1. Summary

Taylor Shellfish Company, Inc. (Taylor) proposes to develop and operate an additional floating mussel aquaculture facility along the east shore of Totten Inlet, within Thurston County, Washington. The tidelands adjacent to the proposed mussel farm site are part of a farm 1.6 miles in length owned and operated by Taylor that includes the existing Gallagher Cove mussel farm. The proposed North Totten Inlet mussel farm raft would be located approximately mid-way through the length of Taylor's tideland ownership. The species to be cultivated is *Mytilus edulis galloprovincialis*. Taylor has cultivated this species of mussel at its two existing farms within Totten Inlet since 1992 (Gallagher Cove) and 1994 (Deepwater Point). It is estimated that the North Totten Inlet farm would produce an average of 877,963 pounds (whole body, wet weight) of mussels for sale each growing season. Development will be phased over a period of approximately 5 years or less. Construction and operation of the mussel farm will be regulated by conditions imposed through several local, State, and Federal permits and authorizations described in Draft EIS Chapter 2, Section 2.4.6.

1.1 Purpose and Objectives of the Proposed Action

The purpose and objectives of the North Totten Inlet Mussel Farm proposal are to:

- Cultivate "Mediterranean" (also known as "Gallo") mussels (*Mytilus edulis galloprovincialis*) for harvest, sale, and distribution in local, State, national and international commercial shellfish markets, using mussel raft culture practices.
- Construct an economically viable addition to the existing Taylor North Totten Inlet mussel farm within Totten Inlet.

Taylor is currently the leading producer of farmed shellfish (mussels, oysters, clams and geoducks) on the West Coast of the United States. The company's mussel farms help them maintain their diverse product line and sustain both a domestic and international customer base. Additional production from the Totten Inlet mussel farm at the North Totten Inlet site would also respond to increased market demand and reduce the seafood trade deficit (i.e., the importation of farmed mussels from other countries).[1]

Taylor currently operates two existing mussel farms in Totten Inlet. Addition of the 58-raft mussel culture proposal at the North Totten site would allow the company to realize operational efficiencies in the form of labor, boat trips, truck trips, and maintenance work. The increase in production associated with the proposed mussel farm would create jobs for eight full-time employees: four on-farm positions, and four off-farm positions.

1.2 History and Background, SEPA Procedures and Public Involvement

Taylor Shellfish submitted an application for a Shoreline Substantial Development Permit accompanied by an Environmental Checklist to Thurston County Development Services on November 13, 1996, for expansion of their existing mussel farm in Gallagher Cove from 21 rafts to 42 rafts, and for development of an additional mussel growing site on 58 rafts proposed at the North Totten Inlet site, north of Gallagher Cove. Public meetings were held in 1997 to explain the proposal and to invite comments. During the period of time while public meetings were being held, the County requested further assessment of the project to address potential impacts related to specific ecological concerns. Taylor responded to the County's request by preparing a *Visual Impact and Ecological Concerns Assessment Report* (EDAW,

[1] U.S. Department of Commerce 2006; and U.S. Department of Agriculture, June 2009.

Inc., January 1998), and by modifying the proposal to eliminate or minimize identified concerns (consistent with WAC 197-11-350[2]). The North Totten mussel farm site was reduced in scope and reconfigured from 108 rafts to 58 rafts aligned in a single row extending waterward from a lower-bank area of the shoreline. This configuration avoided potential impacts to Washington Department of Natural Resources (WDNR)-managed geoduck beds, and reduced the visibility of the proposed mussel farm from homes along the shoreline. The County requested information from State agencies about the capacity of Totten Inlet to support additional Gallo mussel production, and the effect of tidal flushing on the proposed expansion of mussel farming in the Inlet. No definitive local information was available to answer these questions. An additional public hearing was held on May 18, 1998 to receive input regarding the Gallo mussel issue. On June 26, 1998, Taylor requested early notice of the SEPA Threshold Determination from the County. On July 8, 1998, the County submitted a letter to Taylor identifying potential impacts (areas of uncertainty) associated with the revised mussel raft project, and indicating an inclination toward a Determination of Significance, requiring preparation of an Environmental Impact Statement under the Washington State Environmental Policy Act (SEPA). It was not possible to resolve the areas of uncertainty in subsequent correspondence between Taylor and the County; therefore, the County issued a SEPA Threshold Determination of Significance (DS) and EIS Scoping notice on September 14, 1998, requiring preparation of a limited-scope EIS to address the following five issues:

- Impacts to bottom-dwelling organisms (benthic community)
- Impacts to the surrounding water column
- Impacts to the phytoplankton resource, and the effects this could have on other aquaculture and aquatic life in Totten Inlet
- Impacts that could be caused by the escapement and propagation of mussels
- Impacts to marine navigation: lighting, and vessel navigation around the proposed mussel rafts.

