Appendices A-L

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Appendix A. Appropriate Use Findings

A.1 Introduction

The Appropriate Refuge Uses Policy (603 FW 1 (2006)) outlines the process that the Service uses to determine when general public uses on refuges may be considered. Priority public uses previously defined as wildlife-dependent uses (hunting, fishing, wildlife observation and photography and environmental education and interpretation) under the National Wildlife Refuge System Improvement Act of 1997 are generally exempt from appropriate use review. Other exempt uses include situations where the Service does not have adequate jurisdiction to control the activity and refuge management activities. In essence, the appropriate use policy provides refuge managers with a consistent procedure to first screen and then document decisions concerning a non-priority public use. When a use is determined to be appropriate, a refuge manager must then decide if the use is compatible before allowing it on a refuge. For purposes of this CCP an "appropriate use" must meet at least one of the following three conditions.

- The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act.
- The use involves the take of fish and wildlife under state regulations.
- The use has been found to be appropriate as specified in section 1.11 of the policy and documented on FWS Form 3-2319.

During the CCP process, the refuge manager reviewed all existing and proposed refuge uses for Dungeness National Wildlife Refuge that is associated with the Preferred Alternative (Alternative B). Documentation of appropriateness findings for wildlife-dependent uses is not included in this Appendix because wildlife-dependent uses are appropriate by definition. They are, however, evaluated for compatibility in Appendix B, Compatibility Determination. All other refuge uses were evaluated using the criteria described in policy and listed on FWS Form 3-2319. The table below shows the uses evaluated and appropriateness findings made by the refuge manager. Additional documentation is included in this Appendix for each use identified in the table.

Table A-1. Summary of Appropriate Use Findings

Refuge Use	Appropriate	Page
Research, Scientific Collecting, and Survey Activities	Yes	A-2
Boating	Yes	A-5
Horseback Riding	No	A-8
Vehicle Access to New Dungeness Light Station	Yes	A-12
Jogging/ Running	No	A-15

Finding of Appropriateness of a Refuge Use

Refuge Name: Dungeness National Wildlife Refuge

Use: Research, Scientific Collecting, and Survey Activities

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	**X**	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	**X**	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	**X**	
(d) Is the use consistent with public safety?	**X**	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	**X**	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	**X**	
(g) Is the use manageable within available budget and staff?	**X**	
(h) Will this be manageable in the future within existing resources?	**X**	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	**X**	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	**X**	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No **_X_**

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ Appropriate__**X**___

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

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Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Research, Scientific Collecting, and Surveys

Further Explanation of Answers Provided for the Decision Criteria:

Project: Conducting research on refuge lands and waters

Summary: The Refuge receives requests to conduct scientific research on refuge lands and waters. Research applicants must submit a proposal that would outline: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on refuge wildlife and/or habitat, including disturbance (short- and long-term), injury, or mortality; (5) personnel required; (6) costs to the Refuge, if any; and (7) end products expected (i.e., reports, publications). Research proposals would be reviewed by refuge staff, the Regional Office Branch of Refuge Biology, and others as appropriate prior to the Refuge issuing a special use permit (SUP). Projects will not be open-ended, and at a minimum, will be reviewed annually.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

(a) Do we have jurisdiction over the use?
Some or all of the proposed activities would take place within refuge boundaries. The Refuge has jurisdiction over those research projects that are sited within refuge boundaries.

(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?
Any proposed research activities would comply with all applicable laws and regulations and any restrictions or qualifications that are required to comply with laws and regulations would be specified in the SUP.

(c) Is the use consistent with applicable executive orders and Department and Service policies?
Through the review of individual projects, the Refuge would ensure that they are consistent with applicable policies, especially the Research on Service Lands Policy (803 FW 1).

(d) Is the use consistent with public safety?
Through individual project review, the Refuge will ensure that each project is consistent with public safety. If necessary, stipulations to ensure public safety will be included in the project's SUP.

(e) Is the use consistent with goals and objectives in an approved management plan or other document?
Research activities are approved in instances where they can provide meaningful data that may contribute to refuge management and public appreciation of natural resources.

(f) Is the use manageable within available budget and staff?
The Refuge receives fewer than two requests per year for this activity, and it is manageable with available budget and staff.

(g) Will this be manageable in the future within existing resources?
The proposed activity at current levels would be manageable in the future with the existing resources.

(h) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?

The proposed use is beneficial to the Refuge's natural and cultural resources because the types of research projects approved are those that have the distinct likelihood of helping achieve refuge purposes by providing information useful for the management of trust resources and contributing to the public's understanding and appreciation of natural and/or cultural resources.

(i) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see Section 1.6D, 603 FW 1, for description) compatible, wildlife-dependent recreation into the future?

The Refuge will ensure that the research activities do not impair existing or future wildlife-dependent recreational use of the Refuge during individual project review, prior to issuing the SUP for the project.

Finding of Appropriateness of a Refuge Use

Refuge Name: Dungeness National Wildlife Refuge

Use: Boating

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	**X**	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	**X**	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	**X**	
(d) Is the use consistent with public safety?	**X**	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	**X**	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	**X**	
(g) Is the use manageable within available budget and staff?	**X**	
(h) Will this be manageable in the future within existing resources?	**X**	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	**X**	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	**X**	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No **_X_**

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ Appropriate__**X**___

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

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Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Boating (electric and wind driven; human powered; and motorized)

Further Explanation of Answers Provided for the Decision Criteria:

Project: Boating

Summary: Boating occurs in refuge waters primarily in support of fishing and wildlife observation. Boats are allowed in refuge waters from May 15 to September 30. The remainder of the year these waters are closed to all use to protect migrating and wintering species of wildlife. Boaters must operate at a no wake speed and stay 100 yards below mean high tide line thus providing a buffer to wildlife using the shoreline.

For the findings listed on FWS Form 3-2319, a justification has been provided below

(a) Do we have jurisdiction over the use?
An October 20, 1994 memorandum from the Assistant Solicitor, Branch of Fish and Wildlife to the Director, U.S. Fish and Wildlife Service (Service) concludes "… that the Service has statutory authority under the National Wildlife Refuge Administration Act (Administration Act) to regulate activities that occur on water bodies 'within' refuge units. The Service, in terms of its refuge administration regulations, has effectively defined this authority to apply to areas the United States holds in fee or to the extent of the interest held by the United States." The Solicitor also noted that "… other legislative authorities allow the Service to regulate activities on waters that are not 'within' refuge units but those authorities can be exercised only by regulations that are issued to protect migratory birds, to protect refuges that were acquired pursuant to the Migratory Bird Conservation Act, or to protect species listed under the Endangered Species Act or protected by the Marine Mammal Protection Act."

Federal authority to regulate activities on state owned tidelands was reiterated in an August 7, 2003 memorandum to Refuge Chief, Fish and Wildlife Service, Region 1 from the Office of the Solicitor, Pacific Northwest Region concerning airboat use at Willapa National Wildlife Refuge.

(e) Is the use consistent with goals and objectives in an approved management plan or other document?
Boating, in support of recreational fishing and wildlife observation, supports Goals 5 and 6 in the Dungeness NWR CCP.

(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?
Boating was modified with the 1997 Environmental Assessment "Management of Public Use for Dungeness National Wildlife Refuge."

i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?

Boating on refuge waters takes place primarily in support of fishing, wildlife observation and as a means of access to the New Dungeness Light Station. The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation, photography, hunting, fishing, and environmental education as priority public uses on national wildlife refuges. Boating on the Refuge enhances visitor opportunities to participate in a number of these activities. The Service strives to provide visitor uses supporting these activities when compatible with the purpose(s) and goals of the Refuge and the mission of the National Wildlife Refuge System (System).

(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

Based upon the biological impacts presented in the CCP/Environmental Assessment, it is determined that providing boating opportunities at Dungeness NWR will not materially interfere with or detract from the purposes for which the Refuge was established. By limiting areas open to boats, limiting the seasons of use, and complying with stipulations identified in the Compatibility Determination, impacts affiliated with boat use can be lessened. Monitoring of this activity and its impacts will allow the refuge staff to modify programs if needed to ensure this use remains at an acceptable level.

Finding of Appropriateness of a Refuge Use

Refuge Name: Dungeness National Wildlife Refuge

Use: Horseback Riding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	**X**	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	**X**	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	**X**	
(d) Is the use consistent with public safety?		**X**
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	**X**	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	**X**	
(g) Is the use manageable within available budget and staff?		**X**
(h) Will this be manageable in the future within existing resources?		**X**
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	**X**	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?		**X**

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No _**X**_

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate__ **X** ___ Appropriate_____

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

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Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Horseback Riding

Further Explanation of Answers Provided for the Decision Criteria:

Project: Horseback riding

Summary: While not one of the six wildlife-dependent public uses listed or identified in the National Wildlife Refuge System Administration Act, as amended (1997), horseback riding is an existing use on the Dungeness NWR that can facilitate wildlife observation, but is not necessary to achieve it. Since 1997 when an Environmental Assessment (EA) for Management of Public Uses for Dungeness National Wildlife Refuge was finalized, horseback riding has occurred within designated areas of Dungeness NWR. This activity is restricted to the horse trail (approximately 3,110 linear feet), the lower main trail where the horse trail meets the main trail to the beach (approximately 500 linear feet), and west on the refuge beach towards Clallam County Park lands (approximately 1/2 mile). Riding is permitted, with the required reservations, on weekdays from May 15 through September 30 and daily during the remainder of the year. This use is being revisited in compliance with the Appropriate Refuge Uses Policy that was not in effect when the EA was finalized.

For the findings listed on FWS Form 3-2319, a justification has been provided below

(d) Is the use consistent with public safety?
(g) Is the use manageable within available budget and staff?
(h) Will this be manageable in the future within existing resources?
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?
Conflicts between equestrians and other refuge users participating in compatible, wildlife-dependent recreation such as wildlife observation and photography could occur on the horse trail which is also used by non -equestrian visitors. However, conflicts are much more likely to occur on the approximately 500 linear feet section of the main trail where the horse trail connects to the main trail and horses and walking visitors share the trail to the beach. In May 2012, an accident resulting in the serious injury of a non-equestrian visitor occurred along this 500 foot section of shared trail as a result of such conflict.

This section of trail is challenging for horseback riders and pedestrians alike. The average trail slope is approximately 8% with a minimum of 5.4% and maximum of 10%. The average cross-slope (i.e., slope perpendicular to the trail) is approximately 3.5% with a minimum of 0.4% and maximum of 5.9%. The trail width ranges from 8 feet to 10 feet. On one side of the trail, there is a steep drop-off down a bluff. On the other side, there is a steep incline. The amount of traffic along this stretch of trail, particularly during the summer months, provides additional challenges. Coincident with the timing of peak horseback riding from May through September, the main trail receives approximately 50,000 visitors. It is not unusual to have 600 or more visitors per day during the summer and very busy days may have over 900 people (USFWS 2012).

Overall Refuge visitation has ranged in the past five years from relative lows of about 76,000 visitors in 2009 and 2011 to a high of about 80,300 in 2010. By comparison, annual horseback riding reservations averaged 164 for the period from 2008 to 2010. Data from 2011 were not included as the horse trail was closed for about 3 months due to reconstruction of the main trail (USFWS 2012). Statewide, future participation in most outdoor recreation activities including walking, hiking, nature activities (i.e., wildlife observation and photography), and horseback riding are projected to increase at high growth rates (IAC 2003). Combined with the regional and local trends towards increased population (OFM 2012a), overall Refuge visitation is projected to also increase in the future. This growing demand could result in more crowding and increased potential for user conflicts.

In addition to projected increases in Refuge visitation, the demographics of Refuge visitors are also projected to change. In July 2011, visitor surveys were distributed to refuge visitors as part of a National Science Foundation funded research project involving Colorado State University, the National Park Service, the FWS, and the National Parks Conservation Association. Of the 150 respondents who filled out demographic information, 11% were ages 66 and up. The two largest age groups were from 46-55 (20%) and 56-65 (29%) (Davis et al. 2012). According to the State of Washington's Office of Financial Management (OFM) Medium Series Population Projections, all age groups will experience considerable growth through 2020; however, the most growth will be in the older age groups, 50 to 64 and 65 and older (OFM 2012b). Demographic information for visitors to the nearby Olympic National Park (NP) provides additional insight into refuge visitation. Based on a visitor study conducted at Olympic NP in July 2000, most of the visitor groups (64%) were family groups. Seventy-seven percent of the park's visitor groups were groups of two to four people (Van Ormer et al. 2001). Anecdotally, Dungeness NWR sees similar visitor group sizes and, particularly during the summer, a similar proportion of family groups (S. Mayo, personal communication, July 23, 2012).

In summary, the majority of Refuge visitors are pedestrians engaged primarily in compatible, wildlife-dependent activities such as wildlife observation and photography. These pedestrians are of varying ages and abilities; many of the visitor groups are families. There is orders of magnitude difference between the number of pedestrians versus the number on horseback visiting the Refuge. However, due to better weather, longer daylight hours, and more favorable low tide conditions, the peak horseback riding period coincides with the overall Refuge visitation peak during the summer months. Consequently, challenges posed by the physical parameters of the 500 foot section of trail leading down to the beach (i.e., slope, cross-slope, limited mobility perpendicular to the trail due to hillslope and bluff, steep drop-off on one side) are enhanced and the risk of user conflict increases.

Therefore, the Service finds that in order to address public safety concerns and improve the quality of compatible, wildlife-dependent recreation on the Refuge (e.g., wildlife observation and photography), allowing horseback riding and pedestrian use within the 500 foot section of trail is not feasible. The trail is at its maximum allowable width; there are no reasonable methods of guarding or physical separation; and there are no other access alternatives. Additionally, the temporal separation of horseback riders and pedestrians (e.g., specified dates and times exclusively for horseback riding use) is neither practical nor feasible within available budget and staff.

Literature Cited

Davis, S., C. Beard, N. Tilley, and B. Ryndak. Climate change education partnership visitor survey technical report: Dungeness National Wildlife Refuge. Available at: http://climatechangepartnership.org/sites/default/files/downloads/Dungeness%20CCEP%20Visitor%20Survey%20Report.pdf. Accessed July 23, 2012.

IAC (Washington Interagency Committee for Outdoor Recreation). 2003. Estimates of future participation in outdoor recreation in Washington State. Washington Interagency Committee for Outdoor Recreation. Olympia, WA. 62 pp.

OFM (State of Washington Office of Financial Management). 2012a. Washington state growth management population projections for counties: 2010 to 2040. Available at: http://www.ofm.wa.gov/pop/gma/projections12/gma2012_cntyage_med.xls. Accessed July 23, 2012.

OFM. 2012b. 2012 county age and sex projections, five-year intervals and age groups. Available at: http://www.ofm.wa.gov/pop/gma/projections12/projections12.asp. Accessed July 23, 2012.

U.S. Fish and Wildlife Service (USFWS). 2012. Visitation records for the Dungeness National Wildlife Refuge, unpublished. On file at the Washington Maritime National Wildlife Refuge Complex Headquarters. Sequim, Washington.

Van Ormer, C., M. Littlejohn, and J.H. Gramann. Olympic National Park visitor study: summer 2000. University of Idaho Cooperative Park Studies Unit, Moscow, ID. 127 pp. Available at: http://www.nps.gov/olym/parkmgmt/upload/ONPvisitorstudy2000.pdf. Accessed July 23, 2012.

Finding of Appropriateness of a Refuge Use

Refuge Name: Dungeness National Wildlife Refuge

Use: Vehicle Access through Refuge by New Dungeness Light Station Association to New Dungeness Light Station

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	**X**	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	**X**	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	**X**	
(d) Is the use consistent with public safety?	**X**	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	**X**	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	**X**	
(g) Is the use manageable within available budget and staff?	**X**	
(h) Will this be manageable in the future within existing resources?	**X**	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	**X**	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	**X**	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No **_X_**

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ Appropriate__**X**___

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

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Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Transport - Vehicle Access to New Dungeness Light Station

Further Explanation of Answers Provided for the Decision Criteria

Project: Vehicle Access to New Dungeness Light Station

Summary: The U. S. Coast Guard (USCG) withdrew its last keeper from the automated New Dungeness Light Station in March of 1994. Before the Station was unmanned, the USCG accessed the Station by boat, helicopter, and vehicles driven on the beach. The New Dungeness Light Station Association (NDLSA) obtained a renewable license with the USCG to care for the Station in 1994 and have accessed the Station via vehicle under a refuge Special Use Permit since that time. Vehicle use is restricted to volunteer Light Station keeper exchange and for maintenance purposes. Keepers are rotated in and out of the Light Station once a week coinciding with a low tide event either on a Friday or Saturday. During the summer months these exchanges occur during the day while during the winter they occur at night. Maintenance trips are less frequent but average a couple per month. It is the intent of the U. S. Fish and Wildlife Service to acquire the Light Station from the USCG when it is excessed and to enter into an agreement with the NDLSA similar to the one they have with the USCG.

For the findings listed on FWS Form 3-2319, a justification has been provided below.

(d) Is the use consistent with public safety?
The NDLSA access the Refuge beach via Anderson Road so there are no vehicles on refuge trails. Once on the beach (Strait of Juan de Fuca side) they travel no more than 10 to 15 miles per hour and have a low volume horn that they sound if nearing a visitor on the beach so as to not startle them. This mode of transport for keeper exchange and maintenance needs is far safer than using a boat due to the weather and sea conditions that can occur in the Strait of Juan de Fuca.

(e) Is the use consistent with goals and objectives in an approved management plan or other document?
The Refuge has identified in the CCP the intent to acquire the Light Station property from the USCG when it is excessed and then to enter into an agreement with the NDLSA to care, maintain and interpret the facilities.

(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?
This activity has been ongoing since 1994 although neither a compatibility or an appropriateness determination were ever prepared.

(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?
Allowing safe access to the NDLSA to care for, maintain, and interpret the New Dungeness Light Station will contribute to the public's understanding and appreciation of this significant cultural resource.

(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

This use conducted with stipulations to ensure compatibility and under a guiding document (Special Use Permit or Memorandum of Agreement/Understanding) can be accommodated while minimizing impacts on existing wildlife dependent recreational uses.

Finding of Appropriateness of a Refuge Use

Refuge Name: Dungeness National Wildlife Refuge

Use: Jogging /Running

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	**X**	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	**X**	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	**X**	
(d) Is the use consistent with public safety?	**X**	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		**X**
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	**X**	
(g) Is the use manageable within available budget and staff?	**X**	
(h) Will this be manageable in the future within existing resources?	**X**	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?		**X**
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?		**X**

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No _**X**_

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_ **X** ___ Appropriate__ ___

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Jogging/Running

Further Explanation of Answers Provided for the Decision Criteria:

Project: Jogging/running

Summary: Jogging/running currently irregularly occurs on the main and horse trail and on the beach in Zones 1 and 2. This activity was restricted in the 1997 EA – "Management of Public Use for Dungeness National Wildlife Refuge" to these areas although some "illegal" use occurs in Zone 3. This use is being revisited in compliance with the Appropriate Refuge Uses Policy that was not in effect when the EA was finalized.

For the findings listed on FWS Form 3-2319, a justification has been provided below:

(e) Is the use consistent with the goals and objectives in an approved management plan or other document?
Because of the potential for joggers to create sudden disturbance and the potential to interfere with wildlife-dependent uses, this use would interfere with goals and objectives in the CCP.

(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?
The use presents no benefit to the Refuge's natural or cultural resources and it is not thought to contribute to the public's understanding or appreciation of the Refuge's natural or cultural resources.

(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1 for description), compatible, wildlife-dependent recreation into the future?
Jogging has the potential to cause increased levels of disturbance to wildlife when compared to walking. It has been determined that animals show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995) and rapid movement by joggers is more disturbing to wildlife than slower moving hikers (Bennett and Zuelke 1999). Burger (1981) examined the effects of human activity on roosting and migrating birds at a coastal bay refuge along the Atlantic coast. Human activities which involved rapid movements or close proximity to roosting birds, such as jogging even when on the pathway, caused the birds to flush; in comparison, slow walking bird watchers and people walking on the path around the ponds did not usually cause birds to flush. Lafferty (2001) found that joggers had the same probability of disturbing birds but disturbed twice as many birds per disturbing person.

Other compatible wildlife-dependent activities such as wildlife watching, photography, and environmental education, may be negatively affected because of the expected responses by wildlife to the fast moving activity associated with jogging. When wildlife react by moving away from jogging activity or alter behavior by hiding they will be less likely to be observed (Bennett and Zuelke 1999).

User groups of shared-use paths often have conflicting needs. Moore (1994) concluded that trail conflicts can occur among different user groups, among users within the same user group, and as a result of factors not related to trail user activities at all. Conflict has been found to be related to activity style, focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users. This loss of expectation of a quality wildlife dependent experience could result in avoidance of refuge trails by wildlife watchers and photographers who encounter joggers using the same trail.

Based on these studies, we concluded that joggers present a high potential for interfering with quality wildlife viewing.

Literature Cited

Bennett, K.A. and E. Zuelke. 1999. The effects of recreation on birds: a literature review. Delaware Natural Heritage Program. Smyrna, DE.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Gabrielsen, G.W. and E.N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Lafferty, K.D. 2001. Birds at a Southern California beach: seasonality, habitat use and disturbance by human activity. Biodiversity and Conservation 10: 1949-1962.

Moore, R.L. 1994. Conflicts on multiple-use trails: synthesis of the literature and state of the practice. Federal Highway Administration Report No. FHWA-PD-94-031. Report Date: August 1994. Federal Highway Administration. Washington, D.C. 68 pp.

Document continues on next page.

Appendix B. Compatibility Determinations

B.1 Introduction

The compatibility determinations (CDs) we developed during the CCP planning process evaluate uses as projected to occur under Alternative B, the Preferred Alternative, in the Dungeness National Wildlife Refuge draft CCP/EA. The evaluation of funds needed for management and implementation of each use also assumes implementation as described under the Preferred Alternative (also see Appendix C, Implementation). Chapter 6 of the draft CCP/EA also contains analysis of the impacts of public uses to wildlife and habitats. That portion of the document is incorporated through reference into this set of CDs.

B.1.1 Uses Evaluated At This Time

The following section includes full CDs for all refuge uses that are required to be evaluated at this time. According to Service policy, compatibility determinations are to be completed for all uses proposed under a CCP that have been determined to be appropriate. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP. According to the Service's compatibility policy, uses other than wildlife-dependent recreational uses are not explicitly required to be reevaluated in concert with preparation of a CCP, unless conditions of the use have changed or unless significant new information relative to the use and its effects have become available or the existing CDs are more than 10 years old. However, the Service planning policy recommends preparing CDs for all individual uses, specific use programs, or groups of related uses associated with the proposed action. Accordingly, the following CDs are included in this document for public review.

Table B-1. Summary of Compatibility Determinations

Refuge Use	Compatible	Page
Environmental Education, Wildlife Observation, Photography, Interpretation	Yes	B-4
Research, scientific collecting, and surveys	Yes	B-10
Recreational fishing	Yes	B-24
Tribal fishery	Yes	B-30
Boating	Yes	B-36
Vehicle access to New Dungeness Light Station	Yes	B-41

B.1.2 Compatibility–Legal and Historical Context

Compatibility is a tool refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation, the primary focus of national wildlife refuges. Compatibility is not new to the Refuge System and dates back to 1918, as a concept. As policy, it has been used since 1962. The Refuge Recreation Act of 1962 directed the Secretary of the Interior to allow only those public uses of refuge lands that were "compatible with the primary purposes for which the area was established."

Legally, national wildlife refuges are closed to all public uses until officially opened through a compatibility determination. Regulations require that adequate funds be available for administration

and protection of refuges before opening them to any public uses. However, wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) are to receive enhanced consideration and cannot be rejected simply for lack of funding resources unless the refuge has made a concerted effort to seek out funds from all potential partners. Once found compatible, wildlife-dependent recreational uses are deemed the priority public uses at the refuge. If a proposed use is found not compatible, the refuge manager is legally precluded from approving it. Economic uses that are conducted by or authorized by the refuge also require compatibility determinations.

Under compatibility policy, uses are defined as recreational, economic/commercial, or management use of a refuge by the public or a non-Refuge System entity. Uses generally providing an economic return (even if conducted for the purposes of habitat management) are also subject to compatibility determinations. The Service does not prepare compatibility determinations for uses when the Service does not have jurisdiction. For example, the Service may have limited jurisdiction over refuge areas where property rights are vested by others; where legally binding agreements exist; or where there are treaty rights held by tribes. In addition, aircraft overflights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on "overlay refuges" are exempt from the compatibility review process.

New compatibility regulations, required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), were adopted by the Service in October, 2000 (http://refuges.fws.gov/policymakers/nwrpolicies.html). The regulations require that a use must be compatible with both the mission of the System and the purposes of the individual refuge. This standard helps to ensure consistency in application across the Refuge System. The Act also requires that compatibility determinations be in writing and that the public have an opportunity to comment on most use evaluations.

The Refuge System mission emphasizes that the needs of fish, wildlife, and plants must be of primary consideration. The Improvement Act defined a compatible use as one that "in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the Refuge." Sound professional judgment is defined under the Improvement Act as "a finding, determination, or decision, that is consistent with principles of sound fish and wildlife management and administration, available science and resources." Compatibility for priority wildlife-dependent uses may depend on the level or extent of a use.

Court interpretations of the compatibility standard have found that compatibility is a biological standard and cannot be used to balance or weigh economic, political, or recreational interests against the primary purpose of the refuge (Defenders of Wildlife v. Andrus [Ruby Lake Refuge]).

The Service recognizes that compatibility determinations are complex. For this reason, refuge managers are required to consider "principles of sound fish and wildlife management" and "best available science" in making these determinations (House of Representatives Report 105-106). Evaluations of the existing uses on the Dungeness National Wildlife Refuge are based on the professional judgment of refuge and planning personnel including observations of Refuge uses and reviews of appropriate scientific literature.

In July 2006, the Service published its Appropriate Refuge Uses Policy (603 FW 1). Under this policy, most proposed uses must also undergo a review prior to compatibility. Uses excepted from

the policy include priority wildlife-dependent recreational uses, and uses under reserved rights – see policy for more detail. Appropriate use findings for Dungeness NWR are included in Appendix A.

B.2 References

Defenders of Wildlife v. Andrus (Ruby Lake Refuge I). 11 Envtl. Rptr. Case 2098 (D.D.C. 1978), p. 873.

House of Representatives Report 105-106 (on NWRSIA) - http://refuges.fws.gov/policyMakers/mandates/HR1420/part1.html

Compatibility regulations, adopted by the Service in October, 2000: (http://Refuges.fws.gov/policymakers/nwrpolicies.html)

Compatibility Determination

Use: Environmental Education, Wildlife Observation, Photography, and Interpretation

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
- Tidelands of the second class were conveyed to the United State of America, U.S. Fish and Wildlife Service, from the State of Washington through a permanent easement on May 29, 1943, (Deed No. 18251 App. No. 10585), under the authority described in Section 152, Chapter 255, State of Washington Laws of 1927.
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j) as amended
- Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
- Endangered Species Act of 1973

Refuge Purpose(s):
The purposes for the Dungeness NWR have been identified in historic legal documentation establishing and adding refuge lands. The Refuge was originally established to preserve important habitat for native birds with refuge purposes specified as follows:

> "…as a refuge, preserve, and breeding ground for native birds." (Executive Order 2123 dated 20 January 1915.
>
> "... suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." (16 U.S.C. 460k-1)
>
> "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).
>
> "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

In accordance with 601 FW 1, all lands acquired since the original establishment of the Refuge retain these purposes.

National Wildlife Refuge System Mission:

> "The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

In the Refuge Improvement Act, the United States Congress declared wildlife observation and photography, and environmental education and interpretation as four of six priority wildlife-dependent public uses of the NWRS. These four uses are non-consumptive, wildlife-dependent public uses with similar elements and are considered together in this CD.

Existing wildlife dependent public uses include wildlife observation, photography, interpretation, and environmental education. Dungeness NWR is open to public use year-round during daylight hours. Existing public use facilities that are involved in these uses include an orientation kiosk with interpretive panels; an entrance fee kiosk; a 3,300 foot main hiking trail with interpretive panels; a 1,800 foot hiking/horse trail with associated entrance fee kiosk; two observation decks (upper and lower) at the confluence of the main and horse trails; and a parking lot and public restroom leased from Clallam County. Visitors engage in wildlife observation and photography while walking the self-guided forest trail and open areas of Dungeness Spit (approximately 5 miles of beach), sitting on observation benches along the main trail and at the observation decks. "Dungeness Spit," as it is known to the local public, provides an opportunity for the public to enjoy the marine portion of the Refuge. Visitors use select portions of the beach for walking, picnicking, and wading in the course of observing seabirds, shorebirds, bald eagles, and occasional marine mammals. By allowing visitors to access only certain areas of the beach and water and monitoring visitor behavior, adverse effects associated with refuge visitation can be minimized. Complex staff, the Friends of Dungeness NWR, and refuge volunteers provide environmental education programs on site to local schools on a request basis. Interpretation is provided of the wildlife resources and habitat via interpretation panels at the orientation kiosk, along the main trail, and during on-site events by refuge friends, volunteers, and staff.

Availability of Resources:

Base funding is available to cover staff costs and sufficient funds are available to manage the activity at current levels but not at the preferred alternative level. The following funding/annual costs would be required to administer and manage wildlife observation, photography, interpretation, and environmental education activities as designed under the CCP.

Category	One-time Expenses	Recurring Expenses
Special equipment, facilities, or equipment(signs, brochures, EE material)	$23,000	
Monitoring and Administration		$15,000
Maintenance		$22,000
Law Enforcement		$18,000
Totals	**$23,000**	**$55,000**

Anticipated Impacts of the Use(s):
The presence of people observing or photographing wildlife at Dungeness NWR has the potential to cause disturbance to wildlife such as nesting and loafing species and harbor seal pups left on the beach. Human activities on the forest trails and on the beach may result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects or varying levels of behavioral modification (Smith and Hunt 1995). Various studies have shown that the severity of the effects depends upon the distance to the disturbance and its duration, frequency, predictability, and visibility to wildlife (Knight and Cole 1995). The variables found to have the greatest influence on wildlife behavior are (a) the distance from the animal to the disturbance and (b) the duration of the disturbance. Animals also show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995). These wildlife disturbance considerations were folded into the design of the interpretive trail, which helps keep people on a path to reduce off-trail walking, and assists in keeping human activities away from bluff edges.

Of the wildlife dependent public uses proposed, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to casually view species, wildlife photographers are more likely to approach wildlife (Klein 1993) to get that perfect photograph. Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other compounding factors include the potential for photographers to remain close to wildlife for extended periods of time in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. The establishment of seasonally and permanent areas closed to the public on Dungeness and Graveyard Spits and the requirement that visitors remain on forest trails restricts the general visitor and photographers' accessibility to areas where their actions would minimize wildlife disturbance or trample sensitive vegetation.

