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AQUACULTURE IN JEFFERSON COUNTY
A DECISION MAKING ANALYSIS FOR AMENDING THE SHORELINE MANAGEMENT MASTER PROGRAM

by

Mitchell A. Press
Planning Consultant

April 1988

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

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JEFFERSON COUNTY

PROJECT COMPLETION REPORT

Aquaculture Policy Study Project

East Jefferson County Mapping Project
Land Use Maps
Watershed Boundary Maps

JUNE 1988

The preparation of this report was financially aided through a grant (G0088042) from the Washington State Department of Ecology with funds obtained from the United States Department of Commerce, appropriated for Section 306 of the Coastal Zone Management Act of 1972.

PROJECT COMPLETION REPORT

Two elements were proposed to be accomplished during the contact period. Element 1 is the mapping of watersheds within East Jefferson County. Element 2 is the analysis of existing aquaculture practices and policies with a particular emphasis on floating mariculture.

A complete set of maps depicting and delineating watersheds in East Jefferson County has been produced. A working set at a scale of 1:24,000 and a display set at a scale of 1:62,500. In addition, watershed characteristics were mapped identifying land use trends and thirty-eight (38) influencing characteristics. A working set of land use pattern maps were produced at a scale of 1:24,000. Also, produced were maps showing detailed topography within each of the watersheds. The watershed and land use maps are reproducible and will be made available to the public. Base information, such as orthophotographs and working maps will be retained in the planning and building department.

Aquaculture in Jefferson County - A Decision Making Analysis for Amending the Shoreline Management Master Program was prepared under contract. This report analyses the recommendations of the *Jefferson County Aquaculture Policy Study* in light of several recently completed studies and other additional information that has been developed since the policy study was developed. This sixty-six (66) page report provides a detailed analysis of aquaculture, its relationship to existing policies, regulations, and studies, including the above referenced policy study, and suggests ways in which various aspects of this subject may be addressed. The purpose of this report is to provide decision-makers and the public with an objective distillation of information from which policy issues may be reviewed and resolved.

The report analyses the recommendations found in the *Jefferson County Aquaculture Policy Study* in light of several recently completed studies and other information not available at the time the policy study was conducted. The document is divided into three major sections: first, the current status of aquaculture development in both Washington State and British Columbia as well as an overview of recently completed studies concerning aquaculture. Section 3 deals with an analysis of the existing shoreline master program recommended changes resulting from the aquaculture study and other pertinent information, along with an analysis of the above information, and recommended course of action. This section is arranged by issue for easy reference. Finally, the report addresses aquaculture by different types, thus tailoring specific policy considerations by selected form of aquaculture likely to be found in Jefferson County (i.e. finfish net-pen, nori seaweed, mechanical shellfish harvesting, shellfish culture, upland aquaculture, appurtenant upland facilities, and other aquaculture types).

Aquaculture, and particularly floating mariculture, is a complex and controversial subject. The report, *Aquaculture in Jefferson County* will assist policy-makers in Jefferson County to understand and resolve pertinent issues in the update of the *Jefferson-Port Townsend Shoreline Management Master Program.*

ABSTRACT

AQUACULTURE IN JEFFERSON COUNTY

A DECISION MAKING ANALYSIS

FOR AMENDING THE SHORELINE

MANAGEMENT MASTER PROGRAM

AUTHOR: Mitchell A. Press, Planning Consultant

SUBJECT: The document is an analysis of aquaculture regulations and how these regulations relate to the *Jefferson-Port Townsend Shoreline Management Master Program*

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ABSTRACT:

This report examines the regulation of all types of aquaculture as it pertains to the *Jefferson-Port Townsend Shoreline Management Master Program.* It discusses and analyzes a variety of related regulatory documents and environmental impact studies. This analysis provides a framework for developing amendments to the master program as it may better regulate future aquaculture development in Jefferson County.

A major focus of the report is a review of the recommendations of the *Jefferson County Aquaculture Policy Study* in light of several recently completed studies and other additional information that has been received during the two years since the policy study was completed.

This document is divided into two major sections. In the first section the current status of aquaculture development in both Washington and British Columbia is summarized. An overview of some of the studies completed since the aquaculture policy study is also given. The second section serves as a decision-making reference document for county policy makers in adopting specific master program amendments for aquaculture. It lists, by subject, recommendations and findings of various applicable studies followed by an analysis and recommendations for amendment adoption.

TABLE OF CONTENTS

SECTION 1	**INTRODUCTION**	1
SECTION 2	**AQUACULTURE IN THE NORTHWEST: AN UPDATE**	2
2.1	WASHINGTON	3
2.2	BRITISH COLUMBIA	3
2.3	RECENTLY COMPLETED AND ONGOING STUDIES	5
SECTION 3	**SHORELINE MASTER PROGRAM AMENDMENT ANALYSIS GENERAL AQUACULTURE REGULATIONS**	6
3.1	DEFINITION OF AQUACULTURE	7
3.1.1	Existing Documents	7
3.1.2	Analysis	8
3.1.3	Recommendations	9
3.2	STRUCTURAL REMOVAL, LIABILITY	9
3.2.1	Existing Documents	9
3.2.2	Analysis	11
3.2.3	Recommendations	12
3.3	NAVIGATION	13
3.3.1	Existing Documents	13
3.3.2	Analysis	14
3.3.3	Recommendations	14
3.4	NUISANCES - NOISE, SMELL AND GLARE	14
3.4.1	Existing Documents	14
3.4.2	Analysis	15
3.4.3	Recommendations	17
3.5	VISUAL IMPACTS	17
3.5.1	Existing Documents	17
3.5.2	Analysis	21
3.5.3	Recommendations	25
3.6	PREDATOR CONTROL	26
3.6.1	Existing Documents	26
3.6.2	Analysis	27
3.6.3	Recommendations	27
3.7	ENVIRONMENTAL SITING CONSIDERATIONS	27
3.7.1	Existing Documents	27
3.7.2	Analysis	29
3.7.3	Recommendations	29
3.8	WASTE DISPOSAL AND WATER QUALITY	30
3.8.1	Existing Documents	30
3.8.2	Analysis	33
3.8.3	Recommendations	35
3.9	OTHER USE CONFLICTS	36
3.9.1	Existing Documents	36
3.9.2	Analysis	37
3.9.3	Recommendations	41

3.10 MONITORING AND BASELINE STUDIES 42
3.10.1 Existing Documents 42
3.10.2 Analysis 43
3.10.3 Recommendations 45
3.11 CHEMICAL AND ANTIBIOTIC APPLICATIONS 45
3.11.1 Existing Documents 45
3.11.2 Analysis 45
3.11.3 Recommendations 48
3.12 CULTURED SPECIES INTRODUCTIONS 49
3.12.1 Existing Documents 49
3.12.2 Analysis 51
3.12.3 Recommendations 52
3.13 APPLICATION REQUIREMENTS AND ADMINISTRATION 52
3.13.1 Existing Documents 52
3.13.2 Analysis 53
3.13.3 Recommendations 53

SECTION 4 SHORELINE MASTER PROGRAM AMENDMENT ANALYSIS REGULATIONS COVERING SPECIFIC TYPES OF AQUACULTURE 53

4.1 FINFISH NET-PEN MARICULTURE 54
4.1.1 Existing Documents 54
4.1.2 Discussion 58
4.2 NORI SEAWEED 58
4.2.1 Existing Documents 58
4.2.2 Discussion 60
4.3 MECHANICAL SHELLFISH HARVESTING 60
4.3.1 Existing Documents 60
4.3.2 Discussion 62
4.4 SHELLFISH CULTURE 63
4.4.1 Existing Documents 63
4.4.2 Discussion 53
4.5 UPLAND AQUACULTURE 63
4.5.1 Existing Documents 63
4.5.2 Discussion 64
4.6 APPURTENANT UPLAND FACILITY 64
4.7 OTHER AQUACULTURE TYPES 65

SECTION 5 CONCLUSION 65

SECTION 6 APPENDICES

6.1 Biophysical Evaluation of a Marine Fish Farm Site
6.2 British Columbia Marine Fish Farm Development Plan Application
6.3 Washington State Department of Natural Resources Supplement Application Form for Aquaculture Leases
6.4 ICES Code of Practice on the Introduction and Transfer of Non-Indigenous Species

SECTION 7 BIBLIOGRAPHY

SECTION 1

INTRODUCTION

During the past several years, aquaculture development by the inland marine waters of Washington and British Columbia has grown enormously. Although a wide variety of different aquaculture operations are being proposed or developed, the main focus of recent activity has been floating mariculture where organisms such as finfish are placed in a body of marine water above the sea bed. Floating mariculture shows potential for the greatest growth due to the fact that it does not rely on shallow water, which is a limited resource in Puget Sound.

As interest in aquacultural development intensified, awareness of potential environmental impacts and land use conflicts has intensified. Public concerns have been voiced about such issues as the unsightliness of aquaculture facilities, potential effects of domestically raised species on wild stocks, especially with respect to disease transmission and the impacts of aquaculture on other aquatic uses such as coastal navigation and commercial fishing.

Several governmental agencies such as the Washington State Department of Ecology, Washington State Department of Natural Resources, and Washington State Department of Fisheries, have launched a variety of studies to help better identify and mitigate the impacts of aquaculture operations. Although most of these studies have focused on the environmental impacts of fish pens and criteria for siting, other forms of aquaculture such as mechanical shellfish harvesting and nori farming have also been closely examined.

As more specific information is learned about different kinds of aquaculture, it has become evident that existing regulations governing siting and operations have not been adequate for handling the increase in quantity and complexity of recent aquaculture permit applications.

The department of ecology and department of natural resources have taken the lead in developing siting and operational criteria for specific aquaculture types such as fish pens and mechanical harvesters. Each coastal county has taken a slightly different approach in dealing with aquaculture regulations mandated by the Washington State Shoreline Management Act. Some have deferred to state policy, following model regulatory ordinances. Others have gotten much more sophisticated. An example of this is in Island County where its shorelines for potential sites were inventoried for each kind of aquaculture operation. An aquaculture zoning ordinance was later adopted based on the inventory information. Thurston County has recently developed an aquaculture policy designed to encourage the growth of the industry and to protect developments from threats such as water pollution and incompatible upland activities.

In Jefferson County, an aquaculture policy study was conducted in 1986. This study resulted from the growing number of applications received for aquaculture developments. It identified current aquaculture

activity in the county and future aquaculture potential. It also examined environmental impacts of aquaculture. The Jefferson County Aquaculture Task Force comprising a cross section of private and public sector representatives was appointed to develop a general policy for aquaculture growth in the county. They formulated a policy document which made recommendations geared towards minimizing negative environmental impacts and land use conflicts as well as maintaining an environment conducive to a healthy aquaculture industry. Many of the recommendations require amending the ***Jefferson-Port Townsend Shoreline Management Master Program*** so that more specific regulations can be applied to future aquaculture proposals. To date, this report has yet to be officially adopted by the Jefferson County Board of Commissioners.

During the development of the policy recommendations, several applications for fish pen structures were received and reviewed under the county's shoreline program. Opposition to these proposals from several interest groups along with the state's initiation of several studies on the effects of fish farming prompted the board of commissioners to issue a moratorium on the review of any new shoreline permits for fish farms. The moratorium, which only includes fish pens, was issued in November 1986. It was to be in effect until more was known of the effects of these pens on the marine environment.

The purpose of this report is to analyze the recommendations of the Jefferson County Aquaculture Policy in light of several recently completed studies and other additional information which has been received during the two years since the policy study's completion.

This document is divided into three major sections. First, the current status of aquaculture development in both Washington State and British Columbia is summarized in Section 2. An overview of some of the studies completed since the Jefferson County Aquaculture Policy study is also given. Section 3 serves as a decision making reference document for Jefferson County policy makers in adopting specific shoreline program amendments for aquaculture. It lists, by subject, recommendations and findings of various applicable studies. This is followed by an analysis and recommendations for amendment adoption. Finally, regulations or siting criteria for specific types of aquaculture are discussed in Section 4.

SECTION 2

AQUACULTURE IN THE NORTHWEST

AN UPDATE

Recent changes in aquaculture development and regulation in Washington State and British Columbia are briefly described below. In addition studies undertaken or completed since the Jefferson County aquaculture report are summarized. British Columbia is examined due to

recent boom in fish pen mariculture development. Examining their problems and successes can provide valuable insight for developing regulations governing aquaculture in Washington State. Many of the findings, regulations, or policies from the studies described in this section are used in the analysis of specific policies and recommendations in Section 3 and 4 of this report.

2.1 WASHINGTON

During the last decade, interest in aquaculture development for the inland coastal areas of Washington has steadily increased. Floating mariculture, especially fish net-pen farming has recently become the focus of much public concern. Although the first commercial salmon farm began operating in Puget Sound in 1969, specific development proposals began appearing at an increasing rate in the early 1980's. The increase in applications generally coincided with the increased development of British Columbia waters reaching its height in 1986. As of August 1986 commercial yields were about 1500 metric tons per year (1.2 imperial tons per metric ton). As of August 1986, there were fourteen commercial salmon farms operating in Washington.

This last decade has also seen a sizeable mussel raft culture industry develop, especially in Island County. More recently several commercial nori seaweed culture operations have been sited in Puget Sound. More are proposed.

Public opposition has grown as more of those highly visible floating structures have been proposed. Many interest groups are concerned that fish farms or other floating mariculture operation farms would be placed haphazardly throughout Puget Sound without a sound knowledge of their potential effects on other land uses or the surrounding marine environment. Concern was so great that moratoriums on fish farming were placed into effect in three coastal counties: Jefferson, Skagit, and San Juan. Island County went further and issued a moratorium on all forms of aquaculture.

2.2 BRITISH COLUMBIA

British Columbia has experienced a feverish growth in aquaculture development during the last few years, especially with respect to floating fish pens. In 1984, ten licensed salmon farms were operating in British Columbian coastal waters. As of November 30, 1987 there were 118 salmon farms in operation and thirty-five approved but not operating. Fish pens in British Columbia are typically much larger than those found in Washington, covering an average of almost thirteen acres. Average farm net cage volume has more than tripled from 6767 meters in 1986 to 21,265

meters in November 1987. Pens covering over five surface acres are common. (The maximum size of fish pens in Washington State is currently restricted to two acres for any one operation). Over fourteen million cultured fish were stocked in 1987, more than twice the number stocked in 1986.

Almost 400 metric tons of farmed fish were harvested in 1986 with annual production estimated to rise to 2,000 metric tons by the 1990's.

The oyster and trout industry comprise the other two major aquaculture industries in British Columbia. These are growing at a much slower rate. Lease acreage for oysters have grown five percent in 1987 while trout farming has grown by two percent.

In an August 1987 study, it was estimated that direct and indirect employment related to aquaculture in British Columbia is expected to expand from 500 jobs, as was estimated at that time, to 3500 jobs in 1990. It was predicted that salmon-related farms would comprise eighty-four percent of the province's aquaculture by 1990.

In October 1986, as fish pen development began steadily increasing, an outcry from commercial fishing interests caused the government to impose a moratorium on fish pens. Commercial fishermen were concerned mainly about potential impacts on wild fish stocks from disease transmission as well as the physical interference of fish pens on their fishing operations.

The British Columbia government established a commission headed by David Gillespie to conduct a series of public hearings in order to obtain a clearer idea of public concerns and potential environmental problems with fish farming. The Gillespie Report, published in December 1986, contained a series of recommendations addressing many of the public's concerns. Some recommendations most applicable to Washington's regulatory process included standards for fish pen separation, implementation of monitoring and waste disposal requirements, banning the importation of exotic fish species such as Atlantic Salmon, and the launching of land use studies in several of British Columbia's most intensively used shoreline areas (these are known as the Coastal Resource Identification Studies.

The moratorium was lifted in February 1987 with the exception of the areas covered by the Coastal Resources Identification Studies. These studies result in shorelines which are categorized to either discourage fish pen developments, conditionally allow them, or to encourage proposals which go through the normal application process.

The British Columbia government has been an advocate of aquaculture development especially with respect to the fish net-pen industry. Because they believe proper siting and maintaining good water quality benefit the operator, they have tried to minimize regulations and instead provide as much information as possible to assist applicants with siting and good husbandry practices.

2.3 RECENTLY COMPLETED AND ONGOING STUDIES

As interest in aquaculture development has increased, many government agencies have tried to assess potential impacts and appropriate regulatory measures. These studies have added greatly to knowledge of the fish farming industry and potential problems with respect to biological impacts, siting, and potential land use conflicts. A brief summary of each is given below:

1. ***The Environmental Effects of Floating Mariculture in Puget Sound*** by Donald Weston, August 1986. This study was commissioned by the Washington State Department of Fisheries. Dr. Weston conducted a thorough literature review of all research relating to floating mariculture both in the U.S. and abroad. Although he discusses numerous types of mariculture species, his prime focus is fish pens.
2. ***Recommended Interim Guidelines for The Management of Salmon Net-Pen Culture in Puget Sound*** by Science Applications International Corporation (Donald Weston), December 1986. Dr. Weston uses the information found in his report cited above and recommends guidelines which would reduce environmental impacts of fish farms. Although not mandatory, these guidelines are recommended for the permitting of fish pens proposals until the state Environmental Impact Statement (EIS) on net pen culture is released (see Section 4.1, "Finfish Net-pen Mariculture").
3. ***Aquaculture Siting Study*** by EDAW Inc. and CH2M/Hill for the Washington State Department of Ecology, October 1986. The study analyzes the visual impacts of floating aquaculture structures on upland residents and users. A computer model is used to show how placement of structures in different locations will affect the impacts on upland users. Recommendations are made for siting floating structures to minimize visual impacts. (See Section 3.5, "Visual Impacts").
4. ***An Inquiry Into Finfish Aquaculture in British Columbia*** by David Gillespie, December 1986. Concerns of citizens and interest groups over future fish pen development in British Columbia are summarized as a result of a series of public hearings. Pertinent recommendations include:

    a. Siting fish pen operations no closer than three kilometers (1.8 miles) apart.
    b. Eliminating the importation of exotic fish eggs.
    c. Development of monitoring guidelines for permitted fish farms.
    d. The development of land use plans (Coastal Resources Identification Studies) for five intensively used coastal areas. These studies would classify the coastline and waters within the five areas for the acceptability of fish farms based upon biological constraints and use conflicts.

5. ***Draft Programmatic Environmental Impact Statement for Nori Farming and Processing***, Washington State Department of Natural Resources, March 1987. This study examines potential impacts resulting from [illegible] processing facilities. It recommends guidelines for siting such operations. (See Section 4.2, "Nori Seaweed Culture").
6. ***Final Environmental Impact Statement for the Commercial Harvesting of Subtidal Hardshell Clams with a Hydraulic Escalator Shellfish Harvester***, Washington State Department of Fisheries and Washington State Department of Natural Resources, 1978. This study examines a wide spectrum of environmental impacts resulting from the use of mechanical clam harvesters in subtidal waters. It reviews and recommends guidelines for siting this activity and regulating its operation.
7. ***Shellfish Protection Strategy***. Washington State Department of Ecology, 1984. This document describes the problem of commercial shellfish bed closures due to bacterial pollution. It presents a plan for reducing this threat. The plan entails Washington State Department of Ecology and Washington State Department of Social and Health Services performing basin planning, intensive surveys, intensive shellfish aquaculture permit review, and reviewing their point discharge policy.
8. ***Floating Mariculture Land Use Conflict Study***, by John Boyce, Washington State Department of Ecology, to be completed fall 1988. This study will examine potential conflicts between floating mariculture and other marine and upland uses.
9. ***Fish Culture in Floating Net Pens, Programmable Environmental Impact Statement***, Washington State Departments of Fisheries, Natural Resources, Ecology, and Agriculture to be completed 1989. This study will example and evaluate the probable impacts of salmon net-pen farming on the biological, social, and economic environment.

SECTION 3

SHORELINE MASTER PROGRAM

AMENDMENT ANALYSIS:

GENERAL AQUACULTURE

REGULATIONS

In Sections 3 and 4 of this report the aquaculture components of the ***Jefferson-Port Townsend Shoreline Management Master Program*** along with amendments the Aquaculture Policy proposes for the shoreline program are analyzed and evaluated. Recommendations for updating the shoreline program follow this evaluation.

Policies and regulations for all types of aquaculture projects are examined in this section. For each subject, the applicable policies and performance standards in the shoreline program is first listed. Next, related findings, conclusions and recommendations from the proposed Aquaculture Policy are then described. Then other pertinent information or regulations from different governmental jurisdictions or studies are summarized. An analysis of these different approaches is then followed by recommended amendments.

The format of this section should simplify the job of county and city policy makers in developing amendments to the master program for regulating aquaculture in a more desirable manner.

3.1 DEFINITION OF AQUACULTURE

3.1.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program**, (Section 5.30, "Aquaculture").

   a. Definition: Aquaculture is "the farming or culturing of food fish, shellfish, or other aquatic plants or animals. Aquacultural practices are the activities directly related to the cultivation, growth, or harvesting of aquatic plants or animals. For the purposes of this section, related uses such as wholesale and retail sales, processing, packaging, and product storage facilities are not considered aquacultural practices."

2. **Proposed Aquaculture Policy**

   a. Findings:

   * 3.1.1 Aquaculture encompasses everything from finfish to shellfish to aquatic plants; it can occur in the aquatic bedlands, intertidal zone or upland area; it can be operated by a public agency or private business operation; and it can be a commercial or non-commercial business.

   3.1.21 Shellfish processing can be water dependent and associated with an aquacultural operation. Good water quality is critical for operations that must hold shellfish in water baths. The existing shoreline program does not recognize shellfish processing as part of an aquaculture operation. Such activities are a primary use only in designated urban environments.