Taylor appealed the County's decision to require an EIS. Numerous pre-hearing conferences were held on this matter (October 7, 1998; December 16, 1998; and March 19, 1999). Among the issues considered prior to a hearing before the Thurston County Hearing Examiner was a motion of intervention by an organization who identified themselves as the Association for the Protection of Hammersley, Eld and Totten Inlets (APHETI). Following three days of open public hearings before the Thurston County Hearing Examiner conducted March 22, 1999 through March 24, 1999, the requirement to prepare a limited-scope EIS was upheld by the Hearing Examiner (Findings of Fact, Conclusions of Law, and Decision issued June 18, 1999; case number AAPL-98-0809).

Taylor retained a team of technical consultants in 1999 to conduct the required investigations and analyses of the biological issues in the scope of work, and to prepare reports that would be used to prepare this Environmental Impact Statement (EIS). Between 1999 and 2001, Taylor also made some decisions regarding the original proposal, and reduced the scope of the project to the North Totten Inlet site only, to eliminate concerns about potential impacts to polychaete worm tube colonies in sediments beneath the Gallagher Cove proposed mussel farm expansion area.[2] Due to this modification to the proposal, formulation of an alternative configuration for the North Totten Inlet mussel farm to minimize potential impacts to benthic organisms, and more clarity about the proposed scope of work for field studies to be performed, Thurston County conducted a process in March/April 2002 to "refresh" the scope of the EIS to be prepared for the North Totten Inlet Mussel Farm. Based on comments received during the 2002 Scoping process, the same issues were confirmed by the County for study and evaluation in this EIS.

[2] Polychaete worm tubes form substrate upon which spawning herring lay eggs. The herring, in turn, are a food source for salmon. These potential impacts were of concern to the Washington Department of Fish & Wildlife (WDFW).

There will be a 45-day comment period on the Draft EIS. Notice of Availability and compact disks (CDs) of the Draft EIS and final Technical Report files were sent to all agencies, Tribes, organizations, and persons on the Distribution List (Draft EIS Chapter 5). The Notice of Availability indicates where hard copies of the Draft EIS and Technical Reports are available for review. A public meeting will be scheduled during the Draft EIS comment period to provide an opportunity for the public to present additional comments on the proposed action and Draft EIS. The date, time and location of the public meeting was included in the Draft EIS Notice of Availability mailed to everyone on the Distribution List. Notice of the meeting will also be published in *The Olympian*. Interested parties can submit comments on the Shoreline Substantial Development Permit application at any time.

Following the close of the comment period, a Final EIS will be prepared as a companion document to the Draft EIS. All written comments received and oral and written comments presented at the public meeting on the Draft EIS will be published in the Final EIS, along with a written response to these comments. The Final EIS will be distributed to everyone who received the Draft EIS and to persons who commented on the Draft EIS if they were not previously identified on the Distribution List.

Following completion of the EIS process, a public hearing will be held before the Thurston County Hearing Examiner regarding the 1996 Shoreline Substantial Development Permit application for the project. Notice of the hearing will be published in *The Olympian*.

1.3 Technical Report Preparation and Independent Technical Review

Field studies conducted by consultants to Taylor include several biological and biochemical studies prepared by Dr. Kenneth M. Brooks of Aquatic Environmental Sciences; water circulation studies conducted by Evans Hamilton, Inc. (2006 and 2008), and a comprehensive assessment of potential water column impacts of mussel raft culture in Totten Inlet by NewFields Northwest (2009). Much of this information was generated by examination of conditions at the proposed North Totten Inlet site, and at existing nearby mussel culture operations in Totten Inlet (for example, the Taylor Deepwater Point mussel farm used as a reference site), as well as other areas of Puget Sound and around the world.

To assure that the Best Available Science was used in this EIS, Thurston County selected an Independent Technical Review Committee (ITRC) to review and comment on all documents prepared by consultants to Taylor, from the original scope of work and protocols (methods) for these studies, to the findings and conclusions described in the technical reports prepared by these consultants. The ITRC is comprised of a group of distinguished scientists who are recognized experts in their respective fields:

Independent Technical Reviewer	*Area of Expertise*
J.E. Jack Rensel, Ph.D. Rensel Associates Aquatic Science Consultants	Phytoplankton, algal blooms, and effects on benthic organisms and finfish.
Mitsuhiro Kawase, Ph.D. University of Washington School of Oceanography	Physical oceanography: Flushing characteristics (circulation) and water quality (eutrophication).
Jan Newton, Ph.D. University of Washington, Applied Physics Lab	Biological oceanography: Water quality (nutrients, oxygen) and phytoplankton productivity.
Ralph Elston, Ph.D. AquaTechnics, Inc.	Mussel genetics: potential escapement and competition issues.
Roger Newell, Ph.D. University of Maryland, Horn Point Laboratory	Water column and benthic community effects.

The ITR process occurred over a period of 8 years (2001−2008) while the technical studies were being prepared.[3] Key sections of these independently-reviewed technical studies are summarized in Chapter 3 of this Draft EIS to describe elements of the environmental baseline and potential effects from construction and operation of the proposed mussel farm aquaculture. Proposed, required, and other possible mitigation measures are also described in Chapter 3 for each element of the environment.