Impacts from the wildlife dependent public uses of wildlife observation and photography are contained effectively and mitigated within the overall design of the 1997 Environmental Assessment "Management of Public Use for Dungeness National Wildlife Refuge" (USFWS 1997) by providing clearly defined zones where and seasons when these activities can take place, and requiring that visitors restrict their use to those seasons and areas. This strategy will continue to be implemented under the CCP. The Complex is aware that some visitors disregard signs requiring visitors to stay within the designated public use areas (Area Closed signs). Such unauthorized use creates the potential for greater disturbance to wildlife.

The other two wildlife dependent public use programs – interpretation and environmental education – use the existing public facilities, including the kiosk area, trail, interpretive panels, and wildlife observation accommodations (upper and lower observation decks). Impacts from these uses would not be additive with regard to impacts from wildlife observation and photography.

Public Review and Comment:
Public review and comment on this compatibility determination occurred in conjunction with the release of the draft CCP/EA.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
The requirements laid out in the preferred alternative of the Environmental Assessment – "Management of Public Use for Dungeness National Wildlife Refuge" (USFWS 1997) are adopted as stipulations to ensure compatibility and include:

User stipulations:

- Graveyard Spit and the tip of Dungeness Spit are closed to public access
- In Zone 1 – Beach in front of bluffs - Hiking, wildlife observation, and wildlife photography permitted year round
- In Zone 2 – Base of Dungeness Spit out to ½ mile - Hiking, wildlife observation, wildlife photography and incidental beach uses (picnicking and wading) permitted on the Strait of Juan de Fuca side year round and on the Dungeness Harbor side from May 15 to September 30. From October 1 to May 14, the Harbor side of Zone 2 is closed to all access.
- In Zone 3 – Strait side of Dungeness Spit from ½ mile to New Dungeness Light Station – Hiking, wildlife observation, and wildlife photography permitted on the Strait side year round.
- In Zone 4 – Dungeness Spit from lighthouse to end of spit, the Harbor and Bay sides of Dungeness Spit, and all of Graveyard Spit including a 100-yard buffer zone below the mean high tide line - closed to public access year round. Where the refuge boundary does not accommodate a 100 yard buffer, the buffer is slightly narrower. Boats are permitted to land year round, by reservation only through the Complex office (as deemed necessary by the Refuge), in the designated 100 yard zone of beach next to the light station compound on the Bay side of Dungeness Spit. Visitors are allowed to walk through Zone 4 in a designated area to get to and from the landing site to the lighthouse.
- In Zone 5 – Refuge waters and tidelands on the Harbor and Bay sides of Dungeness and Graveyard Spits outside of the 100 yard buffer zone - wildlife observation and photography by use of a boat permitted from May 15 through September 30. From October 1 to May 14 this zone is closed to all public access.

Management actions taken to reduce disturbance to harbor seals pupping in areas open to public use will include:

- As soon as a new pup is found, the immediate area where the pup is located will be closed and marked with cones.
- A volunteer will be stationed at the site whenever possible to prevent disturbance and to educate visitors.
- Brochures, signs, and visitor contacts will be used to educate the public about unnecessary pup disturbance and human intervention.

The response of wildlife to these modifications in public use activities will be monitored and evaluated to measure the effectiveness of the program in meeting refuge purposes. Based on monitoring data, public use regulations could become more restrictive in the future.

Justification:
Wildlife observation, photography, and environmental education and interpretation are priority public uses of the NWRS. Providing opportunities for these activities would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of Dungeness NWR. Wildlife observation, photography, and interpretation would provide an excellent forum for allowing public access and increasing understanding of refuge resources. The educational possibilities provided by these opportunities would outweigh any anticipated negative impacts associated with implementation of the program. The stipulations outlined above, as well as the best management practices identified, would minimize potential impacts relative to wildlife/human interactions.

Although all of these activities can result in disturbance to wildlife, disturbance would be limited in time and space. There is more than an adequate amount of undisturbed habitat available to the majority of refuge wildlife for escape and cover.

It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from wildlife observation, photography, and environmental education and interpretation activities. The relatively limited number of individuals expected to be adversely affected due to allowing these uses would not cause wildlife populations to materially decline, the physiological condition and production of refuge wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted.

Thus, allowing interpretation, environmental education, wildlife observation, and photography to occur with stipulations outlined above would not materially detract or interfere with achieving Dungeness NWR purposes or the NWRS mission, and in some instances may benefit refuge purposes. For example, an educated public is one less likely to damage natural and cultural resources and is more likely to be supportive of funding for national wildlife refuges and other public land.

Mandatory Re-Evaluation Date:

____X___ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

_____ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References:

Dobb, E. 1998. Reality check: the debate behind the lens. Audubon 100(1):44-51, 98-99.

Gabrielsen, G.W. and E.N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbances. Wildlife Society Bulletin 21:31-39.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pages 51-70 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Morton, J.M. 1995. Management of human disturbance and its effects on waterfowl. Pages F59- F86 in: W.R. Whitman, T. Strange, L. Widjeskog, R. Whittemore, P. Kehoe, and L. Roberts, eds. Waterfowl habitat restoration, enhancement and management in the Atlantic flyway. 3rd edition. Dover, DE: Environmental Management Committee, Atlantic Flyway Council Technical Section, and the Delaware Division of Fish and Wildlife.

Smith, L. and J.D. Hunt. 1995. Nature tourism: impacts and management. Pages 203-219 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

USFWS. 1997. Management of public use for Dungeness National Wildlife Refuge – final environmental assessment. U.S. Department of Interior, Fish and Wildlife Service. Sequim, WA. 53 pp. On file at the Washington Maritime National Wildlife Refuge Complex Headquarters. Sequim, Washington.

Refuge Determination:

Prepared by:	_____	_____
	(Signature)	(Date)
Refuge Manager/ Project Leader Approval:	_____	_____
	(Signature)	(Date)

Concurrence:

Refuge Supervisor:	_____	_____
	(Signature)	(Date)
Regional Chief, National Wildlife Refuge System:	_____	_____
	(Signature)	(Date)

Compatibility Determination

Use: Research, Scientific Collecting, and Surveys

Research: Planned, organized, and systematic investigation of a scientific nature.
Scientific collecting: Gathering of refuge natural resources or cultural artifacts for scientific purposes.
Surveys: Scientific inventory or monitoring.

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
- Tidelands of the second class were conveyed to the United State of America, U.S. Fish and Wildlife Service, from the State of Washington through a permanent easement on May 29, 1943, (Deed No. 18251 App. No. 10585), under the authority described in Section 152, Chapter 255, State of Washington Laws of 1927.
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j) as amended
- Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
- Endangered Species Act of 1973

Refuge Purpose(s):
The purposes for the Dungeness NWR have been identified in historic legal documentation establishing and adding refuge lands. The Refuge was originally established to preserve important habitat for native birds with refuge purposes specified as follows:

> "…as a refuge, preserve, and breeding ground for native birds." (Executive Order 2123 dated 20 January 1915.
>
> "... suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." (16 U.S.C. 460k-1)
>
> "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).
>
> "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

In accordance with 601 FW 1, all lands acquired since the original establishment of the Refuge retain these purposes.

National Wildlife Refuge System Mission:

> "The mission of the [National Wildlife Refuge] System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Description of Use(s):

The refuge staff receives periodic requests from non-Service entities (e.g., universities, state or territorial agencies, other Federal agencies, nongovernmental organizations) to conduct research, scientific collecting, and surveys on refuge lands. These project requests can involve a wide range of natural and cultural resources as well as public-use management issues including basic absence/presence surveys, collection of new species for identification, habitat use and life-history requirements for specific species/species groups, practical methods for habitat restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, wilderness character, modeling of wildlife populations, bioprospecting, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species-specific, refuge-specific, or evaluate the relative contribution of the refuge lands to larger landscapes (e.g., ecoregion, region, flyway, national, international) issues and trends.

The Service's Research and Management Studies (4 RM 6) and Appropriate Refuge Uses (603 FW 1.10D(4)) policies indicate priority for scientific investigatory studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitat as well as their natural diversity. Projects that contribute to refuge-specific needs for resource and/or wilderness management goals and objectives, where applicable, would be given a higher priority over other requests.

Availability of Resources:

Refuge staff responsibilities for projects by non-Service entities would be primarily be limited to the following: review of proposals, prepare SUP(s) and other compliance documents (e.g., Section 7 of the Endangered Species Act of 1973, Section 106 of the National Historic Preservation Act), and monitor project implementation to ensure that impacts and conflicts remain within acceptable levels (compatibility) over time. Additional administrative support, logistical and operational support may also be provided depending on each specific request. Estimated costs for one-time (e.g., prepare SUP) and annually re-occurring tasks by refuge staff and other Service employees would be determined for each project. Sufficient funding in the general operating budget of the Refuge must be available to cover expenses for these projects. The terms and conditions for funding and staff support necessary to administer each project on the Refuge(s) would be clearly stated in the SUP(s).

The Refuge has the following staffing and funding to administratively support and monitor research that is currently taking place on refuge lands (see table below). Any substantial increase in the number of projects would create a need for additional resources to oversee the administration and monitoring of the investigators and their projects. Any substantial additional costs above those

itemized below may result in finding a project not compatible unless expenses are offset by the investigator(s), sponsoring agency, or organization.

Category and Itemization	One-time ($)	Annual ($/yr)
Administration and management		$1,000
Maintenance		$500
Monitoring		$1,750
Special equipment, facilities, or improvement		
Totals		**$3,250**

Itemized costs in the previous table are current estimates calculated using **30% of the base cost for a GS-11 Refuge Biologist and a 3% cost of a GS-11 Refuge Manager**.

Anticipated Impacts of the Use(s):
Use of the Refuge to conduct research, scientific collecting, and surveys would generally provide information that would benefit fish, wildlife, plants, and their habitats. Scientific findings gained through these projects provide important information regarding life-history needs of species and species groups as well as identify or refine management actions to achieve resource management objectives in refuge management plans (especially CCPs). Reducing uncertainty regarding wildlife and habitat responses to refuge management actions in order to achieve desired outcomes reflected in resource management objectives is essential for adaptive management in accordance with 522 DM 1.

If project methods impact or conflict with refuge-specific resources, priority wildlife-dependent public uses, other high-priority research, wilderness, and refuge habitat and wildlife management programs, then it must be clearly demonstrated that its scientific findings would contribute to resource management and that the project cannot be conducted off refuge lands for the project to be compatible. The investigator(s) must identify methods/strategies in advance required to minimize or eliminate the potential impact(s) and conflict(s). If unacceptable impacts cannot be avoided, then the project would not be compatible. Projects that represent public or private economic use of the natural resources of any national wildlife refuge (e.g., bioprospecting), in accordance with 16 U.S.C. 715s, must contribute to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission to be compatible (50 C.F.R. 29.1).

Impacts would be project- and site-specific, where they would vary depending upon nature and scope of the field work. Data collection techniques would generally have minimal animal mortality or disturbance, habitat destruction, no introduction of contaminants, or no introduction of non-indigenous species. In contrast, projects involving the collection of biotic samples (plants or animals) or requiring intensive ground-based data or sample collection would have short-term impacts. To reduce impacts, the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) would be collected for identification and/or experimentation and statistical analysis. Where possible, researchers would coordinate and share collections to reduce sampling needed for multiple projects. For example, if one investigator collects fish for a diet study and another research examines otoliths, then it may be possible to accomplish sampling for both projects with one collection effort.

Investigator(s) obtaining required State or Territorial, and Federal collecting permits would also ensure minimal impacts to fish, wildlife, plants, and their habitats. If after incorporating the above strategies, projects would not be compatible if they would result in long-term or cumulative effects.

A Section 7 consultation under the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884, as amended Public Law 93-205) would be required for activities that may affect a federally listed species and/or critical habitat. Only projects which have no effect or would result in not likely to adversely affect determinations would be considered compatible.

Spread of invasive plants and/or pathogens is possible from ground disturbance and/or transportation of project equipment and personnel, but it would be minimized or eliminated by requiring proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary. If after all practical measures are taken and unacceptable spread of invasive species is anticipated to occur, then the project would be found not compatible without a restoration or mitigation plan.

There also could be localized and temporary effects from vegetation trampling, collecting of soil and plant samples, or trapping and handling of wildlife. Impacts may also occur from infrastructure necessary to support a projects (e.g., permanent transects or plot markers, exclosure devices, monitoring equipment, solar panels to power unattended monitoring equipment). Some level of disturbance is expected with these projects, especially if investigator(s) enter areas closed to the public and collect samples or handle wildlife. However, wildlife disturbance (including altered behavior) would usually be localized and temporary in nature. Where long-term or cumulative unacceptable effects cannot be avoidable, the project would not be found compatible. Project proposals would be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems.

At least 6 months before initiation of field work (unless an exception is made by prior approval of the refuge manager), project investigator(s) must submit a detailed proposal using the format provided in Attachment 1. Project proposals would be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems. This assessment would form the primary basis for allowing or denying a specific project. Projects which result in unacceptable refuge impacts would not be found compatible. If allowed and found compatible after approval, all projects also would be assessed during implementation to ensure impacts and conflicts remain within acceptable levels.

If the proposal is approved, then the refuge manager would issue a SUP(s) with required stipulations (terms and conditions) of the project to avoid and/or minimize potential impacts to refuge resources as well as conflicts with other public-use activities and refuge field management operations. After approval, projects also are monitored during implementation to ensure impacts and conflicts remain within acceptable levels based upon documented stipulations.

The combination of stipulations identified above and conditions included in any SUP(s) would ensure that proposed projects contribute to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the Refuge. As a result, these projects would help fulfill refuge purpose(s); contribute to the Mission of the NWRS; and maintain the biological integrity, diversity, and environmental health of the Refuge.

Projects which are not covered by the CCP (objectives under Goal 4 [Gather scientific information (surveys, research, and assessments) to support adaptive management decisions under objectives for Goals 1-3.]) would require additional NEPA documentation.

Public Review and Comment:
This CD was prepared concurrent with the Dungeness NWR CCP/EA. Public notice was provided and open houses were held and written comments were solicited from the public during the scoping period for the CCP/EA. Public review and comment will be solicited during the draft CCP/EA comment period.

Determination: (check one below)

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
Each project will require a SUP. Annual or other short-term SUPs are preferred; however, some permits will be a longer period, if needed, to allow completion of the project. All SUPs will have a definite termination date in accordance with 5 RM 17.11. Renewals will be subject to refuge manager review and approval based timely submission of and content in progress reports, compliance with SUP stipulations, and required permits.

- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.
- Investigators must possess appropriate and comply with conditions of State or Territorial and Federal permits for their projects.
- If unacceptable impacts to natural resources or conflicts arise or are documented by the refuge staff, then the refuge manager can suspend, modify conditions of, or terminate an on-going project already permitted by SUP(s) on the Refuge.
- Progress reports are required at least annually for multiple-year projects. The minimum required elements for a progress report will be provided to investigator(s) (see Attachment 2).
- Final reports are due one year after completion of the project unless negotiated otherwise with the refuge manager.
- Continuation of existing projects will require approval by the Refuge Manager.
- The refuge staff will be given the opportunity to review draft manuscript(s) from the project before being submitted to a scientific journal(s) for consideration of publication.
- The refuge staff will be provided with copies (reprints) of all publications resulting from a refuge project.
- The refuge staff will be provided with copies of raw data (preferably electronic database format) at the conclusion of the project.
- Upon completion of the project or annually, all equipment and markers (unless required for long-term projects), must be removed and sites must restored to the refuge manager's satisfaction. Conditions for clean-up and removal of equipment and physical markers will be stipulated in the SUP(s).
- All samples collected on refuge lands are the property of the Service even while in the possession of the investigator(s). Any future work with previously collected samples not clearly identified in the project proposal will require submission of a subsequent proposal for review and approval. In addition, a new SUP will be required for additional project work. For samples or specimens to be stored at other facilities (e.g., museums), a memorandum of understand will be necessary (see Attachment 3).

- Sampling equipment as well as investigator(s) clothing and vehicles (e.g., ATV, boats) will be thoroughly cleaned (free of dirt and plant material) before being allowed for use refuge lands to prevent the introduction and/or spread of pests.
- The NWRS, specific refuge, names of refuge staff and other Service personnel that supported or contributed to the project will be appropriately cited and acknowledged in all written and oral presentations resulting from projects on refuge lands.
- At any time, refuge staff may accompany investigator(s) in the field.
- Investigator(s) and support staff will follow all refuge-specific regulations that specify access and travel on the Refuge.

Justification:
Research, scientific collecting, and surveys on refuge lands are inherently valuable to the Service because they would expand scientific information available for resource management decisions. In addition, only projects which directly or indirectly contribute to the enhancement, protection, use, preservation, and management of refuge wildlife populations and their habitats generally would be authorized on refuge lands. In many cases, if it were not for the refuge staff providing access to refuge lands and waters along with some support, the project would never occur and less scientific information would be available to the Service to aid in managing and conserving the refuge resources. By allowing the use to occur under the stipulations described above, it is anticipated that wildlife species which could be disturbed during the use would find sufficient food resources and resting places so their abundance and use would not be measurably lessened on the Refuge. Additionally, it is anticipated that monitoring, as needed, would prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats. As a result, these projects would not materially interfere with or detract from fulfilling refuge purpose(s) (including wilderness); contributing to the Mission of the NWRS; and maintaining the biological integrity, diversity, and environmental health of the Refuge.

Mandatory Re-evaluation Date: (provide month and year for "allowed" uses only)

_____ Mandatory 15-year re-evaluation date (wildlife-dependent public uses)

__X___ Mandatory 10-year re-evaluation date (uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence:

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)

Attachment 1

FORMAT FOR PROPOSALS TO CONDUCT RESEARCH OR LONG-TERM MONITORING ON NATIONAL WILDLIFE REFUGES

A Special Use Permit (SUP) is required to conduct research and/or long-term monitoring on refuge lands. To receive a SUP, a detailed project proposal using the following format must be submitted to the refuge manager approximately 6 months prior to the start of the project.

Title:

Principal Investigator(s):
Provide the name(s) and affiliation(s) of all principal investigator(s) that will be responsible for implementation of the research and/or long-term monitoring described in the proposal. In addition, provide a brief description or attach vitae of expertise for principal investigator(s) germane to work described in the proposal.

Background and Justification:
In a narrative format, describe the following as applicable:

- *The resource management issue (e.g., decline in Pisonia rainforest) and/or knowledge gap regarding ecological function that currently exists with any available background information.*
- *Benefit of project findings (e.g., management implications) to resources associated with the Refuge.*
- *Potential consequences if the conservation issue and/or knowledge gap regarding ecological function is not addressed.*

Objectives:
Provide detailed objective(s) for the proposed project.

Methods and Materials:
Provide a detailed description of the methods and materials associated with field and laboratory work (if applicable) to be conducted for the project. Methods should include the following:

- *study area(s)*
- *number of samples;*
- *sampling dates and locations*
- *sampling techniques*
- *data analyses including **statistical methods** and **significance levels**.*

Previously published methods should be cited without explanation; whereas, new or modified techniques should be described in detail. Include number of personnel as well as all facilities and equipment (e.g., vehicles, boats, structures, markers) required to collect samples/data. Provide a clear description of the relationships among study objectives, field methods, and statistical analyses.

Permits:
Identify all State or Territorial and Federal permits required if applicable.

Potential Impacts to Refuge Resources:
Describe potential impacts to threatened or endangered species as well as other refuge plants, wildlife, and fish species that could result from the implementation of project activities on the Refuge. Consider the cumulative impacts associated with this project.

Animal Welfare Plan:
If appropriate, attach a copy of the Institutional Animal Care and Use review and/or animal welfare plans that are required by the principle investigator's affiliation.

Partnerships and Funding Sources:
List other participating institutions, agencies, organizations, or individuals as well as the nature and magnitude of their cooperative involvement (e.g., funding, equipment, personnel).

Project Schedule:
Provide estimated initiation and completion dates for field sampling, laboratory work, data analyses, and report/manuscript preparation. If the project is divided into phases to be accomplished separately provide separate initiation and completion dates for each phase.

Reports and Raw Data:
Establish a schedule for annual progress and final reports; include adequate time for peer review of the final report/manuscript. Draft reports/manuscripts should be submitted to the refuge manager for review prior to submission for consideration of publication. At the conclusion of a research study (manuscripts accepted for publication), an electronic copy of the data (e.g., GIS vegetation layers, animal species composition and numbers, genetics) should be provided to the refuge manager. For long-term monitoring projects, the Service also requires raw data for management and planning purposes for the Refuge.

Publications:
Describe the ultimate disposition of study results as publications in scientific journals, presentation at professional symposiums, or final reports.

Disposition of Samples:
If the project entails the collection of biotic and/or abiotic (e.g., sediment) samples, then describe their storage. Although the samples may be in the possession of scientists for the purposes of conducting the project in accordance with the SUP, the Service retains ownership of all samples collected on refuge lands. If the samples will be used for subsequent research activities that are not described within the original proposal, a new proposal must be submitted to the refuge manager to obtain a SUP before initiation of the follow-up project. After conclusion of the research activities, consult with the refuge manager regarding the final disposition of the samples. If specimens will be curated at a museum, then prepare a MOU using the format provided in Attachment 3.

Attachment 2

ANNUAL PROGRESS REPORTS FOR REFUGE RESEARCH AND LONG-TERM MONITORING PROJECTS

Study title:

Fiscal year:

Progress:
In a narrative format, summarize the work that was completed on the study including the number and types of samples collected and/or data analyses.

Important findings:
In narrative format, generally describe any conclusions and/or management recommendations that may be drawn from the work completed to date.

Describe problems encountered:
In narrative format, describe any problems that were encountered during the year and their effects upon the study.

Proposed resolution to problems:
For each problem encountered, describe the actions that have been taken to remediate it.

Preparer:

Date prepared:

Attachment 3

**MEMORANDUM OF UNDERSTANDING
FOR CURATORIAL SERVICES
BETWEEN THE**

**(Name of the Federal agency)
AND THE
(Name of the Repository)**

This Memorandum of Understanding is entered into this (**day**) day of (**month and year**), between the United States of America, acting by and through the (**name of the Federal agency**), hereinafter called the Depositor, and the (**name of the Repository**), hereinafter called the Repository, in the State/Territory of (**name of the State/Territory**).

The Parties do witnesseth that

WHEREAS, the Depositor has the responsibility under Federal law to preserve for future use certain collections of paleontological specimens and/or biological samples as well as associated records, herein called the Collection, listed in Attachment A which is attached hereto and made a part hereof, and is desirous of obtaining curatorial services; and

WHEREAS, the Repository is desirous of obtaining, housing and maintaining the Collection, and recognizes the benefits which will accrue to it, the public and scientific interests by housing and maintaining the Collection for study and other educational purposes; and

WHEREAS, the Parties hereto recognize the Federal Government's continued ownership and control over the Collection and any other U.S. Government-owned personal property, listed in Attachment B which is attached hereto and made a part hereof, provided to the Repository, and the Federal Government's responsibility to ensure that the Collection is suitably managed and preserved for the public good; and

WHEREAS, the Parties hereto recognize the mutual benefits to be derived by having the Collection suitably housed and maintained by the Repository;

NOW THEREFORE, the Parties do mutually agree as follows:

1. The Repository shall:

    a. Provide for the professional care and management of the Collection from the (**names of the resources**) sites, assigned (**list site numbers**) site numbers. The collections were recovered in connection with the (**name of the Federal or federally-authorized project**) project, located in (**name of the nearest city or town**), (**name of the county, if applicable**) county, in the State/Territory of (**name of the State/Territory**)-

    b. Assign as the Curator, the Collections Manager and the Conservator having responsibility for the work under this Memorandum, persons who are qualified museum professionals and whose expertise is appropriate to the nature and content of

the Collection.

c. Begin all work on or about (**month, date and year**) and continue for a period of (**number of years**) years or until sooner terminated or revoked in accordance with the terms set forth herein.

d. Provide and maintain a repository facility having requisite equipment, space and adequate safeguards for the physical security and controlled environment for the Collection and any other U.S. Government-owned personal property in the possession of the Repository.

e. Not in any way adversely alter or deface any of the Collection except as may be absolutely necessary in the course of stabilization, conservation, scientific study, analysis and research. Any activity that will involve the intentional destruction of any of the Collection must be approved in advance and in writing by the Depositor.

f. Annually inspect the facilities, the Collection and any other U.S. Government-owned personal property. Every (**number of years**) years inventory the Collection and any other U.S. Government-owned personal property. Perform only those conservation treatments as are absolutely necessary to ensure the physical stability and integrity of the Collection, and report the results of all inventories, inspections and treatments to the Depositor.

g. Within five (5) days of discovery, report all instances of and circumstances surrounding loss of, deterioration and damage to, or destruction of the Collection and any other U.S. Government-owned personal property to the Depositor, and those actions taken to stabilize the Collection and to correct any deficiencies in the physical plant or operating procedures that may have contributed to the loss, deterioration, damage or destruction. Any actions that will involve the repair and restoration of any of the Collection and any other U.S. Government-owned personal property must be approved in advance and in writing by the Depositor.

h. Review and approve or deny requests for access to or short-term loan of the Collection (or a part thereof) for scientific and educational uses. In addition, refer requests for consumptive uses of the Collection (or a part thereof) to the Depositor for approval or denial.

i. Not mortgage, pledge, assign, repatriate, transfer, exchange, give, sublet, discard or part with possession of any of the Collection or any other U.S. Government-owned personal property in any manner to any third party either directly or indirectly without the prior written permission of the Depositor, and redirect any such request to the Depositor for response. In addition, not take any action whereby any of the Collection or any other U.S. Government-owned personal property shall or may be encumbered, seized, taken in execution, sold, attached, lost, stolen, destroyed or damaged.

2. The Depositor shall:

    a. On or about (month, date and year), deliver or cause to be delivered to the Repository the Collection, as described in Attachment A, and any other U.S. Government-owned personal property, as described in Attachment B.

    b. Assign as the Depositor's Representative having full authority with regard to this Memorandum, a person who meets pertinent professional qualifications.

    c. Every (number of years) years, jointly with the Repository's designated representative, have the Depositor's Representative inspect and inventory the Collection and any other U.S. Government-owned personal property, and inspect the repository facility.

    d. Review and approve or deny requests for consumptively using the Collection (or a part thereof).

3. Removal of all or any portion of the Collection from the premises of the Repository for scientific or educational purposes; any conditions for handling, packaging and transporting the Collection; and other conditions that may be specified by the Repository to prevent breakage, deterioration and contamination.

4. The Collection or portions thereof may be exhibited, photographed or otherwise reproduced and studied in accordance with the terms and conditions stipulated in Attachment C to this Memorandum. All exhibits, reproductions and studies shall credit the Depositor, and read as follows: "Courtesy of the (**name of the Federal agency**)." The Repository agrees to provide the Depositor with copies of any resulting publications.

5. The Repository shall maintain complete and accurate records of the Collection and any other U.S. Government-owned personal property, including information on the study, use, loan and location of said Collection which has been removed from the premises of the Repository.

6. Upon execution by both parties, this Memorandum of Understanding shall be effective on this (**day**) day of (**month and year**), and shall remain in effect for **(number of years**) years, at which time it will be reviewed, revised, as necessary, and reaffirmed or terminated. This Memorandum may be revised or extended by mutual consent of both parties, or by issuance of a written amendment signed and dated by both parties. Either party may terminate this Memorandum by providing 90 days written notice. Upon termination, the Repository shall return such Collection and any other U.S. Government-owned personal property to the destination directed by the Depositor and in such manner to preclude breakage, loss, deterioration and contamination during handling, packaging and shipping, and in accordance with other conditions specified in writing by the Depositor. If the Repository terminates, or is in default of, this Memorandum, the Repository shall fund the packaging and transportation costs. If the Depositor terminates this Memorandum, the Depositor shall fund the packaging and transportation costs.

7. Title to the Collection being cared for and maintained under this Memorandum lies with the Federal Government.

IN WITNESS WHEREOF, the Parties hereto have executed this Memorandum.

Signed: (signature of the Federal Agency Official) Date: (date)

Signed: (signature of the Repository Official) Date: (date)

Attachment 3A: Inventory of the Collection

Attachment 3B: Inventory of any other U.S. Government-owned Personal Property

Attachment 3C: Terms and Conditions Required by the Depositor

Compatibility Determination

Use: Fishing, General and Other

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
- Tidelands of the second class were conveyed to the United State of America, U.S. Fish and Wildlife Service, from the State of Washington through a permanent easement on May 29, 1943, (Deed No. 18251 App. No. 10585), under the authority described in Section 152, Chapter 255, State of Washington Laws of 1927.
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j) as amended
- Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
- Endangered Species Act of 1973

Refuge Purpose(s):
The purposes for the Dungeness NWR have been identified in historic legal documentation establishing and adding refuge lands. The Refuge was originally established to preserve important habitat for native birds with refuge purposes specified as follows:

> "…as a refuge, preserve, and breeding ground for native birds." (Executive Order 2123 dated 20 January 1915.
>
> "... suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." (16 U.S.C. 460k-1)
>
> "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).
>
> "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

In accordance with 601 FW 1, all lands acquired since the original establishment of the Refuge retain these purposes.

National Wildlife Refuge System Mission:

> "The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use(s):

Two types of fishing occur at Dungeness National Wildlife Refuge; fin fish (salmon species primarily) and shell fish (mollusks and Dungeness crab). The Refuge has jurisdiction over the land base including shorelines to mean high water and the second class tidelands under a perpetual easement from the State of Washington and the waters associated with those tidelands. Anglers accessing the fishing opportunities on the Refuge do so by fishing from the shoreline or from boats. Finfishing from the shoreline occurs on the Strait of Juan de Fuca side of Dungeness Spit from the western boundary east to the New Dungeness Light Station (Zones 1, 2 and 3) and from boats in refuge waters associated with the Refuge's second class tidelands on the Dungeness Harbor and Bay sides of Dungeness Spit outside a 100 yard buffer zone below Mean High Tide (Zone 5). Shellfishing occurs on the Dungeness Harbor side from the base of Dungeness Spit out to ½ mile (Zone 2)—foot access only—and on the Refuge's second-class tidelands and waters associated with these tidelands on the Dungeness Harbor and Bay sides of Dungeness Spit outside a 100 yard buffer zone below Mean High Tide (Zone 5) – boat access only. Public uses of Zones 2 and 5 are restricted to May 15 to September 30. All fishing is conducted in accordance with State regulations.