* The numbers listed beside each finding and conclusion correspond to those in the Jefferson County Aquaculture Policy Study.

b. Conclusions:

3.2.3 The definition of aquaculture should be amended to include related activities, such as shellfish processing that are water dependent.

3.2.18 The definition of aquaculture should be changed to more fully and accurately describe aquacultural practices.

3. **Washington State Department of Natural Resources**

Aquaculture is "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."

3.1.2 ANALYSIS

The Jefferson County Aquaculture Policy study recommends that the shoreline program's definition of aquaculture be amended to be more specific and to incorporate a broader spectrum of activities as being aquaculture such as processing and packing. The existing definition seems unclear concerning activities such as hatchery production or sea ranching. Also, harvesting activities such as mechanical shellfish harvesting are reviewed under the shoreline program because they involve dredging. This activity has been reviewed as an aquaculture development, although it is not included in the definition as farming or culturing. Finally, the shoreline program definition also does not address the existence of different forms of aquaculture such as floating mariculture as opposed to seabed harvesting.

The Washington Department of Natural Resources definition is the most specific of those listed above concerning the different aspects of aquaculture. Accordingly the shoreline program definition should be changed to more specifically identify which practices are or are not considered aquaculture.

The Aquaculture Policy recommends the inclusion of activities such as shellfish processing under the definition of aquaculture. Presently, different performance standards are applied to these activities when reviewing shoreline permit applications. This often makes siting harvesting and processing facilities together difficult.

In examining an aquaculture operation, processing is seen as distinctly separate from the activity of growing fish. Processing can be more obtrusive and objectionable, especially with respect to potential problems with waste disposal, odors and noise. Therefore it is

recommended that these facilities be reviewed under a different set of criteria as with the processing of any raw material. They should not be included in the definition of aquaculture.

3.1.3 RECOMMENDATIONS

1. Change the definition of aquaculture (shoreline management master program Sections 5.30 and 2.5) so that it more specifically identifies which practices are or are not considered aquaculture. The following language is recommended: "Aquaculture is the culture and/or farming of food fish, and other aquatic plants and animals in aquatic areas. Aquaculture practices include hatching, seeding or planting, cultivating, feeding, raising, and harvesting of planted crops. Mechanical dredging of natural stocks is also considered aquaculture under this program. Mariculture is defined as the culture of sea life in salt or brackish water as opposed to freshwater aquaculture. Aquaculture is further divided into floating aquaculture, where organisms are suspended in water by pens, nets or lines; seabed aquaculture where organisms are raised or harvested along the bed of a body of water; and upland aquaculture where organisms are grown above the mean high water mark of a water body. For the purposes of these regulations, related development such as wholesale and retail sales, processing, packaging, and product storage facilities are not considered aquaculture practices."
2. Related Aquaculture operations such as processing and packing should not be reviewed in the same manner as the raising and harvesting of aquaculture products, since these operations create a different set of concerns such as with respect to waste disposal, noise, and odors.

3.2 STRUCTURE REMOVAL, LIABILITY

3.2.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program**, (Section 5.30, "Aquaculture")

   a. Policies:

      3. Recognition should be given to the possible detrimental impact aquacultural activities might have on the aesthetic quality of the shoreline area.
      4. As aquacultural technology expands with increased knowledge and experience, emphasis should be placed on technology that does not materially interfere with navigation or impair the aesthetic and ecological quality of the state's shorelines.

5. Structures or activities associated with aquaculture should be located inland from shoreline areas unless clearly water dependent.

b. Performance Standards:

7. Equipment, structures, and materials shall not be abandoned in the shoreline or wet land area.
11. Permits for aquacultural practices shall become void if the permitted practice is abandoned for a period of two consecutive years.

2. **Proposed Aquaculture Policy**

a. Findings:

2.1.16 The adequacy of anchor and mooring systems (of floating aquaculture projects) can be questionable. The Washington State Department of Natural Resources and the U.S. Army Corps of Engineers reviews these systems but at no time does a qualified engineer approve or disapprove them.

b. Conclusions:

2.2.13 The county should not assume liability for anchor and mooring systems. The county should ensure that adequate liability insurance is being required by the department of natural resources; and should encourage the corps of engineers to review these systems when reviewing permit applications.

2.2.17 A project proponent should be required to immediately remove all moveable equipment and structures placed in the water or along the shoreline should the project cease operation.

3.2.7 Consideration should be given to requiring the applicant to demonstrate diligent use of the shoreline substantial permit.

3. **Washington State Department of Natural Resources**

The Washington State Department of Natural Resources requires performance guarantees of all aquatic land leaseholders. These guarantees are usually in the form of a bond and equal $500 per acre (twice the annual rental rate). The lease site for a development such as fish pens incorporates the area in which the pens are placed in addition to the area required for anchoring the pens or rafts to the sea floor. Finally, the leased area includes space for mooring associated marine vessels. Typically, a fish pen operation two acres in area would require ten to fifteen leased acres. The required bond would total between $5,000 and

$7,500. The department of natural resources also requires the permittee to carry $100,000 liability insurance coverage for each lease.

3.2.2 ANALYSIS

The shoreline program prohibits the abandonment of equipment, structures, and materials in the "shoreline or wet land area". There is, however, no definition of what constitutes abandonment. The program appears to contradict itself by stating that abandonment is acceptable unless the period of abandonment exceeds two years. The only punitive measure taken to prevent abandonment is the revocation of the original shoreline permit once the two year period has passed. It is not clear, however, if the revocation of a shoreline permit would require the operator to remove associated structures, materials, and equipment.

The conditions of several past aquaculture permits go beyond and, in some cases, contradicts the shoreline program's performance standards. Examples of these conditions are as follows:

1. Requiring immediate removal of all equipment and structures placed in the water should the project cease operation (fish pens).
2. Requiring immediate recovery and repair by the permittee of all structures that are damaged or break away from a facility (fish pens).
3. Requiring removal of all components of the project and returning the shoreline as close to its natural condition as possible should the project cease operation. (nori).
4. Requiring a performance bond or security to guarantee clean up. (nori).

The above conditions have been applied inconsistently and sporadically. Many of these conditions result from reacting to citizen concerns on a case by case basis or a lack of past experience with a particular type of development (as was the case with a nori farm permitted during the late 1970's).

It appears that the shoreline program only addresses abandonment for aquaculture developments. This is the only section where removal of abandoned structures is required. Bonds or security guarantees have not been required of permittees other than those proposing aquaculture projects. Many other development types, if not all, are capable of causing impacts such as navigation hazards or eyesores if they are not removed from the water after they cease being used.

If the removal of abandoned structures, equipment, and materials associated with a project is required, it should be required for all structures placed below the ordinary high water mark or on any wetland area. This should apply to all shoreline developments, regardless of the type of development. The department of natural resources currently requires aquatic land leaseholders to remove all structures upon lease expiration.

Security guarantees requirements are inconsistently applied by the county. These often duplicate those already required by the department of natural resources, causing unnecessary expense and hardship by the

applicant. The county could possibly directly access department of natural resource bonding funds through use of intergovernmental agreements between the county and department of natural resources or through joint bonding agreements.

Liability insurance requirements could also be coordinated with the department of natural resources via intergovernmental agreement. Insurance requirements should also be applied consistently not just for aquaculture projects.

To date, only one approved shoreline permit addresses liability as a permit condition. The condition states that "the permittee is liable for all damages to public and private property arising from violation of any provisions of the permit hereby granted, including the cost of restoring the affected area to its condition prior to violation and possible court costs that may ensue from violation." Although this condition was applied to a seaweed rafting operation, it was a response to the county's uncertainty of the adequacy of the project's anchor and mooring system. The aquaculture policy recommendations address the county's lack of expertise in dealing with marine anchor and mooring systems, suggesting that a qualified engineer should examine theses systems to minimize liability.

3.2.3 RECOMMENDATIONS

1. Where possible, the county should coordinate bonding and liability insurance requirements with the department of natural resources. This could be accomplished by means of an intergovernmental agreement or issuing a bond or insurance jointly through the two government agencies. An agreement should allow the county to directly access funds to initiate the clean-up of an area. The county should still retain the right to require a bond or liability insurance greater than that required by the department of natural resources if deemed necessary (see recommended conditions b and c below).
2. Bonding and liability insurance should be required consistently for all developments on aquatic lands as opposed to just for aquaculture developments.
3. The following policies and conditions should be added to the shoreline program, Section 4.10, "Aquatic Shoreline Designations". These would replace Performance Standards 7 and 11 in Section 5.30, "Aquaculture", and would help implement the above two recommendations.

   a. Policy:

      1. Unnecessary or abandoned structures along the shoreline are undesirable and should be removed when they no longer serve a useful purpose.

b. Conditions:

1. Equipment, structures, and materials shall not be abandoned in any wet land area unless otherwise permitted in this program. This includes marine areas below the mean high water mark as well as freshwater lakes, streams, rivers, and wetlands. Structures, equipment, and materials shall be removed immediately upon the cessation of a project's operation or a structure's useful life. Any structure which is damaged or breaks away in the water shall be immediately recovered and repaired by the permittee. Permittees who anticipate a temporary lack of use of a facility or structure may be allowed to keep them in the shoreline area only as allowed by permit.
2. All developments on subtidal or other lands administered by the state shall be required to secure a performance bond or other suitable guarantee to insure immediate removal of all structures should the project cease operation. The county may require security beyond that required by the state if deemed necessary to secure removal of structures. The county shall also require performance bonds or other security to guarantee the removal of structures, equipment, and materials in intertidal waters and freshwater wet lands.
3. The permittee is liable for all damages to public and private property should structures fail. The county does not assume responsibility for permitted structures such as rafts, anchors, and mooring systems. The county may require liability insurance beyond that required by the state if deemed necessary to cover potential damages.

3.3 NAVIGATION

3.3.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program,** (Section 5.30, "Aquaculture")

a. Policies

4. As aquaculture technology expands with increased knowledge and experience, emphasis should be placed on technology that does not materially interfere with navigation.

b. Performance Standards:

1. Aquacultural activities shall be located so as to provide reasonable navigational access to waterfront property owners.
2. Aquacultural structures shall be placed in such a manner so as to minimize interference with navigation.

3. Aquacultural facilities or structures that are hazards to navigation shall be suitably marked.

2. **Proposed Aquaculture Policy**

Navigation conflicts are not addressed in this document except with respect to the adequacy of anchors and moorages as discussed above.

3.3.2 ANALYSIS

1. ***Jefferson-Port Townsend Shoreline Management Master Program***
Performance Standards 2 and 3 are very general and seem more like policies. They do not address the specifics of where floating structures may or may not be placed to avoid navigation conflicts with other uses. Most potential navigation conflicts result from siting floating structures in areas such as established shipping lanes or in narrow passages where barges require a wide swing path for turning. Siting aquaculture facilities in such areas can impede navigation as well as endanger the aquaculture facility. Also, all structures placed in subtidal waters must be marked in accordance with the U.S. Coast Guard Private Aids To Navigation Regulations to minimize navigation hazards. This condition has been included in many past permits, but is not addressed in the shoreline program.

3.3.3 RECOMMENDATIONS

1. Amend Performance Standard 2 of Section 5.30, "Aquaculture" to read: Aquaculture structures shall be placed in such a manner so as to minimize interference with navigation. Aquaculture facilities should therefore not be placed in narrow channels, shipping lanes or in other areas having navigational importance.
2. Add the following performance standard to shoreline program Section 4.101, "Aquatic Shoreline Designations": All structures which could potentially interfere with navigation shall be conspicuously marked and/or shall install obstructional lighting in accordance with the U.S. Coast Guard and all other applicable regulations.

3.4 NUISANCES—NOISE, SMELL AND GLARE

3.4.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program**, (Section 5.30, "Aquaculture").

a. Performance Standards:

4. Aquacultural development shall make adequate provisions to control nuisance factors such as excessive noise and odor.

2. **Proposed Aquaculture Policy**

a. Findings:

3.1.2 . . . Concern about upland aquaculture activities is often centered on nuisance factors like noise, odor, or glare. . .

b. Conclusions:

2.2.5 Aquacultural development should control nuisances such as excessive noise, odor, or glare. Where practicable, controls should be based upon performance standards, not operating standards.

3. **Past Shoreline Permits**

Many conditions for previous shoreline permits have addressed nuisances. These are summarized as follows:

1. Noise shall be controlled by:

a. Limiting noise levels to sixty decibels (dba) at adjacent land property boundaries or adhering to the standards set forth in the state noise standards WAC 173-60-040 for Class "B" commercial operations whichever is lower (fish pens). For a mechanical clam harvester, noise was limited to sixty dba at 100 feet from the operation or fifty-five dba at 250 foot distance.
b. Requiring electrical generators which are water cooled and contained in noise insulated housing.
c. Restricting operation of the generators or the overall operation to daytime hours (hour restrictions vary to between 6:00 a.m. to 8:00 p.m.).

3.4.2 ANALYSIS

Noise, odor and glare comprise the major nuisances from aquaculture operations. Increased boat traffic and upland automobile traffic from employees could cause some additional nuisance to adjacent residents.

Jefferson County has adopted state regulations which set maximum allowable noise limits for within designated residential, commercial, and industrial areas (WAC 173-60-040). These are measured in decibels at the property line of an adjacent land owner. The sixty dba noise limit used for past permitted fish pen operations is based upon the limit set when the noise source and receiving areas are both in commercial zones. This

This limit has been established mainly to control noise conflicts for land-based operations. Aquaculture, however is not exactly a commercial operation under the definition of the shoreline program and, more importantly, it occurs on the water or along the shoreline. No existing noise regulation seems to address projects located over water or by the shoreline. Noise from watercraft are exempt under these regulations. WAC 173-60-070 does state however, that sounds from watercraft will be regulated in the future.

The department of ecology has made a "preliminary determination" that subtidal areas leased for commercial harvesting of hardshell clams (see the final environmental impact statement for the commercial harvesting of subtidal hardshell clams with a hydraulic escalator shellfish harvester, (page 45). Uplands and tidelands adjacent to harvestable tracts are considered residential zones if they are either residential or recreational areas. According to this impact statement, sixty dba is the maximum continuous noise allowed in these residential areas under WAC 173-60-040.

WAC 173-60-040 states a more restrictive noise limit of fifty-seven dba for residential areas receiving noise from commercial zones. This limit is higher when the receiving property is a commercial or industrial zone (sixty and sixty-five dba respectively). This can be exceeded by five dba for fifteen minutes per hour, ten dba for five minutes per hour and fifteen dba for one and a half minutes per hour. Maximum allowable noise is reduced by ten dba between the hours of 10:00 p.m. and 7:00 a.m. when the receiving shorelines are residential or recreational.

These regulations are not well-suited to controlling noise generated in aquatic areas. Limits are set only for upland areas. No protection is given for aquatic recreationalists or other commercial users of aquatic lands. Also, due to the ability of sound to carry further distance over water than land, a noise source on water will likely affect more shoreline areas than upland-based noise sources. Given the state's recognition of our shorelines as places which are unique and require special protection, more specific and perhaps more stringent noise controls are needed for this area.

Noise should be controlled by performance standards rather than by operating standards. Operating standards which require the installation of a certain type of muffling system allows little flexibility for the proponent. Methods may change as technology changes. This also applies to regulating the operation of generators at night. If the goal is to have less noise at night, then appropriate lower decibel standards should be set, rather than an outright prohibition of generators. The state's noise regulations provide an example of this by requiring that noise limits be reduced by ten dba for receiving properties within residential areas between the hours of 10:00 p.m. and 7:00 a.m.

Noise controls for aquaculture operators should be treated no differently than for other types of development such as oil drilling or for dredging. Currently the shoreline program does not regulate noise for other types of development.

Odors are a concern mainly with processing and storing fish products such as feed and shells. Dead fish and waste materials can also cause odors. In British Columbia, other associated activities such as disposal

of fish feed bags by burning have created occasional problems. Covered storage may be one way to minimize odors.

Potential odor problems can be controlled more effectively if they are clearly identified before a project is permitted. This could result in more specific permit conditions which would allow easier enforcement. Performance Standard 2 in the shoreline program Section 5.30, "Industrial and Port Facilities", requires facilities to be "located, designed, and operated to eliminate all unnecessary noxious odors". A similar standard could be used for aquaculture facilities.

Glare is a nuisance associated with any structure lit at night. This could become especially annoying to residents upland of a floating aquaculture facility. Performance Standard 10, Section 5.90, "Industrial and Port Facilities", requires that no direct or reflected glare is visible from adjacent areas. A similar standard could be used for aquaculture facilities.

3.4.3 RECOMMENDATIONS

1. Add a performance standard to the shoreline program (Section 4.10, "Aquatic Shoreline Designations") adopting the maximum noise levels set in WAC 173-60-040 for all aquatic and shoreland areas. All noise generated over water should specifically be treated as a commercial noise source.
2. The county should encourage the department of ecology to develop noise regulations which specifically apply to aquatic and shoreline areas.
3. Add the following performance standard to Section 5.30, "Aquaculture": Odors shall be minimized by using methods such as covering feed storage areas and waste products, such as shells. A specific plan for identifying and minimizing odors shall be developed and approved as part of the permit approval process.
4. Add the following performance standard to Section 5.30, "Aquaculture": Aquacultural facilities shall assure that no direct or reflected glare is visible from adjacent upland areas and that glare in adjacent water areas be minimized.
5. With the adoption of the above performance standards, Performance Standard 4 can be deleted.

3.5 VISUAL IMPACTS

3.5.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program**, (Section 5.30, "Aquaculture").

   a. Policies:

      3. Recognition should be given to the possible detrimental

impact aquacultural activities might have on the aesthetic quality of the shoreline area.

4. As aquacultural technology expands with increased knowledge and experience, emphasis should be placed on technology that does not impair the aesthetic and ecological quality of the state's shorelines.
5. Structures or activities associated with aquaculture should be located inland from shoreline areas unless clearly water dependent.

b. Performance standards:

3. Aquacultural development shall be designed and constructed to harmonize insofar as possible with the local shoreline environment and shall be maintained in a neat and orderly manner.
6. Structures or activities associated with aquaculture that are not water dependent shall be located away from the shoreline proper when practicable.

2. **Proposed Aquaculture Policy**

a. Findings:

2.1.10 Visual and aesthetic impacts can be minimized through design standards, density, height and size restrictions, and shoreline setbacks.

2.1.11. The visual impact of development in the aquatic area may be partially dependent on the height of the shoreline banks.

2.1.12 The Shoreline Management Act (SMA) gives only limited rights to protection of views. The SMA states a preference to "preserve the natural character of the shoreline". The shorelines hearings board has ruled that "preserve" does not preclude development. The SMA differentiates between obstruction of views, as compared to view intrusions. It also states that aesthetic impacts must be recognized.

2.1.13 City, county, state or federal parks along the shoreline are usually provided for the enjoyment of the public. The department of natural resources has an interagency agreement with the Washington State Parks and Recreation Commission restricting leasing of aquatic lands .25 miles in front of state parks

b. Conclusions:

2.2.6 Aquacultural development should be sensitive to the aesthetic and visual impacts on upland property owners and others. Visual impacts of an aquaculture operation should be minimized.

2.2.8 Aquacultural development requiring surface structures should be reviewed for potential intrusions on the natural visual quality of public parks situated along the shorelines.

2.2.9 Upland or shoreline aquaculture facilities should provide adequate buffers to screen operations from any residential uses.

2.2.10 If appropriate, visual and aesthetic impacts should be minimized through performance standards.

c. Other recommendations:

The following recommendations were made for salmon pen development. These could be applied however, to all floating aquaculture operations:

1. Salmon pen development could be restricted in areas with special aesthetic character such as public parks, biological preserves, and common areas where people gather to enjoy unrestricted views of the aquatic area.
2. Density or open space standards could be applied or each farm could be limited in size. An example of density restrictions is to allow only a certain percentage of surface water area to be covered by floating aquaculture operations in a given area.
3. Design standards such as color, height above the water, setbacks from shore, materials and configuration could be regulated.
4. Structures on the water used for equipment storage or employees could be either totally prohibited or efforts could be made at minimizing impact. Submergible structures, for example, would not be as noticeable from the shoreline.

3. **Past Shoreline Permits:**

a. Past shoreline permit conditions have addressed visual and aesthetic impacts in the following manner:

1. Requiring structures to be a color which is unobtrusive to off-shore recreational boaters and adjacent land owners.
2. Requiring Planning and Building Department review and approval of the design and color of all boats regularly moored to a floating facility.
3. Requiring an operation to be maintained in a neat and orderly manner.
4. Prohibiting placement of any unnecessary permanent structures such as equipment sheds or residential structures on the water. Work shelters to protect workers from the elements have been allowed as long as they were on boats moored to a facility. In one case a raft was allowed as a shelter but was only permitted to remain in the water between March and

June. The shelter was permitted only during the first two years of operation before requiring further review. For seasonal operations such as oyster spat collection, floating structures were only allowed in the water during spawning and setting season. Sites for winter upland storage of rafts needed commissioner review and approval. Beach storage was deemed unacceptable.

5. Restricting height of floating structures associated with the pens. A limit of nine feet above the pen walkway level was imposed in one permit.
6. Placing floating operations no closer than 500 feet to a neighboring property line (nori).