1.4 Description of the Proposed Action

The Preferred Alternative (Alternative 1) for the North Totten Inlet Mussel Farm is a 58-raft proposal that will occupy approximately 1.36 acres within an Aquatic Lands Lease area approximately 11.25 acres in size.[4] The lease area will begin about 550 to 600 feet waterward of the Mean Lower Low Water (MLLW) tidal elevation line, and will extend approximately 700 feet further offshore. The length of the lease area will be approximately 700 feet parallel to the shoreline. The proposed project area is illustrated in Draft EIS Chapter 2.

The species to be cultivated is *Mytilus edulis galloprovincialis*. Taylor has cultivated this species of mussel at its two existing farms within Totten Inlet since 1992 (Gallagher Cove) and 1994 (Deepwater Point).

Construction of the raft components will occur at a 130-acre upland site owned and operated by Taylor in Mason County. Each raft in the Alternative 1 configuration would be 30 feet by 34 feet in dimension. Rafts will be attached end to end (with 2 feet in between). It is anticipated that there would be two 8-raft units and six 7-raft units. The longitudinal axis of each raft unit would be parallel to the shore, aligned in a single row of four 2-raft unit groups extending waterward from the shore. There would be approximately 40 feet separating raft units within each group, and 70 feet separating each group (see Figure 2-4 in Draft EIS Chapter 2).

The rafts will be constructed of natural, untreated lumber (Douglas fir), welded aluminum cross beams, and 55-gallon recycled food product barrels (for floatation devices). Synthetic “socks” and ropes will be suspended from the raft structure. Each raft will have multiple grow-out lines suspended from it: approximately 720 lines, 16 feet long. The grow-out lines (an inert plastic mesh) will be seeded (by hand) with immature mussels that require approximately 14 to 18 months to reach harvestable size. Each raft unit will be secured in-place at both ends with nylon lines (rope) and concrete wedge anchors. Predator nets will enclose the underwater features of the rafts to exclude fish, marine birds, and marine mammals. Material that falls into the nets from the rafts will be periodically removed for disposal on land during routine maintenance activities.

The estimated biomass at the time of seeding is 1,520 pounds wet weight. It is estimated that each raft will generate an average of 20,183 pounds whole body, wet weight (meat + shell – cavity liquid) for sale per growing period. The growing period averages 16 months (range: 14 to 18 months). It is estimated that the 58-raft Alternative 1 would produce an average of 877,963 pounds (whole body, wet weight) of mussels for sale each year. All processing will occur at the Taylor Shellfish Lynch Road plant in Mason County.

Mussel harvest from the rafts will not involve any dredge harvesting, tilling, or harrowing of bottom sediments.

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[3] A CD of electronic files of documents produced during the Independent Technical Review process is available from the Thurston County Resource Stewardship Department upon request.

[4] The lease area larger than the footprint of the mussel farm is required for the area of operations associated with the farm.

Full development of the North Totten Inlet mussel farm will occur over a period of approximately 5 years or less. The first phase will likely consist of 12 to 24 rafts, depending on the availability of mussel "seed" to start the first crop, market demand, and the availability of financial resources to construct and initiate the farm. Subsequent phases would likely consist of 12 to 20 rafts per year up to the 58-raft total. The availability of seed, financial resources, and market demand would also be the determining factors for the size of subsequent phases of mussel farm development.

The mussel farm will be regulated by conditions imposed through several local, state, and Federal permits and authorizations: Thurston County Shoreline Substantial Development Permit; Washington Department of Natural Resources Aquatic Lands Lease; U.S. Army Corps of Engineers Individual Permit; compliance with the Federal Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation and Management Act as these regulations relate to potential effects on critical habitat for Threatened or Endangered Species; and U.S. Coast Guard requirements for the installation of private aids to navigation. Applicable permit requirements are described in more detail in Draft EIS Section 2.4.6.

In general, there will be workers on some of the mussel rafts 5 or 6 days per week year-around between approximately 8:00 AM and 3:00 PM. During the summer months, work hours may be earlier. During winter months, work hours may be less due to very cold temperatures. At times, there may be no workers on the rafts for several days at a time.

1.5 Alternatives Considered

The Washington State Environmental Policy Act (SEPA) requires an Environmental Impact Statement (EIS) to evaluate reasonable alternatives that could feasibly attain or approximate the objectives of the proposal, but at a lower environmental cost or decreased level of environmental degradation. SEPA also requires that the No Action Alternative shall be evaluated and compared to other alternatives.

Two-Row Raft Alternative. Because localized and sometimes adverse seasonal effects on bottom-dwelling organisms (benthos) will occur directly beneath the mussel rafts and for a short distance beyond the footprint of the mussel rafts, an alternative raft configuration is evaluated in this EIS, along with an alternative mussel farm management strategy in which these rafts would be relocated every 3 years into the adjacent gap between rafts to allow any build-up beneath the rafts to assimilate at a faster rate. An extra set of anchors would be required mid-way between the initially-installed rows to facilitate this periodic raft relocation.