This CD reassesses and re-evaluates recreational fishing from all shorelines and Dungeness Harbor and Bay areas within the refuge boundary. Under this use fishing would be allowed consistent with State regulations. Specific species/numbers to be taken and open periods would be set by WDFW to match adjacent areas open to fishing, however seasonal closures of Refuge Zones 2 and 5 would continue.

Recreational fishing (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Administration Act, as amended, as a priority public use, provided it is compatible with the purpose for which the Refuge was established.

Availability of Resources

The proposed recreational fishing program would not require any new infrastructure or personnel. Administration of a fishing program would require coordination with the State of Washington and require monitoring and some law enforcement patrols; however refuge staff is in place and capable of conducting these additional duties.

Category	One Time Expenses	Recurring Expenses
Monitoring/Law Enforcement		$4,000
Signage/Brochures	$3,000	$500
Maintenance		$1,500
Totals	**$3,000**	**$6,000**

Anticipated Impacts of the Use(s):

As a solitary and stationary activity, fishing tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al. 1983). It is well recognized that fishing can give many people a

deeper appreciation of fish and wildlife and a better understanding of the importance of conserving habitat, which has ultimately contributed to the Refuge System mission. A goal of Dungeness National Wildlife Refuge is to provide opportunities for wildlife-dependent recreation. Fishing is one of the six priority public uses in the National Wildlife Refuge System. Of key concern, then, is to manage the activity to keep any potential adverse impacts within acceptable limits.

Any angler activities on the Refuge are and would remain consistent with State guidelines. Related impacts for fish stocks associated with recreational fishing in the Strait of Juan de Fuca adjacent to the Refuge and Dungeness Harbor and Bay, are estimated annually and taken into consideration by the State of Washington in the development of annual fishing agreements and associated regulations. Because fishing regulations are established to provide a sustainable fish resource, impacts to fish populations from recreational fishing activity are expected to be minor.

Additional disturbance would be caused to birds and other wildlife using the open waters and where fishing would occur. Fishing activities may influence the composition of bird communities, as well as abundance, and productivity of waterbirds (Bell and Austin 1985, Bouffard 1982, Cooke 1987, Edwards and Bell 1985, Tydeman 1977). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987). Increases in anglers and associated shoreline activity discouraged waterfowl using otherwise suitable habitat (Jahn and Hunt 1964). Anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington, when compared to non-fishing days (Knight et al. 1991). Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere.

Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other water-birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Boating close to shore may disturb harbor seals hauled out on the beach. Impacts of motorized boating can occur even at low densities, given their noise, speed, and ability to cover extensive areas in a short amount of time. (See Boating Compatibility Determination)

Despite the potential impacts that fishing and supporting activities (boating) can have on wildlife, impacts to wildlife from allowing fishing are expected to be minor for the following reasons. The 100 yard buffer from the mean high tide on the Harbor and Bay side of Dungeness and Graveyard Spits coupled with the requirement for boats to have no wake would minimize disturbance to any nesting seabirds or shorebirds and resting or pupping harbor or elephant seals. The majority of waterfowl use on the Refuge occurs in the fall, winter and spring months, with some birds arriving as early as September and October. Because the majority of the fishing activity occurs in the summer and fall (through mid-October), disturbance to waterfowl species is reduced by annual closing refuge waters to all use from 1 October to 14 May.

Public Review and Comment:
Public review and comment on this compatibility determination occurred in conjunction with the release of the draft CCP/EA.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
The requirements laid out in the preferred alternative of the 1997 Environmental Assessment – "Management of Public Use for Dungeness National Wildlife Refuge" (USFWS 1997) are adopted as stipulations to ensure compatibility and include:

User stipulations:

- Graveyard Spit and the tip of Dungeness Spit are closed to public access
- In Zone 1 – Beach in front of bluffs –Fin fishing permitted year round
- In Zone 2 – Base of Dungeness Spit out to ½ mile – Fin fishing permitted on the Strait of Juan de Fuca side year round. Fin fishing and shell fishing permitted on the Dungeness Harbor side from May 15 to September 30 – foot access only. From October 1 to May 14, the Harbor side of Zone 2 is closed to all access.
- In Zone 3 – Strait side of Dungeness Spit from ½ mile to New Dungeness Light Station – Fin fishing permitted year round.
- In Zone 4 – Dungeness Spit from lighthouse to end of spit, the Harbor and Bay sides of Dungeness Spit, and all of Graveyard Spit including a 100-yard buffer zone below the mean high tide line - closed to public access year round. Where the refuge boundary does not accommodate a 100 yard buffer, the buffer is slightly narrower.
- In Zone 5 – Refuge waters and tidelands on the Harbor and Bay sides of Dungeness and Graveyard Spits outside of the 100 yard buffer zone – fin fishing and shell fishing permitted from May 15 through September 30 – boat access only. From October 1 to May 14 this zone is closed to all public access.

The response of wildlife to these modifications in public use activities will be monitored and evaluated to measure the effectiveness of the program in meeting refuge purposes. Based on monitoring data, public use regulations could become more restrictive in the future.

Justification:
Recreational fishing is one of the six priority public uses of the National Wildlife Refuge System. Providing a quality fishing program contributes to achieving one of the Refuge's goals. Despite the potential impacts that fishing and supporting activities (boating) can have on wildlife, impacts to wildlife from allowing fishing are expected to be minor for the following reasons. The 100 yard buffer from the mean high tide on the Harbor and Bay side of Dungeness and Graveyard Spits coupled with the requirement for boats to have no wake would minimize disturbance to any nesting seabirds or shorebirds and resting or pupping harbor or elephant seals. The majority of waterfowl use on the Refuge occurs in the fall, winter and spring months, with some birds arriving as early as September and October. Because the majority of the fishing activity occurs in the summer and fall (through mid-October), disturbance to waterfowl species is reduced by annual closing refuge waters to all use from 1 October to 14 May.

Mandatory Re-Evaluation Date:

____X___ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

_____ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References:

Bell, D.V. and L.W. Austin. 1985. The game-fishing season and its effects on overwintering wildfowl. Biological Conservation 33:65-80.

Bouffard, S.H. 1982. Wildlife values versus human recreation: Ruby Lake National Wildlife Refuge. Transactions of the Forty-Seventh North American Wildlife and Natural Resources Conference 47:553-556.

Cooke, A.S. 1987. Disturbance by anglers of birds at Grafam Water. ITE Symposium 19:15-22.

Edwards, R.W. and D.V. Bell. 1985. Fishing in troubled waters. New Science 1446(7 March):19-21.

Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Technical Bulletin No. 33. Wisconsin Conservation Department. Madison, WI. 212 pp.

Knight, R.L. and D.N. Cole. 1995. Factors that influence wildlife responses to recreationists. Pages 71-79 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press

Knight, R.L., D.P. Anderson, and N.Y. Marr. 1991. Responses of an avian scavenging guild to anglers. Biological Conservation 56:195-205.

Tuite, C.H., M. Owen, and D. Paynther. 1983. Interaction between wildfowl and recreation at Llangorse Lake and Talybont Reservoir, South Wales. Wildfowl 34:48-63.

Tydeman, C.F. 1977. The importance of the close fishing season to breeding bird communities. Journal of Environmental Management 5:289-296.

Refuge Determination:

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence:

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)

Compatibility Determination

Use: Fishing, Other, Tribal

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
- Tidelands of the second class were conveyed to the United State of America, U.S. Fish and Wildlife Service, from the State of Washington through a permanent easement on May 29, 1943, (Deed No. 18251 App. No. 10585), under the authority described in Section 152, Chapter 255, State of Washington Laws of 1927.
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j) as amended
- Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
- Endangered Species Act of 1973

Refuge Purpose(s):
The purposes for the Dungeness NWR have been identified in historic legal documentation establishing and adding refuge lands. The Refuge was originally established to preserve important habitat for native birds with refuge purposes specified as follows:

> "…as a refuge, preserve, and breeding ground for native birds." (Executive Order 2123 dated 20 January 1915.
>
> "... suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." (16 U.S.C. 460k-1)
>
> "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).
>
> "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

In accordance with 601 FW 1, all lands acquired since the original establishment of the Refuge retain these purposes.

National Wildlife Refuge System Mission:

"The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

The S'Klallam and Skokomish Tribes were signatories to the Point-No-Point Treaty with the U.S. Government in 1855. The S'Klallam tribe today consists of the Jamestown S'Klallam, Lower Elwha Klallam, and Port Gamble S'Klallam. In accordance with the Treaty, the Tribes retained the right to fish "at their usual and accustomed places." The Tribes, in exercising their Treaty rights, fish in Dungeness Harbor and Bay by set nets or other traditional methods, or by modern or improved fishing techniques. The U.S. Fish and Wildlife Service recognize that the Treaty fishing rights include access to National Wildlife Refuge lands. This is a treaty right against land owned by the United States. Access to the Refuge is only open to Tribal members involved in fishing. In 1983, the USFWS and the three S'Klallam Tribes signed a Letter of Agreement for Management of the Tribal Fishery on Dungeness National Wildlife Refuge. The Letter of Agreement contained 8 principles of agreement to promote mutual understanding and cooperation between the USFWS and the Tribes of the Point-No-Point Treaty and to provide for orderly conduct of the fishery on Dungeness NWR. These principles of agreement are reflected in the stipulations necessary to ensure compatibility.

Availability of Resources:

The proposed recreational fishing program would not require any new infrastructure or personnel. Administration of the Tribal fishing program would require coordination with the Point-No-Point Treaty Tribes and require monitoring and some law enforcement patrols; however refuge staff is in place and capable of conducting these duties.

Category	One Time Expenses	Recurring Expenses
Administration- Coordination with tribes		$1,500
Monitoring/Law Enforcement		$2,500
Totals		**$4,000**

Anticipated Impacts of the Use(s):

Any Tribal angler activities on the Refuge are and would remain consistent with Tribal guidelines. Related impacts for fish stocks associated with Tribal fishing in Dungeness Harbor and Bay are estimated annually and taken into consideration by the State of Washington and Tribes as co-managers of the fishery in the development of annual fishing agreements and associated regulations. Because fishing regulations are established to provide a sustainable fish resource, impacts to fish populations from Tribal fishing activity are expected to be minor.

Additional disturbance would be caused to birds and other wildlife using the open waters and where fishing would occur. Fishing activities may influence the composition of bird communities, as well as abundance, and productivity of waterbirds (Bell and Austin 1985, Bouffard 1982, Cooke 1987, Edwards and Bell 1985, Tydeman 1977). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987). Increases in anglers and associated shoreline activity discouraged waterfowl using

otherwise suitable habitat (Jahn and Hunt 1964). Anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington, when compared to non-fishing days (Knight et al. 1991). Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere. Tribal members currently may set fires for camping and curing fish and construct temporary shelters as has been done traditionally. These activities reduce drift wood habitat on the spit and may result in a wildfire.

Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other water-birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Boating close to shore may disturb harbor seals hauled out on the beach. Impacts of motorized boating can occur even at low densities, given their noise, speed, and ability to cover extensive areas in a short amount of time. (See Boating Compatibility Determination).

There would be impacts to refuge resources from Tribal fishing. Under the 1983 Letter of Agreement for Management of the Tribal Fishery on Dungeness NWR, Tribal members are allowed access to refuge closed areas in exercising their Treaty Rights. Tribal members can camp, collect drift wood and build fires. These activities result in wildlife displacement, reduce drift wood habitat on the spit and may result in a wildfire. Boating in support of the Tribal fishery can take place in waters closed to public use after September 30th if the fishery continues beyond that date. Wildlife species using these closed areas can be disturbed. In addition avian and marine mammal species may become entangled in Tribal nets and be injured or die.

Despite the potential impacts that Tribal fishing and supporting activities (boating) can have on wildlife, impacts to wildlife from allowing fishing are expected to be minor for the following reasons. In most years relatively few individuals participate in this fishery. The use is limited in time usually beginning in mid- September and finishing in late October before we get large numbers of wintering birds and there is plenty of adjacent sanctuary for disturbed wildlife to escape to. An additional steelhead fishery occurs from December through February but has resulted in very limited participation and occurs mostly outside of refuge waters in the vicinity of Cline Spit. Tribal members must maintain visual contact with their nets and not leave them unattended which reduces the incidence of bycatch of avian and marine mammal species. Fires are not to be left unattended thus reducing the likelihood of a wildfire event.

Public Review and Comment:
Public review and comment on this compatibility determination occurred in conjunction with the release of the draft CCP/EA.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
The principles of agreement as laid out in the 1983 Letter of Agreement For Management of the Tribal Fishery on Dungeness National Wildlife Refuge are adopted as stipulations to ensure compatibility and include:

1. During the prescribed fishing seasons, established by the Tribes and the Washington Department of Fish and Wildlife, the Tribes (Lower Elwha Klallam, Jamestown S'Klallam and Port Gamble S'Klallam) of the Point-No-Point Treaty (PNPT) may conduct their fishery in Dungeness Harbor and Bay in compliance with tribal and applicable state regulations
2. Access by tribal members and fish buyers to the refuge areas, which are the usual and accustomed fishing grounds and stations of the Tribes (Lower Elwha Klallam, Jamestown S'Klallam and Port Gamble S'Klallam), is limited to boat and foot.
3. Leaving equipment (boats, nets, etc.) on the refuge lands is discouraged. The owner assumes all risks associated with unattended equipment
4. The Tribes (Lower Elwha Klallam, Jamestown S'Klallam and Port Gamble S'Klallam) of the PNPT may set fires for camping and curing fish and construct temporary shelters as has been done traditionally. Fires should not be left unattended. Camp sites should be totally removed and fire pits extinguished and covered with sand at the conclusion of the fishing season.
5. The USFWS prohibits pets and littering while on refuge lands
6. The Tribal Enforcement Division will be responsible for ensuring compliance with the above principles and with Tribal fishery regulations and will respond to complaints from USFWS personnel for reasons of non-compliance.
7. The Tribes will notify the USFWS of opening and closing dates of the fishing seasons on Dungeness NWR.
8. The USFWS agrees to discourage visitors to the Dungeness NWR from vandalizing fishing gear or otherwise disturbing Indian fishing activities on refuge lands.

The Letter of Agreement is 29 years old and the Refuge will contact the Tribes concerning updating the document. In particular the Refuge will work to modify conditions 3 and 4. Should these two principles be changed then the CD (stipulations necessary to ensure compatibility) will be modified to reflect same.

Justification:
The USFWS recognizes the Point-No-Point Treat Tribes retained the right to fish "at their usual and accustomed places" and that Dungeness NWR is one of those places. Although there may be some wildlife and habitat disturbance associated with this activity, the USFWS would continue to work with the Tribes to minimize these effects. Although Tribal fishing and associated boating can result in disturbance to wildlife, disturbance is expected to be intermittent and limited in time and space. There are more than adequate amounts of undisturbed habitat available to the majority of wildlife for escape and cover.

It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from Tribal fishing activities. The relatively limited number of individuals expected to be adversely affected due to fishing would not cause wildlife populations to materially decline, the physiological condition and production of affected species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing Tribal fishing to occur with stipulations (1983 Letter of Agreement For Management of the Tribal Fishery on Dungeness National Wildlife Refuge) would not materially detract from or interfere with the purposes for which the Refuge was established or the Refuge System mission.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

_____X___ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References:

Bell, D.V. and L.W. Austin. 1985. The game-fishing season and its effects on overwintering wildfowl. Biological Conservation 33:65-80.

Bouffard, S.H. 1982. Wildlife values versus human recreation: Ruby Lake National Wildlife Refuge. Transactions of the Forty-Seventh North American Wildlife and Natural Resources Conference 47:553-556.

Cooke, A.S. 1987. Disturbance by anglers of birds at Grafam Water. ITE Symposium 19:15-22.

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Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Technical Bulletin No. 33. Wisconsin Conservation Department. Madison, WI. 212 pp.

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Knight, R.L., D.P. Anderson, and N.Y. Marr. 1991. Responses of an avian scavenging guild to anglers. Biological Conservation 56:195-205.

Tydeman, C.F. 1977. The importance of the close fishing season to breeding bird communities. Journal of Environmental Management 5:289-296.

Refuge Determination:

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence:

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)

Compatibility Determination

Use: Boating (Motorized and Non-motorized)

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
- Tidelands of the second class were conveyed to the United State of America, U.S. Fish and Wildlife Service, from the State of Washington through a permanent easement on May 29, 1943, (Deed No. 18251 App. No. 10585), under the authority described in Section 152, Chapter 255, State of Washington Laws of 1927.
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j) as amended
- Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
- Endangered Species Act of 1973

Refuge Purpose(s):
The purposes for the Dungeness NWR have been identified in historic legal documentation establishing and adding refuge lands. The Refuge was originally established to preserve important habitat for native birds with refuge purposes specified as follows:

> "…as a refuge, preserve, and breeding ground for native birds." (Executive Order 2123 dated 20 January 1915.
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> "... suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." (16 U.S.C. 460k-1)
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> "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

In accordance with 601 FW 1, all lands acquired since the original establishment of the Refuge retain these purposes.

National Wildlife Refuge System Mission:

> "The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

Boating use addressed in this compatibility determination is for motorized and non-motorized boats, including kayaks and canoes in refuge waters associated with the Refuge's second class tidelands. Although boating is not a wildlife-dependent public use, it does facilitate other wildlife-dependent uses such as fishing, wildlife observation, and photography. Boating at Dungeness NWR primarily supports fishing (shell fish and fin fish), although wildlife observation and photography are also conducted from these platforms. Access to the New Dungeness Light Station via boat is permitted through a reservation system (See Environmental Education, Wildlife Observation, Photography, and Interpretation Compatibility Determination). Currently boating on refuge waters is limited to May 15 through September 30. Personal watercrafts, wind surfing and para-surfing/sailing are not permitted on refuge waters.

Availability of Resources:

The following funding/annual cost would be required to administer and manage boating activities as described above:

Category	One Time Expense	Recurring Expense
Administration (Reservation system for lighthouse landings)		$1,000
Monitoring		$4,000
Signage/Outreach	$3,500	$500
Totals	**$3,500**	**$5,500**

The Refuge has sufficient staff and funding to allow the use.

Anticipated Impacts of the Use(s):

Dungeness NWR provides crucial foraging and resting habitat for wintering migratory birds, including waterfowl, shorebirds, seabirds, and other waterbirds. Recreational boating affects their use of refuge and other Dungeness Harbor and Bay waters. Boating activity, both motorized and non-motorized, can alter distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation-related disturbances increase (Skagen et al. 1991, Pfister et al. 1992). During migration and wintering Pacific brant can be considered obligate feeders on eelgrass. Because of this the eelgrass beds associated with the Refuge's second-class tidelands are important brant feeding areas.

Another species that could be impacted is the harbor seal. Harbor seals haulout and bear their pups on Dungeness Harbor and Bay tideflats and beaches. Harbor seals are afforded protection under the Marine Mammal Protection Act of 1972.

Canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower areas (Speight 1973, Knight and Cole 1995). Canoes or slow-moving boats have been observed to disturb great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters (98 feet) of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Huffman 1999, DeLong 2002).

The overall effects to wildlife should not be significant because refuge waters are closed to all use during the migration and winter season and there is a requirement to maintain a closed area 100 yard buffer zone below the mean high tide line during periods when these waters are open to public use.

Impacts from boating are contained effectively and mitigated within the overall design of the 1997 Environmental Assessment "Management of Public Use for Dungeness National Wildlife Refuge" (USFWS 1997) by providing clearly defined zones where and seasons when these activities can take place, and requiring that visitors restrict their use to those seasons and areas. This strategy would continue to be implemented under the CCP. The Complex is aware that some visitors disregard signs requiring visitors to stay within the designated public use areas (Area Closed signs). Such unauthorized use creates the potential for greater disturbance to wildlife

Public Review and Comment:
Public review and comment on this compatibility determination occurred in conjunction with the release of the draft CCP/EA.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
The requirements laid out in the preferred alternative of the Environmental Assessment – "Management of Public Use for Dungeness National Wildlife Refuge" (USFWS 1997) are adopted as stipulations to ensure compatibility and include:

- In Zone 4 – Dungeness Spit from lighthouse to end of spit, the Harbor and Bay sides of Dungeness Spit, and all of Graveyard Spit including a 100-yard buffer zone below the mean high tide line - closed to public access year round. Where the refuge boundary does not accommodate a 100 yard buffer, the buffer is slightly narrower.
- In Zone 5 – Refuge waters and tidelands on the Harbor and Bay sides of Dungeness Spit outside the 100 yard buffer – motorized and non-motorized boats (kayaks, small sailboats, canoes, rowboats, etc.) allowed access to the areas west and east of Graveyard Spit in Zone 5, from October 1 to May 14.
- From October 1 to May 14 this zone is closed to all public access.
- Zone 5 is a no wake zone for power boats.
- Boats are permitted to land year round between the hours of 9 AM to 5 PM, by reservation only through the Complex office (as deemed necessary by the Refuge), in the designated 100 yard zone of beach next to the light station compound on the Bay side of Dungeness Spit.

Number of landings is limited to no more than 20 per day. Visitors are allowed to walk through Zone 4 in a designated area to get to and from the landing site to the lighthouse.

The response of wildlife to these modifications in public use activities will be monitored and evaluated to measure the effectiveness of the program in meeting refuge purposes. Based on monitoring data, public use regulations could become more restrictive in the future.

Justification:
Boating itself is not considered wildlife-dependent recreation, but many wildlife-dependent recreational activities (fishing, waterfowl hunting, environmental education, interpretation, and wildlife observation/photography) are associated with boating. Providing opportunities for wildlife-dependent priority public uses would contribute toward fulfilling provisions under the National Wildlife Refuge System Administration Act as amended in 1997. Although boating has a potential to impact wildlife, implementing the prescribed measures listed in the Stipulations section would minimize these impacts. It is anticipated that closing refuge waters to boating during the migration and winter time periods would provide secure feeding and resting places for brant, waterfowl and shorebirds. The 100 yard buffer on the Dungeness Harbor and Bay side of Dungeness and Graveyard Spits would minimize the potential for disturbance to nesting black oystercatchers and harbor seals.

Thus, it is anticipated that birds would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened, the physiological condition and production of waterfowl and other waterbirds would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall status would not be impaired. Thus, allowing boating under the stipulations described above would not materially detract from or interfere with the purposes for which the Refuge was established or the Refuge System mission. The Refuge would also implement a monitoring program to help assess disturbance effects on wildlife and habitat. Improved outreach and educational information for refuge visitors involved in activities associated with boating would also help to reduce the impacts associated with boating activities.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

____X_ __ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References:

DeLong, A. 2002. Managing visitor use and disturbance of waterbirds. a literature review of impacts and mitigation measures. Appendix L in: Stillwater National Wildlife Refuge Complex final environmental impact statement for the comprehensive conservation plan and boundary revision, Volume 2. Department of the Interior, Fish and Wildlife Service, Region 1, Portland, OR. 114 pp.

Huffman, K. 1999. San Diego South Bay survey report-effects of human activity and water craft on wintering birds in South San Diego Bay. USFWS. 45 pp.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pages 51-70 in: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The impact of human disturbance on shorebirds at a migration staging area. Biological Conservation 60:115-126.

Skagen, S.K., R.L. Knight, and G.H. Orians. 1991. Human disturbances of an avian scavenging guild. Ecological Applications 1:215-225.

Speight, M.C.D. 1973. Outdoor recreation and its ecological effects: a bibliography and review. Discussion Papers in Conservation 4. University College. London, United Kingdom. 35 pp.

USFWS. 1997. Management of public use for Dungeness National Wildlife Refuge – final environmental assessment. U.S. Department of Interior, Fish and Wildlife Service. Sequim, WA. 53 pp. On file at the Washington Maritime National Wildlife Refuge Complex Headquarters. Sequim, Washington.

Vos, D.K., R.A. Ryder, and W.D. Graul. 1985. Response of breeding great blue herons to human disturbance in north central Colorado. Colonial Waterbirds 8:13-22.

Refuge Determination:

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence:

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)

Compatibility Determination

Use: Transport - Vehicle Access to New Dungeness Light Station

Refuge Name: Dungeness National Wildlife Refuge

County and State: Clallam County, Washington

Establishing and Acquisition Authorities:

- Executive Order 2123, Dungeness Spit Reservation For Protection of Native Birds, signed 20 January 1915
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Description of Use:

The U.S. Coast Guard (USCG) withdrew its last keeper from the automated New Dungeness light Station (Station) in March of 1994. It planned to board up the buildings and maintain the equipment with regular inspections, a move necessitated by budget reductions and made possible by automation. Other unattended light stations have experienced damage by vandals and general deterioration. The New Dungeness Light Station Association (NDLSA) organized in early 1994 with the mission of protecting and preserving the Station. With help from the U.S. Lighthouse Society it obtained a renewable license from the USCG to care for the Station

Since September 3, 1994, NDLSA has continuously staffed the Station with volunteer keepers who serve in one-week shifts. Keepers, along with their supplies and personal effects, are taken to the Station in a DNLSA vehicle at low tide each week. In addition, vehicles are used to transport work parties when maintenance needs dictate, usually a couple of times a month. During the summer months these exchanges occur during the day while during the winter they occur at night. Volunteer keepers clean and repair buildings, maintain the grounds, and conduct tours for refuge visitors arriving by foot or by water in kayaks or small boats. Typically about 5,000 visitors sign the guest book at the Station every year.

Vehicle access coincides with low tide events. Two vehicles make the trip to ensure if one breaks down the other can move people and equipment and move the stranded vehicle to a safe area. NDLSA vehicle drivers undergo training and are instructed on what to do if approaching walking refuge visitors and the maximum speed allowed on the Refuge.

Availability of Resources

Administration of this use would not require any new infrastructure or personnel but would require coordination with the NDLSA and some increased monitoring by refuge staff.

Category	One Time Expenses	Recurring Expenses
Administration - Coordination with NDLSA		$500
Monitoring		$1,200
Totals		**$1,700**

Anticipated Impacts of the Use(s):

The extent of impacts from vehicle use of the beach varies by season. During the daylight summer months seal pups on the beach may be trampled and resting shorebirds and gulls displaced. Compatible wildlife-dependent activities such as wildlife watching, photography, and environmental education, may be negatively affected because of the expected responses by wildlife to vehicles approaching or passing by. When wildlife react by moving away from or alter behavior by hiding, they are less likely to be observed (Bennett and Zuelke 1999).

User groups of shared-use paths often have conflicting needs. Moore (1994) concluded that trail conflicts can occur among different user groups, among users within the same user group, and as a result of factors not related to trail user activities at all. Conflict has been found to related to activity style, focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users. This loss of expectation of a quality wildlife dependent experience could result in avoidance of refuge beach by wildlife watchers and photographers who encounter vehicles using the same beach.

During the winter season when vehicle use on the beach occurs at night to coincide with winter low tide events impacts to refuge wildlife resources would be minimized but would include resting shorebird and gull displacement. Impacts to marine mammals would be minimal and might affect molting elephant seals. Impacts to refuge visitors would be nil as the Refuge is open only during daylight hours.

Public Review and Comment:
Public review and comment on this compatibility determination occurred in conjunction with the release of the draft CCP/EA.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Levels of use and impacts associated with the use would be monitored to ensure that the use remained compatible. Monitoring would evaluate impacts of the use upon, among others, refuge management activities; fish, wildlife, plants, and their habitats; biological integrity, diversity, and environmental health; and wildlife-dependent public uses. If monitoring revealed that levels of use or associated impacts exceeded those envisioned in the compatibility determination, the use might be re-evaluated and modified to ensure it remained compatible or terminated if found not compatible.
- Vehicle speed while on the Refuge will not exceed 15 MPH
- Vehicles will be equipped with “beepers” and give an audible warning before passing visitors on the beach
- Vehicles will come to a complete stop when approaching children and wait until safe to pass.
- The Refuge will contact NDLSA when seal pups or molting seals are on the beach to inform them of their presence and location.
- Vehicle use is restricted to keeper exchange, major maintenance needs, and emergency evacuation of keepers or NDLSA work party members.
- NDLSA drivers will receive training on safe operation of motor vehicles on the Refuge and on sandy, rocky surfaces.
- Any accidental spillage of petroleum products (gas, oil) resulting from operation of vehicles by the NDLSA will be immediately reported to the refuge manager. Clean-up operations will be conducted immediately, or as soon as it can be safely accomplished, and be the responsibility of the NDLSA.

Justification:
The New Dungeness Light Station is a cultural resource located at the northeast end of Dungeness Spit. The 35 acres presently owned by the USCG is an inholding on Dungeness NWR. The Refuge has identified in the Dungeness NWR CCP its intent to acquire the area when excessed by the USCG and to enter into a formal agreement with the New Dungeness Light Station Association to care, maintain, and interpret the Station. The safe movement of people and supplies necessary to maintain and interpret the Station is best accomplished by allowing vehicle access via the beach at low tides. Weather patterns in the Strait of Juan de Fuca often result in strong westerly winds and subsequent rough water making access by boat unpredictable and hazardous. As describe above, disturbance and other impacts to wildlife and refuge visitors from allowing the use would be negligible. Thus allowing the NDLSA to use vehicles on the beach under a Special Use Permit or Memorandum of Understanding/Agreement and with the stipulations would not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

____X___ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_ X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References:

Bennett, K.A. and E. Zuelke. 1999. The effects of recreation on birds: a literature review. Delaware Natural Heritage Program. Smyrna, DE.

Moore, R.L. 1994. Conflicts on multiple-use trails: synthesis of the literature and state of the practice. Federal Highway Administration Report No. FHWA-PD-94-031. Report Date: August 1994. Federal Highway Administration. Washington, D.C. 68 pp.

Refuge Determination:

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence:

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)

Document continues on next page.

Appendix C. Implementation

C.1 Introduction

Implementation of the Preferred Alternative of the CCP would require increased funding, which would be sought from a variety of sources. This plan would depend upon additional Congressional allocations, partnerships and grants. There are no guarantees that additional federal funds would be made available to implement any of these projects. Other sources of funds would need to be obtained, both public and private. Activities and projects identified would be implemented as funds become available.

The CCP proposes several projects to be implemented over the next fifteen years. Most of these projects are included in the Refuge Operational Needs System (RONS - new staff), or Service Asset Maintenance and Management System (SAMMS - deferred maintenance projects) which are used to request funding from Congress. Visitor Facility and Enhancement (VFE) projects considered for funding must be requested through the Division of Visitor Services. Currently, a large backlog of maintenance needs exists for Dungeness NWR. In 2008, the deferred maintenance backlog for Dungeness NWR was $1,156,000, with more projects needing to be added. An attempt at reducing this backlog needs to be addressed and is included here in the analysis of funding needs. Prioritized staffing needs identified in the RONS would be necessary to implement the CCP to meet refuge goals and objectives and legal mandates. The SAMMS database documents and tracks repairs, replacements, and maintenance of facilities and equipment. Smaller proposed projects would be implemented as funding allows, and funding would be sought for these projects through a variety of sources.