4. **Department of Ecology Aquaculture Siting Study**

The study states that siting and design can have a critical effect on the visual impacts of a floating mariculture facility. Structures have the greatest visual impacts when sited in pristine settings, small enclosed embayments and offshore of high banks where viewers look down over them. The distance offshore is also a major factor. The closer a floating facility is to shore, the greater the visual impact. In terms of design features, the study concludes that operations that occupy the greatest surface area, have a high profile above the water, and which look the most artificial in appearance are most visually obtrusive to shoreline viewers. As a result of the study the following recommendations are made:

a. Floating aquaculture operations should be sited at least 1500 to 2000 feet offshore. At this distance, a facility is visually reduced to a line near the horizon for shoreline viewers. At this distance, size and surface coverage doesn't seem to affect visual impact. If situated closer to shore, structures which are smaller, lower and more dispersed will be less obtrusive.
b. Floating aquaculture structures should be located in the following areas to minimize visual impacts:

    1. By culturally modified landscapes, preferably those with existing commercial/industrial maritime activity.
    2. Along rural or uninhabited shorelines.
    3. Along shorelines having low banks.
    4. Along open shorelines, as opposed to enclosed embayments.

c. Floating aquaculture facilities should be designed in the following manner to minimize visual impacts:

    1. By having a horizontal profile.
    2. By incorporating the facility as part of structures and forms already appearing in the marine environment (such as a pre-existing dock or marina).

3. By limiting the overall size and surface coverage of the structure so that it covers under ten percent of the normal cone of vision of upland viewers.
4. By having a color which complements the dominant blue/green colors of Puget Sound.
5. By being ordered and of limited variation in material and color.

5. **Gillespie Report - British Columbia**

Although this report applies to net-pen mariculture the following recommendations can apply to all farms of floating aquaculture:

1. Finfish farming should not be permitted areas adjacent to provincial parks and recreation areas. Regulations developed to implement this recommendation will not allow new aquaculture operations to be sited in areas fronting and with 3,280 feet (1 kilometer) seaward of provincial parks and ecological resources.
2. A minimum distance separation guideline for fish farms in populated coastal areas should be utilized to reduce impact on upland areas and other resource users.

3.5.2 ANALYSIS

Visual impact is, without question, one of the key reasons why many citizens oppose aquaculture. This is especially true for floating aquaculture facilities. Where upland facilities can often be buffered from view, it is more difficult to hide structures placed offshore. Objections are especially heightened where aquaculture facilities are situated near residential areas, or by shorelines used primarily for recreation. A frequently voiced concern is the effect of offshore development on upland property values.

Visual impacts from floating mariculture facilities are perceived differently from that of upland and seabed operations. Facilities situated along the shoreline far upland are visible by fewer people, mostly adjacent residents or offshore marine boaters. Impacts can be lessened by siting non-water dependent structures for upland of the shoreline or by buffering the site from adjacent residences with fences, vegetation, or berms. Floating structures can either be situated closer to shore, similar to docks, or further away from shore where the structures would be less visible to adjacent shorelines, but more exposed to natural hazards and marine boating traffic.

The department of ecology's aquaculture siting study attempted to look at floating mariculture operations in a more objective manner using computer modeling to show graphically how distance from shore, bank height, size, and configuration of a floating structure would impact views. This information may be useful for permit applicants but cannot be easily used to regulate siting. Because appearance is very subjective in nature, it is difficult to avoid evaluation on a case-by-case basis.

Floating aquaculture facilities which require a large exposed surface area tend to have the greatest visual impact. These include nori racks, fish net pens and mussel rafts. Nori culture requires the seasonal exposure of nori seaweed on the water's surface, where net pens and mussel rafts require more permanent structures upon which to suspend nets. Sea bottom aquaculture is only visible during low tide and therefore has far less visual impact. Upland aquaculture operations such as tank fish culture or hatcheries are usually less visually intrusive due to the buffering effects of surrounding landscape and vegetation.

As discussed in the aquaculture siting study, visual impact appears to be directly related to structure design and facility siting. A discussion of these is presented below:

1. Design:

   a. Currently the shoreline program deals very generally with design in stating that developments "shall be designed and constructed to harmonize with the local environment and shall be maintained in a neat and orderly manner". More specific design considerations are as follows:

      1. **Height**: Most studies concur that the more horizontal the profile, the less intrusive structures become. This is especially true for structures situated on the water. For this reason, "unnecessary" permanent structures such as residences, work shelters, or storage areas are discouraged. One past permit limited height of floating structures to no more than nine feet above the pen walkway. This height limit was probably arbitrarily set, but definitive and easy to enforce. Acceptable height, however, is variable dependent on distance from shore and the height of the shore bluff from which the structure is viewed.
      2. **Size and density**: The smaller a facility, the less visually intrusive, especially for floating structures. An unfortunate side effect of limiting facility size is the occurrence of more structures spread out over a wider area and perhaps operations that are less economically viable. To compensate for limited size, operations may resort to overcrowding their facilities. It is a subjective tradeoff as to which situation presents the greatest overall impacts visually. Currently the department of natural resources limits net-pen operations to two surface acres. The surface area of other forms of aquaculture is not regulated. The department of ecology's interim siting guidelines limit production of finfish in designated bays on a pound harvested per square mile basis, based on biological considerations. The department of natural resources requires that salmon pen operations be separated by a minimum of 6,080 feet (1 nautical mile) unless it can be demonstrated that an area has adequate tidal flushing to prevent excessive or harmful sediment accumulation. Facility density, however, has not been addressed for any form of floating aquaculture facility.

Another approach in limiting size and density is to require that a structure or group of structures cover less than a certain percentage of the normal cone of vision for offshore viewers. Ten percent is suggested in the department of ecology siting study.

3. **Materials and color**: Past shoreline permits have conditioned floating structures to be a color which is unobtrusive to off-shore recreational boats and adjacent land-owners. The department of ecology siting study has shown that colors which complement the dominant blue/green colors of Puget Sounds are the least obtrusive, especially under overcast skies. Structures with little variation in materials and colors also seem to be the least obtrusive. The visual impacts of upland structures is dependent upon natural shoreline features and how well a proposed structure blends with existing structures. Material and color for upland aquaculture facilities should not be regulated unless the county wishes to regulate all upland shoreline developments in a similar manner.
4. **Associated permanent floating structures**: Historically, Jefferson County has considered structures such as sheds, work shelters, and work residences, unnecessary to an aquaculture operation, and therefore has not permitted them. Currently, the shoreline program addresses placement of structures over water in a limited manner. Placement of residential and non-water dependent commercial structures over water is prohibited. It is not specifically prohibited, however, for water dependent industrial development or for aquaculture. Facility caretaker quarters or work shelters are not addressed in the program.

   According to British Columbia authorities, the presence of a permanently manned floating aquaculture site is desirable, especially for net-pen operations due to the value of the fish within the pens, the need for continual attention from the operator and the remoteness of many sites. Jefferson County, however, has been reluctant to set the precedence of allowing permanent structures. Instead, it has permitted shelters on boats which can be temporarily moored to a facility. It has also allowed structures to be barged in alongside the aquaculture site on a seasonal or otherwise temporary basis. In doing so, the county has exercised control over boat or raft design and color. The proposed aquaculture policy suggests an alternative in allowing submersible structures. Thus far, the county's prohibition of _____ structures for shelter or storage seems to have been well accepted by most aquaculture operators. Continuing this policy would help reduce the visual impact of floating mariculture. The county should address this issue in the shoreline program so that future operators be treated consistently.

5. **Storage of rafts or equipment on beaches**: Seasonal floating aquaculture operations must remove rafts or equipment from the water when not in use. The easiest or most logical place to store this equipment is along the shoreline. This minimizes labor in hauling heavy structures to and from the water. The use of the shoreline for storage however, can create an eyesore and are thus considerable objectionable by many. As a result, some previous shoreline permits have prohibited beach storage of floating structures when not being used for aquaculture. County approval of storage sites has also been required. This requirement is backed by shoreline program Performance Standard 6 (SEction 5.30, "Aquaculture") which prohibits the placement of non-water dependent structures by the shoreline.

2. Siting:

a. The shoreline program's only specific aquaculture siting requirement is that non-water dependent operations be sited away from the shoreline when practicable. The department of ecology siting study and aquaculture policy recommendations make several suggestions which could be incorporated into the shoreline program. These are as follows:

1. **Upland structures**: Screening upland aquaculture operations from adjacent areas using berms, vegetation or fencing could minimize objectionable view intrusions.
2. **Proximity to recreation sites**: Viewing an aquaculture facility offshore of a heavily used recreation area such as Fort Warden could be objectionable to many users. Accordingly the department of natural resources will not issue a lease for aquaculture facilities sited within 1,520 feet (.25 nautical miles) offshore of a state park. British Columbia will not allow finfish farms to be placed within 3,280 feet (1 kilometer) of provincial parks or ecological areas. A similar provision could be incorporated into the shoreline program for floating aquaculture facilities and other imposing forms of developments. These operations could be restricted from placement offshore of, adjacent to or within view of federal, county and city shoreline parks and other valued aquatic lands and shoreline areas which are not covered by the department of natural resources agreement. This should apply to all floating structures, not just aquaculture facilities.
3. **Distance from shore**: The department of ecology siting study found that the farther from shore floating structures are placed, the less obtrusive they become to upland viewers. This relationship varies depending upon structure size, its height above the water, and the height of the shoreline banks on which the facility is viewed. As described above, most structures appear to viewers as a line near the horizon when placed 1500 to 2000 feet offshore. Floating aquaculture

operations sited that far offshore, however, may present increased hazards to navigation, higher exposure for the structure as well as greater anchoring expenses, and more difficult physical working conditions for operations. These tradeoffs need to be evaluated on a case-by-case basis.

4. **Relationship to Physical Shoreline Topography**: The department of ecology siting study states that floating structures are visually obtrusive if placed off of an exposed shore as opposed to a closed embayment. Also, floating structures are less visible when viewed from low banks as opposed to high banks. These facts seem difficult to regulate especially given all the other complicating siting factors.
5. **Relationship to Other Land Uses Along the Shoreline**: The department of ecology siting study suggests that a floating structure which is incorporated into or placed alongside an existing structure such as a dock or marina is less obtrusive than a facility with no adjacent structure. If placed in an area with other commercial or industrial maritime activity, it seems to blend in with the landscape. It appears to be most objectionable when placed alongside or offshore of a non-urban residential environment. Accordingly, the county should try to channel floating aquaculture operations away from moderately populated non-urban residential areas. San Juan County has proposed requiring that fish pens be placed no closer than 1500 feet waterward of shorelines designated as suburban to minimize conflicts with upland residents. The applicant however may waive this requirement by submitting a visual impact analysis based upon the department of ecology's aquacultural siting study that shows the visual impacts of siting closer to shore will be minimal.

3.5.3 RECOMMENDATIONS

1. Amend the shoreline program (Section 4.101, "Aquatic Environmental Designations") so that all structures placed in aquatic environments are required to be a color which is unobtrusive to offshore recreational boaters and adjacent upland viewers. Structures situated away from marine shorelines should have a color which complements the dominant blue/green colors of the water surface.
2. Amend the shoreline program (Section 5.30, "Aquaculture") so that it clearly states that the placement of structures appurtenant to floating aquaculture facilities such as work shelters, sleeping quarters, and storage sheds shall b generally prohibited if required, temporary structures such as boats may be used for such purposes.
3. Amend the shoreline program (Section 4.101,"Aquatic Environmental Designations") so that floating structures are prohibited from locating near areas with special aesthetic character such as public parks, biological preserves and historic shoreline viewing areas. Restricting facilities from siting within 1,520 feet (.25 nautical

miles) waterward of these sites would be consistent with department of natural resources guidelines. This siting requirement would assure that these structures are reduced visually to a line near the horizon. To allow more flexibility the county could require a visual impact analysis to show that siting closer would create minimal visual impact. Restricting siting where floating structures significantly affect views even if they are situated beyond the foot limit should also be considered. This can be measured by the percent cone of vision occupied by floating structures for upland viewers (10 percent coverage limits are suggested by the department of ecology siting study).

4. Consider restricting floating structures from siting offshore of densely populated non urban residential developments such as Cape George or Kala Point. This could include all areas designated as suburban. San Juan County requires siting at least 1500 feet offshore of these areas unless visual impact is shown to be minimal using the siting study as a basis for analysis. This approach should be considered for Jefferson County.
5. Consider adopting density and/or size limitations for all floating structures including aquaculture facilities. A two acre size limitation would be consistent with the department of natural resources restriction on salmon pen size. Density could be set by establishing a minimum distance between different aquatic developments or by allowing a maximum surface area coverage of structures per square mile.
6. Amend shoreline program (Section 5.30, "Aquaculture") so that upland aquaculture structures shall be buffered from view of adjacent residents through use of techniques such as vegetation, berms, on fences.
7. Amend the shoreline program (Section 4.101, "Aquatic Environment Designations") to require that all structures placed on the water's surface shall have as low a profile as possible to minimize visual intrusion.

3.6 PREDATOR CONTROL

3.6.1 EXISTING DOCUMENTS

1. **Department of Ecology Interim Guidelines for Net-Pen Culture**: The following guideline applies to net-pen culture but can be used for all types of aquaculture: If predator control is necessary, non-lethal predator control measures should be used against both bird and mammalian predators. Predator control methods must comply with appropriate federal and state rules, and the pen operator shall possess all permits.

2. **Past Shoreline Permits**: Although predator control is not mentioned in the shoreline program, several past permit conditions have addressed the issue. Conditions have included:

   a. Allowing only barrier nets and electronic sound scarers. Other measures would need prior approval by the governing body.
   b. Requiring the covering of all nets.
   c. Prohibiting the shooting or injuring of fish predators.
   d. Allowing only those methods approved by the department of fisheries and department of game.

3.6.2 ANALYSIS

In Jefferson County and throughout the state, there appears to be major objections to controlling predators by injuring or killing them. Also use of chemical controls have raised some questions about effects on the nearby marine environment. Many methods have been used, however, which have effectively eliminated predatory fish kills without harm to predators. These include such methods as placing predator nets above and below floating mariculture operations or rigging a facility with electronic sound scarer systems. Because technological changes will likely produce many alternative predator control methods in the near future, the shoreline program should not specify allowable methods of predator control. The department of ecology's interim guidelines for salmon net-pen culture seems to address this issue adequately enough for use as a general aquaculture guideline.

3.6.3 RECOMMENDATIONS

1. Amend the shoreline program so that the language for controlling predators from the department of ecology's interim guidelines for net-pen culture is adopted for all forms of aquaculture.
2. Any chemical substances needed for predator control should be reviewed and approved by the county and the department of ecology before being used.

3.7 ENVIRONMENTAL SITING CONSIDERATIONS

3.7.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program**, (Section 5.30, "Aquaculture")

a. Policies:

1. Potential locations for aquacultural practices are relatively restricted due to specific biophysical requirements such as water quality, temperature, substrate, dissolved oxygen, and, in marine water, salinity. Priority should be given to aquacultural uses in areas having a high potential for such uses.

2. **Proposed Aquaculture Policy**

a. Findings:

1.1.3 Not all cultured aquatic species are compatible with each other. There is no conclusive evidence on specie compatibility or incompatibility.

2.1.2 There are a wide variety of aquaculture activities, each having different impacts.

2.1.3 Good husbandry practices and proper environmental siting can minimize ecological impacts. Polyculture may also minimize ecological impacts.

2.1.4 Certain aquaculture activities can have adverse impacts on significant habitats if improperly sited.

2.1.5 Aquacultural development can have impacts on the biota. Nutrient loading, water quality degradation and species alteration can become significant depending on location, environmental conditions and culture methods.

2.1.17 Certain aquaculture operations could have adverse impacts on protected and endangered species.

3.1.18 In some instances, the county or city do not have adequate expertise to evaluate the risk of potential impacts to the environment resulting from aquacultural development.

b. Conclusions:

1.2.6 and 2.2.15 Adequate distance between different aquaculture operations and between aquaculture operations and significant populations of natural aquatic species should be provided when there is sufficient potential for the following adverse effects:

a. The cultured aquatic species and/or natural species would be in competition for limited environmental resources (nutrients, water quality, etcetera).
b. Disease would spread between species, or
c. An unwanted dominant species would be established outside of the culture operation.

2.2.2 Aquacultural operations should locate in areas where the ecological quality of the state's shorelines are not

severely impaired. Aquaculture operations should not locate in critical habitat areas.

2.2.3 Aquacultural operations should locate in areas where environmental characteristics, such as tidal currents, water temperature and depth may reduce environmental impacts.

3.7.2 ANALYSIS

The proposed aquaculture policy states that there is a wide variety of aquaculture impacts, each having its own impacts and siting limitations. Due to the different requirements for each kind of aquaculture operation, different environmental siting constraints should be applied for each aquaculture type.

Island County realized this fact when in 1981 it commissioned a regional aquaculture study to identify the opportunities and limitations for different types of aquaculture development in its marine waters. The county inventoried its marine shorelines and mapped them for aquaculture potential. This was based on the different environmental requirements of each species and method of culture of farming.

The departments of fisheries, natural resources, and ecology have developed specific siting guidelines for many aquaculture methods and species. Many of these guidelines are described in Section 4 of this report.

Local government generally does not have the expertise to property evaluate the potential ecological impacts of different aquaculture operations. They, therefore, must rely upon the review of specific sites by state agencies or private experts. It is felt that local government should have the authority to require additional conditions for siting should biological information or circumstances show that these conditions will result in reduced biological impacts.

The shoreline program (Section 5.30, "Aquaculture") states that priority should be given to aquaculture uses in areas having a high potential for such uses. Giving priority to aquacultural development, however must consider its potential conflict with existing uses (see Section 3.90, "Other Use Conflicts"). Environmental siting criteria needs to consider the physical needs of each aquaculture species and the potential for biological conflicts such as with disease transmission or organic waste impacts. This should help determine how close various operations can locate from each other and from naturally occurring species.

3.7.3 RECOMMENDATIONS

1. Amend shoreline program Policy 1 (Section 5.30, "Aquaculture") to read that "Potential locations for aquaculture practices are relatively restricted due to . . . "Priority should be given to aquacultural uses in areas having a high ecological potential for such uses where such development will not severely hinder or conflict with nearby existing uses.

2. Conclusions 1.2.6, 2.2.16, 2.2.2, and 2.2.3 of the proposed aquaculture policy provide good general environmental siting guidelines for aquacultural development. Accordingly these should be considered for adoption as Performance Standards in the shoreline program Section 5.30, "Aquaculture". Inclusion of these would give more authority to impose additional siting conditions if felt that existing state guidelines are inadequate.

3.8 WASTE DISPOSAL AND WATER QUALITY

3.8.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program (Section 5.30, "Aquaculture")**

   a. Performance Standards:

      1. Special precautionary measures shall be taken to minimize the risk of oil or other toxic materials from entering the water or shoreline area.
      5. Aquacultural discards shall be disposed in a manner that will not degrade associated uplands, wetlands, shorelines, or water environments.

2. **Proposed Aquaculture Policy**

   a. Findings:

      1.1.1 Point sources of pollution, such as sewage, utility, and industrial discharges, illegal dumping and oil spills, can cause water quality degradation to aquaculture resources.

      1.1.2 Non-point sources of pollution, such as agricultural run-off, stormwater run-off, failing septic systems, forest practices, marinas and boat moorage, port facilities, landfills, a d atmospheric emissions can cause water quality degradation to aquaculture resources.

      1.1.6 Herbicide, fertilizer or pesticide spraying within watersheds adjacent to productive shellfish areas could be detrimental to those organisms or make them unsafe for human consumption.

      1.1.8 Aquaculture resources and activities can be protected from degradation using regulatory tools such as shellfish

protection districts, a geologically sensitive area ordinance, the open space program, and buffer zones to control stormwater run-off.

1.1.9 Threats to water quality extend beyond the jurisdiction, both physical and legal, of the Shoreline Management Act. Watershed planning is one tool for controlling the sources of water quality degradation.

1.1.11 Aquaculture is a sensitive indicator of water quality.

b. Conclusions:

1.2.2 Shoreline, aquatic and upland development near productive aquacultural areas should be reviewed for potential detrimental impacts on the aquaculture operation. Jefferson County should study and carefully consider adopting more stringent regulations, such as Shellfish Protection Districts, to protect aquaculture resources from degradation. Incentive programs should also be an integral part of any water quality protection program.

1.2.7 Several sections of the shoreline program should be amended to reflect a policy of protecting existing aquaculture operations from point and non-point pollution sources. The following subsections should be reviewed: 5.20, "Agriculture"; 5.70, "Dredging"; 5.80, "Forest Management"; 5.90, "Industrial and Port Facilities"; 5.110, "Marinas"; 5.120, "Mining"; 5.160, "Residential Development"; and 5.200, "Utilities".

The following policies were recommended for adoption in the shoreline program in order to implement Conclusion 1.2.7:

1. Agricultural operations should work with the U.S. Soil Conservation Service and the Jefferson County Conservation District in developing the best management practices in order to protect water quality. Farm management plans should be written to show location of structures, fences, pastures, and surface waters and indicate how animal waste run-off will be controlled. (This policy should be adopted into Section 5.20, "Agriculture" of the master program).
2. Industrial development and port facilities shall not cause deterioration of water quality to the point that shellfish or other marine animals or plants in the vicinity of the proposed activity are unsafe for human consumption. Industrial development and port facilities shall also not alter the biophysical requirements of marine animals and plants. In most cases, industrial or port facilities should not locate closer than one half mile to significant

aquacultural resources. (This policy should be adopted into Section 5.90, "Industrial of Port Facilities" of the master program).