The Two-Row Alternative (Alternative 2) would consist of 50 rafts within a 16-acre Aquatic Lands Lease area (730 ft inshore to offshore[5], by 950 ft in length). Each raft in this alternative would be approximately 30 feet by 40 feet in dimension. There would be 10 raft units of five rafts in each. Rafts would be attached end to end (with 2 feet between) within each 5-raft unit. As with Alternative 1, the longitudinal axis of each raft unit would be parallel to the shore. These would be configured so that there would be two rows of 5-raft units extending waterward from the shore, with approximately 210 feet between each row. Within each row, each raft-unit would be 100 feet from the adjacent waterward raft unit (see Figure 2-7 in Draft EIS Chapter 2). The total water surface coverage would be about 1.38 acres. Alternative 2 would produce approximately the same yield per grow-out period as Alternative 1, or an average of 878,000 pounds of mussels for sale each year. As with Alternative 1, all processing would occur at the Taylor Shellfish Lynch Road Plant in Mason County.

[5] The landward edge of the lease area would be approximately 600 feet waterward of the MLLW elevation line, the same as Alternative 1. The 730-ft width of the Alternative 2 lease area would therefore extend a distance of approximately 1,330 feet from MLLW.

Alternative 2 could have environmental benefits in the form of minimizing effects on bottom sediments and bottom-dwelling organisms, while still functioning as an economically viable operation.

Disadvantages of this alternative would include: additional anchors in the bottom substrate, and raft units that would not be interchangeable with other Taylor mussel farms (due to the 40-foot length rather than 34 feet).

No Action Alternative. Under the No Action Alternative (Alternative 3), no new mussel farm would be created at the North Totten Inlet site. Existing mussel rafts in Totten Inlet would continue to grow *Mytilus edulis galloprovincialis*: the Gallagher Cove 21-raft farm, and the Deepwater Point 48-raft farm operated by Taylor, and the floating long-line system operated in the Deepwater Point area by Kamilche Sea Farms.

Under the No Action Alternative, there would be no additional Aquatic Lands Lease issued by WDNR, no physical presence of rafts, and no potential changes to the local water chemistry, flow (ambient current velocity), or minor effects on the local ecosystem or bottom sediments. On the other hand, there would be no increase in the beneficial effects of shellfish farming in Totten Inlet. As described in the technical studies performed for the proposed action, summarized in Draft EIS Chapter 3, Totten Inlet is becoming increasingly eutrophic.[6] There is a significant body of scientific evidence that indicates the filtering capacity of mussels results in a net reduction in nitrogen in the water column that can help reduce the negative effects to the system from continued or increasing eutrophication attributable to human sources (such as inadequate wastewater treatment in septic systems, and the application of fertilizers to lawns and landscaping).

1.6 Significant Impacts and Mitigation Measures

The full text of the Affected Environment, Potential Impacts, and Mitigation Measures for the proposed action and alternatives is presented in Draft EIS Chapter 3. A summary matrix of potential impacts and mitigation measures is provided in Table 1.6-1, following. In some cases, these descriptions are considerably abbreviated from the full discussion in Draft EIS Chapter 3, and lack explanations of terminology and analytical methods. Summary statements of project impacts in the table also appear in the absence of the context of existing environmental conditions (the Affected Environment discussions in Draft EIS Chapter 3). For these reasons, readers are encouraged to review the more comprehensive discussion of issues of interest in the Draft EIS to develop the most accurate understanding of impacts associated with the proposed action and alternatives.

[6] Eutrophic waters are rich in mineral and organic nutrients, causing plant life (especially algae) to proliferate, thereby reducing the dissolved oxygen content, which can have a detrimental effect on other organisms.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal.[7]

Potential Impacts	***Mitigation Measures***
WATER: Circulation	
There would be little risk of adverse impact to water circulation in Totten Inlet during construction.	Fabrication of mussel raft parts will occur on land at the Taylor Shellfish Lynch Road plant in Mason County, and assembly of the rafts will occur during low tide on the beach at the Taylor Shellfish Totten Inlet Old Plant site.
Current velocities close to the deployed rafts would be expected to increase above ambient velocities. The turbulent eddy and associated eddy friction would create a down-current eddy that mixes ambient water with raft-influenced water, and would affect about 2.36 acres. The volume of water passing through this portion of Totten Inlet is 0.43% of the total volume of water passing through the cross-sectional transect of North Totten Inlet.	The raft arrays will be arranged parallel to the tidal currents to minimize the distance over which water will be slowed. By design, the downstream areas influenced by the rafts will not include sensitive intertidal or shallow subtidal zones.
Alternative 2 would have 9.2% more effect on circulation compared to Alternative 1, but would not significantly affect the environment.	Same as above.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to water circulation as a result of the proposed project with either action alternative.	
WATER: Water Quality – Dissolved Oxygen (DO)	
There would be little risk of adverse impact to dissolved oxygen during construction of the mussel aquaculture facility.	Fabrication of raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
Alternative 1 would create eight "zones of decreased oxygen" 70 to 200+ m (230 to 656 ft+) in length, which would equate to surface area of approximately 2,906 to 8,288 m^2 (0.72 to 2.05 acres).	Best Management Practices (BMPs) for mussel raft culture (including siting and raft configuration) will be employed to maintain water quality.
If 70 m (230 ft) "zones" to DO recovery are assumed for Alternative 1, Alternative 2 would have 91.8% more effect compared to Alternative 1. If 200 m (656 ft) "zones" are assumed for Alternative 1, Alternative 2 would have 15.0% more effect compared to Alternative 1.	Same as above. No additional mitigation for DO concentrations required for Alternative 2, as this alternative would not be likely to have a significant adverse impact on the environment. DO concentrations would generally remain above the biological stress concentration of 5.0 ppm.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to dissolved oxygen as a result of the proposed project with either action alternative.	
WATER: Water Quality – Nutrients	
There would be little risk of adverse impact to silicate, phosphorus, or dissolved inorganic nitrogen (water column nutrients) during construction.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.