Annual revenue sharing payments, associated with Dungeness NWR in Clallam County would continue. Total payments made in 2008 were $228 for 3 acres in Clallam County. In addition Dungeness NWR leases from Clallam County the public restroom and parking lots located adjacent to the main trail entrance for $1,800 a year.

Monitoring activities would be conducted on a percentage of all new and existing projects and activities to document wildlife populations and changes across time, habitat conditions and responses to management practices. Actual monitoring and evaluation procedures would be detailed in step-down management plans. General monitoring activities are discussed in Chapter 2 under Goal 5, which addresses the collection of scientific information (inventories, monitoring, feasibility studies, assessments, and research) to support adaptive management decisions on Dungeness NWR.

C.2 Step-Down Plans

The Comprehensive Conservation Plan is one of several necessary plans used by managers, biologists, and staff for refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several refuge program areas but may lack some of the specifics needed for implementation. Step-down management plans would be developed for individual program areas within approximately 5 years after CCP completion. All step-down plans require appropriate NEPA compliance and implementation may require additional county, state and federal permits. Project-specific plans, with appropriate NEPA compliance, may be prepared outside of these step-down plans. Step-down plans for the Refuge follow in Table C-1.

Table C-1. Dungeness NWR Step-down Management Plans

Step Down Management Plan	Status (Date Completed and/or Date to be Prepared/Updated)
Habitat Management Plan (HMP)	CCP meets requirement for HMP
Forest Management Plan	Initiate planning by 2018
Integrated Pest Management Plan	Prepared concurrently with CCP, Appendix G
Fire Management Plan	Complex-wide plan in draft concurrent with CCP
Visitor Services Plan	
Inventory and Monitoring Plan	

C.3 Costs to Implement CCP

The following sections detail both one-time and recurring costs for various projects, by alternative. One-time costs reflect the initial costs associated with a project, whether it is purchase of equipment, contracting services, construction, a research project, etc. Recurring costs reflect the future operational and maintenance costs associated with the project. The following tables primarily document projects with a physically visible, trackable "on-the-ground" component, such as facilities, habitat restoration, research, and monitoring and surveys. The scope and costs for "administrative" activities such as MOUs, reporting, and establishment of partnerships are difficult to estimate in advance and thus are not accounted for in the tables below.

C.3.1 One-time costs

One-time costs are project costs that have a start-up cost associated with them, such as purchasing a new vehicle for wildlife and habitat monitoring, or designing and installing an interpretive sign. Some are full project costs for those projects that can be completed in three years or less. One-time costs can include the cost of temporary or term salary associated with a short-term project. Salary for existing and new positions, and operational costs, are reflected in operational (or recurring) costs.

Funds for one-time costs would be sought through increases in the Refuge's base funding, special project funds, and grants. Projects listed below in Table C-2 show one-time costs, such as those associated with building and facility needs including removal of old buildings, replacement of buildings, public use facilities, road/trail improvements, and new signs. One-time costs are also associated with projects such as habitat restoration, invasive plant and animal control, and research. New research projects, because of their short-term nature, are considered one-time projects and include costs of contracting services or hiring a temporary for the short-term project. Some project costs are taken from RONS or SAMMS proposals; others are not yet in any project database and their costs have been estimated, particularly if the scope of the project is unknown at this time due to lack of baseline data.

Table C-2. One Time Costs (in thousands) for Research and Assessments; Inventories, Surveys, and Monitoring, Habitat Management and Restoration, Facilities and Public Use-Related Actions

Project Description	Priority	Unit	Alt A	Alt B	Alt C	Potential Fund Source
Research						
Study the value of salt marsh habitat in Graveyard Spit as a nursery area for crab and salmon	Low	Study	0	5	5	1260 funds, grants, partnerships
Study driftwood recruitment and removal rates within the barrier beach and salt marsh habitats	Low	Study	0	10	10	1260 funds, grants
Study climate change impacts to natural spit habitats	High	Study	0	200	200	1260 funds, grants
Study microhabitat characteristics to track changes in distribution and diversity of plant species in the Graveyard RNA	Medium	Study	0	15	15	1260 funds, grants
Study eelgrass distribution and density in Dungeness Harbor and Bay.	High	Study	0	35	35	1260 funds, grants, partnerships
Study habitat quality (water quality, forage fish abundance and distribution and micro and macro invertebrate abundance and distribution of mud flat habitat.	Medium	Project	0	30	30	1260 funds, grants, partnerships
Subtotal (thousands)				**295**	**295**	
Surveys and assessments						
Assess abundance and distribution of Lepidopterans on Dungeness and Graveyard Spits	High	Project	0	8	8	ESA funds, grants
Conduct forest assessment	High	Project	0	20	20	1260 funds

Project Description	Priority	Unit	Alt A	Alt B	Alt C	Potential Fund Source
Conduct road inventory and assessment (Dawley Unit)	Low	Project	0	5	5	1260 funds
Conduct wetland inventory and hydrological assessment	Medium	Project	0	20	20	1260 funds
Conduct baseline breeding bird survey of forest habitat	Medium	Survey	0	3	3	1260 funds, partnerships
Conduct baseline amphibian and bat surveys	Medium	Survey	0	7	7	1260 funds, partnerships
Conduct baseline aquatic species survey of refuge reach of Dean Creek	Medium	Survey	0	2	2	1260 funds, partnerships
Assess habitat suitability for anadromous and resident fish of refuge reach of Dean Creek	Medium	Project	0	2	2	1260 funds, partnerships
Subtotal (thousands)			**0**	**67**	**67**	
Habitat management and restoration						
Map bathymetry of impoundment (Dawley)	Medium	Project	0	7	7	1260 funds
Develop step down forest management plan	High	Project	0	33	33	
Remove small dump site (Dawley)	Low	Project	0	5	5	1260 funds
Slide stabilization on main forest road (Dawley)	High	Project	0	90	90	1260 funds
Rehabilitate unneeded logging spur roads (Dawley**)**	Low	Project	0	22	15	1260 funds
Install new water control structure and water gauge at impoundment (Dawley**)**	Medium	Project	0	12	12	1260 funds
Remove USCG road access dike at base of Dungeness Spit	Medium	Project	0	45	45	1260 funds
Rehabilitate road to beach house (Dawley)	High	Project	0	90	90	1260 funds
Subtotal (thousands)			**0**	**304**	**297**	

Project Description	Priority	Unit	Alt A	Alt B	Alt C	Potential Fund Source
Facilities						
Remove and replace caretaker cabin at Dungeness (Mellus cabin)	High	Project	0	350	350	1260 funds Deferred Maintenance (DM)
Replace caretaker cabin septic system and decommission old system	High	Project	0	18	18	1260 funds (DM)
Remove beach house (Dawley) and decommission septic system	Medium	Project	0	45	45	1260 funds (DM)
Remove mobile home, associated shed and decommission septic system (Dawley)	Medium	Project	0	12	12	1260 funds (DM)
Remove rental house and decommission septic system (Dawley)	Medium	Project	0	32	32	1260 funds (DM)
Remove large wooden shed (Dawley)	Low	Project	0	8	8	1260 funds (DM)
Replace dock (Dawley)	Low	Project	0	85	85	1260 fund (DM)
Subtotal (thousands)			**0**	**550**	**550**	
Public Use						
Design, construct and install information and map panels at Cline Spit and Dungeness Landing	High	Project	0	12	6	8081 funds.
Design, construct and install interpretive panels at New Dungeness Light Station	Medium	Project	0	15	15	8081 funds
Design, construct and install climate change interpretive panel at main trail kiosk	Medium	Project	0	10	10	8081 funds
Develop cultural and environmental education materials for use on the Refuge and in the classroom	Low	Project	0	15	15	1260 funds, grants
Subtotal (thousands)			**0**	**52**	**46**	
Total of all one time project costs				**1,268**	**1,255**	

C.3.2 Annual Operational (Recurring) Costs

Operational costs reflect refuge spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day-to-day operations and projects that last longer than three years. Operational costs use base funding in Service fund code 1260

Table C-3 displays projected annual operating costs under the CCP. The CCP would require increased funding for new or expanded public uses and facilities, habitat management and restoration activities, and new monitoring needs. This table includes such things as salary and operational expenditures such as travel, training, supplies, utilities and maintenance costs. Project costs listed in Table C-3 include permanent and seasonal staff needed year after year to accomplish each project; these staffing costs are not isolated in this table but are included as part of the entire project cost.

Table C-3. Annual Operational (recurring) costs

Activity Description	Alt A Cost est. (K)	Alt B Cost est. (K)	Alt C Cost est. (K)	Potential Fund Source
Research: Facilitate and cooperate in specific research projects to benefit refuge resources	7	**15**	**15**	1260, Special Projects, Grants
Surveys and assessments: Aerial, boat-based and land survey and assessments; joint wildlife surveys with WDFW; continue GIS-based inventory and monitoring programs for plants and wildlife; derelict fishing gear surveys; creosote log deposition surveys; invasive species monitoring; monitor biodiversity trends; provide administrative and material support for all biological activities.	25	**35**	**35**	1260 and special project funds
Habitat management and restoration: inventory, remove, control and prevent new establishment of invasive plants and treat infestations with IPM; implement silvicultural practices outlined in step down forest management plan.	35	**145**	**120**	1260 and special project funds

Activity Description	Alt A Cost est. (K)	Alt B Cost est. (K)	Alt C Cost est. (K)	Potential Fund Source
Facilities maintenance: Maintain and make minor repairs on refuge infrastructure and facilities, equipment, vehicles, boats and interpretive and regulatory signs.	100	**140**	**130**	1260
Public use opportunities and education: Provide funding for and manage a variety of both on-refuge and off-refuge interpretive and education programs; maintain interpretive panels located on and off the Refuge to offer interpretation through self-guided experience; conduct and manage volunteer program; patrol, enforce regulations and educate visitors to the sensitivity of wildlife resources, replace boundary and regulatory signage as needed.	130	**200**	**180**	1260, 8081
Total Recurring Costs by Alternative	**297**	**535**	**480**	

C.3.3 Maintenance Costs

The maintenance need over the next 15 years is defined as funds needed to repair or replace buildings, equipment, and facilities. Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment; adjustments, lubrication, and cleaning (non-janitorial) of equipment; painting; resurfacing; rehabilitation; special safety inspections; and other actions to assure continuing service and to prevent breakdown. Maintenance costs include the maintenance "backlog"—maintenance needs that have come due but are as yet unfunded, as well as the increased maintenance need associated with new facilities

The facilities associated with Dungeness NWR that require maintenance include trails, kiosks, interpretive panels, regulatory signs, roads, parking lots, fencing, public restroom, caretaker cabin and administrative office, shop and garage buildings. Major equipment includes boats, vehicles, tractors, ATVs, and generators. Approximately 65% of operational (non-project) maintenance funding for the Washington Maritime NWR Complex is expended on Dungeness NWR including the Complex headquarters facilities (also see Table C-3); the other approximately 35% is used to maintain facilities, including buildings and equipment, which are located on, or support, the other three Complex Refuges and are not included in this Implementation Plan.

C.3.4 Staffing

Current (2012) staffing and proposed staffing are shown in Table C-4. Current positions below serve all six refuges within the Washington Maritime NWR Complex; because there is no separate budget for the individual refuges, we have chosen to present the entire Complex staff in Table C-4. Approximately 55% of current Complex staff time is expended on Dungeness NWR; the other approximately 45% of staff time is expended on the other five refuges in the Complex. The new position (Environmental Education/Outreach Specialist) would work 70% of the time on Dungeness NWR and the rest of the time on the other refuges in the Complex.

Table C-4. Current and Proposed Staffing

Current Position	**Status**	**GS & Grade**	**Annual Salary Cost (K)**	**Annual Salary (K) x 55%**
Project Leader	PFT	GS-0485-12	107.5	59.1
Deputy Project Leader	PFT	GS-0485-11	91.1	50.1
Wildlife Biologist	PFT	GS-0486-11	87.8	48.3
Park Ranger	PFT	GS-025-09	78.3	43.1
Maintenance Worker	PFT	WG-4749-08	81.7	44.5
Office Automation Clerk	PFT	GS-0326-04	40.5	22.3
Proposed Position				**Annual Salary (K) x 70%**
Environmental Education/Visitor Services Specialist	PFT	GS-1001-7/9	52.3	36.6
Total current and proposed staffing costs				**304**

PFT: Permanent Full Time
GS: General Schedule Federal Employee
WG: Wage Grade Federal Employee

C.3.5 Budget Summary

Table C-5 summarizes the data from Tables C-2 and C-3 and displays the overall funding needed for the Washington Maritime National Wildlife Refuge Complex to implement the CCP for Dungeness NWR.

Table C-5. Budget Summary – One-time projects and annual funding needs for Dungeness NWR as identified in the CCP

Budget Category	Alt A		Alt B		Alt C	
	One time cost (K)	Annual recurring cost (K)	One time cost (K)	Annual recurring cost (K)	One Time Cost (K)	Annual recurring cost (K)
Research	-	7	295	15	295	15
Surveys and assessments	-	25	67	35	67	35
Habitat management and restoration	-	35	304	145	297	120
Facilities and maintenance	-	100	550	140	550	130
Public use opportunities and education	-	130	52	200	46	180
Totals	**-**	**297**	**1,268**	**535**	**1,255**	**480**

C.4 Partnership Opportunities

Partnerships are an important component of the implementation of this CCP and are reflected in the goals, objectives, and strategies identified in Chapter 2. The Refuge's location (Olympic Peninsula) facilitates many opportunities for partnerships. Current and past partners include federal and state agencies, Tribes, non-governmental organizations, schools volunteers, and individuals.

Coordinated partnerships efforts would focus on habitat restoration, land protection, environmental education, fish and wildlife monitoring, outreach, and quality wildlife-dependent recreation. Refuge Complex staff would work to strengthen existing partnerships and would actively look for new partnerships to assist in achieving the goals, objectives, and strategies in this CCP/EA.

Jamestown S'Klallam Tribe

The Service has a close working relationship with the Tribe. The Tribe and the Service have collaborated on a number of projects including addressing water quality issues in Dungeness Harbor and Bay. The Service would partner with the Jamestown S'Klallam Tribe and other interested Tribes to deliver education and interpretation programs and materials that focus on the Refuge and area Native American culture. In addition the Service would partner with interested Tribes for cultural resources inventory, evaluation, and project monitoring, consistent with the regulations of the National Historic Preservation Act.

U. S. Coast Guard (USCG)
The Service would coordinate with the USCG on transfer of the New Dungeness Light Station to the U.S. Fish and Wildlife Service. As part of that transfer the Service would work with the USCG on any unresolved contaminants issues concerning the lighthouse site.

National Oceanic and Atmospheric Administration
National Oceanic and Atmospheric Administration – Fisheries conducts research and monitors marine mammals in the Salish Sea. These activities are managed under a Special Use Permit when conducted on refuge lands and have involved Steller's sea lions, elephant seals, and harbor seals

National Park Service
The Service would partner with Olympic National Park (ONP) on developing and presenting consistent and complementary interpretive material and programs on climate change to visitors and local community members. The Service would formalize an agreement with ONP for support on wildfires for initial attack resources.

U.S. Forest Service
Forest Service personnel from the Olympic National Forest Service staff participated in the preliminary CCP planning phase with several site visits to the forested habitat. The Service would consult with the Olympic National Forest as we develop the Forest Management Plan.

Washington Department of Fish and Wildlife (WDFW)
WDFW's management responsibilities including lands and waters, fish and wildlife, threatened and endangered species and other programs, frequently overlap with USFWS resources and responsibilities. The WDFW and other state agencies are in a unique position to greatly assist the Service in protecting sensitive seabirds and pinnipeds from human disturbance in close proximity to the Complex Refuges. The Service and WDFW share mutual interests in species management, wildlife surveys, developing joint research projects, and education and outreach programs. The WDFW has been closely involved with the Service in waterfowl surveys, pinniped surveys, black oystercatcher and pigeon guillemot surveys, forage fish spawning beach surveys and review of Service's projects in the marine environment.

Washington Department of Ecology (WDOE)
One of Washington Department of Ecology's programs is spill prevention, preparedness, and response. This program focuses on prevention of oil spills to Washington State waters and land, as well as planning for an effective response to oil and hazardous substance spills whenever they occur. The Service would continue its partnership with WDOE in support and maintenance of a regional contingency plan that guides how spills are managed in the Northwest; and in the development and periodic review of Geographic Response Plans.

Washington Department of Natural Resources (WDNR)
Washington Department of Natural Resources has monitored eelgrass in the Salish Sea for a number of years using a variety of techniques including videography. The Service would partner with them for monitoring eelgrass beds in Dungeness Harbor and Bay. In addition the Refuge would consult with them as we develop the Forest Management Plan. The Refuge uses WNDR's Olympic Region as a dispatching resource for wildfires on the Refuge.

Clallam County
The Service would continue its cooperative relationship with Clallam County Parks on management of the Dungeness Recreation Area that lies immediately adjacent to Dungeness NWR and which refuge visitors must pass through to access the Refuge. The Service leases County property for parking lots and a public restroom at the refuge entrance. In addition the Service would continue to work with Clallam County Department of Health and Human Services' Division of Environmental Health on water quality issues in Dungeness Harbor and Bay.

Clallam County Marine Resources Committee (MRC)
The Service has partnered with the MRC for a number of years as the Refuge and its resources are important components of the marine ecosystem of the Strait of Juan de Fuca and the Salish Sea. Removal of derelict fishing gear (crab pots) and survey of eelgrass beds in Dungeness Harbor and Bay are projects the MRC has funded in the past and which the Service wishes to continue with the MRC partnership.

University of Washington (UW)
The Refuge participates in the UW's Coastal Observation and Seabird Survey Team (COASST) program. A citizen science project, COASST monitors local marine resources and ecosystem health. In addition to providing beached bird data to the Refuge these volunteers also act as an "early warning system" to alert the Refuge to any unusual or catastrophic marine events.

Olympic Peninsula Audubon Society (OPAS)
Olympic Peninsula Audubon Society has partnered with the Service on a number of important projects. Members of OPAS assist with the annual Christmas bird count and the Refuge's participation in Cornell Lab of Ornithology feeder watch program. Breeding bird surveys have also been conducted by OPAS members.

New Dungeness Light Station Association
The New Dungeness Lighthouse is maintained and operated by the New Dungeness Light Station Association, a non-profit historical organization, under an agreement with the U.S. Coast Guard (USCG). The Association offers light house tours and interpretation every day of the year. The Service plans on acquiring the light station property from the USCG when it is excessed and then enter into a similar relationship with the Association. The Service would continue to partner with the Association on interpretation of this historical facility.

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Appendix D. Wilderness Review

D.1 Introduction

D.1.1 Refuge Overview

Dungeness National Wildlife Refuge (NWR or Refuge) consists of the Dungeness Unit, which includes the Graveyard Spit Research Natural Area (RNA), and the Dawley Unit. The Dungeness Unit was established to protect and preserve breeding grounds for native birds in 1915. Originally the Unit was part of a lighthouse reservation, on which the New Dungeness Lighthouse was built in 1857. Dungeness Spit is the longest sand spit in North America. Extending five miles into the Strait of Juan de Fuca, it provides habitat for a great variety of migratory shorebirds, waterfowl, marine mammals, and marine life. The waters of Dungeness Bay, with its eelgrass beds, mudflats, and tidelands provide food, shelter, and breeding grounds to support a whole ecosystem teeming with life. Large numbers of brant, wigeon, pintail, mallard and bufflehead spend their winters here. Surf smelt, herring, Pacific sand lance and other species of marine fish breed and rear within the bay. Anadromous fish such as Chinook, chum, pink, Coho salmon and steelhead and cutthroat trout are dependent on nearshore habitats within Dungeness Bay and Harbor during the juvenile rearing period. The bay also serves as a vital nursery area for commercially important species such as marine invertebrates (e.g., Dungeness crab) which seek these areas for refugia. The rare northern elephant seal hauls out on the spit each year. Graveyard Spit supports some of the best remaining coastal strand habitat within the Salish Sea. Upland habitats at the base of Dungeness Spit include forests and sandy bluffs.

The Dawley Unit, located along Sequim Bay, was established as a wildlife sanctuary in 1973. The residential area was heavily developed with the construction of aviaries, ponds, and gardens while the forested tract was altered by logging over the years. The forested area does have an established logging road system, but due to the topography, some areas were protected from further alterations and are considered good second growth forest habitat.

D.1.2 Policy and Direction for Wilderness Reviews

U.S. Fish and Wildlife Service policy (Part 602 FW 3.4 C. (1) (c)) requires that wilderness reviews be completed as part of the CCP process. This review includes the re-evaluation of refuge lands existing during the initial 10-year review period of the Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136), as well as new lands and waters added to the Refuge System since 1974. A preliminary inventory of the wilderness resources is to be conducted during pre-acquisition planning for new or expanded refuges (341 FW 2.4 B, “Land Acquisition Planning”). Refuge System policy on Wilderness Stewardship (610 FW 1-5) includes guidance for conducting wilderness reviews (610 FW 4 – Wilderness Review and Evaluation).

A wilderness review is the process of determining whether the Service should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: wilderness inventory, wilderness study, and wilderness recommendation.

Wilderness Inventory
The inventory is a broad look at a refuge to identify lands and waters that meet the minimum criteria for wilderness—size, naturalness, and outstanding opportunities for solitude or primitive and unconfined type of recreation. All areas meeting the criteria are preliminarily classified as Wilderness Study Areas (WSAs). If WSAs are identified, the review proceeds to the study phase.

Wilderness Study
During the study phase, WSAs are further analyzed:

1. for all values of ecological, recreational, cultural, economic, symbolic
2. for all resources, including wildlife, vegetation, water, minerals, soils
3. for existing and proposed public uses
4. for existing and proposed refuge management activities within the area,
5. to assess the refuge's ability to manage and maintain the wilderness character in perpetuity, given the current and proposed management activities. Factors for evaluation may include, but are not limited to, staffing and funding capabilities, increasing development and urbanization, public uses, and safety.

We evaluate at least an "All Wilderness Alternative" and a "No Wilderness Alternative" for each WSA to compare the benefits and impacts of managing the area as wilderness as opposed to managing the area under an alternate set of goals, objectives, and strategies that do not involve wilderness designation. We may also develop "Partial Wilderness Alternatives" that evaluate the benefits and impacts of managing portions of a WSA as wilderness.

In the alternatives, we evaluate:

1. the benefits and impacts to wilderness values and other resources
2. how each alternative would achieve the purposes of the Wilderness Act and the National Wilderness Preservation System
3. how each alternative would affect achievement of refuge purpose(s) and the refuge's contribution toward achieving the Refuge System mission
4. how each alternative would affect maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health at various landscape scales
5. other legal and policy mandates
6. whether a WSA can be effectively managed as wilderness by considering the effects of existing private rights, land status and service jurisdiction, refuge management activities and refuge uses, and the need for or possibility of eliminating Section 4(c) prohibited uses

Wilderness Recommendation
If the wilderness study demonstrates that a WSA meets the requirements for inclusion in the National Wilderness Preservation System, a wilderness study report should be written that presents the results of the wilderness review, accompanied by a Legislative Environmental Impact Statement (LEIS). The wilderness study report and LEIS that support wilderness designation are then transmitted through the Secretary of the Interior to the President of United States, and ultimately to the United States Congress for action. Refuge lands recommended for wilderness consideration by the wilderness study report will retain their WSA status and be managed as "… wilderness according to the management direction in the final CCP until Congress makes a decision on the area or we amended the CCP to modify or remove the wilderness recommendation" (610 FW 4.22B). When a WSA is revised or eliminated, or when there is a revision in "wilderness stewardship direction, we include appropriate interagency and tribal coordination, public involvement, and documentation of compliance with NEPA" (610 FW 3.13).

D.1.3 Criteria for Evaluating Lands for Possible Inclusion in the National Wilderness Preservation System

The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136), provides the following description of wilderness:

"A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act as an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions..."

The following criteria for identifying areas as wilderness are outlined in Section 2(c) of the Act and are further expanded upon in Refuge System policy (610 FW 4). The first three criteria are evaluated during the inventory phase; the fourth criterion is evaluated during the study phase.

1. Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
2. Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
3. Has at least five thousand acres of land or is of a sufficient size as to make practicable its preservation and use in an unimpaired condition; and
4. May also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Criterion 3 is further defined in Section 3(c) of the Act as 1) a roadless area of 5,000 contiguous acres or more, or 2) a roadless island. Roadless is defined as the absence of improved roads suitable and maintained for public travel by means of 4-wheeled, motorized vehicles that are intended for highway use.

D.1.4 Relationship to Previous Wilderness Reviews

No previous wilderness reviews have been prepared for Dungeness NWR.

D.2 Wilderness Inventory

The following constitutes the inventory phase of the wilderness review for the Dungeness National Wildlife Refuge.

D.2.1 Lands Considered Under This Wilderness Review

All FWS-owned lands and waters (in fee title) within the Dungeness NWR boundary were considered during this wilderness review.

D.2.2 Inventory Units

The first step of a wilderness assessment is to divide a refuge or other management entity into preliminary wilderness evaluation units. The boundaries of these artificial units can follow the refuge

boundary, but may not cross permanent roadways, private or other non-Federal lands, or non-Service owned waterways. These roads, non-Federal lands, or waterways can form the boundary for an individual evaluation unit. Other obvious incompatible wilderness uses or structures (such as refuge headquarters, residential areas, rights-of-way, and non-jurisdictional waters) may also be eliminated from any evaluation units at this time. Once boundaries have been established for each individual evaluation unit, the criteria in Section D.2.3 are applied to determine each unit's suitability as potential wilderness and the need for further evaluation under the Wilderness Study.

In determining units to be evaluated for wilderness character per this inventory, the Refuge was mapped using geographic information system (GIS) software. Using the major constraints set by the Wilderness Act, specifically land ownership/refuge boundary and permanent road systems, initial large evaluation units were developed by including all contiguous lands within those intractable confines. Through this process, four units were defined for evaluation:

For the purposes of this wilderness review, the 392.3 acre **Dungeness Unit** is defined to include all refuge-owned forested lands at the base of Dungeness Spit and Dungeness and Graveyard Spits. Tracts 10a and 12 are not contiguous with the remainder of the unit and thus are considered a separate unit (the 4.9 acre Mellus/Nature Conservancy Unit). The Dungeness Unit consists of coastal strand and spit, coastal lagoon, salt marsh, intertidal mudflat, and upland habitats. Upland habitats include second growth Douglas-fir/western hemlock/western red cedar forest, alder forest, and sandy bluffs. Dungeness Spit is 5.5 miles long and averages 300 feet wide (from mean low water); however the narrowest portion measures approximately 50 feet wide during high tide. Graveyard Spit is about 1.4 miles long and averages 475 feet wide. Cumulatively, Dungeness and Graveyard Spits consist of approximately fifteen miles of undeveloped sandy beach. Graveyard Spit was designated a Research Natural Area in 1990 because of its high quality low intertidal, high salinity sandy marsh; coastal spit with native vegetation; and high salinity coastal lagoon. Refuge visitor and administrative facilities are located on this unit.

The forested 4.9 acre **Mellus/Nature Conservancy (Tracts 10a and 12) Unit** is located east of the base of Dungeness Spit and fronts Dungeness Bay and Harbor. There is private property separating this unit from the main Dungeness Unit. This unit provides a buffer for the Refuge and protects the viewshed to the east of the observation platforms along the main trail on the Dungeness Unit.

The 14.7 acre **Dawley North Unit** is located along the southern part of Sequim Bay and north of Highway 101. The residential area was heavily developed with the construction of aviaries, ponds, and gardens. The Dawley North Unit structures and property are in caretaker status and the Service intends to work with other agencies or conservation organizations to pursue cooperative management.

The 116.5 acre **Dawley South Unit** is located south of Highway 101. This unit is primarily forested with a ribbon of riparian forest along Dean Creek running through the southwest corner and a small 1/5th acre impoundment located in the center of the unit. The forest has been altered by logging over the years and is now considered second growth. Consequently, an established logging road system still persists. State and private land border this unit.

D.2.3 Process of Analysis

The following evaluation process was used in identifying the suitability of refuge units for wilderness designation:

- Determination of refuge unit sizes.
- Assessment of the units' capacity to provide opportunities for solitude or primitive and unconfined recreation.
- Assessment of "naturalness" of refuge units.

General guidelines used for evaluating areas for wilderness potential during this wilderness inventory process include:

1. The area should provide a variety of habitat types and associated abiotic features, as well as a nearly complete complement of native plants and wildlife indicative of those habitat types. Non-native and invasive species should comprise a negligible portion of the landscape.
2. The area should be spatially complex (vertically and/or horizontally) and exhibit all levels of vegetation structure typical of the habitat type, have an interspersion of these habitats, and provide avenues for plant and wildlife dispersal.
3. The area should retain the basic natural functions that define and shape the associated habitats, including but not limited to, flooding regimes, fire cycles, unaltered hydrology and flowage regimes, basic predator-prey relationships including herbivory patterns.
4. Due to their size, islands may not meet the habitat guidelines in 1 and 2 above. Islands should, however, exhibit the natural cover type with which they evolved and they should continue to be shaped and modified by natural processes. Islands should be further analyzed during the study portion of the review if they provide habitat for a significant portion of a population, or key life cycle requirements for any resources of concern or listed species.
5. Potential wilderness areas should be relatively free of permanent structures or man-made alterations. Areas may be elevated to the study phase if existing structures or alterations can be removed or remediated within a reasonable timeframe, and prior to wilderness recommendation to the Secretary of the Interior.

Supplemental Values – The Wilderness Act states that an area of wilderness may contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Supplemental values of the area are optional, but the degree to which their presence enhances the area's suitability for wilderness designation should be considered. The evaluation should be based on an assessment of the estimated abundance or importance of each of the features.

More detail on the factors considered and used for each assessment step follows.

Unit Size: Roadless areas meet the size criteria if any one of the following standards applies:

- An area with over 5,000 contiguous acres solely in Service ownership.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or an area that is markedly distinguished from the surrounding lands by topographical or ecological features.
- An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.

- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Outstanding Solitude or Primitive or Unconfined Recreation:
A designated wilderness area must provide outstanding opportunities for solitude or a primitive and unconfined type of recreation. Possession of only one of these outstanding opportunities is sufficient for an area to qualify as wilderness, and it is not necessary for one of these outstanding opportunities to be available on every acre. Furthermore, an area does not have to be open to public use and access to qualify under these criteria.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. Primitive recreation activities may provide opportunities to experience challenge and risk, self-reliance, and adventure.