3. Marinas and ancillary facilities shall clearly demonstrate that the proposed activity will not cause deterioration of water quality to the point that shellfish or other marine organisms in the vicinity of the proposed activity are unsafe for human consumption. In most cases, marinas should not locate closer than one-half mile to significant aquacultural resource areas. (This policy should be adopted into Section 5.110, "Marinas" of the master program).
4. Residential development in the vicinity of productive aquacultural areas shall install drainage and waste water treatment facilities that prevent any adverse water quality impacts to aquaculture operations. (This policy should be adopted into Section 5.160, "Residential Development" of the master program).
5. Utility outfalls should be located at least on-half mile from commercial shellfish beds, significant recreational shellfish beds or other aquacultural resources. (This policy should be adopted into Section 5.200 of the master program).

1.2.10 Oil bunkering or other similar operations should not be allowed to imperil aquacultural resources.

3. **The Effects of Floating Mariculture - Don Weston**

a. Floating mariculture generates large amounts of solid wastes in the form of unutilized feed and feces (salmon culture) pseudo feces and shell debris (mussel and oyster culture). These wastes can accumulate below a facility resulting in dramatic changes of sediment chemistry and the benthic environment. These effects are highly localized. Even in poor sites visible accumulation of wastes typically are present only within about ten feet of the facility mitigative measure might include:

1. Siting in areas with the greatest current velocity and water depth.
2. Avoid siting in areas where bathymetry would promote the accumulation of wastes (such as in silled embayments).
3. Arrange culture units to disperse wastes over as broad an area as possible.

b. Placement of floating structures such as net-pens or rafts can significantly reduce current velocities. This could promote sedimentation and reduced water flushing. These effects can be reduced by proper placement of these structures in relationship to the predominant currents, especially for multiple rafts or

pens. Multiple pens or rafts should be arranged parallel to the direction of water flow in strong currents. This would minimize alteration of water circulation. Conversely in weak currents structures would be best arranged perpendicular to current flow. Spacing between rafts or pens should be two diameters (of the floating structures) or more. This would minimize the effect of each floating structure on water circulation and consequently water quality in adjacent aquaculture structures.

3.8.2 ANALYSIS

Waste and water contaminants have two main sources: those created on-site by aquaculture operations and those created off-site which could detrimentally affect an aquaculture operation. Since fish, especially shellfish, are so sensitive to water quality, maintaining clean water in the vicinity of aquaculture sites is critical.

In the past, those proposing aquaculture projects have gambled that water quality in the area surrounding their site would remain acceptable in order for their operation to continue. As seen with the decertification of portions of Quilcene Bay along with other areas in Puget Sound, there are no guarantees that marine waters will remain clean enough to support aquaculture without a concerted effort on the part of local and state government. The work program set forth in the Puget Sound Water Quality Management Plan (1987) has created funds and a plan for monitoring the marine waters of Puget Sound as well as reducing some sources of pollution such as failing septic systems.

Waste and water quality problems created on-site by aquaculture operations are relatively easy to regulate. The quantity and types of waste and contaminants differ with each type of aquaculture. The shoreline program addresses on-site wastes by prohibiting the disposing of aquaculture "discards" which will degrade the water environment and associated uplands (Performance Standard 4, Section 5.30, "Aquaculture"). The newly adopted Island County shoreline program section on aquaculture is more specific in requiring:

1. No garbage, wastes or debris shall be allowed to accumulate at the site of any aquaculture operation.
2. No processing of any aquacultural product, except for the washing or removal of surface materials or organisms shall occur in or over the water after harvest unless specifically approved by permit.
3. Aquaculture processing and maintenance wastes shall be disposed of in a manner that will ensure compliance with all applicable governmental waste disposal standards.

There is also the issue of feces and pseudo feces from all cultured aquatic fauna. These may result in organic buildup in the vicinity of each farm site. The environmental effects of floating mariculture by Don Weston suggests that siting farms in deep, well-flushed waters can reduce these localized impacts. Proper orientation, especially of multiple floating structures can reduce water quality degradation as well as benthic sedimentation. Orientation of floating aquaculture structures is

an area which is currently not addressed in the shoreline program or any state governmental regulation. Siting facilities according to the criteria described in Section 3.7, "Environmental Siting", and Section 4, "Regulations Covering Specific Types of Aquaculture", will reduce the site specific impacts these wastes create.

British Columbia has experienced problems with disposal of human wastes, solid wastes from daily operations, and fish mortalities; especially for finfish farms. (In British Columbia, mortality rates of thirty percent for net-pen operations are common). Many of these problems stem from the fact that the more remote a site is, the more costly waste disposal becomes. Also the fear of contamination from dead fish has discouraged many barge operators from hauling them away.

As British Columbia's aquaculture industry has grown, so has their ability to deal with waste. Fish waste disposal has become a new growing industry in the province. Disposal entails barging out aquaculture mortalities and reprocessing them for feed or fertilizer, incineration, or disposing them upland in an acceptable manner. Also, the government is increasing their monitoring efforts to be certain that waters near aquaculture farms are clean.

As a result of initial problems with disposal of mortalities and domestic sewage, the British Columbia government has amended its waste management act to address acceptable methods of waste disposal for aquaculture facilities, and to help insure compliance. A marine fish farm development plan is required for all permit applicants which details on operations proposed waste management plan (see Appendix 6.2).

A waste disposal plan would help identify potential sources of wastes, anticipated waste quantities including mortalities, and clearly identify how these wastes would be handled. It is therefore recommended that the shoreline program require development of such a plan for all major aquaculture projects.

In Washington, where sites are less remote, monitoring and minimizing of human wastes on-site seems easier to accomplish. Prohibition of permanent residents on-water in addition to requiring proper on-site waste disposal systems would help reduce human wastes. (Thus far, on-site waste disposal has only been required for one fish pen permit (SH-85) in Jefferson County). Unfortunately, it is difficult to monitor whether these systems are actually being used. British Columbia has experienced the same difficulty.

Waste and water quality problems created off-site are much more difficult to control. Potentially devastating water pollution can originate from miles away; either from a single point source such as an industrial or sewer treatment discharges or from a variety of small non-point sources such as failing septic tanks and cattle wastes seeping into groundwater and streams far up a watershed above an aquaculture site.

The Puget Sound Water Quality Authority has authorized the studies currently being conducted in Dabob and Quilcene Bays, and their upland watersheds to identify and control these pollution sources. This problem, however, promises to be a continual and growing one, especially as development in these areas increase.

The proposed aquaculture policy has dealt with this issue in several ways. First, it suggests restricting development which could detrimentally impact aquaculture farms. It takes the position that

"productive" aquaculture areas must be protected from potentially harmful development.

It appears inconsistent however, for numerous kinds of development in the shoreline program to have specific provisions for creating no detrimental effects on aquaculture while other forms of development and valued activities such as recreation are not protected.

A more appropriate goal may be to minimize impacts of upland developments on marine water quality to protect many uses such as recreation, fisheries and aquaculture. If this goal is adopted, the shoreline program amendments suggested in the proposed aquaculture policy conclusion 1.2.7 should not just single out the protection of aquaculture. The same applies to conclusion 1.2.10 of the Proposed Aquaculture Policy that suggests protecting aquaculture from potential water quality hazards due to oil transshipment and other similar operations.

It seems inevitable that many will feel that the cost of protecting all existing and potential aquaculture sites will be too great. For this reason it is suggested that the county identify the aquaculture areas it most wishes to protect from upland and adjacent development (see Section 3.11, "Other Use Conflicts"). The county could even go further in establishing clean water zones where keeping high standards of water quality supporting aquaculture and other uses are the primary management goal. Due to the limited jurisdiction of the Shoreline Management Act, this can only be accomplished through regulatory tools incorporating an entire watershed.

3.8.3 RECOMMENDATIONS

1. Ad the following performance standard to the shoreline program (Section 5.30, "Aquaculture": "Floating structures should be sited and oriented _____ in a manner which most effectively disperses culture wastes and reduces water quality degradation".
2. Add the following shoreline program performance standard to replace Performance Standards 1 and 5: "A waste disposal plan will be submitted and approved with the permit application. This will detail the type and quantity of wastes materials expected from the proposed operation, and manner in which each waste type will be disposed. This plan will also include but is not limited to human wastes, aquaculture bi-products, feces, mortalities, feed, toxic materials, and operational solid wastes such as feed bags and garbage". British Columbia's marine fish farm development plan (Appendix 6.2) provides a good model for such a plan. Add the following performance standard to the shoreline program: "No processing of any aquacultural product shall occur in or over the water."
3. Add the following performance standard to the shoreline program (Section 5.30, "Aquaculture"): Waste materials or fish bi-products will be disposed of in a manner that minimized water quality degradation. Waste materials entering the water shall meet all state and federal water quality and waste discharge standards.
4. Amend shoreline program Sections 5.90, "Industrial and Port Facilities; 5.110, "Marinas"; 5.20, "Agriculture"; 5.160, "Residential Development"; and 5.200, "Utilities", so that the

following condition is added in each section: "Development shall not cause significant deterioration of water quality in biologically unique and environmentally sensitive waters, major aquaculture areas and designated recreation areas". The county should also consider designating certain marine waters as "clean water areas" where maintaining good water quality is a primary management goal. The county's major aquaculture areas such as Dabob, Quilcene, and Discovery Bays should be considered for designation as "clean water areas" so that they may be given special protection against potentially damaging upland or adjacent development. This could be coordinated with the ongoing watershed monitoring programs funded by the Puget Sound Water Quality Authority. (See Section 3.11, "Other Use Conflicts").

5. Several other measures are recommended to reduce water quality degradation from other uses. These are discussed in Section 3.11, "Other Use Conflicts."

3.9 OTHER USE CONFLICTS

3.9.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program** (Section 5.30, "Aquaculture")

   a. Policies:

      1. Shoreline and upland development in productive aquacultural areas or those areas with a high potential for aquacultural uses should be reviewed for detrimental impacts on aquaculture.

2. **Land Use Classification**

The shoreline program classification table (Section 4, "Shoreline Designations and Project Classifications") classifies aquaculture as a primary use in conservancy and aquatic environments, a secondary use in suburban and urban environments, and a conditional use in natural environments.

3. **Proposed Aquaculture Policy**

   a. Findings:

      1.1.4 These areas have unique value because of significant natural production for aquaculture; Dabob and Quilcene Bays (for natural oyster spawning and setting) Discovery

Bay (for natural native littleneck clam spawning and setting) and Kilisut Harbor (for clams and oysters).

1.1.5 Further development of the upland, aquatic and shoreline areas could cause pressure to change existing aquaculture activities such as limiting hours of operations and opposition to expansion efforts.

1.1.7 Poaching and vandalism of aquaculture resources is a threat to the industry.

1.1.10 The public puts a high priority on existing cultured species, both commercial and non-commercial.

3.1.11 A definition of compatibility with adjacent shoreline designations could help evaluation of project proposals to be more objective.

b. Conclusions:

1.2.2 Shoreline, aquatic and upland development near productive aquacultural areas should be reviewed for potential detrimental impacts on the aquaculture operation.

2.2.1 Aquacultural operations should be sited so as to not cause undue conflicts with existing uses, such as recreational boating, sport fishing, commercial fishing (including subtidal shellfish resources), navigation, or environmentally sensitive areas. Siting decisions should be based on an evaluation of whether or not the proposed activity causes an undue conflict and whether or not existing uses are substantial and verifiable. Unlimited recreational activity or navigational use of the water should not be considered normal public use.

4. **Gillespie Report - British Columbia**

Coastal Resource Identification Studies should be initiated to direct aquaculture applications away from major resource and user conflict areas. This will allow aquaculture proposals to be diverted to areas where physical impacts on other users will be lessened. Specific siting within these remaining areas can then be determined on the basis of environmental factors.

3.9.2 ANALYSIS

As with any other commercial or industrial use, aquaculture can conflict with other nearby uses in many ways. Several sections of this report have already examined many areas of conflict such as water pollution, navigation hindrances, noise, odor, and view obstruction. This section addresses both conflicts which have not yet been discussed such as with fishing. Ways of resolving these conflicts and those discussed in the previous sections of this report are then suggested.

1. Fishing Conflicts

A major area of conflict lies with the fishing industry. In Alaska and British Columbia many fishing groups have opposed fish net-pen mariculture to such an extent that a moratorium was imposed on their placement in marine waters. In Washington State, the fishing industry is also quite vocal in its opposition to many forms of floating mariculture. Primary objections appear to be the following:

a. The impacts of pen-raised fish on the natural stocks which the fishing industry harvests. This issue is most important especially when pen-raised fish like atlantic salmon are exotic species potentially carrying foreign diseases.
b. The physical placement of floating structures in Puget Sound can greatly hinder fishing operations. According to John Boyce, author of a report on aquaculture use conflicts, this is especially true for gillnetters, where nets hundreds of feet in length drift to snag fish. Because of the difficulty of maneuvering around obstructions such as pens, the presence of pens, especially placed off of a peninsula, can eliminate quite a large area for gillnetting.
c. Many fishermen view aquaculture as a threat to a big state industry. Aquaculture products could compete with naturally harvested products.

It is difficult to determine the most heavily used or most productive fishing areas due to its variability. The usage of an area is determined by the type of fishery involved and governmental management policies. According to John Boyce, heavily used fishing areas are mainly dictated by the department of fisheries establishment of fishing management areas and the openings and closures of a particular area for fishing. When an area is opened, it is usually opened for a very limited period of time with few, if any other areas in the state opened simultaneously. As a result, many of the regions fishermen converge on one area at the same time. Most fishermen usually start fishing at one end of the management area and work their way towards the other end. For this reason it is most congested at the boundary of a management area. Thus, because the Hood Canal Bridge constitutes one such management area boundary, it is heavily crowded during an opening of each of these two areas. The state is currently working on establishing guidelines for determining the most congested areas for fishing.

The county has historically lacked knowledge concerning its best sites for fishing it is also concerned that a single use such as fishing or aquaculture does not preclude aquatic development in all areas. Given this situation, it may make sense to work with commercial fisherman and review state guidelines when or if they are established to identify valued fishing areas before a site-specific development proposed is made. This would minimize reacting on a case-by-case basis and allow better predictability for both project applicants and affected users.

2. IMPACTS OF OTHER DEVELOPMENT ON AQUACULTURE

The proposed aquaculture policy discusses at great length the potential impacts of other land and water uses on aquacultural development. The closure of several bays in Puget Sound, including sections of Quilcene Bay for commercial shellfish harvests have shown how existing upland use can have a devastating effect on near-shore aquaculture operations.

The proposed aquaculture policy recommends that the county examine the environment beyond an immediate project site when evaluating aquaculture proposals. This would allow the county to assess and take action to reduce negative impacts which ultimately could ruin aquaculture operations and natural harvests in certain bays. This policy also recommends adopting special protective measures for several bays which have unique or special significance for aquaculture. This includes Dabob and Quilcene Bays for natural oyster spawning and setting, Discovery Bay for natural native littleneck clam spawning and setting, and Kilisut Harbor for clams and oysters.

These four areas comprise the primary shellfish harvesting sites in Jefferson County. The department of ecology's Shellfish Protection Strategy specifically identifies Dabob Bay as being a site of intensive shellfish aquaculture. Due to their extreme sensitivity to pollutants, and the presence of a highly valued shellfish industry, these areas should be given special protection from other potentially harmful uses. As suggested in the previous section of this report, perhaps these areas along with other valued water bodies could be designated as "clean water areas" where maintaining high water quality standards is a priority. This would help protect aquaculture as well as other resources such as recreation and unique biological areas. Also comprehensive planning designations for these four areas should be reviewed for potential conflicts.

Much of the conflict between aquaculture and other uses is subjective, and deals with a combination of factors. The potential transformation of shoreline areas which are viewed as pristine into commercial sites can be greatly disturbing for upland residents or recreationalists who are used to unobstructed views.

Conflicts with other uses vary greatly depending on the type of aquaculture present. Shellfish culture is most affected by water quality due to its filter feeding of water. Pollution can cause increases in plankton blooms and increased disease outbreaks in finfish resulting in high mortalities.

Aquaculture can have large impacts on shoreline views, especially when floating structures such as rafts or net-pens are involved. Aesthetics is not as big of a factor when culture is on the sea floor.

Conflicts are unavoidable. Although they can be mitigated to some extent, they cannot be eliminated. Where conflicts do occur it is important for local government to decide which use takes precedence. Should a use which has occurred historically have a greater claim to particular waterbody than a new proposed use? There is no easy answer. Decision makers should consider how extensive the previous use was in that area, the economical benefit derived from the historical use as opposed to the proposed use, and alternative sites for both uses.

Many of these problems can be reduced with the imposition of more stringent standards for aquaculture operators and for upland uses such as agriculture and residential developments. Inevitably, however, the county must make some basic siting decisions, where in specific areas one use will take precedence over the other.

The shoreline program (Policy 2, Section 5.30, "Aquaculture") attempts to protect aquaculture development by suggesting the consideration of detrimental impacts of other uses on aquaculture in "productive aquaculture areas" when reviewing shoreline permits. Nothing in the shoreline program, however, clearly protects these "other uses" from conflicting land uses.

The Land Use Classification Table in the shoreline program (Section 4, "Shoreline Designations and Project Classifications") does attempt to prioritize the importance of aquaculture by making it a primary use in all aquatic environments, regardless of the type of intensity of upland use. This classification is compatible with RCW 90.58, the Shoreline Management Act that states that water dependent uses are preferred uses of marine waters of the state. The shoreline hearings board elaborated on this position (SHB 209) emphasizing the importance of aquaculture by stating that " . . . in specific circumstances with adequate environmental safeguards aquaculture is a desired and preferred water-dependent use of the shoreline." This interpretation of the value of aquaculture, however, does little to realistically deal with conflicting uses. Designation of aquaculture as a secondary use in suburban and urban environments and as a conditional use in natural environments has no significance with many if not the majority of aquaculture proposals. It only affects those operations which require upland structures. This excludes the most objectionable and controversial aquaculture development from these more stringent and restrictive classifications. It is therefore clear that the classification of aquaculture development should be based upon upland shoreline designations. Further, the fact that some forms of aquaculture create more impacts and are more objectionable suggest that all kinds of aquaculture should not be lumped together. It may be more appropriate to classify floating aquaculture in a more restrictive manner than sea bed aquaculture.

Island County recently attempted to resolve aquaculture conflicts by creating aquaculture zones where aquaculture would be encouraged. In other areas of high conflict and biological constraints, permit applications for aquaculture were not accepted. The ordinance was quickly rescinded due to objections from upland residents within view of the aquaculture zones.

The Coastal Resource Identification Studies in British Columbia could provide a model for resolving conflict between different users of a limited resource. Identification of environmentally sensitive and significant areas along with input from the leaders of a wide cross section of affected interest groups resulted in the classification of certain marine waters for aquaculture desirability or opportunity.

3.9.3 RECOMMENDATIONS

1. Amend the Land Use Classification Table in the shoreline program (see Section 4, "Shoreline Designations and Project Classifications") so that the classification of aquaculture in water bodies is more dependent upon adjacent upland uses. Aquaculture operations in aquatic environmental designations could be classified as the same as that for its nearest upland designation. A less restrictive classification could be applied for aquaculture operations which are completely water-based and far enough from shore that upland conflicts are greatly reduced. (Perhaps the 1500-2000 foot distance recommended to minimize visual impacts in the department of ecology's aquaculture siting study could be applied). Further, the classification of aquaculture should be segmented so that floating aquaculture is classified in a more restrictive manner than sea bed aquaculture.
2. Evaluate use priorities in the county's aquatic and shoreline areas. This may, at the very lease, result in the designation of areas where activities such as aquaculture or specifically floating aquaculture are not considered a preferred use. The prohibition or discouragement of aquaculture in certain areas may be due to biological constraints or unacceptable conflicts with adjacent users such as with upland suburban residential areas, known recreation areas, congested or heavily used fishing resources, or areas with potential navigation hazards.

   The process used for designating areas of conflict could be similar to that used in British Columbia's Coastal Resources Identification Studies. In these studies all potentially affected interests were included in identifying areas where possible conflicts would be unacceptable. The result was the designation of shoreline areas where aquaculture applications are either discouraged, conditionally accepted, or allowed to run through the normal review process.

3. Potential conflicts with commercial fishermen need to be addressed for aquaculture proposals, especially those which involve floating structures. To implement this, the shoreline program, (Section 5.30, "Aquaculture") should be amended to require such consideration. This could entail prohibiting or discouraging floating aquaculture in areas which are intensively used for fishing and where such activity will significantly interfere with existing fishing operations. It could also discourage siting floating aquaculture operations near fish management area boundaries due to anticipated boating congestion.

3.10 MONITORING AND BASELINE STUDIES

3.10.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program** (Section 5.30, "Aquaculture").

   a. Performance Standards:

      10. Applications for the harvesting of subtidal benthic infauna and animals shall provide a written assessment of each tract area, containing at the minimum the following information:

         a. Tract size and location.
         b. Harvesting techniques.
         c. Resource and resource abundance (amount, distribution, and diversity).
         d. Associated flora and fauna (amount, distribution, and diversity).
         e. Substrate composition.
         f. Relationship to an approved state-wide management plan.
         g. Relationship to other permits, rules, and regulations.

2. **Proposed Aquaculture Policy**

   a. Findings:

      2.1.5 Aquacultural development can have impacts on the biota nutrient loading, water quality degradation and species alteration can become significant depending on location, environmental conditions and culture methods.

   b. Conclusions:

      1.2.12. Jefferson County should ensure that general ambient water quality monitoring is an ongoing effort in order to identify potential problems before they occur.
      2.2.4 Aquatic farmers should employ best management or husbandry practices for their operation in order to minimize environmental impacts.
      2.2.14 Under some conditions it may be appropriate for Jefferson County to require continued environmental monitoring and reporting of projects.

