013, Washington DNR had a combined total of nine agreements and applications for rafts in seven counties, encumbering approximately 0.6 hectares (1.5 acres) of state-owned aquatic lands (Table 3.22). These activities were found in the North Cascades, Northwest Coast, Okanogan, and Puget Trough ecoregions. Washington DNR estimates no new agreements by 2040 for rafts in the North Cascades, Northwest Coast, and Okanogan ecoregions, and one additional agreement for the Puget Trough ecoregion.

Table 3.22. Raft agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
North Cascades	Skagit	1
Northwest Coast	Clallam	1
	Grays Harbor	1
Okanogan	Okanogan	1
Puget Trough	King	2
	Pierce	1
	San Juan	2
	Total Agreements	**9**

Multiple-element structures

Marinas

In March 2013, Washington DNR had a combined total of 347 agreements and applications for marinas in 25 counties, encumbering approximately 274 hectares (677 acres) of state-owned aquatic lands (Table 3.23). The lease terms of two of those agreements are longer than the term of the incidental take permit and will not be covered by the habitat conservation plan. These activities were found in the Canadian Rockies, Columbia Plateau, East Cascades, North Cascades, Northwest Coast, Okanogan, Puget Trough, and West Cascades ecoregions. Washington DNR estimates no new agreements by 2040 for marinas in the Canadian Rockies and West Cascades ecoregions; one new agreement in the Columbia Plateau, East Cascades, and Okanogan ecoregions; three new agreements in the Northwest Coast ecoregion; eight new agreements in the North Cascades ecoregion; and 71 new agreements in the Puget Trough ecoregion.

Table 3.23. Marina agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Canadian Rockies	Pend Oreille	2
	Benton	1
Columbia Plateau	Douglas	1
	Grant	1
East Cascades	Chelan	7
North Cascades	Skagit	23
	Clallam	9
	Jefferson	6
Northwest Coast	Pacific	3
	Wahkiakum	4
Okanogan	Okanogan	4
	Spokane	1
	Clark	8
	Cowlitz	14
	Island	2
	King	97
	Kitsap	33
Puget Trough	Lewis	1
	Mason	10
	Pierce	55

Ecoregion	County(s)	Number of Agreements
	San Juan	40
	Snohomish	7
	Thurston	9
	Whatcom	7
West Cascades	Skamania	2
	Total Agreements	**347**

Shipyards and terminals

In March 2013, Washington DNR had a combined total of 123 agreements and applications for shipyards and terminals in 22 counties, encumbering approximately 454 hectares (1,123 acres) of state-owned aquatic lands (Table 3.24). These activities were found in the Columbia Plateau, East Cascades, North Cascades, Northwest Coast, and Puget Trough ecoregions. Washington DNR estimates one new agreement by 2040 for shipyards and terminals in the Columbia Plateau and East Cascades ecoregions, two new agreements in the North Cascades ecoregion, three new agreements in the Northwest Coast ecoregion, and 20 new agreements in the Puget Trough ecoregion.

Table 3.24. Shipyard and terminal agreements by ecoregion and county.

Ecoregion	County(s)	Number of Agreements
Columbia Plateau	Benton	1
	Franklin	1
	Yakima	1
East Cascades	Chelan	2
	Kittitas	1
North Cascades	Skagit	5
Northwest Coast	Clallam	8
	Grays Harbor	9
	Jefferson	3
	Pacific	6
	Wahkiakum	4
Puget Trough	Clark	8
	Cowlitz	4
	Island	2
	King	36
	Kitsap	3

Ecoregion	County(s)	Number of Agreements
	Lewis	1
	Mason	1
	Pierce	16
	San Juan	3
	Snohomish	2
	Whatcom	6
	Total Agreements	123

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