Naturalness and Wildness: the area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.
This criterion must be evaluated in the context of current natural conditions and societal values and expectations without compromising the original intent of the Wilderness Act. It is well recognized that there are few areas remaining on the planet that could be truly classified as primeval or pristine, with even fewer, if any, existing in the conterminous United States. Likewise, few areas exist that do not exhibit some impact from anthropogenic influences, be it noise, light, or air pollution; water quality or hydrological manipulations; past and current land management practices; roads or trails, suppression of wildfires; invasions by non-native species of plants and animals; or public uses. While allowing for the near-complete pervasiveness of modern society on the landscape, the spirit of the Wilderness Act is to protect lands that still retain the wilderness qualities of being: 1) natural, 2) untrammeled, 3) undeveloped. These three qualities are cornerstones of wilderness character. For areas proposed or designated as wilderness, wilderness character must be monitored to determine baseline conditions and thereafter be periodically monitored to assess the condition of these wilderness qualities. Proposed and designated wilderness areas by law and policy are required to maintain wilderness character through management and/or restoration in perpetuity.

Defining the first two qualities (natural and untrammeled) requires knowledge and understanding of the ecological systems which are being evaluated as potential wilderness. Ecological systems are comprised of three primary attributes – composition, structure, and function. Composition is the components that make up an ecosystem, such as the habitat types, native species of plants and animals, and abiotic (physical and chemical) features. These contribute to the diversity of the area. Structure is the spatial arrangement of the components that contribute to the complexity of the area. Composition and structure are evaluated to determine the naturalness of the area. Function is the processes that result from the interaction of the various components both temporally and spatially, and the disturbance processes that shape the landscape. These processes include, but are not limited to, predator-prey relationships, insect and disease outbreaks, nutrient and water cycles, decomposition, fire, windstorms, flooding, and both general and cyclic weather patterns. Ecological functions are evaluated to determine the wildness or untrammeled quality of the area.

The third quality assessment is whether an area is undeveloped. Undeveloped refers to the absence of permanent structures such as roads, buildings, dams, fences, and other man-made alterations to the landscape. Exceptions can be made for historic structures or structures required for safety or health considerations, providing they are made of natural materials and relatively unobtrusive on the landscape.

D.2.4 Summary of Inventory Results and Conclusion

Table D-1 summarizes the above evaluation factors for each of the units that were delineated and evaluated as described in Sections D.1.1 and D.2.3.

In this inventory, the 392.3 acre Dungeness Unit, 4.9 acre Mellus/Nature Conservancy (Tracts 10a and 12) Unit, 14.7 acre Dawley North Unit, and 116.5 acre Dawley South Unit did not meet the minimum wilderness criteria for size, outstanding opportunities for solitude and primitive/unconfined recreation, or naturalness. While the Refuge contains some excellent examples of coastal habitats, the small acreage, discontinuous refuge lands, and the presence of heavily used roads adjacent to the Refuge results in a determination that Dungeness National Wildlife Refuge does not satisfy minimum wilderness suitability criteria.

Table D-1. Results of Wilderness Inventory for Dungeness NWR

Refuge Unit	Size	Outstanding opportunities for solitude or primitive/unconfined recreation	Naturalness	Summary: Area will move forward for Wilderness Study
Dungeness Unit	No	NE	NE	No
Mellus/Nature Conservancy (Tracts 10a and 12) Unit	No	NE	NE	No
Dawley North Unit	No	NE	NE	No
Dawley South Unit	No	NE	NE	No

Notes:
NE – Not evaluated (once any wilderness criteria was not met, further evaluation was not conducted.)

Document continues on next page.

Appendix E. Biological Resources of Concern

E.1 Introduction

Management direction of individual refuges is driven by refuge purposes and statutory mandates, coupled with species and habitat priorities. Management on a refuge should first and foremost address the individual refuge purposes. Additionally, management should address maintenance and, where appropriate, restoration of Biological Integrity, Diversity, and Environmental Health (BIDEH) as well as management for NWRS Resources of Concern. In this approach, each refuge contributes to the goals of the NWRS (601 FW 1) and achievement of the NWRS Mission.

In concert with this approach, and as an initial step in planning, the planning team identified resources of concern for Dungeness National Wildlife Refuge (NWR or Refuge). As defined in the Policy on Habitat Management Plans (620 FW 1), resources of concern are:

> "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW1.4G)."

To provide a framework for development of goals and objectives in the CCP, the planning team identified resources of concern, following the process outlined in the Service's draft Identifying Refuge Resources of Concern and Management Priorities: A Handbook (USFWS 2009).

E.2 Comprehensive Resources of Concern

A comprehensive list of potential resources of concern was created early in the planning process. The team identified species, species groups, and communities of concern, based upon a review of the Refuge's establishing history and purposes, a description of the key habitat types existing at the Refuge and a review of numerous conservation plans (see Section 1.7 of the draft CCP/EA), many of which highlight priority species or habitats for conservation. The Comprehensive Resources of Concern list is contained in Table E-1.

Table E-1. Dungeness National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities [8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5 [10]	Refuge Occurrence	Ecological Significance
SEABIRDS														
Double-crested Cormorant					S4S5B			NC R			X		Year-round	
Pelagic Cormorant					S4B, S4N		BCR5	HC			X		Year-round	
Heermann's Gull					S5N			MC					Migration & winter	
Western Gull					S4B, S4N			LC					Year-round	
Glaucous-winged/Western Gull					S5B, S5N, S4B, S4N								Year-round	Close proximity to largest colony in Salish Sea
Caspian Tern				M	S3B		BCR5	MC					Breeding	First observed in 2003, issues with avian & mammalian predation
Marbled Murrelet			T	T	S3		BCR5	HC		X	X		Adjacent to Dawley Unit, Breeding	
Pigeon Guillemot					S4B, S4N			MC			X		Breeding; foraging	
SHOREBIRDS														
Black-bellied Plover					S4N				3		X		Migration, winter	
Snowy Plover			T	E	S1				5	X			Very limited observations	Reports on Dungeness Spit in 1995, 1996, 2012; nonbreeding
Black Oystercatcher				M	S4		N, R1, BCR5		4	X			Year-round	
Whimbrel					S3N		N, R1, BCR5		4				Migration	
Sanderling					S4N				3		X		Migration, winter	
Western					S4S5N				3		X		Migration	

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities[8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5[10]	Refuge Occurrence	Ecological Significance
Sandpiper														
Least Sandpiper					S4N				3		X		Migration	
Dunlin		X			S4S5N				3		X		Migration, winter	
WATERFOWL														
Brant					S3N		GBBDC			X	X		Migration, winter	
Harlequin Duck					S2B, S3N		GBBDC				X		Migration, winter	
Mallard					S5B, S5N		GBBDC							
American Wigeon					S4B, S5N		GBBDC				X		Migration, winter	
Northern Shoveler					S4B, S3N								Migration, winter	
Northern Pintail					S3B, S4N		GBBDC			X			Migration, winter	
Green-winged Teal					S4B, S3N								Migration, winter	
Greater Scaup					S3N		GBBDC			X	X		Migration, winter	
Lesser Scaup					S3N, S4B		GBBDC			X	X		Migration, winter	
Surf Scoter					S3N					X	X		Migration, winter	
White-winged Scoter					S3N					X	X		Migration, winter	
Black Scoter					S3N					X	X		Migration, winter	
Common Goldeneye					S5N								Migration, winter	
Barrow's Goldeneye					S3B, S4N								Migration, winter	
OTHER WATERBIRDS														
Great Blue Heron				M	S4S5B, S5N					X	X		Year-round	Limited abundance
RAPTORS														
Bald Eagle				S	S4B, S4N		N, R1, BCR5			X	X	14	Year-round	

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities [8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5 [10]	Refuge Occurrence	Ecological Significance
Northern Harrier					S3B, S3N							12	Year-round	
Sharp-shinned Hawk					S3S4B, S4N							14	Year-round	
Cooper's Hawk					S4B, S4N							15	Year-round	
Merlin					S3B, S4N							13	Migration	
Peregrine Falcon				S	S2B, S3N		N, R1, BCR5			X	X	13	Year-round	
LANDBIRDS														
Snowy Owl				M	S3N							n/a	Irruptive winter visitor	
Band-tailed Pigeon			SC		S4B						X		Year-round	
Short-eared Owl					S2S3B, S3N		N, R1				X	12	Breeding	
Northern Saw-whet Owl					S4B, S4N							15	Migration, winter	
Rufous Hummingbird					S4B		N, R1, BCR5				X	17	Year-round	
Belted Kingfisher					S5							14	Year-round	
Red-breasted Sapsucker					S4S5						X	18	Year-round	
Pileated Woodpecker		X		S	S4							12	Year-round	
Pacific-slope Flycatcher					S4S5B						X	17	Breeding	
Hutton's Vireo					S5							16	Year-round	
Steller's Jay					S5							14	Year-round	
Northwestern Crow					S4?							17	Year-round	
Chestnut-backed Chickadee					S5						X	17	Year-round	
Bewick's Wren					S5		N					11	Year-round	
Golden-crowned Kinglet					S4S5B						X	17	Year-round	
Varied Thrush					S5B, S5N							15	Year-round	
Orange-crowned Warbler					S4B							14	Breeding, migration	

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities[8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5[10]	Refuge Occurrence	Ecological Significance
Townsend's Warbler					S4N, S5B							16	Breeding, migration	
Spotted Towhee					S5B, S5N							14	Year-round	
Bullock's Oriole					S4B							14	Migration	
Pine Siskin					S4S5B							14	Year-round	
MARINE MAMMALS														
Pacific Harbor Seal		X		M	S4	X					X		Year-round	pupping site
Northern Elephant Seal					SNA	X							Haul-out	rare
OTHER SPECIES														
Pacific Sand Lance										X	X		Year-round, spawning	key component of the marine food web
Surf Smelt					SNR					X	X		Year-round, spawning	key component of the marine food web
Pacific Herring					SNR						X		Year-round, spawning	key component of the marine food web
Puget Sound Chinook			T	S C	SNR								Year-round, Dungeness Unit	
Hood Canal Summer Chum			T	S C	SNR								varies, Dungeness Unit	
Keen's Myotis				C	S1					X	X		potential at Dawley Unit	
Townsend's Big-eared Bat			S C	C	S2S3					X	X		potential at Dawley Unit	
Cope's Giant Salamander					S3S4						X		potential at Dawley Unit	
Olympic Torrent Salamander					S3						X		potential at Dawley Unit	
Long-legged Myotis			S C	M	S3S4								potential at Dawley Unit	
Long-eared Myotis			S C	M	S4								potential at Dawley Unit	

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities [8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5 [10]	Refuge Occurrence	Ecological Significance
Western Toad				S	S3						X		Dawley Unit	T&E - forest/wetlands
Red-legged Frog					S4						X		Dawley Unit	
Sand-verbena Moth			C	C	S1?					X			Year-round Graveyard Spit	10 sites globally, 1 observation on Graveyard Spit
NATIVE STRAND PLANTS														
Common Eelgrass		X											year-round	
American Dunegrass		X											year-round	
Large-headed Sedge		X											year-round	
ECOLOGICAL SYSTEMS														
Sandy Bluff		X											to the west of the base of Dungeness Spit	Unarmored bluffs a key conservation issue in the Salish Sea
Barrier Beach		X											Graveyard and Dungeness Spits	Dungeness Spit one of the longest natural sand spits in the world
Barrier Lagoon and Mudflats		X											Dungeness Harbor/ within Dungeness and Graveyard Spits	
Eelgrass Beds		X											Dungeness Harbor and Bay	Declining habitat type

Species/Habitat	Refuge Purpose Species	BIDEH	Fed ESA Status [1]	State Status [2]	State Rank WNHP [3]	MMPA Species [4]	USFWS Bird of Management Concern or Bird of Conservation Concern [5]	Pacific Region Seabird Plan [6]	N Pacific Coast Shorebird Plan [7]	State Wildlife Action Plan Priorities [8]	TNC WV/PT/GB EA [9]	PIF Species Assessment - BCR5 [10]	Refuge Occurrence	Ecological Significance
Salt Marsh		X											Within Graveyard Spit, small sections found within the Harbor at the base of Dungeness Spit	Declining habitat type
Mixed Coniferous Forests		X											Dungeness and Dawley Units	Declining habitat type
Seasonal Freshwater Wetlands		X											Dungeness and Dawley Units	Declining habitat type
Instream		X											Dawley Unit	
Managed Wetland		X											Dawley Unit	

1 Status under the Endangered Species Act - E = Endangered; T = Threatened; C = Candidate
2 State listing status - E = Endangered; T = Threatened; C = Candidate; S = Sensitive; M = Monitor; R1 = More data required to review status
3 Washington Natural Heritage Program state rank - see http://www1.dnr.wa.gov/nhp/refdesk/lists/stat_rank.html for a description of ranks
4 Species listed under the Marine Mammal Protection Act
5 USFWS Bird of Management Concern (USFWS 2005a) and USFWS Birds of Conservation Concern (USFWS 2008) lists - N = National; R1 = Region 1; BCR5 = Bird Conservation Region 5; GBBDC - Game Bird Below Desired Condition
6 Pacific Region Seabird Conservation Plan (USFWS 2005b) status - HC = High Concern; MC = Moderate Concern; NAR = Not at Risk
7 Northern Pacific Coast Regional Shorebird Conservation Plan (Drut and Buchanan 2000) status - 4 = High Concern; 3 = Moderate Concern
8 Washington Comprehensive Wildlife Conservation Plan priority species (WDFW 2005)
9 The Nature Conservancy Willamette Valley Puget Trough Georgia Basin Ecoregional Assessment (Floberg et al. 2004)
10 PIF Species Assessment Scores - Regionally Important Species (higher #s = higher conservation Concern) (PIF 2010)

E.3 Ecological System Descriptions

Vegetation types and nomenclature in the following section are classified according to the International Terrestrial Ecological System Classification being developed by NatureServe and its natural heritage program members. Ecological systems are being described for the coterminous United States, southern Alaska, and adjacent portions of Mexico and Canada and are defined as follows:

> "Terrestrial ecological systems are specifically defined as a group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. A given system will typically manifest itself in a landscape at intermediate geographic scales of tens to thousands of hectares and will persist for 50 or more years. This temporal scale allows typical successional dynamics to be integrated into the concept of each unit. With these temporal and spatial scales bounding the concept of ecological systems, we then integrate multiple ecological factors—or diagnostic classifiers—to define each classification unit. The multiple ecological factors are evaluated and combined in different ways to explain the spatial co-occurrence of plant associations." (Comer et al. 2003)

Thus, ecological systems link together recurring groupings of U.S. National Vegetation Classification (US-NVC) associations and alliances (Grossman et al. 1998, Anderson et al. 1998, Jennings et al. 2003) found in similar physical settings and influenced by similar dynamic processes such as fire or flooding. The nested US-NVC hierarchy groups associations into alliances based on common dominant or diagnostic species in the upper most canopy. By non-hierarchically grouping together associations and alliances using larger-scale environmental patterns and concepts, ecological systems form a "meso-scale" classification that lies between the finer-scale (floristic) classes and the generalized formation (physiognomic) levels of the US-NVC (Comer et al. 2003). As a "meso-scale" classification, ecological systems are more readily mapped, identifiable in the field, and practically understood as ecological units and wildlife habitats. Consequently, regional GAP analysis efforts have generally adopted them as target map units. Given their utility for standardized vegetation type mapping, ecological systems classification was performed for Dungeness National Wildlife Refuge. All ecological system descriptions based on NatureServe (2012) and available online at: http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol.

E.3.1 Shoreline

North Pacific Coastal Cliff and Bluff
This ecological system includes unvegetated or sparsely vegetated rock cliffs and very steep bluffs of glacial deposits along the Pacific Ocean and associated marine and estuarine inlets. It is restricted to degrading slopes from southwestern British Columbia south into central Oregon. It is composed of barren and sparsely vegetated substrates, typically including exposed sediments, bedrock, and scree slopes. Exposure to waves, eroding and desiccating winds, slope failures and sheet erosion create gravelly to rocky substrates that are often unstable. There can be sparse cover of forbs, grasses, lichens and low shrubs.

North Pacific Maritime Coastal Sand Dune and Strand
This system includes beach strand (not the beach itself but sparsely or densely vegetated areas behind the beach), foredunes, sand spits, and active to stabile backdunes and sandsheets derived from quartz

or gypsum sands. The mosaic of sparse to dense vegetation in dune systems is driven by sand deposition, erosion, and lateral movement. Disturbance processes include dune blowouts caused by wind and occasional wave overwash during storm tidal surges. Coastal dunes often front portions of inlets and tidal marshes. Dune vegetation typically includes herbaceous, succulent, shrub, and tree species with varying degrees of tolerance for salt spray, wind and sand abrasion, and substrate stability. Dune succession is highly variable, so species composition can vary significantly among occurrences. These dunes can be dominated by *Leymus arenarius* (= *Elymus arenarius*), *Festuca rubra, Leymus mollis,* or various forbs adapted to salty dry conditions. *Gaultheria shallon* and *Vaccinium ovatum* are major shrub species. Forested portions of dunes are included within this system and are characterized (at least in the south) by *Pinus contorta var. contorta* early in succession, *Picea sitchensis* somewhat later in the sere, and in some cases *Tsuga heterophylla* later still. *Pseudotsuga menziesii* sometimes codominates in Oregon. Disturbance processes include dune blowouts caused by wind and occasional wave overwash during storm tidal surges. Late-sere forests, dominating stabilized dune systems where active dune processes are nearly absent and that compositionally represent the adjacent matrix system, are excluded from this dune system. Interdunal wetlands occur commonly within the matrix of this system and sometimes are extensive in deflation plains or old dune troughs, but are considered part of various separate wetland ecological systems depending on their hydrology, and are not part of this upland system.

E.3.2 Intertidal/Subtidal

Temperate Pacific Intertidal Flat (Dungeness Unit)
Tidal flats form a narrow band along oceanic inlets and are more extensive at the mouths of larger rivers. Algae are the dominant vegetation on mud or gravel flats where little vascular vegetation is present due to daily tidal flooding of salt or brackish water. Characteristic species include *Vaucheria longicaulis* and *Enteromorpha* spp. Vascular species are sparse, if present, and may include salt-tolerant species such as *Eleocharis palustris*, *Salicornia* spp., *Plantago maritima, Glaux maritima,* and other plants common to lower salt marshes; cover is less than 10%. The dominant processes are tectonic uplift or subsidence, isostatic rebound, and sediment deposition.

North Pacific Maritime Eelgrass Bed (Dungeness Unit)
Eelgrass beds are found within the subtidal and intertidal zones. Intertidal zones are found with clear water in bays, inlets and lagoons, typically dominated by macrophytic algae and marine aquatic angiosperms along the temperate Pacific Coast. Subtidal portions are never exposed while intertidal areas support species that can tolerate exposure to the air. Common substrates include marine silts, but may also include exposed bedrock and cobble, where many algal species become attached with holdfasts. Beds are dominated by *Zostera marina*.

Transitional Vegetation Herbaceous-Woody Mix (Dungeness Unit)
Transitional Vegetation Short Shrub (Dungeness and Dawley Units)

E.3.3 Forest

North Pacific Lowland Riparian Forest and Shrubland (Dungeness and Dawley Units)
Lowland riparian systems are linear in character, occurring on floodplains or lower terraces of rivers and streams. Major broadleaf dominant species are *Acer macrophyllum*, *Alnus rubra*, *Populus balsamifera* ssp. *trichocarpa*, *Salix sitchensis, Salix lucida* ssp. *lasiandra*, *Cornus sericea*, and *Fraxinus latifolia*. Conifers tend to increase with succession in the absence of major disturbance.

Conifer-dominated types are relatively uncommon and not well-described; *Abies grandis*, *Picea sitchensis*, and *Thuja plicata* are important. Riverine flooding and the succession that occurs after major flooding events are the major natural processes that drive this system. Very early-successional stages can be sparsely vegetated or dominated by herbaceous vegetation.

North Pacific Maritime Dry-Mesic Douglas-Fir-Western Hemlock Forest (Dungeness and Dawley Units)

This ecological system occurs throughout low-elevation western Washington, except on extremely dry or moist to very wet sites. These forests occur on the drier to intermediate moisture habitats and microhabitats within the Western Hemlock Zone of the Pacific Northwest. Climate is relatively mild and moist to wet, however mean annual precipitation can be as low as 20 inches in the extreme rainshadow, falling predominantly as winter rain. Snowfall ranges from rare to regular, and summers are relatively dry. This is generally the most extensive forest in the lowlands on the west side of the Cascades and forms the matrix within which other systems occur as patches including North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir Forest and Woodland.

Overstory canopy is dominated by *Pseudotsuga menziesii*, with *Tsuga heterophylla* generally present in the subcanopy or as a canopy dominant in old-growth stands. *Abies grandis, Thuja plicata,* and *Acer macrophyllum* codominants are also represented. In the driest climatic areas, *Tsuga heterophylla* may be absent, and *Thuja plicata* takes its place as a late-seral or subcanopy tree species. *Gaultheria shallon, Mahonia nervosa, Rhododendron macrophyllum, Linnaea borealis, Achlys triphylla,* and *Vaccinium ovatum* typify the poorly to well-developed shrub layer. *Acer circinatum* is a common codominant with one of more of these other species. The fern *Polystichum munitum* can be codominant with one or more of the evergreen shrubs on sites with intermediate moisture availability (mesic). Young stands may lack *Tsuga heterophylla* or *Thuja plicata,* especially in the Puget Lowland. *Tsuga heterophylla* is generally the dominant regenerating tree species. Other common associates include *Acer macrophyllum, Abies grandis,* and *Pinus monticola*. This is in contrast to North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest, which occurs on sites where soils remain moist to subirrigated for much of the year and fires were less frequent. Fire is (or was) the major natural disturbance. In the past (pre-1880), fires were high-severity or, less commonly, moderate-severity, with natural return intervals of 100 years or less in the driest areas, to a few hundred years in areas with more moderate to wet climates. This system was typified by a moderate-severity fire regime involving occasional stand-replacing fires and more frequent moderate-severity fires. This fire regime would create a complex mosaic of stand structures across the landscape.

North Pacific Maritime Mesic-Wet Douglas-Fir-Western Hemlock Forest (Dungeness and Dawley Units)

This ecological system occurs throughout low-elevation western Washington, except on extremely dry sites and in the hypermaritime zone near the outer coast where it is rare. These forests occur on moist habitats and microhabitats, mainly lower slopes or valley landforms, within the Western Hemlock Zone of the Pacific Northwest. They differ from North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest primarily in having more hydrophilic undergrowth species, moist to subirrigated soils, high abundance of shade- and moisture-tolerant canopy trees, as well as higher stand productivity, due to higher soil moisture and lower fire frequency. Climate is relatively mild and moist to wet, however this system can be found in areas with mean annual precipitation as low as 20 inches in the extreme rainshadow (predominantly as winter rain). Snowfall ranges from rare to regular (but consistent winter snowpacks are absent or minimal), and summers are relatively

dry. In some wetter climatic areas, it forms the matrix within which other systems occur as patches, especially riparian wetlands. In this area, it occurs as small to large patches within a matrix of North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest and North Pacific Dry Douglas-fir-(Madrone) Forest and Woodland.

Overstory canopy is dominated by *Pseudotsuga menziesii, Tsuga heterophylla*, and/or *Thuja plicata*, as well as *Chamaecyparis lawsoniana* in western Oregon, away from the coast. *Pseudotsuga menziesii* is usually at least present to more typically codominant or dominant. *Acer macrophyllum* and *Alnus rubra* (the latter primarily where there has been historic logging disturbance) are commonly found as canopy or subcanopy codominants, especially at lower elevations. In a natural landscape, small patches can be dominated in the canopy by these broadleaf trees for several decades after a severe fire. *Polystichum munitum*, *Oxalis oregana*, *Rubus spectabilis*, and *Oplopanax horridus* typify the poorly to well-developed herb and shrub layers. *Gaultheria shallon*, *Mahonia nervosa*, *Rhododendron macrophyllum*, and *Vaccinium ovatum* are often present but are generally not as abundant as the aforementioned indicators; except where *Chamaecyparis lawsoniana* is a canopy codominant, they may be the dominant understory. *Acer circinatum* is a very common codominant as a tall shrub. Stands included are best represented on lower mountain slopes of the coastal ranges with high precipitation, long frost-free periods, and low fire frequencies. Young stands may lack *Tsuga heterophylla* or *Thuja plicata*, especially in the Puget Lowland. *Tsuga heterophylla* is generally the dominant regenerating tree species. Other common associates include *Abies grandis*, which can be a codominant especially in the Willamette Valley - Puget Trough - Georgia Basin ecoregion. Soils are moist to somewhat wet but not saturated for much of the year and are well-drained to somewhat poorly drained. Typical soils for *Polystichum* sites would be deep, fine- to moderately coarse-textured, and for *Oplopanax* sites, soils typically have an impermeable layer at a moderate depth. Both types of soils are well-watered from upslope sources, seeps, or hyperheic sources. This is in contrast to North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest, which occurs on well-drained soils, south-facing slopes, and dry ridges and slopes where soils remain mesic to dry for much of the year. Fire is (or was) the major natural disturbance in all but the wettest climatic areas. In the past (pre-1880), fires were less commonly high-severity, typically mixed-severity or moderate-severity, with natural return intervals of a few hundred to several hundred years. This system was formerly supported by occasional, stand-replacing fires. More frequent moderate-severity fires would generally not burn these moister microsites.

North Pacific Oak Woodland (Dungeness Unit)
This system is associated with dry, predominantly low-elevation sites and/or sites that experienced frequent presettlement fires. In the Puget Lowland and Georgia Basin, this system is primarily found on dry sites, typically either shallow bedrock soils or deep gravelly glacial outwash soils. Even where more environmentally limited, the system is strongly associated with a pre-European settlement, low-severity fire regime. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. The vegetation ranges from savanna and woodland to forest dominated by deciduous broadleaf trees, mostly *Quercus garryana*. Codominance by the evergreen conifer *Pseudotsuga menziesii* is common. This system is borderline between small patch and large patch in its dynamics.

E.3.4 Wetlands

North Pacific Hardwood-Conifer Swamp (Dungeness and Dawley Units)
Also known as Palustrine forested Wetland in the Cowardin classification system (Cowardin et al. 1979), North Pacific Hardwood-Conifer Swamps mostly small-patch size, occurring sporadically in glacial depressions, in river valleys, around the edges of lakes and marshes, or on slopes with seeps that form subirrigated soils. This system is indicative of poorly drained, mucky areas, and areas are often a mosaic of moving water and stagnant water. Soils can be woody peat, muck, or mineral. Typical of extensive upland forests, this type can be dominated by any one or a number of conifer and hardwood species (*Tsuga heterophylla, Picea sitchensis, Tsuga mertensiana, Chamaecyparis nootkatensis, Pinus contorta var. contorta, Alnus rubra, Fraxinus latifolia*, *Betula papyrifera*) that are capable of growing on saturated or seasonally flooded soils. Overstory is often less than 50% cover, but shrub understory can have high cover.

Temperate Pacific Tidal Salt and Brackish Marsh (Dungeness Unit)
Also known as Estuarine Emergent Wetland in the Cowardin classification system (Cowardin et al. 1979), intertidal salt and brackish marshes are primarily associated with estuaries or coastal lagoons. Salt marshes are limited to bays and behind sand spits or other locations protected from wave action. Typically these areas form with a mixture of inputs from freshwater sources into coastal saltwater, so they commonly co-occur with brackish marshes. This is a small-patch system, confined to specific environments defined by ranges of salinity, tidal inundation regime, and soil texture. Patches usually occur as zonal mosaics of multiple communities. They vary in location and abundance with daily and seasonal dynamics of freshwater input from inland balanced against evaporation and tidal flooding of saltwater. Summer-dry periods result in decreased freshwater inputs from inland. Hypersaline environments within salt marshes occur in “salt pans” where tidal water collects and evaporates. Characteristic plant species include *Distichlis spicata, Monanthochloe littoralis, Limonium californicum, Jaumea carnosa, Salicornia* spp., *Suaeda* spp., *Batis maritima*, and *Triglochin* spp. Low marshes are located in areas that flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids, especially *Salicornia virginica, Distichlis spicata, Schoenoplectus maritimus* (= *Scirpus maritimus*), *Schoenoplectus americanus* (= *Scirpus americanus*), *Carex lyngbyei*, and *Triglochin maritima*. High marshes are located in areas that flood infrequently and are dominated by medium-tall graminoids and low forbs, especially *Deschampsia caespitosa, Argentina egedii, Juncus balticus*, and *Symphyotrichum subspicatum* (= *Aster subspicatus*). Transition zone (slightly brackish) marshes are often dominated by *Typha* spp. or *Schoenoplectus acutus*. The invasive weed *Lepidium latifolium* is a problem in many of these marshes. Rare plant species include *Cordylanthus maritimus* ssp. *maritimus*.

E.4 References

Anderson, M., P. Bourgeron, M.T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D.H. Grossman, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A.S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: list of types. The Nature Conservancy. Arlington, VA. 502 pp.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: a working classification of U.S. terrestrial systems. NatureServe. Arlington, VA. 75 pp.

Cowardin, L.M., V.Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior; Fish and Wildlife Service. Washington, D.C. 130 pp.

Drut, M. and J.B. Buchanan. 2000. U.S. shorebird conservation plan: Northern Pacific Coast regional shorebird management plan. Portland, OR: Fish and Wildlife Service, U.S. Department of the Interior. 31 pp.

Floberg, J., M. Goering, G. Wilhere, C. MacDonald, C. Chappell, C. Rumsey, Z. Ferdana, A. Holt, P. Skidmore, T. Horsman, E. Alverson, C. Tanner, M. Bryer, P. Iachetti, A. Harcombe, B. McDonald, T. Cook, M. Summers, and D. Rolph. 2004. Willamette Valley-Puget Trough-Georgia Basin ecoregional assessment, volume one: report. Prepared by The Nature Conservancy with support from the Nature Conservancy of Canada, Washington Department of Fish and Wildlife, Washington Department of Natural Resources (Natural Heritage and Nearshore Habitat programs), Oregon State Natural Heritage Information Center and the British Columbia Conservation Data Centre. 150 pp.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I, the National Vegetation Classification System: development, status, and applications. The Nature Conservancy. Arlington, VA. 126 pp.