3. **Past Shoreline Permits**

Many past shoreline permits have required operators to provide specific operating plans and regular monitoring. Although these conditions have been required for mainly salmon-net pen farms, they can be applied for other kings of aquaculture:

a. Requiring water quality monitoring. Although monitoring variables are inconsistent, monitoring has included water temperature, near-surface dissolved oxygen, phytoplankton occurrence and maximum and minimums surface and bottom tidal currents, salinity and fecal coliform levels. Many permits do not specify which variables need monitoring. Most permits have required monitoring for a period of two years; some have required it for the duration of the project; others, especially those permitted more than three or four years ago, do not have any monitoring requirements. Some require monitoring reports to be submitted yearly.

b. Requiring submittal of a farm operation plan which includes much of the information required under the department of ecology interim siting guidelines for net-pen mariculture.

c. Stating that the shoreline permit would be reevaluated after two years of operation. Based upon monitoring resulted or other information indicating water environmental degradation, the permit may be revised or rescinded.

4. **Gillespie Report - British Columbia**

Although this report specifically addressed net-pen aquaculture, the following recommendation can be applied to all aquaculture operations:

> The government should establish a mandatory environmental monitoring and data gathering system for each aquaculture site and surrounding area. The results should be submitted regularly for review. The government is establishing standards for these parameters to determine whether or not an operation should be moved.

3.10.2 ANALYSIS

Environmental features such as water quality, the presence of biologically sensitive or important flora and fauna, substrate characteristics and upland shoreline conditions should be assessed before any aquaculture operation is established. This allows both the operator and permitting agencies to assess initial baseline conditions and to accurately measure how an operation impacts its surrounding environment. Regular monitoring can help identify any problems before they become major. It is felt therefore, that a baseline survey and regular monitoring should be required for all aquaculture projects that have the

potential to significantly alter their immediate environment or for operations which could be harmed due to upland or nearby pollution sources.

Baseline information and regularly monitored data should vary dependent on the type of aquaculture method used, species reared, operation size and unique environmental conditions. The department of ecology has recommended that specific baseline information be required prior to permit approval for finfish net-pen farms (Section 4.1, "Finfish Net-Pen Aquaculture"). The annual monitoring for specific data is recommended for operations exceeding 20,000 pounds of annual production. Additional baseline information and monitored data is suggested for operations with over 100,000 pounds produced annually. These guidelines are based on the fact that larger farms can cause greater concentrations of wastes. This seems like an appropriate way to handle monitoring and baseline information for all aquaculture types.

The information required by the shoreline program (Performance Standard 10, Section 5.30, "Aquaculture") appears to be appropriate for the harvesting of subtidal benthic infauna and animals specific siting requirements established by the department of natural resources and other state agencies (see Section 4, "Regulations Covering Specific Types of Aquaculture") often require diver surveys of the proposed site to assess suitability before a lease or permit is granted for a project. The department of social and health services has a monitoring program for commercial shellfish beds.

Questions have arisen over the ability of the applicant to conduct adequate and objective monitoring. It is also clear that local officials have limited ability to interpret the results of any monitoring program. This is especially true where no parameters have been established for the range of acceptability of various measured information. With respect to fish net-pens, British Columbia has attempted to notify applicants of site acceptability for parameters such as BOD or nitrogen levels (see Appendix 6.1). Currently, the department of social and health services has established threshold levels for the certification of commercial shellfish beds, especially with respect to coliform bacteria counts. If shellfish beds exceed these levels, it is decertified and product from these beds can no longer be commercially sold. In order to allow fairness to aquaculture operators, it is felt that monitored data should be measured against an objective standard of what is and is not acceptable. Such standards make the implementation of monitoring a visibly important and objective process. Objective standards, however should be established by state government, not the county.

Because of limited staff and technical ability the county should minimize its role in environmental monitoring and assessment. Expertise in this area has generally been provided by the state. The county could, however adopt all non-mandatory siting and monitoring guidelines used by the state such as the interim guidelines for siting fish net-pens. The county could also reserve the right to require baseline data or monitoring beyond that required by the state, should they feel special circumstances merit such a requirement.

In the past, many operators were required to provide site baseline information and conduct regular monitoring. The county was left with the task of interpreting and evaluating this information. More objective and

meaningful monitoring could be obtained through contracting with a third party to gather and interpret this information. As described earlier the department of social and health services provides this service in its monitoring program for certified shellfish beds. Regardless of whoever provides the monitoring, it is strongly felt that the cost of gathering and interpreting data should be borne by the operator, not government.

3.10.3 RECOMMENDATIONS

1. Add a performance standard to the shoreline program (Section 5.30, "Aquaculture") that requires baseline information on the surrounding environment of a proposed project shall be provided in accordance with all adopted and recommended guidelines established by the sate. The county should reserve the right to require additional information if deemed necessary.
2. Add a performance standard to the shoreline program (Section 5.30, "Aquaculture") that requires the regular monitoring of site conditions in accordance with all adopted and recommended guidelines established by the state. The county should reserve the right to require additional monitored data if deemed necessary.
3. The gathering of technical data and monitored information should be conducted and evaluated by a professionally qualified and independent party at the operator's expense.
4. The county should encourage the appropriate state agencies to establish criteria for the acceptability of monitored data for all types of aquaculture. If an operation does not meet these criteria, it should either cease operation, change location, or change in some other manner so that it operates within acceptable standards. Providing these criteria would make monitoring a more meaningful and objective process.

3.11 CHEMICAL AND ANTIBIOTIC APPLICATIONS

3.11.1 EXISTING DOCUMENTS

1. **Proposed Aquaculture Policy:**

   a. Findings:

      1.1.6 Herbicides, fertilizer or pesticide spraying within watersheds adjacent to productive shellfish areas could

be detrimental on these organisms or make them unsafe for human consumption.

2.1.7 Medicinal treatments to control disease in animals or plants grown for human consumption must be approved for use by the U.S. Food and Drug Administration. The impacts of these medicines on other aquatic species has been determined in some but not all instances.

2.1.8 Chemical treatments are sometimes used to control predators, fouling, etcetera. The impacts of these chemicals on other aquatic species has been determined in some but not all instances.

b. Conclusions:

2.2.11 Aquacultural development which proposes medicinal treatments or chemical applications should provide adequate evidence that such activities will have minimal or no effect on the environment.

2. Past Shoreline Permit Conditions

Although these were applied to net-pen operations, these conditions could be applied more generally:

a. No anti-fouling chemicals shall be used on the nets.
b. Any medication shall only be administered to fish via food, injection, or off-site bath dipping; no sea baths shall be permitted.

3. Environmental Effects of Floating Mariculture - Don Weston

No chemicals are used for disease treatment in suspended mollusc culture. There are three antibiotics licensed by the food and drug administration for use on fish food: oxytetracycline (OTC), sulfamerazine, and romet 30. OTC is by far the most widely used in Puget Sound. The use of OTC does not appear to present a major environmental concern given the infrequency of usage, its high water solubility, the rapid dilution which could be expected. This conclusion is based upon the limited mariculture development anticipated in Puget Sound (thirty to forty, two acre fish pen operations was a figure later stated by Dr. Weston).

4. Department of Ecology Interim Net-pen Siting Guidelines

Although these apply to net-pen operations, these conditions could be applied more generally:

a. Tributyltin should not be used as an anti-fouling agent (on the nets). The use of other anti-fouling agents should be reviewed

on a case-by-case basis by state environmental management agencies. Any anti-foulant use should be reported to the department of ecology.

b. Only antibiotics licensed by the food and drug administration shall be used, and these should be used only on a short-term basis for disease treatment or disease prevention. Antibiotics should not be used prophylactically on a long-term basis. The department of fisheries should be notified of all antibiotic usage at the time of treatment, and should be informed of the disease or condition being treated and the antibiotic used.

5. **Gillespie Report - British Columbia**

Although applied to net-pen operations, these conditions could be used more generally.

a. The government should increase its research, health, inspection, and testing activities with respect to the impact of toxicants, hormones and antibiotics. This would provide more information on the type, degree and severity of risks as a basis for eliminating them. Recent studies indicate no human health implications with the possible exception of the toxicant tributyltin (TBT) used as an anti-foulant.

b. The government should encourage establishment of standards for finfish aquaculture equipment to remove the potential for accumulation of toxicants in farm fish products. The source of most toxicants in fish flesh is plastics and paint used in the net pen structures. The toxicant TBT is of major concern, and should be fully reviewed for impacts on health. Shortly after this report was published the use of TBT was banned in British Columbia.

3.11.2 ANALYSIS

Chemicals and antibiotics are used for disease control, altering genetic or sexual characteristics of cultures species or controlling unwanted vegetation on nets and other aquatic structures. They are also introduced through construction materials such as paint and treated pilings.

There is a long history of chemical usage in aquaculture to control predators especially with respect to oysters. Currently the pesticide sevin is currently used in the northwest to control burrowing shrimp in oysters. Antibiotics are administered to finfish typically two to three times per year via fish food to treat disease. Hormones are used in very limited quantities to change the sexual characteristics of finfish to increase growth or limited the possibility of reproduction. Plastics and other chemicals leaching out from floating structures have been known to cause some mortalities. Finally chemicals have been used as anti-foulants, mostly for net-pens and longlines.

As Weston indicates with antibiotic treatments, given the small quantity of aquaculture development anticipated for the Puget Sound region and the rate at which these chemicals are diluted, their presence will probably not pose a major problem.

This conclusion, however, is based upon very limited studies of the effects of toxicants. It does not consider the effects of aquaculture operations sited in areas of poor water circulation. It also does not address hormone treatments, anti-foulants, and the potential leaching of construction materials. Due to unknown cumulative effects, chemical and antibiotic applications should be kept to a minimum and be very closely monitored. This could be accomplished by an outright prohibition, or regulating use in a manner similar to that of the department of ecology's interim net-pen siting guidelines. These guidelines, however, address only anti-foulants and antibiotics. Structure materials and use of hormones regulated under these guidelines. The shoreline program should allow the least quantity of chemicals and antibiotics possible.

Island County's shoreline program requires a permit applicant to identify all pesticides, herbicides, antibiotics, vaccines, growth stimulants, anti-fouling agents, or other chemicals that the applicant anticipates using. Proof of approval for the use of these from several appropriate federal and state agencies must be submitted to the county before its use is allowed. It also requires where feasible cleaning of nets and other equipment by air drying, spray washing or hand washing instead of by application of anti-foulants.

The use of chemical anti-foulants for longlines or fish pens was very common at one time in Puget Sound. Recently, since the chemical TBT was found to be highly toxic to other forms of marine life, it's use in Washington State has been prohibited regularly. Many fish pen operators eliminate using net foulants by regularly switching nets and air-drying the old net. This appears workable for all but exterior predator nets, which are too large for easy removal. The banning of chemical use for anti-foulants for all structures but predator nets is therefore felt to be justified.

Since little information is available on the leaching of construction materials such as woods and plastics, these should be closely monitored. Any materials known to be detrimental to marine organisms should not be used for aquaculture structures.

To minimize the use of chemicals it is suggested that the applicant be required to identify the type of quantity of chemicals, hormones, and antibiotics intended for use, as well as frequency of treatment.

3.11.3 RECOMMENDATIONS

1. Add a performance standard to the shoreline program (Subsection 5.30, "Aquaculture") stating that the use of pesticides, herbicides, antibiotics, vaccines, growth stimulants, anti-fouling agents, or other chemicals shall be kept to a minimum. Use of such chemicals and other additives must be approved by all appropriate federal and state agencies prior to use. The applicant must provide proof of approval, and if the farm is situated near commercial shellfish beds, certification that use of these substances will have a negligible

effect on these organisms. Non-chemical anti-foulant methods shall be used wherever possible.

3.12 CULTURED SPECIES INTRODUCTIONS

3.12.1 EXISTING DOCUMENTS

1. Proposed Aquaculture Policy

a. Findings:

2.1.19 The import, export, or transfer of aquatic animals or plants or the viable sexual products thereof, requires permit approval from the department of fisheries.

3.1.22 Concern has been expressed about the proliferation and lack of regulation and enforcement of small scale aquaculture efforts. Ongoing aquaculture operations may be required under the authority of the Shoreline Management Act to receive substantial development permits. Transfer or introduction of animals and plants resulting in potentially unwanted pests and predators and disease is the primary issue of concern. It is the authority of the department of fisheries to regulate such activities.

b. Conclusions:

2.2.16 The department of fisheries should be the lead agency for regulatory decisions regarding the import, export, or transfer of aquatic species. The department should conduct this business with a high degree of professional competence and close coordination with local jurisdictions.

2. Department of Ecology Interim Net-Pen Siting Guidelines

Although recommended for net-pen farms, the following could apply to all aquaculture operations:

a. Transfer of live fish or their reproductive products within the state or their importation into state shall be done in accordance with all applicable state and federal standards.

3. Environmental Effects of Floating Mariculture - Don Weston

The accidental introduction of species including pathogens, probably constitutes the greatest environmental threat posed by aquaculture.

does not completely eliminate it. Examples of unwanted introductions include the Japanese oyster drill which was accidentally introduced with the pacific oyster and the introduction of whirling disease caused by the transfer of live and frozen trout.

There is no evidence that the interbreeding between cultured or hatchery stock and wild animals have threatened the survival of any population. Interbreeding is a concern when the genera of the cultured species is the same as species in surrounding waters and the cultured species is released or escapes. It is thus a concern with the culturing of species such as Coho salmon. Sterilizing of cultured fish would eliminate any possibility of hybridization.

4. **Washington State Department of Fisheries Regulations for the Importation of Live Aquatic Organisms (WAC 220-77)**

Some of the most important requirements are summarized as follows:

a. General Requirements:

1. Importation of food fish or shellfish into the state must obtain a permit from the department of fisheries. Any transferred fish must be examined for disease by a state approved inspector unless the stock's disease history alleviates this need. Requests for introductions of exotic species must be reviewed under the State Environmental Policy Act. A report describing potential environmental risks and potential benefits must be written.

b. Oysters:

1. A certificate must be obtained certifying a shipment to be free of oyster drill and other pests. This must be issued by an approved pathologist or department of fisheries inspector following inspection at the place of origin for the oysters, shells or seeds to be imported.

c. Salmon:

1. No live salmonoids or their reproductive products may be imported from Europe except eyed Atlantic salmon eggs. Importing these eggs require certifying the parent stock as disease free, submission of the stock's health history to the state, disinfection of the eggs and the holding of the eggs in a quarantine facility for ninety days following swim-up.

5. **ICES Study - Environmental Impact of Mariculture**

The importation of exotic species or disease organism poses the greatest environmental risk in mariculture. Unlike other environmental effects, the consequences may be widespread and irreversible. Therefore,

effects, the consequences may be widespread and irreversible. Therefore, the importation of live animals or their reproductive products is subject to a greater degree of regulatory scrutiny than any other aspects of mariculture.

The report "strongly recommends" that adherence to the ICES Code of Practice on the Introduction and Transfer of Non-Indigenous Species (see Appendix 6.4). This code recommends extensive research and international collaboration prior to the introduction of an exotic species. Once the decision is made to transfer or introduce a non-indigenous species, only the first generation progeny of the introduced species can be transplanted. Prior to this, a brood stock must first be established in an approved quarantine situation to make sure that no diseases or parasites are present. After progeny release, the quarantine area and all effluent must then be sterilized.

The United States along with the United Kingdom, Norway, Denmark, Sweden, West Germany, France, Canada, Netherlands, Spain, USSR, Finland, and Portugal are member countries. The United States, including the State of Washington has yet to adopt this code.

6. The Gillespie Report - British Columbia

The importation of exotic eggs will be phased out by 1989. This will allow enough time to establish a brood stock necessary to support the anticipated level of production. This restriction was imposed due to the feared import of unwanted organisms or related disease.

3.12.2 ANALYSIS

It is clear that the introduction of exotic species and pathogens should be avoided at all costs. Washington State has taken precautions to protect against unwanted introductions. The International Council for the Exploration of the Sea takes much greater precautions in prohibiting using brood taken directly from imported eggs. Countries such an New Zealand are much more strict in prohibiting the importation of any living fish products including eggs.

The British Columbia government is banning the importation of Atlantic Salmon eggs by 1989 because "this risk exists despite severe screening, quarantine, and effluent treatment standards imposed by government on brood stock". The 1989 deadline was set to allow enough time for brood stock to produce enough eggs to supply west coast farms.

These findings suggest that the state of Washington should consider reexamining its policy on the importation of exotic species. Although its required quarantine, health history checks, and monitoring is far more strict than that required by many other countries and states. Washington's import policies are far less stringent than those recommended by ICES.

Adoption of the ICES standards for importation of exotics, it would require about six to eight years to produce Atlantic salmon brood acceptable for commercial use. Due to this constraint, immediate

adoption of the ICES standard would impose an undue hardship on existing salmon farm operators. Adoption for a set date in the future, however is recommended.

The potential interbreeding of escaped cultured stocks and wild stocks appears to be a concern for cultured species of the same genera as such as with native and cultured stocks of Coho salmon due to concerns over genetic alterations and the spreading of disease from other stocks of the same species.

Aquatic species transferred within the state are currently inspected and certified as disease free prior to transfer. Also, according to Dr. Weston concerns of the genetic alterations of wild stocks should be put into perspective by considering that "the numbers of fish intentionally released in fisheries enhancement programs (The Environmental Effects of Floating Mariculture, 1988). The risk that may exist can be reduced by:

a. Minimizing escapes.
b. Using cultured stocks that are genetically similar to the wild population.
c. Using cultured stocks that are poorly adopted to survival in the wild.
d. Sterilizing cultured stocks to prevent any possibility of interbreeding.

3.12.3 RECOMMENDATIONS

1. Encourage the state to reexamine its policies towards the importation of exotic species. The state should consider eventual adoption of the ICES code of practice on the introduction and transfer of non-indigenous species.

3.13 APPLICATION REQUIREMENTS AND ADMINISTRATION

3.13.1 EXISTING DOCUMENTS

1. **Shoreline Management Master Program** (Section 6.40,"Application")

   a. The shoreline program requires notification of adjacent landowners during the shorelines permit application process. The property must be posted as well as notification published in an official county newspaper.

3.13.2 ANALYSIS

Notification of adjacent landowners seems to be adequate in reaching most affected people in the case of proposed developments in upland areas or in aquatic areas close to the shoreline. Many developments in aquatic environments directly affect a greater number of people than land-based developments. In addition to being viewed by a greater number of upland users, many developments such as rafts, long lines or fish pens are placed in public waters competing with numerous other uses. As a result, it is necessary to contact a wider range of affected groups such as fishermen, recreational boaters, etcetera. The county may want to consider clarifying the need for greater public notification where developments occur in aquatic environments, especially subtidal, or state-owned waters.

In addition, it is apparent that given the complexity of most aquaculture operations, it is difficult for an applicant to easily and consistently submit all the required information. British Columbia has done an excellent job of developing an application form for marine fish farm proposals (see Appendix 6.2, "British Columbia's Marine Fish Farm Development Plan"). The county may wish to adopt this form to suit their own needs. The application should complement that already required by the department of natural resources. (See Appendix 6.3).

3.13.3 RECOMMENDATIONS

1. Amend the shoreline program (Section 6.40, "Application") so that in the case of proposed developments in aquatic environments all identified interest groups and shoreline residents within 1,500 feet of the proposed site should be notified of the proposal by mail. Also, upland areas near the proposal site shall be posted with public notices. Finally, notices more visible than those currently published in the local newspaper should be considered.
2. The development of a supplementary application form is recommended for future aquaculture applications. This should incorporate all the information required after the shoreline program has been revised. It should also correspond with similar applications required by the department of natural resources.

SECTION 4

REGULATIONS COVERING

SPECIFIC TYPES OF AQUACULTURE

This report has thus far addressed regulations which can apply to more than one type of aquaculture. Requirements or conditions relating to

specific aquaculture species or methods are described in this section. Most of these specific criteria have been developed and adopted by governmental agencies though many of the studies previously discussed (see Section 2.3, "Recently Completed and Ongoing Studies"). In most cases, conditions specific to a particular type of aquaculture are set by a state agency such as the department of ecology, natural resources, or fisheries.

The shoreline master program is designed to condition permits to satisfy local needs and desires as well as to augment state requirements. In the past, conditions have been imposed upon applications which are regulated through other state agencies. Knowledge of state requirements and recommendations regarding specific types of aquaculture can help eliminate regulating duplication and possible contradictory requirements.

County decision makers should use the information contained in this section as a reference and to compliment the general aquaculture amendments discussed in Section 3 of this report. The county may choose to adopt recommended siting and operating guidelines developed by the state such as the Washington State Department of Ecology Recommended Interim Guidelines for the Management of Salmon Net-Pen Culture in Puget Sound. It may also impose more stringent regulations than those required or suggested by the state. Due to the increasing rate at which new methods of aquaculture are being introduced to the area, county regulations should be flexible enough to cover existing and future aquaculture types.

In this section, siting criteria and regulations are reviewed for several specific types of aquaculture. For each aquaculture type, specific criteria are summarized according to its source. A discussion of each aquaculture type than follows.