[7] Statements summarized in the Mitigation Measures column describe elements of the proposal that will avoid, minimize, or compensate for potential adverse effects, as well as offsetting beneficial effects of the proposed mussel farm.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Potential Impacts	***Mitigation Measures***
Suspended mussel culture can affect nutrients in the water column in several ways, including: removal of organic and inorganic nutrients in the water column through filtration and tissue storage, transformation and regeneration of nutrients through excretion of urea and biodeposits, and settlement and decomposition of biodeposits.	Best Management Practices (BMPs) for mussel raft culture (such as pen set-up and cleaning, harvest timing and techniques) will be employed to maintain water quality during operation of the floating mussel aquaculture facility. The rafts will be constructed of natural, untreated lumber (Douglas fir), welded aluminum cross beams, and 55-gallon recycled food product barrels (for floatation devices), which will have no negative effect on water quality. No additional mitigation is required for potential effects on nutrients in the water column because impacts would not be significant. See the explanations below.
Mussels may exert a minor influence on local silicate fluxes. Due to high existing concentrations of silicates in Totten Inlet, such that silicate concentrations are not limiting diatom growth, there is no reason to believe that the addition of the proposed North Totten Inlet mussel farm would significantly alter the silicate cycle in Totten Inlet.	No mitigation would be necessary for potential minor effects on silicate concentrations in Totten Inlet.
Minor changes in phosphorus concentrations were recorded as water passed through the reference site (Deepwater Point) raft array. Changes did not appear to constitute a significant change in phosphorus levels as a result of the mussel raft array. In addition, the effect of increased phosphorus concentrations on phytoplankton populations is expected to be minimal because nitrogen is considered the limiting nutrient during the summer season.	No mitigation would be necessary for potential minor effects on phosphorus concentrations in Totten Inlet.
Inorganic nitrogen concentrations are expected to increase in the immediate vicinity of the proposed mussel farm during June through September, with ammonium as the principal form present within the mussel raft. Predicted concentrations for the North Totten Inlet mussel farm approach WDOE criteria for high concentrations of ammonium (>5 µM).	An important consideration related to the effects of the proposed mussel farm on Totten Inlet is the removal of nitrogen (N) through mussel assimilation and removal via harvest. This is considered a beneficial remediation effect because South Puget Sound is exhibiting adverse ecological changes associated with over-enrichment by human-derived nitrogen and phosphorus inputs. Nitrogen removal by the Alternative 1 configuration of the North Totten Inlet mussel farm would represent 17 to 40% of the nitrogen introduced to Totten Inlet by human activities.
The footprint of ammonium effect for Alternative 1 would be approximately 2,906 m^2 (31,280 sq ft).	Approximately 70 m (230 ft) down-current of the mussel raft array, dissolved inorganic nitrogen (DIN) concentrations appear to return to ambient ammonium conditions. Therefore, no mitigation would be required for the potential minor ammonium effects of Alt 1.
Assuming the footprint of ammonium effect for Alternative 1 would be approximately 2,906 m^2 (31,280 sq ft), Alternative 2 could have 46% more effect; however, this would still be minor.	Similar to Alternative 1, no mitigation would be required for the potential minor ammonium effects of Alternative 2.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Significant Unavoidable Adverse Impacts: There would no significant unavoidable adverse impacts to silicate, phosphorous or dissolved inorganic nitrogen as a result of the proposed project with either action alternative.	
Potential Impacts	***Mitigation Measures***
MARINE PLANTS: Phytoplankton	
There would be no impact to phytoplankton during construction and assembly of the mussel aquaculture facility.	No mitigation for phytoplankton would be required during mussel raft fabrication because fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
During the spring/summer period, the North Totten Inlet mussel farm may remove approximately 0.3 to 0.9% of the primary production[8] over 50% of the area of Totten Inlet (representing the Northern Totten Inlet basin); whereas the North Totten Inlet mussel farm would be predicted to remove approximately 1.4 to 4.4% of the seasonal production relative to 10% of Totten Inlet, representing a small portion of North Totten Inlet immediately surrounding the rafts.	Best Management Practices (BMPs) for mussel raft culture (including siting and raft configuration) will be employed to maintain water quality and primary production. The rafts will be constructed of natural, untreated lumber (Douglas fir), welded aluminum cross beams, and 55-gallon recycled food product barrels (for floatation devices), which will have no negative effect on water quality that could negatively affect primary production.
For the fall/winter period, the North Totten Inlet mussel farm may remove approximately 0.5 to 1.4% of the primary production over 50% of Totten Inlet and the North Totten Inlet mussel farm would be predicted to remove approximately 1.1 to 7.3% of the seasonal production relative to the 10% of Totten Inlet.	Same as above.
With Alternative 2, the potential effects to phytoplankton would be the same as those described for Alternative 1 because production under either alternative would be similar.	Same as above.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to phytoplankton as a result of the proposed project with either action alternative.	
MARINE PLANTS: Macroalgae	
There would be little risk of adverse impact to macroalgae during construction of the mussel aquaculture facility.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
With Alternative 1, there is a potential for shading the sparse coverage of fixed macroalgae under the two shoreward raft units.	In the Alternative 1 raft configuration, the rafts are separated to facilitate access by work boats. This separation will allow light to penetrate between the rafts. In addition, tidal currents will move the raft units such that any one area of the bottom will not be constantly shaded. The raft structure, mooring lines, and the mussels themselves will form hard substrate that typically is colonized by various species of macroalgae. For all of these reasons, it is unlikely that mitigation would be required for macroalgae.