Jennings, M., O. Loucks, D. Glenn-Lewin, R. Peet, D. Faber-Langendoen, D. Grossman, A. Damman, M. Barbour, R. Pfister, M. Walker, S. Talbot, J. Walker, G. Hartshorn, G. Waggoner, M. Abrams, A. Hill, D. Roberts, D. Tart, and M. Rejmanek. 2003. Guidelines for describing associations and alliances of the U.S. National Vegetation Classification. Version 3.0 November 2003. The Ecological Society of America, Vegetation Classification Panel. Washington, D.C. 100 pp. (+ appendices).

NatureServe. 2012. International ecological classification standard: terrestrial ecological classifications. NatureServe Central Databases. Arlington, VA. Data current as of April 24, 2012.

NAWMP (North American Waterfowl Management Plan) Plan Committee. 2004. North American waterfowl management plan 2004. strategic guidance: strengthening the biological foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales. 22 pp.

PIF (Partners in Flight). 2010. Species assessment database. Available at: http://www.rmbo.org/pif/scores/scores.html. Accessed March 23, 2010.

USFWS (U.S. Fish and Wildlife Service). 2005a. Birds of management concern - Region 1 & Region 8 (CNO). U.S. Department of the Interior, Fish and Wildlife Service, Region 1. Portland, OR. 16 pp.

USFWS. 2005b. Regional seabird conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Pacific Region, Migratory Birds and Habitat Programs. Portland, OR. 261 pp. Available at: http://www.fws.gov/pacific/migratorybirds/PDF/Seabird Conservation Plan Complete.pdf. Accessed July 3, 2011.

USFWS. 2008. Birds of conservation concern 2008. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management. Arlington, VA. 85 pp.

USFWS. 2009. Identifying refuge resources of concern and management priorities: a handbook. United States Department of the Interior, U.S. Fish and Wildlife Service, National Wildlife Refuge System. 67 pp.

WDFW (Washington Department of Fish and Wildlife). 2005. Washington's comprehensive wildlife conservation strategy. Washington Department of Fish and Wildlife. Olympia, WA. 723 pp.

Appendix F. Statement of Compliance

STATEMENT OF COMPLIANCE
for Implementation of the
Dungeness National Wildlife Refuge, Clallam County, Washington
Comprehensive Conservation Plan

The following executive orders and legislative acts have been reviewed as they apply to implementation of the Dungeness National Wildlife Refuge Comprehensive Conservation Plan (CCP).

National Environmental Policy Act (1969), as Amended (42 U.S.C. § 4321 et seq.)
The planning process has been conducted in accordance with National Environmental Policy Act (NEPA) implementing procedures, with U.S. Department of the Interior and U.S. Fish and Wildlife Service (Service) procedures, and in coordination with the affected public. The requirements of NEPA (42 U.S. Code [U.S.C.] § 4321 et seq.) and its implementing regulations in 40 Code of Federal Regulations (CFR) 1500-1508 have been satisfied in the procedures used to reach decisions. These procedures included the development of a range of alternatives for the CCP; analysis of the likely effects of each alternative; and public involvement throughout the planning process. The start of the scoping period was announced through a *Federal Register* notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. The draft CCP/environmental assessment (EA) was released for a 30-day public comment period. The affected public was notified of the availability of the document through a *Federal Register* notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. Copies of the draft CCP/EA and/or planning updates were distributed to an extensive mailing list. In addition, the Service participated in a variety of public outreach efforts throughout the planning process (see Appendix K).

The CCP is programmatic in many respects and specific details of certain projects and actions cannot be determined until a later date depending on funding and implementation schedules. Certain projects or actions may require additional NEPA compliance.

National Historic Preservation Act (1966), as Amended (16 U.S.C. § 470 et seq.)
The management of the archaeological and cultural resources of the Refuge would comply with the regulations of Section 106 of the National Historic Preservation Act. Under the proposed action, historic properties would be maintained and repaired as funding becomes available. Maintenance and improvement of historic resources would result in positive impacts to cultural resources; however, determining whether a particular action has the potential to affect cultural resources is an ongoing process that occurs as step-down and site-specific project plans are developed. Should additional historic properties be identified or acquired in the future, the Service would comply with the National Historic Preservation Act if any management actions have the potential to affect these properties.

Executive Order 12372. Intergovernmental Review
Coordination and consultation with affected Tribal, local and State governments, other Federal agencies, and the landowners has been completed through personal contact by refuge staff, Refuge Supervisors and/or inclusion of the appropriate entities on the CCP mailing list.

Executive Order 13175. Consultation and Coordination with Indian Tribal Governments
As required under the Secretary of the Interior Order 3206—American Indian Tribal Rights, Federal Tribal Responsibilities, and the Endangered Species Act—the Project Leader notified and consulted interested tribes. Refuge staff initiated consultation with representatives of the Jamestown S'Klallam Indian Tribe during the planning process.

Executive Order 12898. Federal Actions to Address Environmental Justice in Minority and Low-Income Populations
All Federal actions must address and identify, as appropriate, disproportionally high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes in the United States. Actions in all alternatives were evaluated and no adverse human health or environmental effects were identified for minority or low-income populations, Indian tribes, or anyone else.

Wilderness Preservation Act of 1964 (16 U.S.C. § 1131 et seq.)
The Service has evaluated the suitability of the Refuge for wilderness designation through the "Inventory" phase according to the guidelines of the Wilderness Review process as described in 610 FW 4. In this inventory no areas on the Refuge were found to meet the minimum wilderness criteria for size, naturalness or outstanding opportunities for solitude and primitive/unconfined recreation (see Appendix D for additional details).

Architectural Barriers Act of 1968, as Amended (42 U.S.C. § 4151 et seq.)
This Act requires access to Federal facilities for people with disabilities. Access for persons with disabilities has been considered during the planning process and actions related to access are found in Chapter 2 of the CCP/EA.

National Wildlife Refuge System Administration Act of 1966, as Amended (16 U.S.C. § 668dd-668ee)
This Act requires the Service to develop and implement a CCP for each refuge. The CCP identifies and describes refuge purposes; the vision and goals for the refuge; fish, wildlife, and plant populations and related habitats on the refuge; archaeological and cultural values of the refuge; issues that may affect populations and habitats of fish, wildlife, and plants; actions necessary to restore and improve biological diversity on the refuge; and opportunities for wildlife-dependent recreation, as required by the Act.

During the CCP process, the refuge manager evaluated all existing and proposed uses at the Refuge. Priority wildlife-dependent uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation) are considered automatically appropriate under Service policy and thus exempt from appropriate uses review. Compatibility determinations have been prepared for all uses found appropriate (see Appendices A and B).

E.O. 13186. Responsibilities of Federal Agencies to Protect Migratory Birds
This Order directs agencies to take certain actions to further implement the Migratory Bird Treaty Act. A provision of the Order directs Federal agencies to consider the impacts of their activities, especially in reference to birds on the Service's list of Birds of Conservation Concern. It also directs agencies to incorporate conservation recommendations and objectives in the North American Waterbird Conservation Plan and bird conservation plans developed by Partners in Flight into agency planning as described in Chapter 1. The effects to refuge habitats used by migratory birds from habitat, public use, and cultural resources actions were assessed within the CCP/EA.

Endangered Species Act (1973), as Amended (16 U.S.C. § 1531 et seq.)
This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of state programs. Documentation is required under Section 7 of the Act. Refuge policy requires the refuge manager to document issues that affect or may affect endangered species before initiating projects. Consultation on specific projects would be conducted prior to implementation to avoid any adverse impacts to these species and their habitats.

Coastal Zone Management Act, as Amended (16 U.S.C. § 1451 et seq.)
Section 307(c)(1) of the Coastal Zone Management Act of 1972 as amended, requires each Federal agency conducting or supporting activities directly affecting the coastal zone, to conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state coastal management programs. The implementation of the Dungeness NWR CCP is consistent with the Coastal Zone Management Act.

Executive Order 11990. Protection of Wetlands
The CCP is consistent with Executive Order 11990 because CCP implementation would protect any existing wetlands.

Executive Order 11988. Floodplain Management
Under this order, Federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains." The CCP is consistent with Executive Order 11988 because CCP implementation would maintain and enhance riverine, riparian, wetland habitats located within floodplains on the Refuge, which will minimize flood impacts and continue to contribute to the natural and beneficial fish and wildlife resource values unique to the area.

Integrated Pest Management (IPM), 517 DM 1 and 7 RM 14
In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) approach has been adopted to eradicate, control, or contain pest and invasive species on the Refuge. In accordance with 517 DM 1, only pesticides registered with the US Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

See 602 FW 3, Exhibit 2 for other potential compliance requirements

Chief, Division of Planning, Visitor Services, and Transportation	Date

Document continues on next page.

Appendix G. Integrated Pest Management

G.1 Background

IPM is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. IPM is also a scientifically based, adaptive management process where available scientific information and best professional judgment of the refuge staff as well as other resource experts would be used to identify and implement appropriate management strategies that can be modified and/or changed over time to ensure effective, site-specific management of pest species to achieve desired outcomes. In accordance with 43 CFR 46.145, adaptive management would be particularly relevant where long-term impacts may be uncertain and future monitoring would be needed to make adjustments in subsequent implementation decisions. After a tolerable pest population (threshold) is determined considering achievement of refuge resource objectives and the ecology of pest species, one or more methods, or combinations thereof, would be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding would be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as CCP strategies (see Section 2.0 of this CCP/EA) in an adaptive management context to achieve refuge resource objectives. In order to satisfy requirements for IPM planning as identified in the Director's Memo (dated September 9, 2004) entitled *Integrated Pest Management Plans and Pesticide Use Proposals: Updates, Guidance, and an Online Database*, the following elements of an IPM program have been incorporated into this draft CCP/EA:

- Habitat and/or wildlife objectives that identify pest species and appropriate thresholds to indicate the need for and successful implementation of IPM techniques; and
- Monitoring before and/or after treatment to assess progress toward achieving objectives including pest thresholds.

Where pesticides would be necessary to address pests, this Appendix provides a structured procedure to evaluate potential effects of proposed uses involving ground-based applications to refuge biological resources and environmental quality in accordance with effects analyses presented in Section 4.0 (Environmental Consequences) of this draft CCP/EA. Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate BMPs, where necessary, would be allowed for use on the Refuge.

This Appendix does not describe the more detailed process to evaluate potential effects associated with aerial applications of pesticides. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides would be similar to the process described in this Appendix for ground-based treatments of other pesticides.

G.2 Pest Management Laws and Policies

In accordance with Service policy 569 FW 1 (Integrated Pest Management), plant, invertebrate, and vertebrate pests on units of the National Wildlife Refuge System can be controlled to ensure balanced

wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. Pest control on federal (refuge) lands and waters also is authorized under the following legal mandates:

- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee);
- Plant Protection Act of 2000 (7 USC 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 USC 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 USC 136-136y);
- National Invasive Species Act of 1996 (16 USC 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701);
- Food Quality Protection Act of 1996 (7 USC 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 USC 426-426c, 46 Stat. 1468).

Pests are defined as "…living organisms that may interfere with the site-specific purposes, operations, or management objectives or that jeopardize human health or safety" from Department policy 517 DM 1 (Integrated Pest Management Policy). Similarly, 569 FW 1 defines pests as "…invasive plants and introduced or native organisms that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety." 517 DM 1 also defines an invasive species as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health." Throughout the remainder of this draft CCP/EA, the terms pest and invasive species are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality.

In general, control of pests (vertebrate or invertebrate) on the Refuge would conserve and protect the nation's fish, wildlife, and plant resources as well as maintain environmental quality. From 569 FW 1, animal or plant species, which are considered pests, may be managed if the following criteria are met:

- Threat to human health and well being or private property, the acceptable level of damage by the pest has been exceeded, or State or local government has designated the pest as noxious;
- Detrimental to resource objectives as specified in a refuge resource management plan (e.g., comprehensive conservation plan, habitat management plan), if available; and
- Control would not conflict with attainment of resource objectives or the purposes for which the Refuge was established.

The specific justifications for pest management activities on the Refuge are the following:

- Protect human health and well being;
- Prevent substantial damage to important to refuge resources;
- Protect newly introduced or re-establish native species;
- Control non-native (exotic) species in order to support existence for populations of native species;
- Prevent damage to private property; and
- Provide the public with quality, compatible wildlife-dependent recreational opportunities.

In accordance with Service policy 620 FW 1 (Habitat Management Plans), there are additional management directives regarding invasive species found on the Refuge:

- "We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."
- "Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species..."

Animal species damaging/destroying federal property and/or detrimental to the management program of a refuge may be controlled as described in 50 CFR 31.14 (Official Animal Control Operations). For example, the incidental removal of beaver damaging refuge infrastructure (e.g., clogging with subsequent damaging of water control structures) and/or negatively affecting habitats (e.g., removing woody species from existing or restored riparian) managed on refuge lands may be conducted without a pest control proposal. We recognize beavers are native species and most of their activities or refuge lands represent a natural process beneficial for maintaining wetland habitats. Exotic nutria, whose denning and burrowing activities in wetland dikes causes cave-ins and breaches, can be controlled using the most effective techniques considering site-specific factors without a pest control proposal. Along with the loss of quality wetland habitats associated with breaching of impoundments, the safety of refuge staffs and public (e.g., auto tour routes) driving on structurally compromised levees and dikes can be threaten by sudden and unexpected cave-ins.

Trespass and feral animals also may be controlled on refuge lands. Based upon 50 CFR 28.43 (Destruction of Dogs and Cats), dogs and cats running at large on a national wildlife refuge and observed in the act of killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife. Feral animals should be disposed by the most humane method(s) available and in accordance with relevant Service directives (including Executive Order 11643). Disposed wildlife specimens may be donated or loaned to public institutions. Donation or loans of resident wildlife species would only be made after securing State approval (50 CFR 30.11 [Donation and Loan of Wildlife Specimens]). Surplus wildlife specimens may be sold alive or butchered, dressed and processed subject to federal and state laws and regulations (50 CFR 30.12 [Sale of Wildlife Specimens]).

G.3 Strategies

To fully embrace IPM as identified in 569 FW 1, the following strategies, where applicable, would be carefully considered on the Refuge for each pest species.

G.3.1 Prevention

This would be the most effective and least expensive long-term management option for pests. It encompasses methods to prevent new introductions or the spread of the established pests to un-infested areas. It requires identifying potential routes of invasion to reduce the likelihood of infestation. Hazard Analysis and Critical Control Points (HACCP) planning can be used determine if current management activities on a refuge may introduce and/or spread invasive species in order to identify appropriate BMPs for prevention. See http://www.haccp-nrm.org/ for more information about HACCP planning.

Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods (e.g., wash stations) to prevent re-introductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish newly disturbed sites, prevention would require a reporting mechanism for early detection of new pest occurrences with quick response to eliminate any new satellite pest populations. Prevention would require consideration of the scale and scope of land management activities that may promote pest establishment within un-infested areas or promote reproduction and spread of existing populations. Along with preventing initial introduction, prevention would involve halting the spread of existing infestations to new sites (Mullin et al. 2000). The primary reason for prevention would be to keep pest-free lands or waters from becoming infested. Executive Order 11312 emphasizes the priority for prevention with respect to managing pests.

The following would be methods to prevent the introduction and/or spread of pests on refuge lands:

- Before beginning ground-disturbing activities (e.g., disking, scraping), inventory and prioritize pest infestations in project operating areas and along access routes. Refuge staff would identify pest species on-site or within reasonably expected potential invasion vicinity. Where possible, the refuge staff would begin project activities in un-infested areas before working in pest-infested areas.
- The refuge staff would locate and use pest-free project staging areas. They would avoid or minimize travel through pest-infested areas, or restrict to those periods when spread of seed or propagules of invasive plants would be least likely.
- The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned of pests. Where possible, the refuge staff would clean equipment before entering lands at on-refuge approved cleaning site(s). This practice does not pertain to vehicles traveling frequently in and out of the project area that would remain on roadways. Seeds and plant parts of pest plants would need to be collected, where practical. The refuge staff would remove mud, dirt, and plant parts from project equipment before moving it into a project area.
- The refuge staff would clean all equipment, before leaving the project site, if operating in areas infested with pests. The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned.
- Refuge staffs, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).
- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with on-going restoration of desired vegetation. The refuge staff would revegetate disturbed soil (except travel ways on surfaced projects) to optimize plant establishment for each specific site. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching as necessary. The refuge staff would use native material, where appropriate and feasible. The refuge staff would use certified weed-free or weed-seed-free hay or straw where certified materials are reasonably available.
- The refuge staff would provide information, training, and appropriate pest identification materials to permit holders and recreational visitors. The refuge staff would educate them about pest identification, biology, impacts, and effective prevention measures.
- The refuge staff would require grazing permittees to utilize preventative measures for their livestock while on refuge lands.

- The refuge staff would inspect borrow material for invasive plants prior to use and transport onto and/or within refuge lands.
- The refuge staff would consider invasive plants in planning for road maintenance activities.
- The refuge staff would restrict off-road travel to designated routes.

The following would be methods to prevent the introduction and/or spread of pests into refuge waters:

- The refuge staff would inspect boats (including air boats), trailers, and other boating equipment. Where possible, the refuge staff would remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. Where possible, the refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. If possible, the refuge staff would wash and dry boats, downriggers, anchors, nets, floors of boats, propellers, axles, trailers, and other boating equipment to kill pests not visible at the boat launch.
- Where feasible, the refuge staff would maintain a 100-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. Where possible, the refuge staff would inspect and clean equipment before moving to new sites or one project area to another.

These prevention methods to minimize/eliminate the introduction and/or spread of pests were taken verbatim or slightly modified from Appendix E of US Forest Service (2005).

G.3.2 Mechanical/Physical Methods

These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plants species, these treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical) and include pulling, grubbing, digging, tilling/disking, cutting, swathing, grinding, sheering, girdling, mowing, and mulching of the pest plants.

For animal species, Service employees or their authorized agents could use mechanical/physical methods (including trapping) to control pests as a refuge management activity. Based upon 50 CFR 31.2, trapping can be used on a refuge to reduce surplus wildlife populations for a “balanced conservation program” in accordance with federal or state laws and regulations. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state.

Each of these tools would be efficacious to some degree and applicable to specific situations. In general, mechanical controls can effectively control annual and biennial pest plants. However, to control perennial plants, the root system has to be destroyed or it would resprout and continue to grow and develop. Mechanical controls are typically not capable of destroying a perennial plant’s root system. Although some mechanical tools (e.g., disking, plowing) may damage root systems, they may stimulate regrowth producing a denser plant population that may aid in the spread depending upon the target species (e.g., Canada thistle). In addition, steep terrain and soil conditions would be major factors that can limit the use of many mechanical control methods.

Some mechanical control methods (e.g., mowing), which would be used in combination with herbicides, can be a very effective technique to control perennial species. For example, mowing perennial plants followed sequentially by treating the plant regrowth with a systemic herbicide often would improve the efficacy of the herbicide compared to herbicide treatment only.

G.3.3 Cultural Methods

These methods would involve manipulating habitat to increase pest mortality by reducing its suitability to the pest. Cultural methods would include water-level manipulation, mulching, winter cover crops, changing planting dates to minimize pest impact, prescribed burning (facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species), flaming with propane torches, trap crops, crop rotations that would include non-susceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, proper trash disposal, planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

G.3.4 Biological Control Agents

Classical biological control would involve the deliberate introduction and management of natural enemies (parasites, predators, or pathogens) to reduce pest populations. Many of the most ecologically or economically damaging pest species in the United States originated in foreign countries. These newly introduced pests, which are free from natural enemies found in their country or region of origin, may have a competitive advantage over cultivated and native species. This competitive advantage often allows introduced species to flourish, and they may cause widespread economic damage to crops or out compete and displace native vegetation. Once the introduced pest species population reaches a certain level, traditional methods of pest management may be cost prohibitive or impractical. Biological controls typically are used when these pest populations have become so widespread that eradication or effective control would be difficult or no longer practical.

Biological control has advantages as well as disadvantages. Benefits would include reducing pesticide usage, host specificity for target pests, long-term self-perpetuating control, low cost/acre, capacity for searching and locating hosts, synchronizing biological control agents to hosts' life cycles, and the unlikelihood that hosts would develop resistance to agents. Disadvantages would include the following: limited availability of agents from their native lands, the dependence of control on target species density, slow rate at which control occurs, biotype matching, the difficulty and expense of conflicts over control of the target pest, and host specificity when host populations are low.

A reduction in target species populations from biological controls is typically a slow process, and efficacy can be highly variable. It may not work well in a particular area although it does work well in other areas. Biological control agents would require specific environmental conditions to survive over time. Some of these conditions are understood; whereas, others are only partially understood or not at all.

Biological control agents would not eradicate a target pest. When using biological control agents, residual levels of the target pest typically are expected; the agent population level or survival would be dependent upon the density of its host. After the pest population decreases, the population of the biological control agent would decrease correspondingly. This is a natural cycle. Some pest populations (e.g., invasive plants) would tend to persist for several years after a biological control agent becomes established due to seed reserves in the soil, inefficiencies in the agents search behavior, and the natural lag in population buildup of the agent.

The full range of pest groups potentially found on refuge lands and waters would include diseases, invertebrates (insects, mollusks), vertebrates, and invasive plants (the most common group). Often it is assumed that biological control would address many if not most of these pest problems. There are several well-documented success stories of biological control of invasive weed species in the Pacific Northwest including Mediterranean sage, St. Johnswort (Klamath weed) and tansy ragwort. Emerging success stories include Dalmatian toadflax, diffuse knapweed, leafy spurge, purple loosestrife and yellow star thistle. However, historically, each new introduction of a biological control agent in the United States has only about a 30% success rate (Coombs et al. 2004). Refer to Coombs et al. (2004) for the status of biological control agents for invasive plants in the Pacific Northwest.

Introduced species without desirable close relatives in the United States would generally be selected as biological controls. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted as biological controls (Center et al. 1997, Hasan and Ayres 1990).

The refuge staff would ensure introduced agents are approved by the applicable authorities. Except for a small number of formulated biological control products registered by USEPA under FIFRA, most biological control agents are regulated by the US Department of Agriculture (USDA)-Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ). State departments of agriculture and, in some cases, county agricultural commissioners or weed districts, have additional approval authority.

Federal permits (USDA-APHIS-PPQ Form 526) are required to import biocontrols agents from another state. Form 526 may be obtained by writing:

USDA-APHIS-PPQ
Biological Assessment and Taxonomic Support
4700 River Road, Unit 113
Riverdale, MD 20737

Or through the internet at:

http://www.aphis.usda.gov/ppq/permits/bioligical/weedbio.html

The Service strongly supports the development, and legal and responsible use of appropriate, safe, and effective biological control agents for nuisance and non-indigenous or pest species.

State and county agriculture departments may also be sources for biological control agents or they may have information about where biological control agents may be obtained. Commercial sources should have an Application and Permit to Move Live Plant Pests and Noxious Weeds (USDA-PPQ Form 226 USDA-APHIS-PPQ, Biological Assessment and Taxonomic Support, 4700 River Road, Unit 113, Riverdale, MD 20737) to release specific biological control agents in a state and/or county. Furthermore, certification regarding the biological control agent's identity (genus, specific epithet, sub-species and variety) and purity (e.g., parasite free, pathogen free, and biotic and abiotic contaminants) should be specified in purchase orders.

Biological control agents are subject to 7 RM 8 (Exotic Species Introduction and Management). In addition, the refuge staff would follow the International Code of Best Practice for Classical Biological Control of Weeds (http://sric.ucdavis.edu/exotic /exotic.htm) as ratified by delegates to the X International Symposium on Biological Control of Weeds, Bozeman, MT, July 9, 1999. This code identifies the following:

- Release only approved biological control agents,
- Use the most effective agents,
- Document releases, and
- Monitor for impact to the target pest, non-target species and the environment.

Biological control agents formulated as pesticide products and registered by the USEPA (e.g., *Bti*) are also subject to PUP review and approval (see below).

A record of all releases would be maintained with date(s), location(s), and environmental conditions of the release site(s); the identity, quantity, and condition of the biological control agents released; and other relevant data and comments such as weather conditions. Systematic monitoring to determine the establishment and effectiveness of the release is also recommended.

NEPA documents regarding biological and other environmental effects of biological control agents prepared by another federal agency, where the scope is relevant to evaluation of releases on refuge lands, would be reviewed. Possible source agencies for such NEPA documents include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s) from the review. Incorporating by reference (43 CFR 46.135) is a technique used to avoid redundancies in analysis. It also can reduce the bulk of a Service NEPA document, which only must identify the documents that are incorporated by reference. In addition, relevant portions must be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

G.3.5 Pesticides

The selective use of pesticides would be based upon pest ecology (including mode of reproduction), the size and distribution of its populations, site-specific conditions (e.g., soils, topography), known efficacy under similar site conditions, and the capability to utilize best management practices (BMPs) to reduce/eliminate potential effects to non-target species, sensitive habitats, and potential to contaminate surface and groundwater. All pesticide usage (pesticide, target species, application rate, and method of application) would comply with the applicable federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting. Before pesticides can be used to eradicate, control, or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 569 FW 1. PUP records would provide a detailed, time-, site-, and target-specific description of the proposed use of pesticides on the Refuge. All PUPs would be created, approved or disapproved, and stored in the Pesticide Use Proposal System (PUPS), which is a centralized database only accessible on the Service's intranet (https://systems.fws.gov/pups). Only Service employees would be authorized to access PUP records for a refuge in this database.

Application equipment would be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas and degradation of surface and groundwater quality. Where possible, target-specific equipment (e.g., backpack sprayer, wiper) would be used to treat target pests. Other target-specific equipment to apply pesticides would include soaked wicks or paint brushes for wiping vegetation and lances, hatchets, or syringes for direct injection into stems. Granular pesticides may be applied using seeders or other specialized

dispensers. In contrast, aerial spraying (e.g., fixed wing or helicopter) would only be used where access is difficult (remoteness) and/or the size/distribution of infestations precludes practical use of ground-based methods.

Because repeated use of one pesticide may allow resistant organisms to survive and reproduce, multiple pesticides with variable modes of action would be considered for treatments on refuge lands and waters. This is especially important if multiple applications within years and/or over a growing season likely would be necessary for habitat maintenance and restoration activities to achieve resource objectives. Integrated chemical and non-chemical controls also are highly effective, where practical, because pesticide-resistant organisms can be removed from the site.

Cost may not be the primary factor in selecting a pesticide for use on a refuge. If the least expensive pesticide would potentially harm natural resources or people, then a different product would be selected, if available. The most efficacious pesticide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats would be acceptable for use on refuge lands in the context of an IPM approach.

G.3.6 Habitat Restoration/Maintenance

Restoration and/or proper maintenance of refuge habitats associated with achieving wildlife and habitat objectives would be essential for long-term prevention, eradication, or control (at or below threshold levels) of pests. Promoting desirable plant communities through the manipulation of species composition, plant density, and growth rate is an essential component of invasive plant management (Masters et al. 1996, Masters and Shelly 2001, Brooks et al. 2004). The following three components of succession could be manipulated through habitat maintenance and restoration: site availability, species availability, and species performance (Cox and Anderson 2004). Although a single method (e.g., herbicide treatment) may eliminate or suppress pest species in the short term, the resulting gaps and bare soil create niches that are conducive to further invasion by the species and/or other invasive plants. On degraded sites where desirable species are absent or in low abundance, revegetation with native/desirable grasses, forbs, and legumes may be necessary to direct and accelerate plant community recovery, and achieve site-specific objectives in a reasonable time frame. The selection of appropriate species for revegetation would be dependent on a number of factors including resource objectives and site-specific, abiotic factors (e.g., soil texture, precipitation/temperature regimes, and shade conditions). Seed availability and cost, ease of establishment, seed production, and competitive ability also would be important considerations.

G.4 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) of pest problems is too extensive and beyond the available capital resources to effectively address during any single field season. To manage pests in the Refuge, it would be essential to prioritize treatment of infestations. Highest priority treatments would be focused on early detection and rapid response to eliminate infestations of new pests, if possible. This would be especially important for aggressive pests potentially impacting species, species groups, communities, and/or habitats associated refuge purpose(s), NWRS resources of concern (federally listed species, migratory birds, selected marine mammals, and interjurisdictional fish), and native species for maintaining/restoring biological integrity, diversity, and environmental health.

The next priority would be treating established pests that appear in one or more previously un-infested areas. Moody and Mack (1988) demonstrated through modeling that small, new outbreaks of invasive plants eventually would infest an area larger than the established, source population. They also found that control efforts focusing on the large, main infestation rather than the new, small satellites reduced the chances of overall success. The lowest priority would be treating large infestations (sometimes monotypic stands) of well-established pests. In this case, initial efforts would focus upon containment of the perimeter followed by work to control/eradicate the established infested area. If containment and/or control of a large infestation is not effective, then efforts would focus upon halting pest reproduction or managing source populations. Maxwell et al. (2009) found treating fewer populations that are sources represents an effective long-term strategy to reduce of total number of invasive populations and decreasing meta-population growth rates.

Although state-listed noxious weeds would always of high priority for management, other pest species known to cause substantial ecological impact would also be considered. For example, cheatgrass may not be listed by a state as noxious, but it can greatly alter fire regimes in shrub steppe habitats resulting in large monotypic stands that displace native bunch grasses, forbs, and shrubs. Pest control would likely require a multi-year commitment from the refuge staff. Essential to the long-term success of pest management would be pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

G.5 Best Management Practices (BMPs)

BMPs can minimize or eliminate possible effects associated with pesticide usage to non-target species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of Interior Pesticide Use Policy (517 DM 1) and the Service Integrated Pest Management policy (569 FW 1), the use of applicable BMPs (where feasible) also would likely ensure that pesticide uses may not adversely affect federally listed species and/or their critical habitats through determinations made using the process described in 50 CFR part 402.
The following are BMPs pertaining to mixing/handling and applying pesticides for all ground-based treatments of pesticides, which would be considered and utilized, where feasible, based upon target- and site-specific factors and time-specific environmental conditions. Although not listed below, the most important BMP to eliminate/reduce potential impacts to non-target resources would be an IPM approach to prevent, control, eradicate, and contain pests.

G.5.1 Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks would not be left unattended during filling.
- All pesticide containers would be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
- All pesticide spray equipment would be properly cleaned. Where possible, rinsate would be used as part of the make-up water in the sprayer tank and applied to treatment areas.
- The refuge staff would triple rinse and recycle (where feasible) pesticide containers.
- All unused pesticides would be properly discarded at a local “safe send” collection.
- Pesticides and pesticide containers would be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife and prevent soil and water contaminant.

- The refuge staff would consider the water quality parameters (e.g., pH, hardness) that are important to ensure greatest efficacy where specified on the pesticide label.
- All pesticide spills would be addressed immediately using procedures identified in the refuge spill response plan.