4.1 FINFISH NET-PEN MARICULTURE

4.1.1 EXISTING DOCUMENTS

1. Department of Ecology Interim Siting Guidelines

   a. Accumulation of feed and feces under fish pens is minimized by siting pens according to the size of the operation,m the depth of water beneath the pens and the mean current velocity under the pens. The minimum depth recommended beneath the pens ranges from twenty to sixty feet depending on the size of the operations (Figure 1 shows the specific siting guidelines relating to depth and velocity).
   b. Habitats of special significance shall be protected from accumulation of feed and feces. If these habitats are present in

depths of seventy-five feet or less, pens should not be located above them within 300 feet of the direction of prevailing tidal currents, or within 150 feet in any other direction. Habitats of special significance are specifically identified.

c. Pens should not be located within 1500 feet of bird and mammalian habitats of special significance including seal and sea lion haulout areas, seabird nesting sites or colonies, and areas specifically identified as critical for feeding or migration of birds and mammals.

d. Pens should be sited to minimize water quality degradation and to minimize significant contribution to phytoplankton productivity in any given area. Therefore, pens should not be sited in areas with chronic water quality problems and should be limited in areas with intermittent water quality problems. In Jefferson County, Hood Canal south of Hazel Point on the Coyle Peninsula, and Dabob and Quilcene Bays are identified as areas of special concern. These areas have chronic low dissolved oxygen in deeper waters and persistent nitrogen depletion in surface waters. Fish pens in these areas are not recommended unless the applicant can demonstrate that respiration and BOD will not significantly depress dissolved oxygen levels and that nutrients from the fish pens will not affect the frequency, extent, intensity or duration of phytoplankton blooms. Maximum annual production limits of 540,000 pounds are recommended for Discovery Bay and 1,900,000 pounds for the Hood Canal north of Hazel Point. For all other marine areas in the county, fish density should not exceed 1,000,000 pounds of annual production per square nautical mile. More stringent production limits may be imposed to protect water quality in specific embayments.

e. Tributyltin (TBT) should not be sued as an anti-fouling agent on nets. The use on other anti-fouling agents should be reviewed on a case-by-case basis by the state. Any anti-foulant used should be reported to the department of ecology.

f. Only antibiotics licensed by the FDA shall be sued, and these should be used only on a short-term basis for disease treatment or prevention. The department of fisheries shall be notified of all antibiotic usage at the time o treatment and the reasons for its use.

g. Transfer of live fish or their reproductive products into or within the state shall be done in accordance with all applicable state and federal standards.

h. Applications for fish pens should contain an operations plan with the following information:

   1. Site improvements such as the number of pens, their size and configuration.
   2. Relationship of proposed structures to the natural environment such as water depth or distance from shore.
   3. Schedule of projected site improvements and maintenance.
   4. Description of cultured species, fish size at harvest, annual production, pounds of fish on-site throughout the year, average and maximum stocking density, source of eggs and

smolt, type of feed used, feeding method, chemical use, predator control measures and anti-foulant use.

i. A site characterization survey should be performed prior to permit application. This should include the following surveys:

   1. Bathymetric survey.
   2. Hydrographic survey.
   3. Diver survey of biological resources to be done between April and September.

j. A benthic baseline survey sampling sediment chemistry and benthic infauna should be performed for operations with annual production projected to exceed 100,000 pounds. This should be conducted after installing pens and before stocking with fish.

k. An annual summer diver survey should be performed by operations anticipating annual production exceeding 20,000 pounds. For operations exceeding 100,000 pounds per year, annual summer monitoring should also include a benthic survey water quality sampling, and a hydrographic survey

l. Unpelletized net feed (minced fish or shell fish) should not be used in net-pen culture.

2. Department of Natural Resources Commissioners Order on Salmon Pen Siting

This order, issued September 1986, sets the following requirements for placement of fish pens in state-owned waters (this incorporates all subtidal waters):

a. The total surface area for pens in any one net-pen operation cannot exceed two acres.
b. Pens must be placed in water with a minimum depth of forty feet at mean lower low water.
c. Different net-pen operations must be separated by at least one mile unless it can be demonstrated that tidal flushing is adequate to prevent excessive or harmful sediment accumulation.

3. Gillespie Report - British Columbia

a. Studies to date do not confirm the fears expressed over the effects of fish farming on the marine environment.
b. Alteration of the local seabed due to the buildup of organic waste from fish pens is identified as a major impact. More studies on the long-term effects of salmon farming on water quality, and bottom dwellers such as shellfish is recommended.
c. The required separation between fish farms should be increased from .8 kilometers to 3 kilometers. Although the report recommends applying this standard to separate finfish farms from oyster farms, this was never put into effect. The stated reason

for this requirement was to minimize the risk of transferring diseases between fish farms. Growing salmon and oysters however, should be allowed on the same site for the same farm operator, as long as existing farms are protected from new owners.

d. The importation of Atlantic salmon eggs should be ended due to the risk of introducing European diseases to wild stocks with consequent impacts on the fishing industry. "This risk exists despite the severe screening, quarantine, and effluent treatment standards imposed by the government on brood stock". Importation is to end in March 1989, long enough to allow brood stock to produce enough eggs to supply west coast arms. This also places greater importance on the need to produce surplus Chinook and Coho eggs for the aquaculture industry.

e. Research, health inspection and testing activities with respect to the impact of toxicants, hormones and antibiotics should be increased. Recent studies have indicated no human health implications with the possible exception of the toxicant TBT. Investigative research and testing is required to provide more information on the type, degree and severity of risks.

f. Finfish aquaculture equipment standards should be established to remove the potential for accumulation of toxicants in farm fish products. The source of most toxicants in fish flesh is plastics and paint used in the net-pen structures. The toxicant TBT is of major concern. It should be fully reviewed for impacts on health. In the meantime its use should be discouraged.

g. Several Coastal Resource Identifications Studies should be conducted in high use areas to identify areas of biological impacts and use conflicts. Presently most of these studies have been completed.

h. As a result of the Gillespie Report, the British Columbia Ministry of Environment has written environmental siting guidelines of water characteristics best suited or growing health fish. These parameters are guidelines, not regulations and are summarized in Appendix 6.1.

4. Proposed Aquaculture Policy

Disease outbreaks increase with crowding, warm water, and stress. To minimize disease outbreaks:

a. The county should consider setting density limits. The industry optimal standard is twenty kilograms of fish per cubic meter throughout the growth cycle. This concentration may be too dense if water circulation or other factors were not ideal.

b. The county should consider locating pens where the water temperature exceeds fifteen degrees celsius and is less than six degrees celsius in the winter.

c. Pens should only be allowed in areas where phytoplankton looms are not a serious problem.

d. Pens should be located only in areas having adequate dissolved oxygen levels..

4.1.2 DISCUSSION

The Washington State Department of Ecology Interim Siting Guidelines are the most stringent siting standards recommended for fish pens anywhere according to Dr. Weston, author of these guidelines. These were designed with the intent of being overly cautious, especially given the incomplete research regarding several types of associated impacts. These guidelines shall likely be revised upon completion of the state's programmatic environment impact assessment of salmon net-pen farms.

Although these guidelines set production limits in terms of pounds harvested per square mile, they do not address limits such as surface area coverage of pens or physical spacing between pens. The department of natural resources commissioners order, however, does contain spacing requirements and surface area limits. These guidelines, for the most part have addressed the proposed aquaculture policy recommendation. Establishing density limits within pens may be considered, however, it is within the best interest of the operator to establish an optimal density. The county should at the very least adopt the standards developed by the departments of ecology and natural resources or the siting of fish net-pen mariculture.

4.2 NORI SEAWEED

4.2.1 EXISTING DOCUMENTS

1. **Department of Natural Resources Draft Programmatic Environmental Impact Statement on Nori**

   a. To minimize impacts on water quality:

      1. Operations could be located away from sources of organics and heavy metals.
      2. Operations could be located away from areas decertified for shellfish.
      3. The nets should be maintained to prevent overgrowth and natural decay.

   b. To minimize effects on adjacent plants and birds:

      1. Prevent siting over eelgrass or seaweed beds.
      2. Control import of exotic species of nori to control disease.

3. Restrict siting from bald eagle or osprey nesting sites, heron rookeries, trumpeter swan winter occupation areas, and bird refugees. Peregrine falcons should be given line of sight buffering.

c. If herring spawn on nori, delay harvest until after they hatch. Also do not locate nori farming in known areas of herring or smelt spawn.
d. Farms should not be allowed in the migration paths of whales and porpoises. Also farms should not be located near known haul out areas of seals and sea lions. Walkways and docks should be built so that seals cannot use them. Avoid areas where sea otters are known to live.
e. Control odor by requiring removal of rotting seaweed from the site, including associated boats and tracks.
f. Nori requires the following environmental conditions:

Temperature:	0-25° C for Japanese Species 0-15° C for Washington Species
Salinity:	15-35°/00
Nitrogen:	>.007 mg/liter
Phosphorus:	>.005 mg/liter
PH:	8.0 - 8.3 best 7.0 - 8.5 acceptable
Currents:	< 5 knots (<.5 knots for working at site)
Waves:	< 1 foot for raft-style farming

2. **Proposed Aquaculture Policy**

a. Netting apparatus may impede wave action. Effect can be minimized by placing the net lengths parallel to tidal action and perpendicular to the predominant wave direction.
b. Benthic flora are shaded by nets and nori leaves. This reduces light penetration and inhibits photosynthesis. These impacts can be minimized by placing the nets in deeper water or by removing the nets during the summer when maximum benthic growth occurs.
c. Importation of porphyria from Japan and attached organisms is the biggest environmental concern of nori farming. To minimize the risk of importing diseases, it has been recommended that only conchocelis cultures be imported, not pre-seeded rafts.

3. **Past Permits**

a. Past shoreline permits issued for nori farms have contained the following specific conditions:

1. The poles shall not exceed three inches in diameter at the top. They shall be a natural color that blends with the character of the area.
2. All pole structures shall be removed from the bay by Memorial Day weekend each year of operation and not replaced until after Labor Day.

4.2.2 DISCUSSION

The impacts from nori are similar to those of most floating aquaculture operations. unlike other aquaculture types however, there are no wastes created by seaweed as well as no food or chemicals required for culturing. The need for spreading of nori on nets or poles above water can result in a blockage of light to benthic organisms below and racks which cover a very large area.

In February 1987, the department of fisheries enacted regulations controlling the import of marine plants (WAX 220-77-060) much of this section specifically deals with nori culture. Other than this, few specific regulations regarding siting of nori operations have been developed by the state. This is probably due to small number of commercially viable farms currently in operation. Due to recent research efforts by groups such as the department of natural resources, more is now known about cost effective methods of nori culture in Puget Sound. It is therefore no surprise that the number of applications for nori culture has been increasing.

It is suggested that the county require applicants to adhere to the mitigation measures described in the draft programmatic impact statement on nori. It should also review nori in a manner consistent with other floating mariculture facilities. Finally, requiring the removal of floating structures during seasons of intensive recreational use in certain cases seems appropriate to reduce potential conflicts.

4.3 MECHANICAL SHELLFISH HARVESTING

4.3.1 EXISTING DOCUMENTS

The Shorelines Hearings Board case of Island County vs English Bay Enterprises, LTD (1974) established that mechanical dam harvesting is conducted in the same manner as dredging due to its "dumping" and "filling" activities. It therefore ruled that this activity was considered substantial development under the Shoreline Management Act.

The following documents address mechanical harvesting below the extreme low water mark. To date, no harvesting upland on this mark has been permitted.

1. **Final environmental impact statement for the commercial harvesting of subtidal clams with a hydraulic escalator harvester.**

   a. Major impacts of mechanical harvesting include:

      1. Destruction of benthic organisms and habitat due to removal of seabed material.
      2. Increased sedimentation due to disturbance of seabed. This temporarily reduces water quality.
      3. Noise and visual impacts. Temporary reduction of natural hardshell clam populations.
      4. Adherence to department of fisheries siting guidelines and department of ecology's noise criteria (see Section 3.3, "Nuisances: Noise, Odor and Glare" will minimize most of the major impacts of this activity.
      5. Conflicts with adjacent tidelands and uplands could be further reduced by examining each proposal on a case-by-case basis. Straying of harvesters onto private tidelands could be reduced by clearly marking the shoreward boundary of each clam tract. Also, controlling when harvesting occurs could reduce conflicts with users of adjacent waters and shoreline.

2. **Washington State Department of Fisheries Regulations**

   a. To minimize the amount of fine material that potentially could be put into suspension by the hydraulic washing action of a harvester, the physical size composition of the substrate material must average more than ten percent above 500 microns in size with an average of less than fifteen percent being smaller than 63 microns.
   b. To minimize the potential for water quality degradation the chemical composition of the substrate material must be less than the following:

      1. 1.0 mg/g kjeldahl nitrogen
      2. 1.0 mg/g total phosphates
      3. .6 mg/g total sulfides
      4. 6% volatile solids
      5. 7.0 mg/g biological oxygen demand (BOD)

   c. The clam bed must have an average of at least .25 pounds per square foot of harvestable size clams and less than one adult geoduck per square yard.
   d. Eelgrass abundance in a clam bed shall not exceed ten turions per quarter meter squared (thirteen turions are allowed of samples

taken between March and October). No more than ten percent of the 1/4 m^2 samples may exceed twenty turions per 1/4 m^2.

e. Mechanical harvesting will be avoided in clam beds where there is a reasonable probability that harvesting would significantly effect "biota of significance" such as Dungeness Crab, herring kelp or other species of particular commercial, recreational, or biological importance.

3. **Washington State Department of Natural Resources**

a. To prevent harvester from straying onto private tidelands, shoreward boundaries of harvest tracts must be marked.
b. In subtidal areas of Puget Sound the use of mechanical harvesters is limited to bedlands leased by the department of natural resources. The amount of area available for harvesting is controlled and the number of operators is restricted.

4. **Past Shoreline Permits**

a. In Kilisut Harbor where a tract bordered Fort Flagler State Park harvesting was limited to months when less public use occurs.
b. In Agate passage harvesting is not allowed to take place on weekends when the area is greatly used for recreation.
c. Several permits had the following condition:

"The leased area shall be marked during harvest operations by a line of buoys around the perimeter of the tract. Buoy placement shall enable the harvester and other interested parties to clearly establish the location of the harvest operation as being only within the lease area."

4.3.2 DISCUSSION

The department of fisheries along with the department of natural resources has issued specific siting criteria for mechanical subtidal harvesting which are quite comprehensive. The shoreline program (Section 5.30, "Aquaculture," Performance Standard 10) required baseline information which can reveal how well an operation meets these criteria. Because use of the harvester is temporary and can create a nuisance to nearby recreational boaters and upland users, past shoreline permit conditions have restricted harvester use to weekdays or non-summer months when conflicts will be minimized. This kind of condition should be considered for all temporary marine development activities which affect known recreation areas.

4.4 SHELLFISH CULTURE

4.4.1 EXISTING DOCUMENTS

1. **Proposed Aquaculture Policy**

   a. Extensive culture operations in shallow, confined bays could have a noticeable effect on the local ecosystem due to the reduction of phytophlankton and the enrichment of the site with organic materials from feces and pseudofeces. The significance is dependent upon the operation size, depth of water and the velocity of tidal current.
   b. Seed collection occurs during a relatively short period when spawn is naturally released into the water.

4.4.2 DISCUSSION

Shellfish culture entails seed collection, as well as growout. Growout can occur in subtidal or intertidal areas on the seabed or by using floating structures such as longlines or rafts. Occasionally substrate habitat improvement is employed to improved culture yields.

Due to the numerous modes for culturing shellfish, no one set of siting criteria is sufficient. Culturing from rafts or longlines creates the most impacts and accordingly should be reviewed as floating mariculture. Habitat improvement entails using landfill material and possible dredging. This activity should be reviewed as such under the criteria of the dredging and landfill, sections of the shoreline program (Sections 5.70 and 5.100).

4.5 UPLAND AQUACULTURE

4.5.1 EXISTING DOCUMENTS

1. **Proposed Aquaculture Policy**

   a. All hatchery facilities are similarly in that they require withdrawal and elimination of water. The most common concerns are erosion and siltation from water runoff, amount of sediment,

nutrients and oxygen demanding substances in discharged water, emission of light and glare, and compatibility with adjacent land use.

b. Pollution abatement systems are used to help settle out suspended solids in discharge water. The agitation from pumping water into settling ponds decreases particulate size, decreasing the ability of particulates to settle, and resulting in the discharge of poorer quality water. An alternative is use of a gravity flow pollution abatement system which requires no pumping.
c. Shellfish hatcheries will discharge much smaller concentrations and volumes of solids than fish hatcheries. Due to the growing of algae for feeding shellfish, emission of light and glare can be a concern.
d. Discharge of water should not occur in ecologically sensitive areas.

2. **Past Permits**

a. All earthwork shall be so contained as to prevent erosion and siltation to the beach area.
b. All exposed slopes and cuts shall be appropriately angled and planted with vegetative cover.
c. Disturbance of shore vegetation shall be kept to a minimum.

4.5.2 DISCUSSION

Upland aquaculture includes tank, pond and all freshwater culture including hatcheries.

There appears to be little if any state regulation of siting an upland hatchery facility or upland aquatic farms. As with all projects involving movement of earth, erosion needs to be minimized. These concerns are addressed in many sections of the shoreline. The main difference between an contained upland facility and a marine operation is that waste materials can be controlled more readily and becomes a point source of pollution. The outfall from such a facility should be required to meet environmental protection agency water quality standards prior to discharge back into an open body of water

4.6 APPURTENANT UPLAND FACILITIES

Facilities such as equipment storage, offices, boat launching facilities, parking areas, processing plants, and waste disposal can be

integral to an aquaculture operation. These, however, are defined as commercial development and should be regulated by those policies and performance standards listed in other sections of the shoreline program such as Section 5.50, "Commercial Development". Examples of conditions regulating these facilities in past permit are listed below:

a. The fuel storage tank shall be sited in such a manner that leakage is contained on the property or controlled within the existing ponds.
b. Natural landscaping of the site shall be employed.
c. Disturbance of shore vegetation shall be kept to a minimum.
d. Solid waste, including but not limited to clam and oyster shells, shall not be dumped or stored at the subject site.

4.7 OTHER AQUACULTURE TYPES

During the last few years several types of aquaculture which have proven successful in other parts of the world have been proposed for Puget Sound such as kelp harvesting and herring spawn on kelp. With the exploding interest in aquaculture many new forms of aquaculture will likely be proposed in the near future.

Each aquaculture type will have some unique impacts which may need to be addressed specifically in the shoreline permit conditions. The shoreline program should be flexible enough to allow for adequately regulating these activities.

SECTION 5 CONCLUSION

The recent increase in intensity and complexity of aquacultural development within the waters of the Puget Sound area has created much public concern over the potential conflicts with other uses as well as biological and aesthetic impacts. Numerous studies as well as increased development has shown the need for more comprehensive regulation of aquacultural developments, especially for those which require floating structures.

Without adequate regulation, Jefferson County has reacted to individual proposals inconsistently, often making different requirements for similar developments. Permit conditions for aquaculture projects have

structures or potentially noisy developments. This is likely the result of an effort to minimize public objection to developments which are unfamiliar.

The lack of consistency and predictability in the permitting process has resulted in unnecessary polarization between those groups supporting and opposing aquaculture. Identifying areas where certain kinds of aquaculture are unacceptable or specific siting and operating standards could eliminate much wasted time, effort, and expenditure for developers as well as opponents. It would also help citizens feel that local government is responsive to their desires.

The adoption of more specific regulations would allow potential applicants to have a much clearer idea of the county's expectations and the likelihood of project acceptance.

Although documents such as the Washington State Department of Ecology's Interim Siting Guidelines for the Management of Salmon Net-Pen Culture in Puget Sound has provided a major step in establishing predictable consistent criteria for siting to minimize biological impacts, it is up to local government to deal with use conflicts. Accordingly, the county should act promptly to amend their shoreline program so that it 56 deals with these issues in a more specific and consistent manner.

SECTION 6

APPENDICES

APPENDIX 6.1

BIOPHYSICAL EVALUATION OF A MARINE FISH FARM SITE

Introduction

The selection of a suitable location for a salmon farm is of paramount importance to the success of its operation. Biological and physical factors that will contribute to the growth and health of seapen-reared fish need to be both understood and measured. In addition, many of the problems related to adverse conditions such as high water temperatures, plankton, predators, winds, waves and water currents can be alleviated by careful site selection.

The following outlines the biophysical evaluation of a marine fish farm site needed to complete a Marine Fish Farm Development Plan.

Biophysical Information

Exposure to Winds and Waves:

The following information is required to evaluate the degree of shelter from winds and waves, and to determine the engineering specifications for floats, anchoring and breakwaters:

- maximum fetch;
- fetch direction
- prevailing wind direction in spring, summer, fall and winter;
- maximum wave height anticipated.

Weather conditions must also be considered when servicing isolated salmon farms. Poor weather conditions en route to the site can restrict access to the farm to supply fish feed, maintain facilities, or to move fish product.

Water Depth:

It is important to have sufficient water depth to ensure that the fish are not affected by the organic materials (feed and fecal materials) that may accumulate and the toxic gases that may be released. Thus, it is necessary to measure the depth below the bottom of the seapens at the lowest tide.

Tidal Range:

To determine anchoring/securing requirements for floats and seapens, it is necessary to measure the range between mean tide and large tide. This information is often available from the Canadian Tide and Current Tables. The information also enables an assessment of expected water currents and aids in calculating depths below seapens.

Water Circulation:

Seawater circulation or flushing rate through seapens is important for waste removal, supply of oxygenated water, reduced temperature and salinity stratification. However, excessive water flow can flush feed out of the seapens before capture by fish. There is also some evidence that excessive water flow can exhaust fish, especially those introduced into seapens when they are either young (eg. smolts), in poor condition, or both. High water flows can necessitate special measures to secure seapens and prevent either bellowing or damaging nets, especially those nets fouled with marine organisms (mussels, seaweeds, etc).

Circulation measurements should be taken at slack water on a neap tide to determine the minimum exchange of water through seapens to ensure the good health and growth of fish. Measurements should be taken at peak flow on a spring tide to determine the maximum currents that fish, seapens and floats must withstand.