[8] Primary production is the total amount of new organic matter produced by photosynthesis in plants; in this case, microscopic plants known as phytoplankton.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Potential Impacts	***Mitigation Measures***
With Alternative 2, there may be potential for shading the sparse coverage of fixed macroalgae under three of the 10 five-raft units (the two shallow raft units in the northeast row, and the most shallow in the southwest row).	See mitigation for Alternative 1 above. In addition, if the Alternative 2 configuration is selected, the raft units would be relocated every 3 years into the adjacent gap between rafts, would allow any build-up beneath the rafts to assimilate at a faster rate. If required, appropriate mitigation would be imposed by regulatory agencies with jurisdiction (such as the U.S. Army Corps of Engineers through compliance required with the conditions of the Biological Evaluation to be prepared for an Individual Permit).
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to macroalgae as a result of the proposed project with either action alternative.	
ANIMALS: Invertebrates − Zooplankton	
There would be little risk of adverse impact to zooplankton during construction of the mussel aquaculture facility.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
Impacts to zooplankton attributable to operating either mussel farm action alternative include indirect effects of removal of zooplankton food organisms (phytoplankton), as well as direct effects in the form of removal of some zooplankton by the feeding mussels. The mussel raft array would create small areas of raft-affected water. The proposed mussel farm would be unlikely to create irreversible impacts to the hydrologic or biological health of this subbasin of Puget Sound due to characteristics of the proposed site and regional-specific physical and biological factors described in technical reports prepared for the project.	For every possible adverse effect to zooplankton, there would be mitigating positive effects. The predominant effect would be net removal of nitrogen from the ecosystem when the mussels are harvested. Other positive effects would include providing cover and food organisms for juvenile fish. No mitigation measures are recommended to address the insignificant effects of the proposed mussel farm on zooplankton in North Totten Inlet.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to zooplankton as a result of the proposed project with either action alternative.	
ANIMALS: Macroinvertebrates − Benthos	
There would be little risk of adverse impact to macroinvertebrates during construction of the mussel aquaculture facility.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach. Assembled rafts will be towed to the site for anchoring.
A small amount (434 sq ft) of benthic habitat may be displaced by the concrete wedge anchors that secure the rafts in-place.	The anchor ropes will provide more than an equal amount of substrate for other marine organisms to attach.
Studies of the existing Deepwater Point mussel farm showed subtle infaunal community effects extending a distance of 45 m (148 ft) to 75 m (246 ft) down-current. Each row of eight, 34-ft wide raft units in Alternative 1 could be envisioned to result in triangular "zones" of infaunal community effects both up-current and down-current on areas ranging between 0.92 to 1.54 acres. Low sulfide and total volatile solids concentrations observed at Deepwater Point indicate that natural attenuation of substrate chemistry toward baseline conditions occurred very quickly with no evidence of cumulative effects. This suggests there would not be an adverse long-term effect on benthic invertebrates arising from the North Totten Inlet mussel farm.	The rafts will be sited in a well-flushed area and configured to minimize effects on benthic organisms. Technical studies indicate that no additional mitigation for benthic organisms would be required.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Potential Impacts	***Mitigation Measures***
Compared to similar calculations for the raft units in Alternative 1, Alternative 2 could have up to 45 to 48% greater effects on benthic organisms than Alternative 1, ranging from approximately 1.33 to 2.28 acres.	An off-setting management feature of Alternative 2 to relocate raft units every 2 to 3 years would allow the infaunal community to be restored down-current from the former raft unit locations. This procedure, however, will still result in a similar amount of effect. The effect would, however, be temporary and would occur at different locations and different times. As with Alternative 1, technical studies indicate that no additional mitigation for benthic organisms would be required.
Significant Unavoidable Adverse Impacts: There would be no permanent significant unavoidable adverse impacts to macroinvertebrates (benthic organisms) as a result of the proposed project with either action alternative.	
ANIMALS: Native Mussel Species	
There would be little risk of adverse impact to native mussel species during construction.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site. No native mussels occur on this beach.
The risk of *M. e. galloprovincialis* to displace or "genetically pollute" *M. e. trossulus* stocks in Puget Sound is low, and it is unlikely that the proposed project will have a significant adverse effect.	No specific mitigation is proposed for addressing genetic interaction as an impact resulting from the proposed project.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to the genetic make-up of native mussel populations in North Totten Inlet as a result of the proposed project with either action alternative.	
ANIMALS: Fish	
There would be no risk of adverse impact to fish during construction.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site. Because only hand tools will be used for assembly, there is no risk of pollutants entering the water that could affect water quality or fish habitat.
Effects on fish that would result from the North Totten Inlet mussel farm would be linked to the magnitude of effect on their prey, which in turn would be linked to project effects on production of phytoplankton and zooplankton, and environmental parameters related to primary production and the benthos. Based on the analyses described in Draft EIS Chapter 3, it is unlikely that there would be any significant adverse impact to fish or their prey organisms as a result of the proposed action.	Best Management Practices (BMPs) for mussel raft culture (e.g., siting and raft configuration) that will be employed to maintain water quality will also serve to maintain plankton production and prey species populations. The rafts will be constructed of natural, untreated lumber (Douglas fir), welded aluminum cross beams, and 55-gallon recycled food product barrels (for floatation devices), which will have no adverse effect on water quality or the food chain, and therefore no adverse impact on fish habitat.
Under Alternative 1, there could be positive effects for fish, because the encrusting organisms that will form on the raft structures and anchor cables will supply food for several species of fish, including surf perches.	The NMFS Biological Opinion on Nationwide Permit 48 for existing mussel farms requires growers to minimize disturbance of inter-tidally spawned forage fish eggs when accessing their culture site. This practice will be employed at the North Totten Inlet site. Because the proposed mussel farm will be located over a subtidal area, the only potential interaction with inter-tidally spawned forage fish is related to access. Taylor's intertidal shellfish farming operations in the upper intertidal area of the North Totten Inlet site are covered under Nationwide Permit 48 for existing shellfish cultivation activities.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