G.5.2 Applying Pesticides

- Pesticide treatments would only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate, state or BLM certification to safely and effectively conduct these activities on refuge lands and waters.
- The refuge staff would comply with all federal, state, and local pesticide use laws and regulations as well as Departmental, Service, and NWRS pesticide-related policies. For example, the refuge staff would use application equipment and apply rates for the specific pest(s) identified on the pesticide label as required under FIFRA.
- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators would review the labels, MSDSs, and Pesticide Use Proposal (PUPs) for each pesticide, determining the target pest, appropriate mix rate(s), PPE, and other requirements listed on the pesticide label.
- A 1-foot no-spray buffer from the water's edge would be used, where applicable and where it does not detrimentally influence effective control of pest species.
- Use low-impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Use low-volume rather than high-volume foliar applications where low-impact methods above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates.
- Applicators would use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators would use the largest droplet size that results in uniform coverage.
- Applicators would use drift reduction technologies such as low-drift nozzles, where possible.
- Where possible, spraying would occur during low (average<7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85°F).
- Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment would be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications would be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) would typically be conducted during early morning hours.
- Spray applications would not be conducted on days with >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize/eliminate potential runoff.
- Where possible, applicators would use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.

- Where possible, applicators would use a non-toxic dye to aid in identifying target area treated as well as potential over spray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, the application would be stopped until repairs can be made to the sprayer.
- For pesticide uses associated with cropland and facilities management, buffers, as appropriate, would be used to protect sensitive habitats, especially wetlands and other aquatic habitats.
- When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones may be identified to protect sensitive areas downwind of applications. The refuge staff would only apply adjacent to sensitive areas when the wind is blowing the opposite direction.
- Applicators would utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
- The refuge staff would consider timing of application so native plants are protected (e.g., senescence) while effectively treating invasive plants.
- Rinsate from cleaning spray equipment after application would be recaptured and reused or applied to an appropriate pest plant infestation.
- Application equipment (e.g., sprayer, ATV, tractor) would be thoroughly cleaned and PPE would be removed/disposed of on-site by applicators after treatments to eliminate the potential spread of pests to un-infested areas.
- Cleaning boots (or use rubber boots to aid in sanitation) and brush off clothing in a place where monitoring is feasible to control for new seed transportation.

G.6 Safety

G.6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE would be worn at all times during handling, mixing, and applying. PPE can include the following: disposable (e.g., Tyvek) or laundered coveralls; gloves (latex, rubber, or nitrile); rubber boots; and/or an NIOSH-approved respirator. Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions. Persons mixing these solutions can be best protected if they wear long gloves, an apron, footwear, and a face shield.

Coveralls and other protective clothing used during an application would be laundered separately from other laundry items. Transporting, storing, handling, mixing and disposing of pesticide containers would be consistent with label requirements, USEPA and OSHA requirements, and Service policy.

If a respirator is necessary for a pesticide use, then the following requirements would be met in accordance with Service safety policy: a written Respirator Program, fit testing, physical examination (including pulmonary function and blood work for contaminants), and proper storage of the respirator.

G.6.2 Notification

The restricted entry interval (REI) is the time period required after the application at which point someone may safely enter a treated area without PPE. Refuge staff, authorized management agents of the Service, volunteers, and members of the public who could be in or near a pesticide treated area within the stated re-entry time period on the label would be notified about treatment areas. Posting would occur at any site where individuals might inadvertently become exposed to a pesticide during other activities on the Refuge. Where required by the label and/or state-specific regulations, sites would also be posted on its perimeter and at other likely locations of entry. The refuge staff would also notify appropriate private property owners of an intended application, including any private individuals who have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

G.6.3 Medical Surveillance

Medical surveillance may be required for Service personnel and approved volunteers who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with 242 FW 7.12A, Service personnel would be medically monitoring if one or more of the following criteria is met: exposed or may be exposed to concentrations at or above the published permissible exposure limits or threshold limit values (see 242 FW 4); use pesticides in a manner considered "frequent pesticide use"; or use pesticides in a manner that requires a respirator (see 242 FW 14 for respirator use requirements). In 242 FW7.7A, "**Frequent Pesticide Use** means when a person applying pesticide handles, mixes, or applies pesticides, with a Health Hazard rating of 3 or higher, for 8 or more hours in any week or 16 or more hours in any 30-day period." Under some circumstances, individuals may be medically monitored who use pesticides infrequently (see section 7.7), experience an acute exposure (sudden, short-term), or use pesticides with a health hazard ranking of 1 or 2. This decision would consider the individual's health and fitness level, the pesticide's specific health risks, and the potential risks from other pesticide-related activities. Refuge cooperators (e.g., cooperative farmers) and other authorized agents (e.g., state and county employees) would be responsible for their own medical monitoring needs and costs.

Standard examinations (at refuge expense) of appropriate refuge staff would be provided by the nearest certified occupational health and safety physician as determined by Federal Occupational Health.

G.6.4 Certification and Supervision of Pesticide Applicators

Appropriate refuge staff or approved volunteers handling, mixing, and/or applying or directly supervising others engaged in pesticide use activities would be trained and state or federally (BLM) licensed to apply pesticides to refuge lands or waters. In accordance with 242 FW7.18A and 569 FW 1.10B, certification is required to apply restricted use pesticides based upon USEPA regulations. For safety reasons, all individuals participating in pest management activities with general use pesticides also are encouraged to attend appropriate training or acquire pesticide applicator certification. The certification requirement would be for a commercial or private applicator depending upon the state. New staff unfamiliar with proper procedures for storing, mixing, handling, applying, and disposing of herbicides and containers would receive orientation and training before handling or using any products. Documentation of training would be kept in the files at the refuge office.

G.6.5 Record Keeping

Labels and material safety data sheets
Pesticide labels and material safety data sheets (MSDSs) would be maintained at the refuge shop and laminated copies in the mixing area. These documents also would be carried by field applicators, where possible. A written reference (e.g., note pad, chalk board, dry erase board) for each tank to be mixed would be kept in the mixing area for quick reference while mixing is in progress. In addition, approved PUPs stored in the PUPS database typically contain website links (URLs) to pesticide labels and MSDSs.

Pesticide use proposals (PUPs)
A PUP would be prepared for each proposed pesticide use associated with annual pest management on refuge lands and waters. A PUP would include specific information about the proposed pesticide use including the common and chemical names of the pesticide(s), target pest species, size and location of treatment site(s), application rate(s) and method(s), and federally listed species determinations, where applicable.

In accordance with Service guidelines (Director's memo [December 12, 2007]), a refuge staff may receive up to five-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or a habitat management plan (HMP) if IPM strategies and potential environmental effects are adequately addressed within appropriate NEPA documentation.

PUPs would be created, approved or disapproved, and stored as records in the Pesticide Use Proposal System (PUPS), which is centralized database on the Service's intranet (https://systems.fws.gov/pups). Only Service employees can access PUP records in this database.

Pesticide usage
In accordance with 569 FW 1, the refuge Project Leader would be required to maintain records of all pesticides annually applied on lands or waters under refuge jurisdiction. This would encompass pesticides applied by other federal agencies, state and county governments, non-government applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, desiccants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:

- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated
- Total amount of pesticides used (lbs. or gallons)
- Total amount of active ingredient(s) used (lbs.)
- Target pest(s)
- Efficacy (% control)

To determine whether treatments are efficacious (eradicating, controlling, or containing the target pest) and achieving resource objectives, habitat and/or wildlife response would be monitored both pre- and post-treatment, where possible. Considering available annual funding and staffing, appropriate monitoring data regarding characteristics (attributes) of pest infestations (e.g., area, perimeter, degree of infestation-density, % cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database (e.g., Refuge Habitat Management Database), preferably a geo-referenced data management system (e.g., Refuge Lands GIS) to facilitate data analyses and subsequent reporting. In accordance with adaptive management, data analysis and interpretation would allow treatments to be modified or changed over time, as necessary, to achieve resource objectives considering site-specific conditions in conjunction with habitat and/or wildlife responses. Monitoring could also identify short- and long-term impacts to natural resources and environmental quality associated with IPM treatments in accordance with adaptive management principles identified in 43 CFR 46.145.

G.7 Evaluating Pesticide Use Proposals

Pesticides would only be used on refuge lands for habitat management as well as croplands/facilities maintenance after approval of a PUP. In general, proposed pesticide uses on refuge lands would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Section 7.5). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. In general, only pesticide uses with appropriate BMPs (see Section 4.0) for habitat management and cropland/facilities maintenance on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

G.7.1 Overview of Ecological Risk Assessment

An ecological risk assessment process would be used to evaluate potential adverse effects to biological resources as a result of a pesticide(s) proposed for use on refuge lands. It is an established quantitative and qualitative methodology for comparing and prioritizing risks of pesticides and conveying an estimate of the potential risk for an adverse effect. This quantitative methodology provides an efficient mechanism to integrate best available scientific information regarding hazard, patterns of use (exposure), and dose-response relationships in a manner that is useful for ecological risk decision-making. It would provide an effective way to evaluate potential effects where there is missing or unavailable scientific information (data gaps) to address reasonable, foreseeable adverse effects in the field as required under 40 CFR Part 1502.22. Protocols for ecological risk assessment of pesticide uses on the refuge were developed through research and established by the US Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section 6.2.3.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the USEPA to meet regulatory requirements under FIFRA. These studies assess the acute (lethality) and chronic (reproductive) effects associated with short- and long-term exposure to pesticides on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants. Other effects data publicly available would also be utilized for risk assessment protocols described herein. Toxicity endpoint and environmental fate data are available from a variety of resources. Some of the more useful resources can be found in Section 7.5.

Table G-1. Ecotoxicity tests used to evaluate potential effects to birds, fish, and mammals to establish toxicity endpoints for risk quotient calculations

Species Group	Exposure	Measurement endpoint
Bird	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[1]
Fish	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[2]
Mammal	Acute	Oral Lethal Dose (LD_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[3]

[1]Measurement endpoints typically include a variety of reproductive parameters (e.g., number of eggs, number of offspring, eggshell thickness, and number of cracked eggs).
[2]Measurement endpoints for early life stage/life cycle typically include embryo hatch rates, time to hatch, growth, and time to swim-up.
[3]Measurement endpoints include maternal toxicity, teratogenic effects or developmental anomalies, evidence of mutagenicity or genotoxicity, and interference with cellular mechanisms such as DNA synthesis and DNA repair.

G.7.2 Determining Ecological Risk to Fish and Wildlife

The potential for pesticides used on the refuge to cause direct adverse effects to fish and wildlife would be evaluated using USEPA's Ecological Risk Assessment Process (USEPA 2004). This deterministic approach, which is based upon a two-phase process involving estimation of environmental concentrations and then characterization of risk, would be used for ecological risk assessments. This method integrates exposure estimates (estimated environmental concentration [EEC] and toxicological endpoints [e.g., LC_{50} and oral LD_{50}]) to evaluate the potential for adverse effects to species groups (birds, mammals, and fish) representative of legal mandates for managing units of the NWRS. This integration is achieved through risk quotients (RQs) calculated by dividing the EEC by acute and chronic toxicity values selected from standardized toxicological endpoints or published effect (Table G-1).

$$RQ = EEC/Toxicological\ Endpoint$$

The level of risk associated with direct effects of pesticide use would be characterized by comparing calculated RQs to the appropriate Level of Concern (LOC) established by US Environmental Protection Agency (1998 [Table G-2]). The LOC represents a quantitative threshold value for screening potential adverse effects to fish and wildlife resources associated with pesticide use. The following are four exposure-species group scenarios that would be used to characterize ecological risk to fish and wildlife on the Refuge: acute-listed species, acute-nonlisted species, chronic-listed species, and chronic-nonlisted species.

Acute risk would indicate the potential for mortality associated with short-term dietary exposure to pesticides immediately after an application. For characterization of acute risks, median values from LC50 and LD50 tests would be used as toxicological endpoints for RQ calculations. In contrast, chronic risks would indicate the potential for adverse effects associated with long-term dietary exposure to pesticides from a single application or multiple applications over time (within a season and over years). For characterization of chronic risks, the no observed concentration (NOAEC) or no observed effect concentration (NOEC) for reproduction would be used as toxicological endpoints for RQ calculations. Where available, the NOAEC would be preferred over a NOEC value.

Listed species are those federally designated as threatened, endangered, or proposed in accordance with the Endangered Species Act of 1973 (16 USC 1531-1544, 87 Stat. 884, as amended-Public Law 93-205). For listed species, potential adverse effects would be assessed at the individual level because loss of individuals from a population could detrimentally impact a species. In contrast, risks to nonlisted species would consider effects at the population level. A RQ<LOC would indicate the proposed pesticide use "may affect, not likely to adversely affect" individuals (listed species) and it would not pose an unacceptable risk for adverse effects to populations (non-listed species) for each taxonomic group (Table G-2). In contrast, an RQ>LOC would indicate a "may affect, likely to adversely affect" for listed species and it would also pose unacceptable ecological risk for adverse effects to nonlisted species.

Table G-2. Presumption of unacceptable risk for birds, fish, and mammals (USEPA 1998)

Risk Presumption		**Level of Concern**	
		Listed Species	**Non-listed Species**
Acute	Birds	0.1	0.5
	Fish	0.05	0.5
	Mammals	0.1	0.5
Chronic	Birds	1.0	1.0
	Fish	1.0	1.0
	Mammals	1.0	1.0

Environmental exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides which would be sprayed can move through the air (e.g., particle or vapor drift) and may eventually end up in other parts of the environment such as non-target vegetation, soil, or water. Pesticides applied directly to the soil may be washed off the soil into nearby bodies of surface water (e.g., surface runoff) or may percolate through the soil to lower soil layers and groundwater (e.g., leaching) (Baker and Miller 1999, Pope et al. 1999, Butler et al. 1998, Ramsay et al. 1995, EXTOXNET 1993a). Pesticides which would be injected into the soil may also be subject to the latter two fates. The aforementioned possibilities are by no means complete, but it does indicate movement of pesticides in the environment is very complex with transfers occurring continually among different environmental compartments. In some cases, these exchanges occur not only between areas that are close together, but it also may involve transportation of pesticides over long distances (Barry 2004, Woods 2004).

Terrestrial exposure

The ECC for exposure to terrestrial wildlife would be quantified using an USEPA screening-level approach (USEPA 2004). This screening-level approach is not affected by product formulation

because it evaluates pesticide active ingredient(s). This approach would vary depending upon the proposed pesticide application method: spray or granular.

Terrestrial-spray application

For spray applications, exposure would be determined using the Kanaga nomogram method (USEPA 2012, USEPA 2004, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (USEPA 2005). To estimate the maximum (initial) pesticide residue on short grass (<20 cm tall) as a general food item category for terrestrial vertebrate species, T-REX input variables would include the following from the pesticide label: maximum pesticide application rate (pounds active ingredient [acid equivalent]/acre) and pesticide half-life (days) in soil. Although there are other food item categories (tall grasses; broadleaf plants and small insects; and fruits, pods, seeds and large insects), short grass was selected because it would yield maximum EECs (240 ppm per lb. ai/acre) for worst-case risk assessments. Short grass is not representative of forage for carnivorous species (e.g., raptors), but it would characterize the maximum potential exposure through the diet of avian and mammalian prey items. Consequently, this approach would provide a conservative screening tool for pesticides that do not biomagnify.

For RQ calculations in T-REX, the model would require the weight of surrogate species and Mineau scaling factors (Mineau et al. 1996). Body weights of bobwhite quail and mallard are included in T-REX by default, but body weights of other organisms (Table 3) would be entered manually. The Mineau scaling factor accounts for small-bodied bird species that may be more sensitive to pesticide exposure than would be predicted only by body weight. Mineau scaling factors would be entered manually with values ranging from 1 to 1.55 that are unique to a particular pesticide or group of pesticides. If specific information to select a scaling factor is not available, then a value of 1.15 would be used as a default. Alternatively, zero would be entered if it is known that body weight does not influence toxicity of pesticide(s) being assessed. The upper bound estimate output from the T-REX Kanaga nomogram would be used as an EEC for calculation of RQs. This approach would yield a conservative estimate of ecological risk.

Table G-3. Average body weight of selected terrestrial wildlife species frequently used in research to establish toxicological endpoints (Dunning 1984)

Species	Body Weight (kg)
Mammal (15 g)	0.015
House sparrow	0.0277
Mammal (35 g)	0.035
Starling	0.0823
Red-winged blackbird	0.0526
Common grackle	0.114
Japanese quail	0.178
Bobwhite quail	0.178
Rat	0.200
Rock dove (aka pigeon)	0.542
Mammal (1,000 g)	1.000
Mallard	1.082
Ring-necked pheasant	1.135

Terrestrial – granular application

Granular pesticide formulations and pesticide-treated seed would pose a unique route of exposure for avian and mammalian species. The pesticide is applied in discrete units which birds or mammals might ingest accidentally with food items or intentionally as in the case of some bird species actively seeking and picking up gravel or grit to aid digestion or seed as a food source. Granules may also be consumed by wildlife foraging on earthworms, slugs or other soft-bodied soil organisms to which the granules may adhere.

Terrestrial wildlife RQs for granular formulations or seed treatments would be calculated by dividing the maximum milligrams of active ingredient (a.i.) exposed (e.g., EEC) on the surface of an area equal to 1 square foot by the appropriate LD50 value multiplied by the surrogate's body weight (Table G-3). An adjustment to surface area calculations would be made for broadcast, banded, and in-furrow applications. An adjustment also would be made for applications with and without incorporation of the granules. Without incorporation, it would be assumed that 100% of the granules remain on the soil surface available to foraging birds and mammals. Press wheels push granules flat with the soil surface, but they are not incorporated into the soil. If granules are incorporated in the soil during band or T-band applications or after broadcast applications, it would be assumed only 15% of the applied granules remain available to wildlife. It would be assumed that only 1% of the granules are available on the soil surface following in-furrow applications.

EECs for pesticides applied in granular form and as seed treatments would be determined considering potential ingestion rates of avian or mammalian species (e.g., 10-30% body weight/day). This would provide an estimate of maximum exposure that may occur as a result of granule or seed treatment spills such as those that commonly occur at end rows during application and planting. The availability of granules and seed treatments to terrestrial vertebrates would also be considered by calculating the loading per unit area (LD_{50}/ft^2) for comparison to USEPA Level of Concerns (USEPA 1998). The T-REX version 1.2.3 (USEPA 2005) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas would be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% granules, bait, or seed remain unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft.^2/acre)/(row\ spacing\ (ft.))] / (row\ spacing\ (ft.)\}$$

or

$$mg\ a.i./ft^2 = [(lbs\ product/1{,}000\ ft.\ row)(\%\ a.i.)(1{,}000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, and seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1{,}000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}590\ mg/lb.)] / (43{,}560\ ft.^2/acre)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*
- *Conversion for calculating mg a.i./ft.^{2} using ounces: 453,580 mg/lb. /16 = 28,349 mg/oz.*

The following equation would be used to calculate an RQ based on the EEC calculated by one of the above equations. The EEC would be divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table G-3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, an RQ>LOC would be a presumption of unacceptable ecological risk. An RQ<LOC would be a presumption of acceptable risk with only minor, temporary, or localized effects to species.

Aquatic exposure

Exposures to aquatic habitats (e.g., wetlands, meadows, ephemeral pools, water delivery ditches) would be evaluated separately for ground-based pesticide treatments of habitats managed for fish and wildlife compared with cropland/facilities maintenance. The primary exposure pathway for aquatic organisms from any ground-based treatments likely would be particle drift during the pesticide application. However, different exposure scenarios would be necessary as a result of contrasting application equipment and techniques as well as pesticides used to control pests on agricultural lands (especially those cultivated by cooperative farmers for economic return from crop yields) and facilities maintenance (e.g., roadsides, parking lots, trails) compared with other managed habitats on the Refuge. In addition, pesticide applications may be done <25 feet of the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (≥25 feet) would be used for croplands/facilities maintenance treatments.

Habitat treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table 4) would be would be derived from Urban and Cook (1986) that assumes an intentional overspray to an entire, non-target water body (1-foot depth) from a treatment <25 feet from the high water mark using the max application rate (acid basis [see above]). However, use of BMPs for applying pesticides (see Section 4.2) would likely minimize/eliminate potential drift to non-target aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100% overspray (RQ>LOC), then the proposed pesticide use may be disapproved or the PUP would be approved at a lower application rate to minimize/eliminate unacceptable risk to aquatic organisms (RQ=LOC).

Table G-4. Estimated Environmental Concentrations (ppb) of pesticides in aquatic habitats (1 foot depth) immediately after direct application (Urban and Cook 1986)

Lbs/acre	EEC (ppb)
0.10	36.7
0.20	73.5
0.25	91.9
0.30	110.2
0.40	147.0
0.50	183.7
0.75	275.6
1.00	367.5
1.25	459.7
1.50	551.6
1.75	643.5
2.00	735.7
2.25	827.6
2.50	919.4
3.00	1,103.5
4.00	1,471.4
5.00	1,839
6.00	2,207
7.00	2,575
8.00	2,943
9.00	3,311
10.00	3,678

Cropland/facilities maintenance treatments

Field drift studies conducted by the Spray Drift Task Force, which is a joint project of several agricultural chemical businesses, were used to develop a generic spray drift database. From this database, the AgDRIFT computer model was created to satisfy USEPA pesticide registration spray drift data requirements and as a scientific basis to evaluate off-target movement of pesticides from particle drift and assess potential effects of exposure to wildlife. Several versions of the computer model have been developed (i.e., v2.01 through v2.10). The Spray Drift Task Force AgDRIFT® model version 2.01 (SDTF 2003, AgDRIFT 2001) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications >25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agdrift.com. At this website, click “AgDRIFT 2.0” and then click “Download Now” and follow the instructions to obtain the computer model.

The AgDRIFT model is composed of submodels called tiers. Tier I Ground submodel would be used to assess ground-based applications of pesticides. Tier outputs (EECs) would be calculated with AgDRIFT using the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium droplet size, EPA-defined wetland, and a ≥25-foot distance (buffer) from treated area to water.

Use of information on effects of biological control agents, pesticides, degradates, and adjuvants

NEPA documents regarding biological and other environmental effects of biological control agents, pesticides, degradates, and adjuvants prepared by another federal agency, where the scope would be

relevant to evaluation of effects from pesticide uses on refuge lands, would be reviewed. Possible source agencies for such NEPA documents would include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s). Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It also would reduce the bulk of a Service NEPA document, which only would identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

In accordance with the requirements set forth in 43 CFR 46.135, the Service would specifically incorporate through reference ecological risk assessments prepared by the US Forest Service (http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm) and Bureau of Land Management (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). These risk assessments and associated documentation also are available in total with the administrative record for the Final Environmental Impact Statement entitled *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants* (USFS 2005) and *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS* (PEIS) (BLM 2007). In accordance with 43 CFR 46.120(d), use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses would avoid redundancy and unnecessary paperwork.

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide and adjuvant uses prepared by the US Forest Service would be incorporated by reference:

- 2,4-D
- Chlorsulfuron
- Clopyralid
- Dicamba
- Glyphosate
- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE) based surfactants

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the Bureau of Land Management would be incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr

- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive (diflufenzopyr and dicamba)
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (*Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals*)

Assumptions for ecological risk assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the US Environmental Protection Agency's (2004) process. These assumptions may be risk neutral or may lead to an over- or under-estimation of risk from pesticide exposure depending upon site-specific conditions. The following describes these assumptions, their application to the conditions typically encountered, and whether or not they may lead to recommendations that are risk neutral, underestimate, or overestimate ecological risk from potential pesticide exposure.

- Indirect effects would not be evaluated by ecological risk assessments. These effects include the mechanisms of indirect exposure to pesticides: consuming prey items (fish, birds, or small mammals), reductions in the availability of prey items, and disturbance associated with pesticide application activities.
- Exposure to a pesticide product can be assessed based upon the active ingredient. However, exposure to a chemical mixture (pesticide formulation) may result in effects that are similar or substantially different compared to only the active ingredient. Non-target organisms may be exposed directly to the pesticide formulation or only various constituents of the formulation as they dissipate and partition in the environment. If toxicological information for both the active ingredient and formulated product are available, then data representing the greatest potential toxicity would be selected for use in the risk assessment process (USEPA 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.
- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data are selected for the most sensitive species tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data would not be limited to the species previously listed as common surrogates.
- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted-average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or

maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data are usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.

- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they would be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days exposure exceeds a Level of Concern may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the Level of Concern translates into greater the ecological risk. This is a qualitative assessment, and is subject to reviewer's expertise in ecological risk assessment and tolerance for risk.
- The length of time used to calculate the TWA can have a substantial effect on the exposure estimates and there is no standard method for determining the appropriate duration for this estimate. The T-REX model assumes a 21-week exposure period, which is equivalent to avian reproductive studies designed to establish a steady-state concentration for bioaccumulative compounds. However, this does not necessarily define the true exposure duration needed to elicit a toxicological response. Pesticides, which do not bioaccumulate, may achieve a steady-state concentration earlier than 21 weeks. The duration of time for calculating TWAs would require justification and it would not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.
- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most pertinent for assessing exposure in terrestrial species that forage on vegetation. However, these data are often not available and it can be misleading particularly if the compound is prone to "wash-off." Soil half-life is the most common degradation data available. Dissipation or degradation data that would reflect the environmental conditions typical of refuge lands would be utilized, if available.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column.

- Actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area, or adjacent areas receiving pesticide at rates commensurate with the treatment rate. This assumption would produce a maximum estimate of exposure for risk characterization. This assumption would likely lead to an overestimation of exposure for species that do not permanently and exclusively occupy the treated area (USEPA 2004).
- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the USEPA risk assessment protocols. Research suggests <15% of the diet can consist of incidentally ingested soil depending upon species and feeding strategy (Beyer et al. 1994). An assessment of pesticide concentrations in soil compared to food item categories in the Kanaga nomogram indicates incidental soil ingestion would not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists of a contaminated food source (Fletcher et al. 1994). An exception to this may be soil-applied pesticides in which exposure from incidental ingestion of soil may increase. Potential for pesticide exposure under this assumption may be underestimated for soil-applied pesticides and overestimated for foliar-applied pesticides. The concentration of a pesticide in soil would likely be less than predicted on food items.
- Exposure through inhalation of pesticides is not considered in the USEPA risk assessment protocols. Such exposure may occur through three potential sources: spray material in droplet form at time of application, vapor phase with the pesticide volatilizing from treated surfaces, and airborne particulates (soil, vegetative matter, and pesticide dusts). The USEPA (1990) reported exposure from inhaling spray droplets at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size (particles reaching the lung) in birds is limited to maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of pesticide application scenarios indicate that less than 1% of the applied material is within the respirable particle size. This route of exposure is further limited because the permissible spray drop size distribution for ground pesticide applications is restricted to ASAE medium or coarser drop size distribution.
- Inhalation of a pesticide in the vapor phase may be another source of exposure for some pesticides under certain conditions. This mechanism of exposure to pesticides occurs post application, and it would pertain to those pesticides with a high vapor pressure. The USEPA is currently evaluating protocols for modeling inhalation exposure from pesticides including near-field and near-ground air concentrations based upon equilibrium and kinetics-based models. Risk characterization for exposure with this mechanism is unavailable.
- The effect from exposure to dusts contaminated with the pesticide cannot be assessed generically as partitioning issues related to application site soils and chemical properties of the applied pesticides render the exposure potential from this route highly situation specific.
- Dermal exposure may occur through three potential sources: direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, incidental contact with contaminated vegetation, or contact with contaminated water or soil. Interception of spray and incidental contact with treated substrates may pose risk to avian wildlife (Driver et al. 1991). However, available research related to wildlife dermal contact with pesticides is extremely limited, except dermal toxicity values are common for some mammals used as human surrogates (rats and mice). The USEPA is currently evaluating protocols for modeling dermal exposure. Risk characterization may be underestimated for this route of exposure, particularly with high risk pesticides such as some organophosphates or carbamate

insecticides. If protocols are established by the USEPA for assessing dermal exposure to pesticides, they would be considered for incorporation into pesticide assessment protocols.

- Exposure to a pesticide may occur from consuming surface water, dew or other water on treated surfaces. Water soluble pesticides have the potential to dissolve in surface runoff and puddles in a treated area may contain pesticide residues. Similarly, pesticides with lower organic carbon partitioning characteristics and higher solubility in water have a greater potential to dissolve in dew and other water associated with plant surfaces. Estimating the extent to which such pesticide loadings to drinking water occurs is complex and would depend upon the partitioning characteristics of the active ingredient, soils types in the treatment area, and the meteorology of the treatment area. In addition, the use of various water sources by wildlife is highly species-specific. Currently, risk characterization for this exposure mechanism is not available. The USEPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the USEPA for assessing exposure to pesticides through drinking water, these protocols would be incorporated into pesticide risk assessment protocols.
- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides; equipment calibration; and proper application with annual continuing education.
- The USEPA relies on Fletcher (1994) for setting the assumed pesticide residues in wildlife dietary items. The USEPA (2004) "believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify." Fletcher's (1994) research suggests that the pesticide active ingredient residue assumptions used by the USEPA represent a 95th percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates USEPA residue assumptions for short grass was not exceeded. Baehr and Habig (2000) compared USEPA residue assumptions with distributions of measured pesticide residues for the USEPA's UTAB database. Overall residue selection level will tend to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole above-ground plant material, but others will preferentially select different plant structures. Also, species may preferentially select a food item although multiple food items may be present. Without species specific knowledge regarding foraging behavior characterizing ecological risk other than in general terms is not possible.
- Acute and chronic risk assessments rely on comparisons of wildlife dietary residues with LC_{50} or NOEC values expressed as concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake

estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed. Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods are not accounting for a potentially important aspect of food requirements.