Ideally, the maximum and minimum ranges in water circulation are measured seasonally in order to determine extreme adverse circumstances. An example is a sustained slack tide in summer which can result in oxygen depletion and toxic waste build-up that causes fish mortalities. Conversely, a peak spring tide in fall or spring could result in nets being damaged by fast currents.

Water Temperature, Salinity & Dissolved Oxygen:

Water temperature and salinity information is required in a Development Plan. The measurement of dissolved oxygen is advised, but not required. Since seasonal variability occurs with these parameters, it is necessary to obtain summer, fall, winter, and spring measurements. In particular, it is important to measure extremes in water conditions such as high water temperatures in summer which will stress fish. When annual water temperatures are obtained, they are to be recorded as mean, minimum and maximum. Other sources of data maybe used to provide a complete seasonal analysis of the site, such as data obtained from the Federal Institute of Ocean Sciences. The use of such information would be considered secondary to the information collected by direct measurement at the proposed site.

For an accurate evaluation, it is necessary that temperature and salinity measurements be taken throughout the water column. The following depths provide a vertical profile of temperature/salinity: 0, 1, 2, 3, 4, 5, 10 meters and the bottom. Measurements should also be taken at slack water on a neap tide (minimum water flow) and at peak flow on a spring tide (maximum water flow). The averages of these temperatures/salinities are recorded.

Bottom Profile and Substrate Type:

The bottom profile and substrate type within the proposed site are required on the site diagrams within the Development Plan. A bottom profile provides detailed information on depths under seapens and anchoring requirements.

Substrate is a good indicator of what type of bottom currents are present to minimize the build-up of organic materials from feed and fecal deposition. For example, a muddy substrate indicates poor water circulation which could lead to excessive build-up of organic materials and a production of toxic gases under the seapens. Both sounding and diving within the site are recommended means to collect this information.

Marine Flora and Fauna:

Observing the marine flora and fauna under the seapens and within the proposed site provides an indication of the marine habitat. This information is useful to determine the potential productivity of the site for fish farming. It also provides an assessment of possible impacts to marine resources such as herring spawning areas. Diving and recording marine species present is the most effective method of assessment. The measurement of marine flora and fauna is a Federal Fisheries and Ocean's Dive-Survey requirement.

Predators:

The primary predators that can cause significant loss of reared fish are seals, dogfish, otters, herons, cormorants and seagulls. Information on their presence as a potential problem to a farm operation can be obtained from local knowledge, observation, provincial museum and publications. Methods to alleviate potential losses such as installation of a predator net for seals or an electric fence for otters can then be determined.

Plankton:

Intensive concentrations (blooms) of certain species of plankton can be deleterious to fish - particularly those that release toxins and those that damage fish gills. Other potential effects of plankton blooms are oxygen depletion during respiration and release of toxins when plankton die-off such as during the Spring season. Personal observations and local knowledge can provide an initial assessment of this problem, but noting environmental conditions conducive to plankton blooms is needed to predict potentially serious situations. Periodic and seasonal Secchi disc readings should be done to assess plankton abundance, whilst noting environmental conditions such as water temperatures and recent weather conditions. The use of bubbler systems and other methods are being considered as methods for mitigating the effects of plankton blooms.

Pollution:

Water pollution can manifest in many ways - from industrial discharges and cleaning of boat bilges to spills of gas, oils, cleansers or other toxic substances. Effects on fish can range from mortalities (lethal and sub-lethal) to tainting of fish flesh. Obvious sources of known industrial discharges should be considered as well as the potential for inadvertent pollution such as from a marina. When in doubt about water quality, water chemistry measurements for such toxic substances as heavy metals, phenols, chlorine, etc. should be undertaken.

The Ministry of Environment and Parks' Regional Waste Management Office can help locate recorded effluent discharges.

Other Factors:

The proximity of the salmon farm site to any salmon-bearing stream or marine fish habitat such as herring spawning grounds should be considered. There is the potential for transfer of fish disease from wild fish to reared fish, and vice versa. Owing to this possibility, the Federal Fisheries and Oceans does not allow fish farms to be situated within 1 kilometre from a salmon-bearing stream, unless approved by their District Fisheries Officer.

The proximity of a site to another fish farm should also be considered. There is the potential for transfer of fish disease between farms. Owing to this possibility, the Ministry of Agriculture and Fisheries does not allow farms to be situated within 3 kilometres of each other unless the applicant demonstrates no impact on adjacent farm operations.

There is some evidence that marine fish farms located close to shellfish could affect the shellfish growth and marketability. There are also suggestions that shellfish can harbour some diseases that are harmful to farmed fish such as Vibro sp. Thus, the boundary of a farm site cannot be located within 125 metres of the boundary of a shellfish site (tenure or application) or area. Shellfish applications or existing tenures are recorded at the Regional B.C. Lands Office, whereby recreational or wild shellfish areas are generally known by the District Federal Fisheries Officers or the Shellfish Unit of the Ministry of Agriculture and Fisheries.

Finfish Unit
Commercial Fisheries Branch
Ministry of Agriculture and Fisheries
Victoria, BC..

January, 1987

MARINE FISH FARM SITE EVALUATION CRITERIA

BIOPHYSICAL CAPABILITY	HIGH	MEDIUM	LOW
1. Water temperature (single incident)	Summer $\leq 16^{o}C$ Winter $\geq 7^{o}C$	Summer 17-20°C Winter 5-6°C	Summer $\geq 21^{o}C$ Winter $\leq 4^{o}C$
2. Salinity	$\geq 24^{o}/oo$	15-23°/oo	< 15°/o
3. Circulation in seapen @ 8-10/m^3 stocking density	> 2 cm/sec	2 cm/sec	$\leq$ 2 cm/sec
4. Protection	well protected > 2' wave	moderate protection < 3' wave	risky > 3'wave
5. Predators	no known observations; seals, otters, sea lions, mink	observations noted	known haul-out or colony nearby
6. Depth below seapen bottom at 0'	> 10 m	2-10 m	< 2 m
7. Pollution	no known sources; future impacts unlikely	no sources at present; some future impact possible	industrial or septic pollution nearby
8. Plankton	no record of chaetocerus or heavy plankton blooms	location suspect	known plankton blooms

APPENDIX 6.2

BRITISH COLUMBIA **MARINE FISH FARM DEVELOPMENT PLAN** APPLICATION

Name of Applicant: _____

Address: _____

_____

_____

Postal Code: _____

Telephone: _____ (office)

_____ (home)

Location of Site: _____

Ministry of Forests and Lands File No: _____

Date of "Application for Crown Land": _____

DESCRIPTION OF MARINE SITE

1) Map reference: Latitude _____° _____' _____"
Longitude _____° _____' _____"

2) Geographic description of site (use nearby land/marine features): _____

_____

3) Area of site applied for: _____ hectare(s)

SITE SUITABILITY

(Contact Ministry of Agriculture and Fisheries for assistance if required)

1) Exposure to winds and waves:

- maximum fetch _____ nautical miles
- fetch direction _____ compass direction
- maximum wave height anticipated: _____ metres
- prevailing wind direction (note direction that winds blow from):
  spring _____ summer _____ fall _____ winter _____

2) Minimum water depth below the bottom of the netpens: _____ metres

3) Annual tidal range:
mean tide _____ metres large tide _____ metres

4) Water circulation at seapens:

- slack water on a neap tide _____ cm/second
- maximum flow on a spring tide _____ cm/second

5) Annual water temperature: mean _____ ° C
minimum _____ ° C
maximum _____ ° C

6) Salinity and temperature profiles at proposed site - quarterly:

Depth (metres)	Spring		Summer		Fall		Winter	
	Temp. °C	Sal. 0/00	Temp. °C	Sal. 0/00	Temp. °C	Sal. 0/00	Temp. °C	Sal. 0/00
0								
1								
2								
3								
4								
5								
10								
bottom								

7) Known predators present in the area which pose a threat to pen-reared fish and/or associated equipment are : _____

_____
(seals, otters, herons, cormorants, dogfish ...)

8) Algae-blooms harmful to fish recorded in the area: yes _____ no _____ - If yes, identify the date, the species responsible and the source(s) of your information _____

9) Nearby sources of water pollution that could be harmful to pen-reared fish: yes _____ no _____. If yes, identify the source, type and quantity of pollutant(s) involved _____

_____

10) Distance by water to the nearest known marine fish farm: _____ km.

11) Site bottom characteristics based on a SCUBA survey (attach additional pages if necessary):

a) describe the substrate at the site; _____
(rock, sand, mud, etc.)

_____

b) describe the animals and plants at the site _____
(starfish, geoduck clams,

_____
kelp, eelgrass, etc.)

OPERATIONAL CHARACTERISTICS
(contact Ministry of Agriculture and Fisheries for assistance if required)

Scale of Operation

1) Expected maximum stocking (rearing density) within the growout seapens: _____ kg/m^3.

2) At full operation and for each species (where applicable) state: (i) the expected number of smolts introduced each year, (ii) average weight of harvested fish (kilograms), (iii) age at harvest (months from smolt to harvest losses (percentage):

	NO. OF SMOLTS	HARVEST WT. (kg)	HARVEST Age (mos)	SMOLT TO HARVEST LOSSES (%)
Chinook				
Coho				
Rainbow				
Other (Specify)				

EXAMPLE

Coho	50,000	2.5	16	25%

3) Fish of different year-class to be reared on-site: yes _____ no _____

4) Brood-stock to be reared: yes _____ no _____. If yes, state maximum number and weight of each species: _____

_____

Water Quality Factors

1) Nets to be treated with marine anti-foulant: yes _____ no _____
If yes, state type (brand or active ingredient) of anti-foulant

_____

2) Type of fish feed to be used: _____
(eg. dry pellets, silage)

and commercial brand(s) if known) _____

3) Automatic feeders to be used: yes _____ no _____

4) Feed-fine recovery system proposed: yes _____ no _____

5) If floating accommodation is proposed, state type of sewage system to be employed: _____
(eg. open-discharge, storage tank)

6) Fish fecal and feed bottom-deposits to be removed or dispersed: yes _____ no _____ If yes, state proposed method and frequency

_____
(eg. dredging, dispersion)

7) An area within the proposed site will be used for the relocation of seapens to control excessive organic deposition on the seabed: yes _____ no _____ (Note: except as warranted, only the area needed for one year "fallow" period will be approved; required to be shown in the fish farm lay-out diagram)

8) Fish processing to be undertaken on-site: yes _____ no _____ If yes, what type of processing _____ ;
(eg. gilling, gutting)

quantity of fish harvest at full operation (tonnes/year) _____ ;

and how will processing waste be handled _____

_____
(eg. silage, land discharge, burning)

9) Fish silage or other feed manufacturing proposed: yes _____

no _____ If yes, what type of feed _____

INFORMATION RELATED TO OTHER COASTAL RESOURCE USES

1) The proposed site in or near (1 km)a designated boat anchorage: yes ____ no _____ (Check marine charts and/or Coast Guard).

2) The site is on or near (1 km) of an area used by recreational boaters for passage, moorage or shore access: yes _____ no _____ unknown _____ (Information sources: boat cruising guides, Coast Guard, Federal Small Craft Harbours Branch, Prov. Parks Branch, Council of B.C. Yacht Clubs, Association of Marine Underwriters of B.C.)

3) The site is used or proposed for log-handling or other use (marine or upland): yes _____ no _____ unknown _____ (Information sources: District B.C. Forest Office, B.C. District Lands Office)

4) The site is within 1 km of a coastal marine park or ecological reserve: yes _____ no _____ (Check with B.C. Regional Parks Office, Planning and Ecological Reserves).

5) The site is within 1 km of an Indian Reserve boundary: yes _____ no _____ (Check with B.C. District Lands Office)

6) The site is used for commercial fishing (anchoring, seining, trolling, crabbing, shrimping etc): yes _____ no _____ unknown _____ (Check with District Federal Fisheries Office)

7) The site is within 125 metres of an intertidal or subtidal shellfish bed which is subject to commercial, recreational or native Indian harvest: yes _____ no _____ unknown _____ (Check with Local Tribal Council, District Lands Office, District Federal Fisheries Office)

8) The site is on or near (1 km) marine fisheries habitat of such as herring or cod spawning, salmon holding/rearing areas: yes _____ no _____ unknown _____ ? (Check with District Federal Fisheries Office)

9) The site is on or near (1 km) the mouth of any salmonid-bearing water course (salmon, trout): yes _____ no _____ unknown _____. If yes, state how far: _____ km. (Check with District Federal Fisheries Office)

10) The site (both foreshore and upland) is zoned for marine fish farming: yes _____ no _____ (Check with Regional District Offices). If no, state the current plan and zoning designations: _____

11) The site fronts foreshore area of an upland owner: yes _____ no _____. (Check with Regional B.C. Lands Office). If yes, state the current use of upland and foreshore _____

Note: Attach a map which locates and summarizes the above information.

FISH FARM FACILITIES AND LAYOUT

Please attach the following diagrams; they should be drawn/drafted in ink, to scale and be consistent with other information in the Development Plan (Important information requirements and examples of diagrams are provided in the "Introduction" document)

Coastal Resource Uses Map (includes information requested above)

Location Map

Fish Farm Layout (include both upland and foreshore uses and facilities).

Details of Fish Farm Construction (including anchoring or securing system).

SCHEDULE A

Schedule of Improvements

Description of Improvements	Total Area (m^2)	Date of Completion

Schedule of Production

Fish first introduced in: _____ _____ and full production
(month) (year)

of _____ tonnes of fish on-site will be reached in: _____ _____
(month) (year)

The range of fish tonnage (tonnes) on-site within the following calendar years will be as follows:

Year 1 - Max._____ Year 2 - Max._____
Min._____ Min._____

Year 3 - Max._____ Year 4 - Max._____
Min._____ Min._____

Year 5 - Max._____
Min._____

SCHEDULE A

Schedule of Improvements (example)

Description of Improvements	Total Area (m^2)	Date of Completion
Work, Storage and office float (15 m by 20 m)	300 m^2	March 1986
Barge Accommodation (10 m by 20 m)	200 m^2	March 1986
Breakwater (log) 140 m		
Seapens and walkways (Dimensions & depth)		
3 - (15 m by 15 m by 10 m)	675 m^2	April 1986
16 - (15 m by 15 m by 10 m)	3600 m^3	April 1987
16 - (15 m by 15 m by 10 m)	3600 m^3	April 1988
4 - (15 m by 15 m by 10 m)	900 m^2	April 1989

Schedule of Production

Fish first introduced in: April (month) 1986 (year) and full production of 276 tonnes of fish on-site will be reached in: August (month) 1990 (year)

The range of fish tonnage (tonnes) on-site within the following calendar years will be as follows:

Year 1 - Max. 12 Min. 0

Year 2 - Max. 85 Min. 30

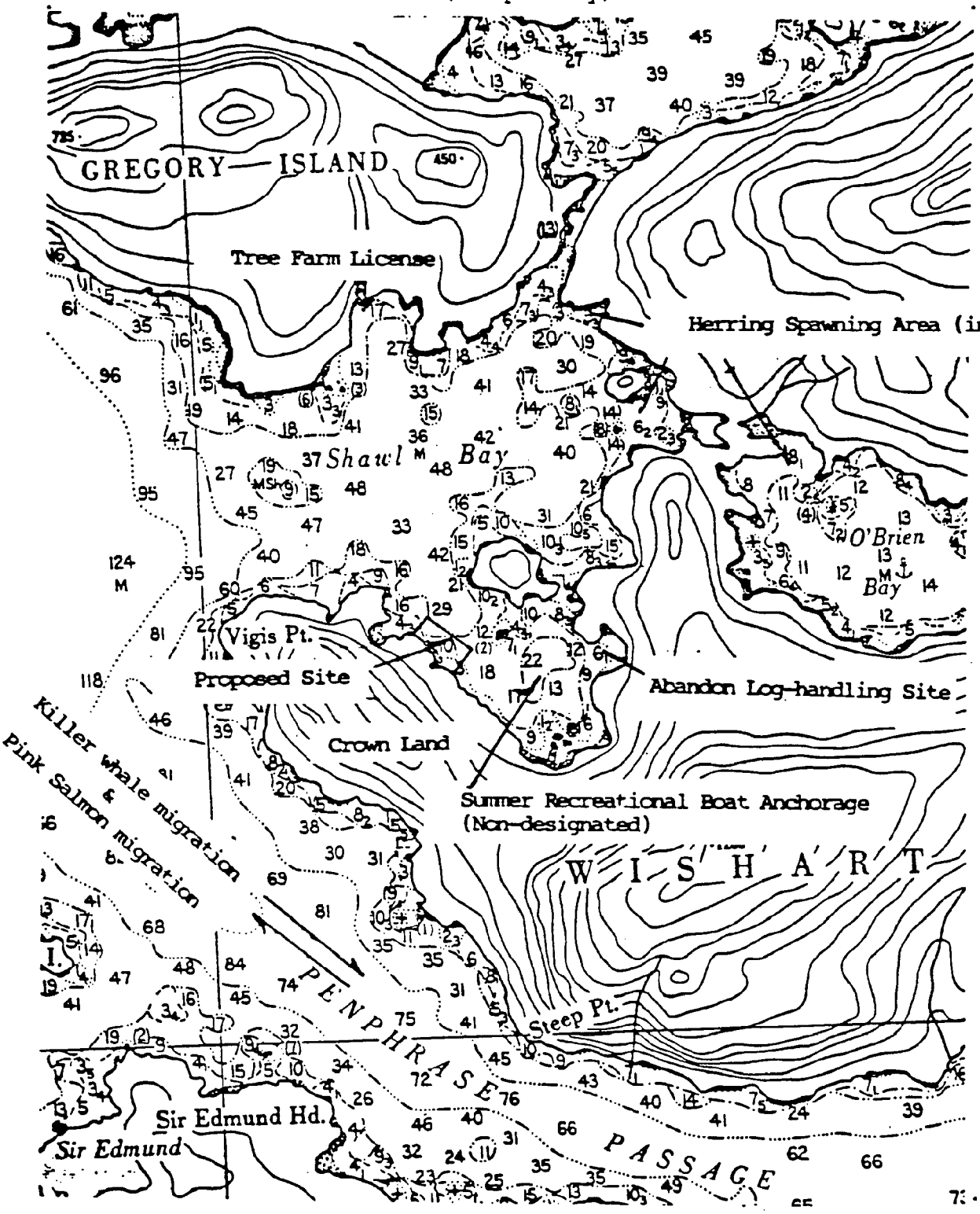
Year 3 - Max. 210 Min. 30

Year 4 - Max. 276 Min. 30

Year 5 - Max. 276 Min. 30

FIGURE 1

COASTAL RESOURCES USE MAP
(Example Only)



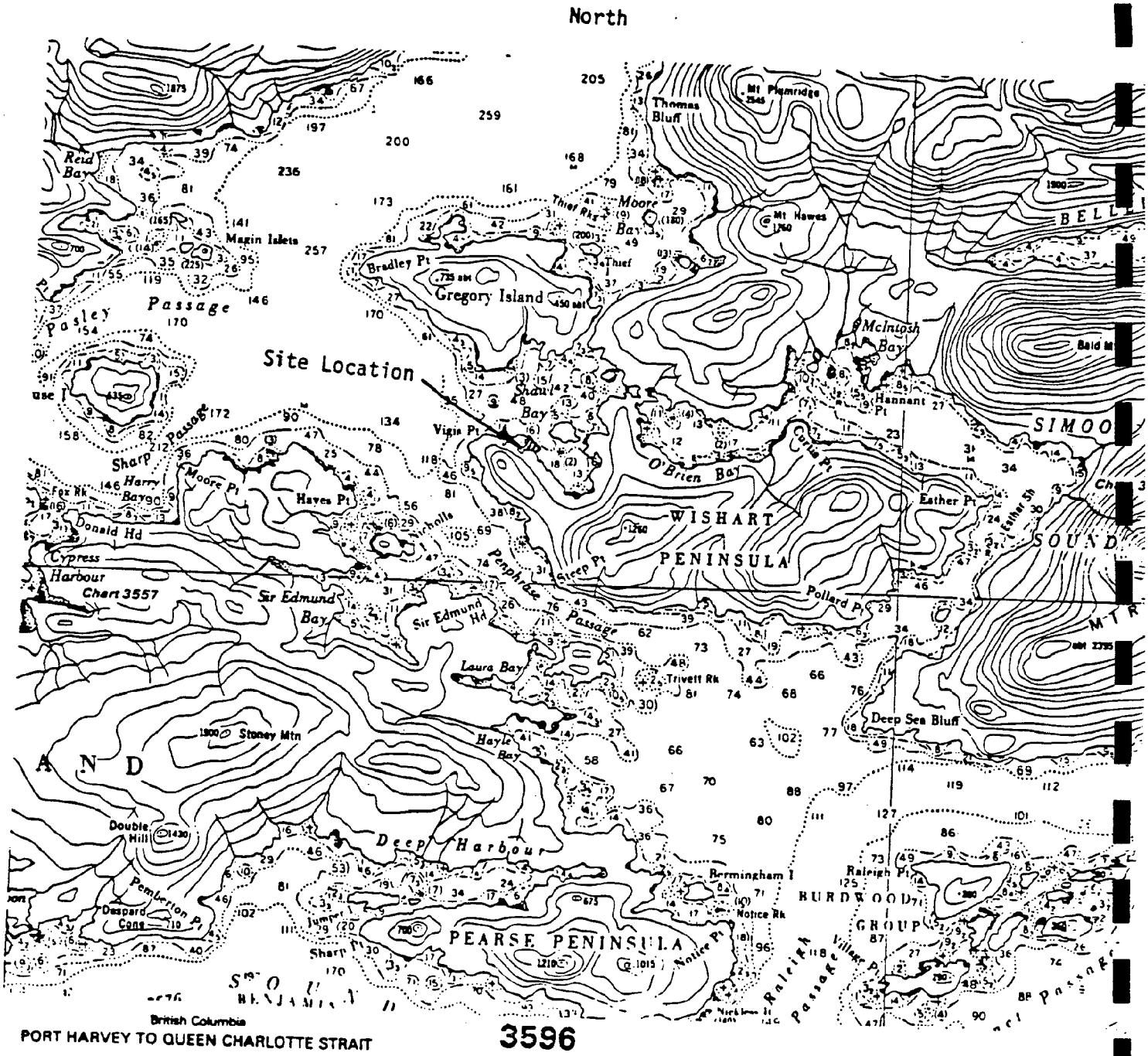


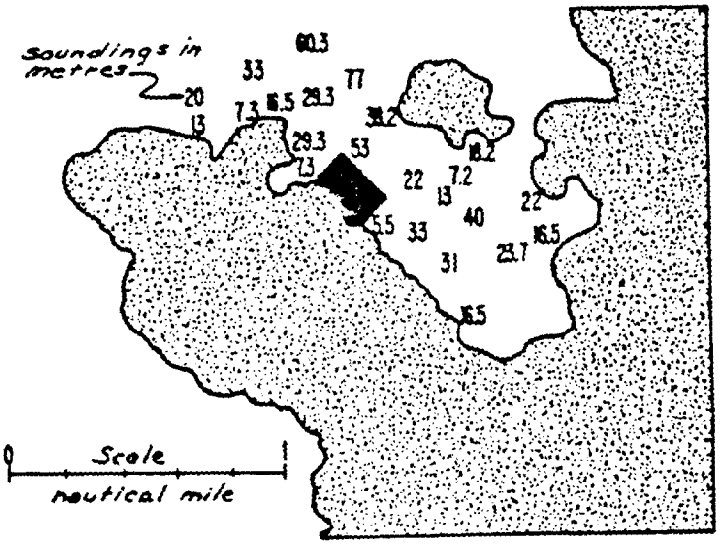
FIGURE 2 - Site location map (Example Only)

Proposed site is in Shawl Bay - Wishart Peninsula

FIGURE 3
FISH FARM LAYOUT AT FULL PRODUCTION

(EXAMPLE ONLY)

Approximate size of proposed site is 3.8 hectares.