There would be more anchor lines and structure surface in the Alternative 2 two-row raft configuration.	Same as above.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to fish or fish habitat as a result of the proposed project under either action alternative.	
Potential Impacts	***Mitigation Measures***
ANIMALS: Birds	
There would be little risk of adverse impact to birds during construction. Noise from hand tools and disturbance from human activity is expected to be temporary, occasional, and minor. While local bird species may leave the area temporarily, they would be expected to return when the noise-generating activities are completed.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
There would be low risk for the proposed mussel farm to have an adverse impact on birds.	The rafts will be sited and configured to minimize direct effects on birds and indirect effects on prey species. The raft structures will provide perching and resting areas for local birds (especially cormorants and gulls) when not occupied by staff performing mussel culture duties.
Because the rafts will displace a very small amount of the surface area of Totten Inlet and the activity will not result in noise levels much different from existing conditions, the proposed project is unlikely to have a significant adverse effect on birds.	The U.S. Fish and Wildlife Service (USFWS) Biological Opinion for Nationwide Permit 48 for shellfish aquaculture in Washington (USFWS 2009) confirms no significant anticipated effect on birds. Therefore, no mitigation for birds would be required.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to birds as a result of the proposed project with either action alternative.	
ANIMALS: Marine Mammals	
There would be little risk of adverse impact to marine mammals during construction. Noise from hand tools and disturbance from human activity is expected to be temporary, occasional, and minor. While local species may leave the area temporarily, they would be expected to return when brief construction activities are completed.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.
Noise generated by marine vessels, hand tools and disturbance associated with human maintenance and harvesting activities is expected to be similar to baseline activities at existing mussel farms in Totten Inlet at Gallagher Cove and Deepwater Point. While some marine mammals may avoid the area temporarily, they would be expected to return when human disturbances cease.	The rafts will be sited and configured to minimize effects on marine mammals. During maintenance and harvest operations, due care will taken to minimize disturbance of marine mammals, particularly seals and sea lions, in compliance with the Marine Mammal Protection Act.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to marine mammals as a result of the proposed project with either action alternative.	
ANIMALS: Protected, Threatened and Endangered Species	
There would be little or no risk of adverse impact to bald eagles, marbled murrelets, bull trout, Puget Sound Chinook salmon, steelhead trout, or Southern Resident killer whales during construction. Noise from hand tools and disturbance from human activity is expected to be temporary, occasional, and minor.	Fabrication of mussel raft parts will occur on land, and assembly of the rafts will occur on the beach at the Old Plant site.