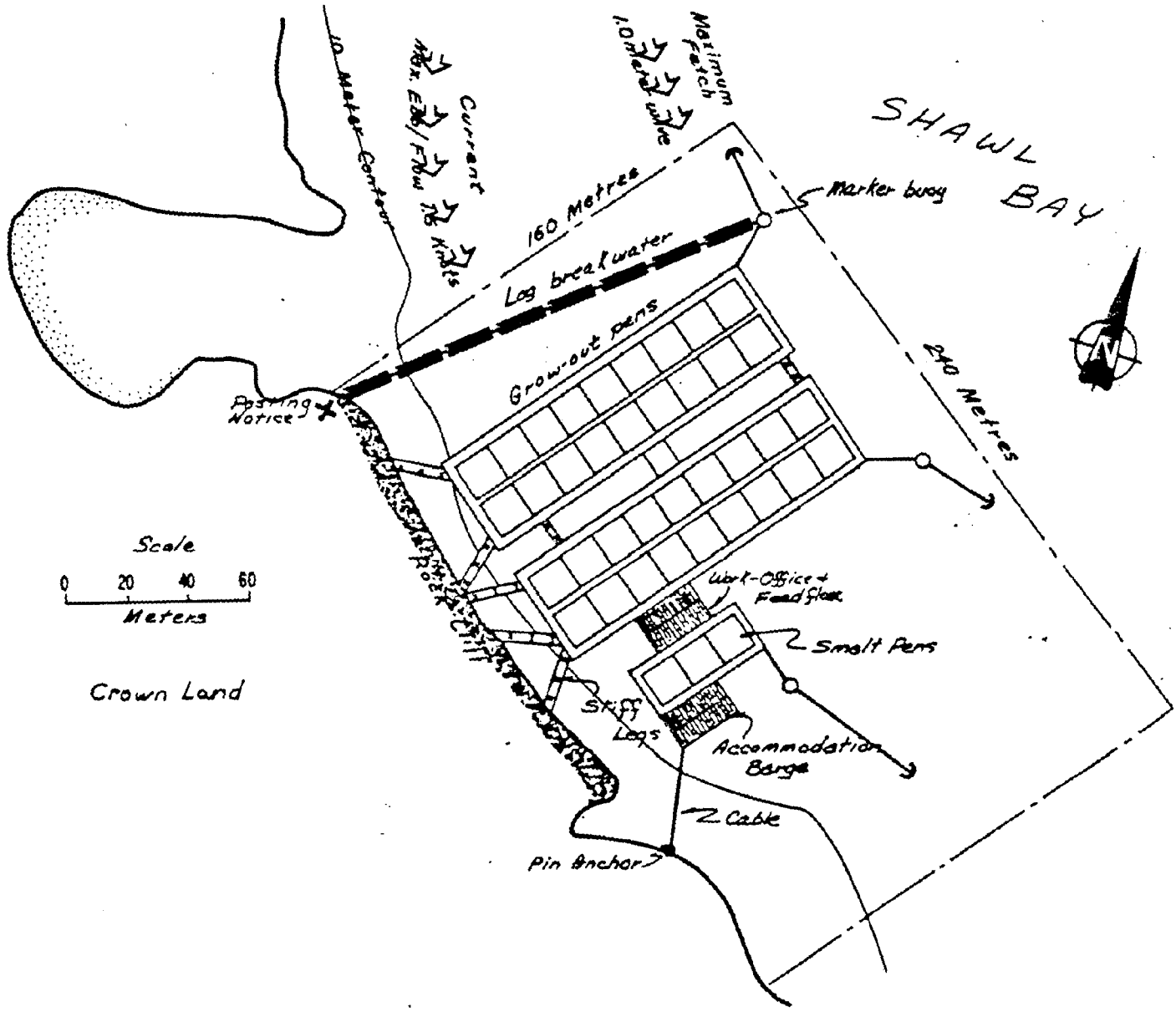


FIGURE 4
DETAILED DIAGRAM OF SEAPEN (EXAMPLE ONLY)

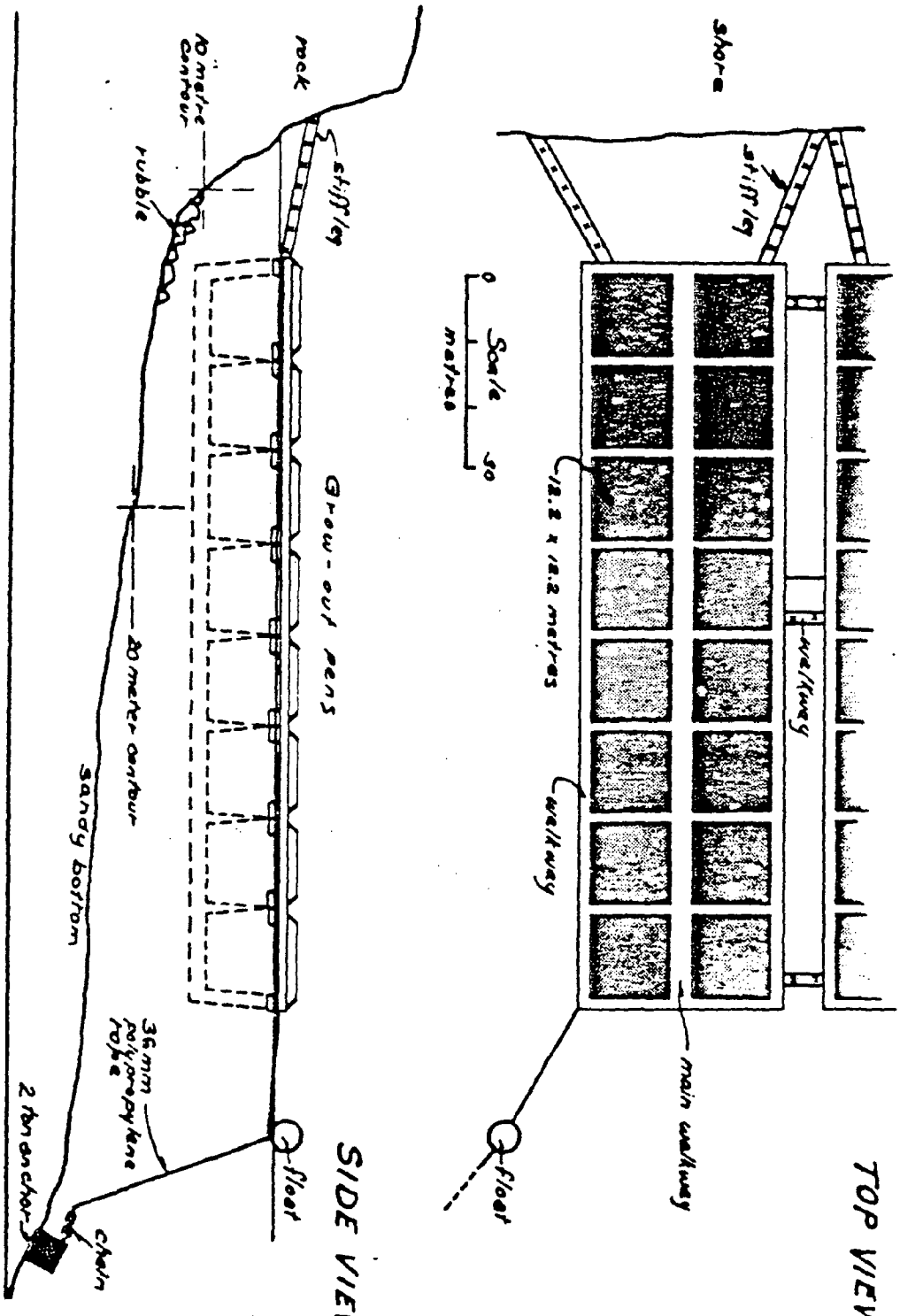
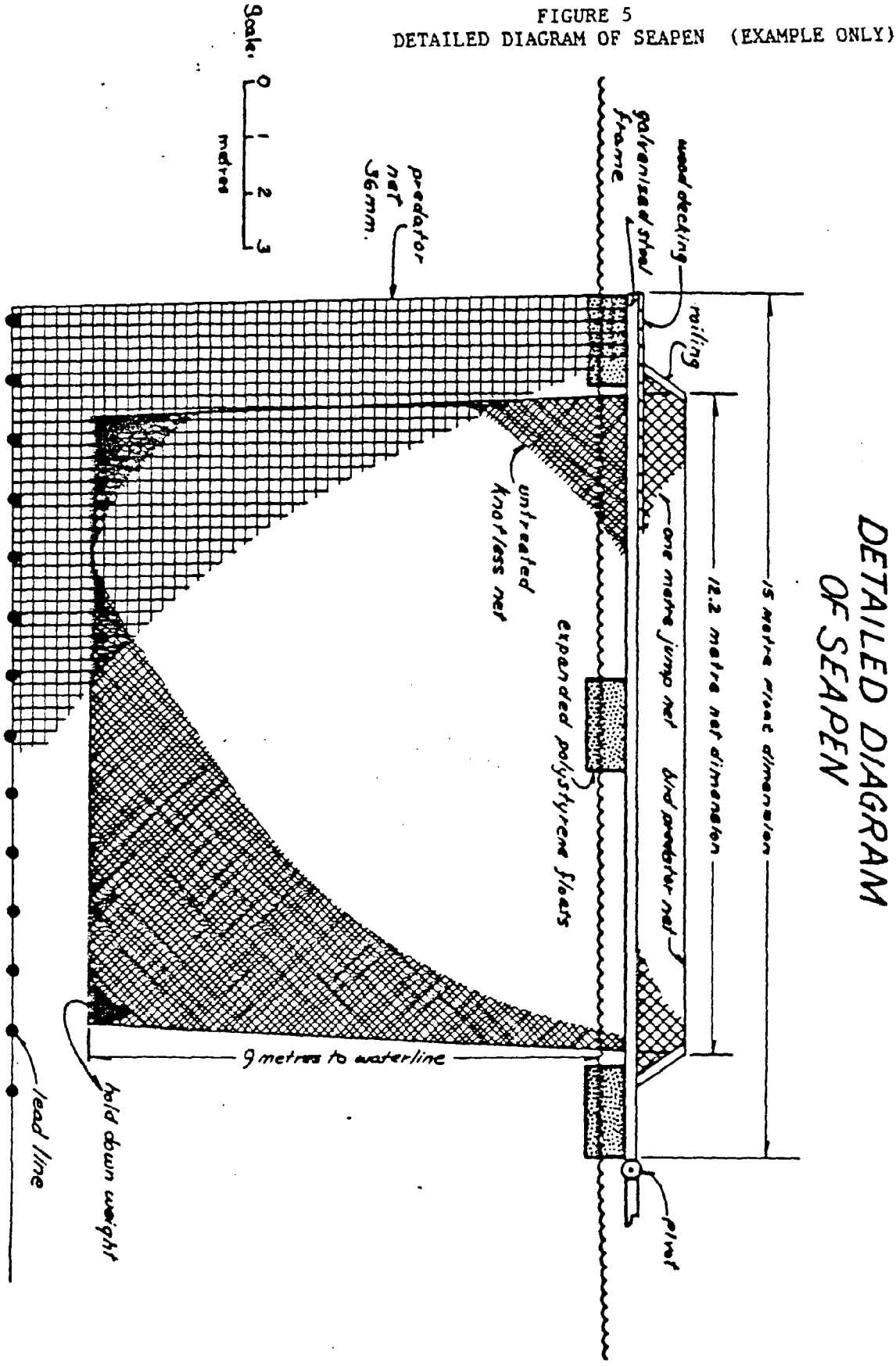


FIGURE 5
DETAILED DIAGRAM OF SEAPEN (EXAMPLE ONLY)



APPENDIX 6.3

WASHINGTON STATE
DEPARTMENT OF NATURAL RESOURCES
SUPPLEMENTAL APPLICATION FORM
FOR AQUACULTURE LEASES

A. Applicant Information

Name _____

Address _____

_____

_____

Phone _____

Applicant is applying as Individual___, Corporation___,
General Partnership___, or Limited Partnership___.

B. Site Plan

Submit preliminary maps and drawings containing the information required for Exhibit A in "DNR Standard Requirements for Aquatic Land Lease Exhibits" (pages 5 - 7). Corps of Engineers' or shoreline management permit drawings may be used as the basis for the preliminary maps provided they contain the information required for Exhibit A. (Before the lease is approved, exhibits must conform to all the requirements stated).

C. Plan of Development and Operation

Provide a draft narrative containing the information required for Exhibit B in "DNR Standard Requirements for Aquatic Land Lease Exhibits" (page 7). In addition, provide the following information in separate sections:

1. Types and expected useful life of of improvements, the materials to be used and the anchoring system. Anchoring systems are a particular concern and should be explained and diagrammed in detail. The suitability of the anchoring system in relation to physical conditions at the site such as wind, waves, currents, and substrate should be described. Sources of physical information should be referenced.

2. Schedule of development, by year, referenced to the site plan

3. Work force at the site

4. Number of boats

5. Timing of work - hours, days, months of operation

6. Use of temporary or short-term equipment such as nursery nets

7. Species to be reared, sources of stock, and anticipated production levels

8. Chemicals, feed, antibiotics, etc. to be introduced into the water

9. Harvest, feeding, and tending operations

10. Maintenance methods and timing

11. Methods of predator control

12. Waste discharges

13. Hazardous materials used or generated such as solvents, gas, oil, or pesticides

14. Environmental monitoring

15. Location of any publicly owned sites to be used for loading or unloading boats

16. Any subleasing plans

C. Management Capability

The department must ensure that the developer has the financial and technical resources to have a reasonable chance of success not only to initiate operation but to sustain itself over the term of the lease. Therefore, the following proprietary information is requested. This information will remain confidential and should be submitted as an appendix to the main proposal.

1. Submit a pro forma statement of income and expenses for the term of the proposed lease.

2. State the amount, timing, and source of capital investments and operating expenses required for the project. If other than your own funds are to be used, submit a statement of financial backing, such as a letter from a lender, demonstrating the availability of the funds.

3. If a lender will be involved, state whether it will be taking a security interest in the leasehold.

4. Submit a description of the managerial qualifications of the staff including previous business experience and technical expertise.

D. Compatibility with Adjacent Land Uses

The department wants to ensure that proposed development will be compatible with other existing and potential uses of aquatic lands and with adjacent upland uses. Compatibility will be evaluated in detail through the shoreline permitting and SEPA review process. For the purposes of this application, provide the following information:

1. Describe any potential boundary line problems which may arise if the aquatic lands at or near the site were leased for similar or other types of uses.

2. Discuss the potential for drift of structures to be placed on site.

3. Explain whether a buffer or separation is needed between your proposed use and any other uses of adjacent aquatic lands or uplands.

4. Describe any adverse impacts which might occur to your proposed use as a result of other operations in the vicinity.

E. State Environmental Policy Act Compliance

If DNR is the lead agency, submit an environmental checklist. If DNR is not the lead agency, submit copies of whatever environmental documents have been filed to date with the lead agency.

F. Supplemental Environmental and Land Use Information

If not contained in the environmental checklist or impact statement, submit the following information (possible sources of information are listed in parentheses):

1. Currents/flushing rates - estimate the direction and speed of major surface currents at the site (CZ Atlas*)

2. Bottom type, flora and fauna - describe the physical and biological character of the bottom at the site (CZ Atlas)

3. Littoral drift - provide any available information on the amount and direction of littoral drift on adjacent shorelines (CZ Atlas)

4. Wind, waves - describe maximum, average, and predominant directions (CZ Atlas)

5. Public use and access

   a. What public recreational use is currently made of state-owned aquatic lands at the site, on adjacent tidelands and within 1/4 mile of the site? (Local parks and recreation plans, local shoreline management master program)

   b. How will the proposed development impact the above uses?

6. Navigation

   a. What recreational or commercial navigational use is there of the project site? (navigation charts, Coast Guard, local shoreline management master program)

   b. How will the proposed development impact the above uses?

7. Renewable resource use

   a. Are there any comercially or recreationally harvestable plants or animals on the site? (CZ Atlas, Washington Department of Natural Resources, Fisheries, or Game staff)

   b. How would the above resources be affected by the proposal?

*Washington Coastal Zone Atlas, available at city and county shoreline administrators' offices and in Olympia at the Department of Ecology library.

APPENDIX 6.4

ICES CODE OF PRACTICE AND GUIDELINES FOR IMPLEMENTATION

At its Statutory Meeting in 1973, the International Council for the Exploration of the Sea adopted a "Code of Practice to Reduce the Risks of Adverse Effects Arising from Introduction of Non-indigenous Marine Species." Regulatory agencies of all member countries are encourage to use the strongest possible measure to prevent unauthorized or unapproved introductions. At its Statutory Meeting in 1979 the Council adopted a revised code, as described in the following sections (ICES Cooperative Research Report No. 130, 1984)

1. Recommended procedure for all species prior to reaching a decision regarding new introductions (A recommended procedure for introduced or transferred species which are part of current commercial practice is given in Section C).

   (a) Member countries contemplating any new introduction should be requested to present to the Council at an early stage, information on the species, stage in the life cycle, area of origin, proposed place of introduction and objectives, with such information on its habitat, epifauna, associated organisms, potential competition to species in the new environment, etc., as is available. The Council should then consider the possible outcome of the introduction, and offer advice on the acceptability of the choice.

   (b) Appropriate authorities of the importing country (including fishery management authorities) should examine each "candidate for admission" in its natural environment, to assess the justification for the introduction, its relationship with other members of the ecosystem, and the role played by parasites and diseases.

   (c) The probable effects of an introduced species into the new area should be assessed carefully, including examination of the effects ~~of~~ any previous introductions of this or similar species in other areas.

   (d) Results of (2) and (3) should be communicated to the Council for evaluation and comment.

2. If the decision is taken to proceed with the introduction, the following action is recommended:

   (a) A broodstock should be established in an approved quarantine situation. The first generation progeny of the introduced species can be transplanted to the natural environment if no diseases or parasites become evident, but not the original import. The quarantine period will be used to provide opportunity for observation for disease and parasites. In the case of fish, broodstock should be developed from stocks imported as eggs or juveniles, to allow sufficient time for observation in quarantine.

(b) All effluents from hatcheries or establishments used for quarantine purposes should be sterilized in an approved manner which should include the killing of all living organisms present in the effluents.

(c) A continuing study should be made of the introduced species in its new environment, and progress reports submitted to the International Council for the Exploration of the Sea.

3. Regulatory agencies of all member countries are encouraged to use the strongest possible measures to prevent unauthorized or unapproved introductions.

4. Recommended procedure for introduced or transferred species which are part of current commercial practice.

(a) Periodic inspection (including microscopic examination) by the receiving country of material prior to mass transplantation to confirm freedom from introducible pests and diseases. If inspection reveals any undesirable development, importation must be immediately discontinued. Findings and remedial actions should be reported to the International Council for the Exploration of the Sea.

(b) Inspection and control of each consignment on arrival.

(c) Quarantining or disinfection whenever possible and where appropriate.

(d) Establishment of broodstock certified free of specific pathogens.

It is appreciated that countries will have different attitudes toward the selection of the place of inspection and control of the consignment, either in the country of origin or in the country of receipt.

SECTION 7

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