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Potential Impacts	***Mitigation Measures***
Operation of the proposed new mussel rafts under either action alternative may affect but would be unlikely to adversely affect bald eagles because the closest known nest tree is more than 1.8 miles from the project area, and disturbance associated with the new mussel farm will not be noticeably different compared to baseline conditions.	No additional mitigation measures are recommended for the proposed North Totten Inlet mussel farm relative to bald eagles.
Operation of the proposed new mussel farm under either action alternative would be unlikely to adversely affect marbled murrelets because it is considered unlikely that they occur in Totten Inlet.	Best Management Practices (BMPs) for mussel raft culture (including siting and raft configuration) will be employed to maintain water quality. This will result in avoiding potential adverse impacts to protected, threatened, or endangered species or their prey species. The USFWS Biological Opinion for Nationwide Permit 48 for shellfish aquaculture in Washington (USFWS 2009) states that mussel raft culture activities are listed as those with potential effects that are expected to be insignificant (immeasurable) or discountable (extremely unlikely to occur) for marbled murrelets.
There would be no measurable risk of significant adverse operational impacts to bull trout under either action alternative because this species rarely (if ever) occurs in Totten Inlet.	The measures listed above are also applicable to bull trout.
There would be no measurable risk of significant adverse operational impacts to Puget Sound Chinook salmon with either action alternative because the potential for this species to be present in Totten Inlet is considered rare.	The NMFS Biological Opinion on Nationwide Permit 48 recommends the following measures for existing mussel culture activities. Taylor proposes to also employ these measures at the North Totten Inlet site: . Growers should strictly adhere to their code of practice to ensure minimized effects to listed species. . Growers should continue to minimize disturbance of inter-tidally spawned forage fish eggs when accessing their culture sites.
There would be no risk of significant adverse operational impacts to steelhead trout with either action alternative because their occurrence in Totten Inlet is uncommon.	Same as above.
There would be no measureable risk of significant adverse operational impacts to Southern Resident killer whales because of their low level of occurrence in Totten Inlet, the fact that whales would move away from any human activity disturbance in the immediate vicinity of the mussel rafts, and because of their ability to echo-locate and avoid underwater objects.	Same as above.
Significant Unavoidable Adverse Impacts: There would be no significant unavoidable adverse impacts to bald eagles, marbled murrelets, bull trout, Puget Sound Chinook salmon, steelhead trout, or Southern Resident killer whale as a result of the proposed project with either action alternative.	

Table 1.6-1. Summary matrix of environmental impacts and mitigation measures associated with the North Totten Inlet Mussel Farm proposal, *continued*.

Potential Impacts	***Mitigation Measures***
NAVIGATION	
There would be no potential impacts to navigation during the fabrication and assembly of rafts to create the North Totten Inlet mussel farm, as these activities would occur on land.	No mitigation required for navigation during mussel raft fabrication and assembly.
There could be a temporary safety hazard when the rafts are floated into place, before navigation lights or other markers are installed.	Taylor routinely installs two solar-powered navigation lights to identify the width of the raft structure, and as a back-up in case one of the lights burns out. These and/or temporary visual markers would be installed concurrent with floating the first rafts into place within the North Totten Inlet mussel farm, and would be maintained throughout operation of the farm.
No safety hazards to vessel navigation within Totten Inlet would be anticipated in the developed and operational condition of the North Totten Inlet mussel farm, as the structure would be equipped with all private aids to navigation required by the U.S. Coast Guard (33 CFR, Parts 62 and 66). The Coast Guard has no record of a precedent indication that mussel rafts so-equipped cause a safety hazard to navigation within Totten Inlet.	Marine marker lights on buoys will be required to mark the boundary of the proposed mussel raft, and/or lights on the ends of each raft to identify the obstruction on the water surface. Navigation charts will be revised to apply a symbol to indicate the presence of the mussel raft and any buoys, lights, or "dayshapes" installed to mark the raft location in the waterway.
	When the rafts are deployed and the private aids to navigation are installed, the U.S. Coast Guard will make a public notice announcement by marine radio broadcast, followed by inclusion of information regarding the new structure their printed weekly public notice.
Significant Unavoidable Adverse Impacts: Given that there is no record of conflicts between vessel traffic in Totten Inlet and existing mussel rafts in the Inlet, and given that the new North Totten Inlet mussel raft would be equipped with all Federally-required private aids to navigation, no significant unavoidable adverse impacts to the navigable waterway would be anticipated.	

1.7 Major Issues, Significant Areas of Controversy and Uncertainty, and Issues to be Resolved

Technical analysis of the issues identified for study in this limited-scope EIS (listed above in Section 1.2 and summarized in Draft EIS Chapter 3) reveals no significant unavoidable adverse impacts or remaining issues to be resolved as a result of the proposed expansion of mussel farm operations within Totten Inlet. More subjective issues raised in public comments opposing the project will likely persist as an area of controversy.