- There are several other assumptions that can affect non-target species not considered in the risk assessment process. These include possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic and biotic factors) and behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are usually characterized in the published literature in only a general manner limiting their value in the risk assessment process.
- It is assumed that aquatic species exclusively and permanently occupy the water body being assessed. Actual habitat requirements of aquatic species are not considered. With the possible exception of scenarios where pesticides are directly applied to water, it is assumed that no habitat use considerations specific for any species would place the organisms in closer proximity to pesticide use sites. This assumption produces a maximum estimate of exposure or risk characterization. It would likely be realistic for many aquatic species that may be found in aquatic habitats within or in close proximity to treated terrestrial habitats. However, the spatial distribution of wildlife is usually not random because wildlife distributions are often related to habitat requirements of species. Clumped distributions of wildlife may result in an under- or over-estimation of risk depending upon where the initial pesticide concentration occurs relative to the species or species habitat.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column. Additional chemical exposure from materials associated with suspended solids or food items is not considered because partitioning onto sediments likely is minimal. Adsorption and bioconcentration occurs at lower levels for many newer pesticides compared with older more persistent bioaccumulative compounds. Pesticides with RQs close to the listed species level of concern, the potential for additional exposure from these routes may be a limitation of risk assessments, where potential pesticide exposure or risk may be underestimated.
- Mass transport losses of pesticide from a water body (except for losses by volatilization, degradation and sediment partitioning) would not be considered for ecological risk assessment. The water body would be assumed to capture all pesticide active ingredients entering as runoff, drift, and adsorbed to eroded soil particles. It would also be assumed that pesticide active ingredient is not lost from the water body by overtopping or flow-through, nor is concentration reduced by dilution. In total, these assumptions would lead to a near maximum possible water-borne concentration. However, this assumption would not account for the potential to concentrate pesticide through the evaporative loss. This limitation may have the greatest impact on water bodies with high surface-to-volume ratios such as ephemeral wetlands, where evaporative losses are accentuated and applied pesticides have low rates of degradation and volatilization.
- For acute risk assessments, there would be no averaging time for exposure. An instantaneous peak concentration would be assumed, where instantaneous exposure is sufficient in duration to elicit acute effects comparable to those observed over more protracted exposure periods (typically 48 to 96 hours) tested in the laboratory. In the absence of data regarding time-to-

toxic event, analyses and latent responses to instantaneous exposure, risk would likely be overestimated.

- For chronic exposure risk assessments, the averaging times considered for exposure are commensurate with the duration of invertebrate life-cycle or fish-early life stage tests (e.g., 21-28 days and 56-60 days, respectively). Response profiles (time to effect and latency of effect) to pesticides likely vary widely with mode of action and species and should be evaluated on a case-by-case basis as available data allow. Nevertheless, because the USEPA relies on chronic exposure toxicity endpoints based on a finding of no observed effect, the potential for any latent toxicity effects or averaging time assumptions to alter the results of an acceptable chronic risk assessment prediction is limited. The extent to which duration of exposure from water-borne concentrations overestimate or underestimate actual exposure depends on several factors. These include the following: localized meteorological conditions, runoff characteristics of the watershed (e.g., soils, topography), the hydrological characteristics of receiving waters, environmental fate of the pesticide active ingredient, and the method of pesticide application. It should also be understood that chronic effects studies are performed using a method that holds water concentration in a steady state. This method is not likely to reflect conditions associated with pesticide runoff. Pesticide concentrations in the field increase and decrease in surface water on a cycle influenced by rainfall, pesticide use patterns, and degradation rates. As a result of the dependency of this assumption on several undefined variables, risk associated with chronic exposure may in some situations underestimate risk and overestimate risk in others.
- There are several other factors that can affect non-target species not considered in the risk assessment process. These would include the following: possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic [not pesticides] and biotic factors), and sub-lethal effects such as behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are not routinely assessed by regulatory agencies. Therefore, information on the factors is not extensive limiting their value for the risk assessment process. As this type of information becomes available, it would be included, either quantitatively or qualitatively, in this risk assessment process.
- USEPA is required by the Food Quality Protection Act to assess the cumulative risks of pesticides that share common mechanisms of toxicity, or act the same within an organism. Currently, USEPA has identified four groups of pesticides that have a common mechanism of toxicity requiring cumulative risk assessments. These four groups are: the organophosphate insecticides, N-methyl carbamate insecticides, triazine herbicides, and chloroacetanilide herbicides.

G.7.3 Pesticide Mixtures and Degradates

Pesticide products are usually a formulation of several components generally categorized as active ingredients and inert or other ingredients. The term active ingredient is defined by the FIFRA as preventing, destroying, repelling, or mitigating the effects of a pest, or it is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. In accordance with FIFRA, the active ingredient(s) must be identified by name(s) on the pesticide label along with its relative composition expressed in percentage(s) by weight. In contrast, inert ingredient(s) are not intended to affect a target pest. Their role in the pesticide formulation is to act as a solvent (keep the active ingredient is a liquid phase), an

emulsifying or suspending agent (keep the active ingredient from separating out of solution), or a carrier (such as clay in which the active ingredient is impregnated on the clay particle in dry formulations). For example, if isopropyl alcohol would be used as a solvent in a pesticide formulation, then it would be considered an inert ingredient. FIFRA only requires that inert ingredients identified as hazardous and associated percent composition, and the total percentage of all inert ingredients must be declared on a product label. Inert ingredients that are not classified as hazardous are not required to be identified.

The USEPA (September 1997) issued Pesticide Regulation Notice 97-6, which encouraged manufacturers, formulators, producers, and registrants of pesticide products to voluntarily substitute the term "other ingredients" for "inert ingredients" in the ingredient statement. This change recognized that all components in a pesticide formulation potentially could elicit or contribute to an adverse effect on non-target organisms and, therefore, are not necessarily inert. Whether referred to as "inerts" or "other ingredients," these constituents within a pesticide product have the potential to affect species or environmental quality. The USEPA categorizes regulated inert ingredients into the following four lists (http://www.epa.gov/opprd001/inerts/index.html):

- List 1 – Inert Ingredients of Toxicological Concern
- List 2 – Potentially Toxic Inert Ingredients
- List 3 – Inerts of Unknown Toxicity
- List 4 – Inerts of Minimal Toxicity

Several of the List 4 compounds are naturally-occurring earthen materials (e.g., clay materials, simple salts) that would not elicit toxicological response at applied concentrations. However, some of the inerts (particularly the List 3 compounds and unlisted compounds) may have moderate to high potential toxicity to aquatic species based on MSDSs or published data.

Comprehensively assessing potential effects to non-target fish, wildlife, plants, and/or their habitats from pesticide use is a complex task. It would be preferable to assess the cumulative effects from exposure to the active ingredient, its degradates, and inert ingredients as well as other active ingredients in the spray mixture. However, it would only be feasible to conduct deterministic risk assessments for each component in the spray mixture singly. Limited scientific information is available regarding ecological effects (additive or synergistic) from chemical mixtures that typically rely upon broadly encompassing assumptions. For example, the US Forest Service (2005) found that mixtures of pesticides used in land (forest) management likely would not cause additive or synergistic effects to non-target species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004). Moreover, information on inert ingredients, adjuvants, and degradates is often limited by the availability of and access to reliable toxicological data for these constituents.

Toxicological information regarding "other ingredients" may be available from sources such as the following:

- TOMES (a proprietary toxicological database including USEPA's IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- USEPA's ECOTOX database, which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).
- Material Safety Data Sheets (MSDSs) from pesticide suppliers.
- Other sources such as the Farm Chemicals Handbook.

Because there is a lack of specific inert toxicological data, inert(s) in a pesticide may cause adverse ecological effects. However, inert ingredients typically represent only a small percentage of the pesticide spray mixture, and it would be assumed that negligible effects would be expected to result from inert ingredient(s).

Although the potential effects of degradates should be considered when selecting a pesticide, it is beyond the scope of this assessment process to consider all possible breakdown chemicals of the various product formulations containing an active ingredient. Degradates may be more or less mobile and more or less hazardous in the environment than their parent pesticides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent pesticides and degradates would make assessing potential degradate effects extremely difficult. For example, a less toxic and more mobile, bioaccumulative, or persistent degradate may have potentially greater effects on species and/or degrade environmental quality. The lack of data on the toxicity of degradates for many pesticides would represent a source of uncertainty for assessing risk.

A USEPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not possible to quantify the potential effects of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific information allowed a determination of whether the joint action of a mixture would be additive, synergistic, or antagonistic. Such information would not likely exist unless the mode of action would be common among the chemicals and receptors. Moreover, the composition of and exposure to mixtures would be highly site- and/or time-specific and, therefore, it would be nearly impossible to assess potential effects to species and environmental quality.

To minimize or eliminate potential negative effects associated with applying two or more pesticides as a mixture, the use would be conducted in accordance with the labeling requirements. Labels for two or more pesticides applied as a mixture should be completely reviewed, where products with the least potential for negative effects would be selected for use on the Refuge. This is especially relevant when a mixture would be applied in a manner that may already have the potential for an effect(s) associated with an individual pesticide (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions would increase the level of uncertainty in terms of risk to species or potential to degrade environmental quality.

Adjuvants generally function to enhance or prolong the activity of pesticide. For terrestrial herbicides, adjuvants aid in the absorption into plant tissue. Adjuvant is a broad term that generally applies to surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration requirements as pesticides and the USEPA does not register or approve the labeling of spray adjuvants. Individual pesticide labels identify types of adjuvants approved for use with it. In general, adjuvants compose a relatively small portion of the volume of pesticides applied. Selection of adjuvants with limited toxicity and low volumes would be recommended to reduce the potential for the adjuvant to influence the toxicity of the pesticide.

G.7.4 Determining Effects to Soil and Water Quality

The approval process for pesticide uses would consider potential to degrade water quality on and off refuge lands. A pesticide can only affect water quality through movement away from the treatment

site. After application, pesticide mobilization can be characterized by one or more of the following (Kerle et al. 1996):

- Attach (sorb) to soil, vegetation, or other surfaces and remain at or near the treated area;
- Attach to soil and move off-site through erosion from runoff or wind;
- Dissolve in water that can be subjected to runoff or leaching.

As an initial screening tool, selected chemical characteristics and rating criteria for a pesticide can be evaluated to assess potential to enter ground and/or surface waters. These would include the following: persistence, sorption coefficient (K_{oc}), groundwater ubiquity score (GUS), and solubility.

Persistence, which is expressed as half-life ($t_{½}$), represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996). Half-life data are usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, half-life describes the rate for degradation only. As for half-life, units of dissipation time are usually expressed in days. Field or foliar dissipation time is the preferred data for use to estimate pesticide concentrations in the environment. However, soil half-life is the most common persistence data cited in published literature. If field or foliar dissipation data are not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent would be less likely to move across the soil surface into surface waters or to leach through the soil profile and contaminate groundwater. Conversely, pesticides that are not strongly adsorbed to soil particles, are highly water soluble, and are persistent in the environment would have greater potential to move from the application site (off-site movement).

The degree of pesticide adsorption to soil particles and organic matter (Kerle et al. 1996) is expressed as the soil adsorption coefficient (K_{oc}). The soil adsorption coefficient is measured as micrograms of pesticide per gram of soil (µg/g) that can range from near zero to the thousands. Pesticides with higher K_{oc} values are strongly sorbed to soil and, therefore, would be less subject to movement.

Water solubility describes the amount of pesticide that will dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/L or parts per million [ppm]). Pesticide with solubility <0.1 ppm are virtually insoluble in water, 100-1,000 ppm are moderately soluble, and >10,000 ppm highly soluble (USGS 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The Groundwater Ubiquity Score (GUS) is a quantitative screening tool to estimate a pesticide's potential to move in the environment. It utilizes soil persistence and adsorption coefficients in the following formula.

$$GUS = \log_{10}(t_{½}) \times [4 - \log_{10}(K_{oc})]$$

The potential pesticide movement rating would be based upon its GUS value. Pesticides with a GUS <0.1 would considered to have an extremely low potential to move toward groundwater. Values of 1.0-2.0 would be low, 2.0-3.0 would be moderate, 3.0-4.0 would be high, and >4.0 would have a very high potential to move toward groundwater.

Water solubility describes the amount of pesticide dissolving in a specific quantity of water, where it is usually measured as mg/L or ppm. Solubility is useful as a comparative measure because pesticides with higher values are more likely to move by runoff or leaching. GUS, water solubility, t½, and K_{oc} values are available for selected pesticides from the OSU Extension Pesticide Properties Database at http://npic.orst.edu/ppdmove.htm. Many of the values in this database were derived from the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope et al. 1992).

Soil properties influence the fate of pesticides in the environment. The following six properties are mostly likely to affect pesticide degradation and the potential for pesticides to move off-site by leaching (vertical movement through the soil) or runoff (lateral movement across the soil surface).

- Permeability is the rate of water movement vertically through the soil. It is affected by soil texture and structure. Coarse textured soils (e.g., high sand content) have a larger pore size and they are generally more permeable than fine textured soils (i.e., high clay content). The more permeable soils would have a greater potential for pesticides to move vertically down through the soil profile. Soil permeability rates (inches/hour) are usually available in county soil survey reports.
- Soil texture describes the relative percentage of sand, silt, and clay. In general, greater clay content with smaller the pore size would lower the likelihood and rate water that would move through the soil profile. Clay also serves to adsorb (bind) pesticides to soil particles. Soils with high clay content would adsorb more pesticide than soils with relatively low clay content. In contrast, sandy soils with coarser texture and lower water holding capacity would have a greater potential for water to leach through them.
- Soil structure describes soil aggregation. Soils with a well-developed soil structure have looser, more aggregated, structure that would be less likely to be compacted. Both characteristics would allow for less restricted flow of water through the soil profile resulting in greater infiltration.
- Organic matter would be the single most important factor affecting pesticide adsorption in soils. Many pesticides are adsorbed to organic matter which would reduce their rate of downward movement through the soil profile. Also, soils high in organic matter would tend to hold more water, which may make less water available for leaching.
- Soil moisture affects how fast water would move through the soil. If soils are already wet or saturated before rainfall or irrigation, excess moisture would run off rather than infiltrate into the soil profile. Soil moisture also would influence microbial and chemical activity in soil, which effects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide will degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for

movement in conjunction with appropriate best management practices (see below) would be used in an IPM framework to treat pests while minimizing effects to non-target biota and protecting environmental quality.

Along with soil properties, the potential for a pesticide to affect water quality through runoff and leaching would consider site-specific environmental and abiotic conditions including rainfall, water table conditions, and topography (Huddleston 1996).

- Water is necessary to separate pesticides from soil. This can occur in two basic ways. Pesticides that are soluble move easily with runoff water. Pesticide-laden soil particles can be dislodged and transported from the application site in runoff. The concentration of pesticides in the surface runoff would be greatest for the first runoff event following treatment. The rainfall intensity and route of water infiltration into soil, to a large extent, determine pesticide concentrations and losses in surface runoff. The timing of the rainfall after application also would have an effect. Rainfall interacts with pesticides at a shallow soil depth (¼ to ½ inch), which is called the mixing zone (Baker and Miller 1999). The pesticide/water mixture in the mixing zone would tend to leach down into the soil or runoff depending upon how quickly the soil surface becomes saturated and how rapidly water can infiltrate into the soil. Leaching would decrease the amount of pesticide available near the soil surface (mixing zone) to runoff during the initial rainfall event following application and subsequent rainfall events.
- Terrain slope would affect the potential for surface runoff and the intensity of runoff. Steeper slopes would have greater potential for runoff following a rainfall event. In contrast, soils that are relatively flat would have little potential for runoff, except during intense rainfall events. In addition, soils in lower areas would be more susceptible to leaching as a result of receiving excessive water from surrounding higher elevations.
- Depth to groundwater would be an important factor affecting the potential for pesticides to leach into groundwater. If the distance from the soil surface to the top of the water table is shallow, pesticides would have less distance to travel to reach groundwater. Shallower water tables that persist for longer periods would be more likely to experience groundwater contamination. Soil survey reports are available for individual counties. These reports provide data in tabular format regarding the water table depths and the months during which it is persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

G.7.5 Determining Effects to Air Quality

Pesticides may volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure which would be affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these numbers easier to compare, vapor pressure may be expressed in exponent form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with $I<10$ would have a low potential to volatilize; whereas, pesticides with $I>1{,}000$ would have a high potential to volatilize (OSU 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database.

G.7.6 Preparing a Chemical Profile

The following instructions would be used by Service personnel to complete Chemical Profiles for pesticides. Specifically, profiles would be prepared for pesticide active ingredients (e.g., glyphosate, imazapic) that would be contained in one or more trade name products that are registered and labeled with USEPA. All information fields under each category (e.g., Toxicological Endpoints, Environmental Fate) would be completed for a Chemical Profile. If no information is available for a specific field, then "No data are available in references" would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the "worst-case scenario" would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/facilities maintenance treatments pertaining to refuges. Where the "worst-case scenario" likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section 5.0), the proposed pesticide's use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the Refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on refuge lands. In general, PUPs would be approved for pesticides with Chemical Profiles where there would be no exceedances of threshold values. However, BMPs are identified for some screening tools that would minimize/eliminate potential effects (exceedance of the threshold value) as a basis for approving PUPs.

Date: Service personnel would record the date when the Chemical Profile is completed or updated. Chemical Profiles (e.g., currently approved pesticide use patterns) would be periodically reviewed and updated, as necessary. The most recent review date would be recorded on a profile to document when it was last updated.

Trade Name(s): Service personnel would accurately and completely record the trade name(s) from the pesticide label, which includes a suffix that describes the formulation (e.g., WP, DG, EC, L, SP, I, II or 64). The suffix often distinguishes a specific product among several pesticides with the same active ingredient. Service personnel would record a trade name for each pesticide product with the same active ingredient.

Common chemical name(s): Service personnel would record the common name(s) listed on the pesticide label or material safety data sheet (MSDS) for an active ingredient. The common name of a

pesticide is listed as the active ingredient on the title page of the product label immediately following the trade name, and the MSDS, Section 2: Composition/ Information on Ingredients. A Chemical Profile is completed for each active ingredient.

Pesticide Type: Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, desiccant, fungicide, fumigant, growth regulator, insecticide, piscicide, or rodenticide.

EPA Registration Number(s): This number (EPA Reg. No.) appears on the title page of the label and MSDS, Section 1: Chemical Product and Company Description. It is not the EPA Establishment Number that is usually located near it. Service personnel would record the EPA Reg. No. for each trade name product with an active ingredient based upon PUPs.

Pesticide Class: Service personnel would list the general chemical class for the pesticide (active ingredient). For example, malathion is an organophosphate and carbaryl is a carbamate.

CAS (Chemical Abstract Service) Number: This number is often located in the second section (Composition/Information on Ingredients) of the MSDS. The MSDS table listing components usually contains this number immediately prior to or following the % composition.

Other Ingredients: From the most recent MSDS for the proposed pesticide product(s), Service personnel would include any chemicals in the pesticide formulation not listed as an active ingredient that are described as toxic or hazardous, or regulated under the Superfund Amendments and Reauthorization Act (SARA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Administration (OSHA), State Right-to-Know, or other listed authorities. These are usually found in MSDS sections titled “Hazardous Identifications,” “Exposure Control/Personal Protection,” and “Regulatory Information.” If concentrations of other ingredients are available for any compounds identified as toxic or hazardous, then Service personnel would record this information in the Chemical Profile by trade name. MSDS(s) may be obtained from the manufacturer, manufacturer’s website or from an on-line database maintained by Crop Data Management Systems, Inc. (see list below).

G.7.7 Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then “No data are available in references” would be recorded as the data entry. Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

Mammalian LD_{50}: For test species in the scientific literature, Service personnel would record available data for oral lethal dose (LD50) in mg/kg-bw (body weight) or ppm-bw. Most common test species in scientific literature are the rat and mouse. The lowest LD50 value found for a rat would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk to mammals (see Table 1 in Section 7.1).

Mammalian LC_{50}: For test species in the scientific literature, Service personnel would record available data for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species in scientific literature are the rat and mouse. The lowest LC_{50} value found for a rat would be used as a toxicological endpoint for diet-based RQ calculations to assess acute risk (see Table G-1 in Section 7.1).

Mammalian Reproduction: For test species listed in the scientific literature, Service personnel would record the test results (e.g., Lowest Observed Effect Concentration [LOEC], Lowest Observed Effect Level [LOEL], No Observed Adverse Effect Level [NOAEL], No Observed Adverse Effect Concentration [NOAEC]) in mg/kg-bw or mg/kg-diet for reproductive test procedure(s) (e.g., generational studies [preferred], fertility, new born weight). Most common test species available in scientific literature are rats and mice. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for a rat would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section 7.1).

Avian LD_{50}: For test species available in the scientific literature, Service personnel would record values for oral lethal dose (LD_{50}) in mg/kg-bw or ppm-bw. Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LD_{50} value found for an avian species would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk (see Table G-1 in Section 7.1).

Avian LC_{50}: For test species available in the scientific literature, Service personnel would record values for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LC_{50} value found for an avian species would be used as a toxicological endpoint for dietary-based RQ calculations to assess acute risk (see Table G-1 in Section 7.1).

Avian Reproduction: For test species available in the scientific literature, Service personnel would record test results (e.g., LOEC, LOEL, NOAEC, NOAEL) in mg/kg-bw or mg/kg-diet consumed for reproductive test procedure(s) (e.g., early life cycle, reproductive). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for an avian species would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section 7.1).

Fish LC_{50}: For test freshwater or marine species listed in the scientific literature, Service personnel would record a LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are the bluegill, rainbow trout, and fathead minnow (marine). Test results for many game species may also be available. The lowest LC_{50} value found for a freshwater fish species would be used as a toxicological endpoint for RQ calculations to assess acute risk (see Table G-1 in Section 7.1).

Fish Early Life Stage (ELS)/Life Cycle: For test freshwater or marine species available in the scientific literature, Service personnel would record test results (e.g., LOEC, NOAEL, NOAEC, LOAEC) in ppm for test procedure(s) (e.g., early life cycle, life cycle). Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow. Test results for other game species may also be available. The lowest test value found for a fish species (preferably freshwater) would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section 7.1).

Other: For test invertebrate as well as non-vascular and vascular plant species available in the scientific literature, Service personnel would record LC_{50}, LD_{50}, LOEC, LOEL, NOAEC, NOAEL, or EC_{50} (environmental concentration) values in ppm or mg/L. Most common test invertebrate species available in scientific literature are the honey bee and the water flea (*Daphnia magna*). Green algae (*Selenastrum capricornutum*) and pondweed (*Lemna minor*) are frequently available test species for aquatic non-vascular and vascular plants, respectively.

G.7.8 Ecological Incident Reports

After a site has been treated with pesticide(s), wildlife may be exposed to these chemical(s). When exposure is high relative to the toxicity of the pesticides, wildlife may be killed or visibly harmed (incapacitated). Such events are called ecological incidents. The USEPA maintains a database (Ecological Incident Information System) of ecological incidents. This database stores information extracted from incident reports submitted by various federal and state agencies and non-government organizations. Information included in an incident report is date and location of the incident, type and magnitude of effects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue and cholinesterase activity analyses conducted during the investigation.

Incident reports can play an important role in evaluating the effects of pesticides by supplementing quantitative risk assessments. All incident reports for pesticide(s) with the active ingredient and associated information would be recorded.

G.7.9 Environmental Fate

Water Solubility: Service personnel would record values for water solubility (S_w), which describes the amount of pesticide that dissolves in a known quantity of water. S_w is expressed as mg/L (ppm). Pesticide S_w values would be categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1,000 ppm, highly soluble >10,000 ppm (USGS 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through runoff and leaching.

S_w would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

Soil Mobility: Service personnel would record available values for soil adsorption coefficient (K_{oc} [µg/g]). It provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil. K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand).

K_{oc} values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Persistence: Service personnel would record values for soil half-life (t½), which represents the length of time (days) required for 50% of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the t½ value, soil persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If soil t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If soil t½ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil t½ values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil t½ describes the rate for degradation only. As for t½, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil t½, which is derived in a laboratory. However, soil t½ is the most common persistence data available in the published literature. If field dissipation data are not available, soil half-life data would be used in a Chemical Profile. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Based upon the DT_{50} value, environmental persistence in the soil also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If soil DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If soil DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil DT50 values (preferred over soil t½) would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below), if available.

Aquatic Persistence: Service personnel would record values for aquatic t½, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the t½ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If aquatic t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic t½ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Aquatic Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade or move (dissipate); whereas, aquatic t½ describes the rate for degradation only. As for t½, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Potential to Move to Groundwater: Groundwater Ubiquity Score (GUS) = $\log_{10}$(soil t ½) x [4 – $\log_{10}(K_{oc})$]. If a DT_{50} value is available, it would be used rather than a t ½ value to calculate a GUS score. Based upon the GUS value, the potential to move toward groundwater would be recorded as one of the following categories: extremely low potential<1.0, low - 1.0 to 2.0, moderate - 2.0 to 3.0, high - 3.0 to 4.0, or very high>4.0.

Threshold for Approving PUPs:

If GUS ≤4.0, then a PUP would be approved without additional BMPs to protect water quality.
If GUS >4.0, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Volatilization: Pesticides may volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere. The potential for a pesticide to volatilize is a function of its vapor pressure that is affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these values easier to compare, vapor pressure would be recorded by Service personnel in exponential form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with I<10 would have low potential to volatilize; whereas, pesticides with I >1,000 would have a high potential to volatilize (OSU 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database (see References).

Threshold for Approving PUPs:

If I ≤1,000, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.
If I >1,000, then a PUP would only be approved with additional BMPs specifically to minimize drift and protect air quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to reduce volatilization and potential to drift and degrade air quality:*

- *Do not treat when wind velocities are <2 or >10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures >85°F.*
- *Use the lowest spray height possible above target canopy.*
- *Where identified on the pesticide label, soil incorporate pesticide as soon as possible during or after application.*

Octanol-Water Partition Coefficient (K_{ow}): The octanol-water partition coefficient (K_{ow}) is the concentration of a pesticide in octanol and water at equilibrium at a specific temperature. Because octanol is an organic solvent, it is considered a surrogate for natural organic matter. Therefore, K_{ow} would be used to assess potential for a pesticide to bioaccumulate in tissues of aquatic species (e.g., fish). If K_{ow} >1,000 or S_w<1 mg/L and soil t½>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (USGS 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.
If there is a high potential to bioaccumulate in aquatic species (Kow>1,000 or Sw<1 mg/L and soil t½>30 days), then the PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Bioaccumulation/Bioconcentration: The physiological process where pesticide concentrations in tissue would increase in biota because they are taken and stored at a faster rate than they are metabolized or excreted. The potential for bioaccumulation would be evaluated through bioaccumulation factors (BAFs) or bioconcentration factors (BCFs). Based upon BAF or BCF values, the potential to bioaccumulate would be recorded as one of the following: low – 0 to 300, moderate – 300 to 1,000, or high >1,000 (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF≤1,000, then a PUP would be approved without additional BMPs.
If BAF or BCF>1,000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Worst-Case Ecological Risk Assessment
Max Application Rates (acid equivalent): Service personnel would record the highest application rate of an active ingredient (ae basis) for habitat management and cropland/facilities maintenance treatments in this data field of a Chemical Profile. These rates can be found in Table CP.1 under the column heading "Max Product Rate – Single Application (lbs/acre – AI on acid equiv basis)". This table would be prepared for a Chemical Profile from information specified in labels for trade name products identified in PUPs. If these data are not available in pesticide labels, then write "NS" for "not specified on label" in this table.

EECs: An estimated environmental concentration (ECC) represents potential exposure to fish and wildlife (birds and mammals) from using a pesticide. EECs would be derived by Service personnel using an USEPA screening-level approach (USEPA 2004). For each max application rate [see description under **Max Application Rates (acid equivalent)**], Service personnel would record 2 EEC values in a Chemical Profile; these would represent the worst-case terrestrial and aquatic exposures for habitat management and croplands/facilities maintenance treatments. For terrestrial and aquatic EEC calculations, see description for data entry under **Presumption of Unacceptable Risk/Risk Quotients**, which is the next field for a Chemical Profile.

Presumption of Unacceptable Risk/Risk Quotients: Service personnel would calculate and record acute and chronic risk quotients (RQs) for birds, mammals, and fish using the provided tabular formats for habitat management and/or cropland/facilities maintenance treatments. RQs recorded in a Chemical Profile would represent the worst-case assessment for ecological risk. See Section 7.2 for discussion regarding the calculations of RQs.

For aquatic assessments associated with habitat management treatments, RQ calculations would be based upon selected acute and chronic toxicological endpoints for fish and the EEC would be derived from Urban and Cook (1986) assuming 100% overspray to an entire 1-foot deep water body using the max application rate (ae basis [see above]).

For aquatic assessments associated with cropland/facilities maintenance treatments, RQ calculations would be done by Service personnel based upon selected acute and chronic toxicological endpoints for fish and an EEC would be derived from the aquatic assessment in AgDRIFT® model version 2.01 under Tier I ground-based application with the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and 25-foot distance (buffer) from treated area to water.

See Section 7.2.1.2 for more details regarding the calculation of EECs for aquatic habitats for habitat management and cropland/facilities maintenance treatments.

For terrestrial avian and mammalian assessments, RQ calculations would be done by Service personnel based upon dietary exposure, where the "short grass" food item category would represent the worst-case scenario. For terrestrial spray applications associated with habitat management and cropland/facilities maintenance treatments, exposure (EECs and RQs) would be determined using the Kanaga nomogram method through the USEPA's T-REX version 1.2.3. T-REX input variables would include the following: max application rate (acid basis [see above]) and pesticide half-life (days) in soil to estimate the initial, maximum pesticide residue concentration on general food items for terrestrial vertebrate species in short (<20 cm tall) grass.

For granular pesticide formulations and pesticide-treated seed with a unique route of exposure for terrestrial avian and mammalian wildlife, see Section 7.2.1.1.2 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with Levels of Concern (LOCs) established by USEPA (see Table G-2 in Section 7.2). If a calculated RQ exceeds an established LOC value (in brackets inside the table), then there would be a potential for an acute or chronic effect (unacceptable risk) to federally listed (T&E) species and nonlisted species. See Section 7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for approving PUPs:

If RQs≤LOCs, then a PUP would be approved without additional BMPs.
If RQs>LOCs, then a PUP would only be approved with additional BMPs specifically to minimize exposure (ecological risk) to bird, mammal, and/or fish species. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to reduce potential risk to non-listed or listed species:*

- *Lower application rate and/or fewer number of applications so RQs≤LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs≤LOCs.*

Justification for Use: Service personnel would describe the reason for using the pesticide based control of specific pests or groups of pests. In most cases, the pesticide label provides the appropriate information regarding control of pests to describe in the section.

Specific Best Management Practices (BMPs): Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to non-target species and/or degradation of environmental quality from drift, surface runoff, or leaching. These BMPs would be based upon

scientific information documented in previous data fields of a Chemical Profile. Where necessary and feasible, these specific practices would be included in PUPs as a basis for approval.

If there are no specific BMPs that are appropriate, then Service personnel would describe why the potential effects to refuge resources and/or degradation of environmental quality is outweighed by the overall resource benefit(s) from the proposed pesticide use in the BMP section of the PUP. See Section 4.0 of this document for a complete list of BMPs associated with mixing and applying pesticides appropriate for all PUPs with ground-based treatments that would be additive to any necessary, chemical-specific BMPs.

References: Service personnel would record scientific resources used to provide data/information for a chemical profile. Use the number sequence to uniquely reference data in a chemical profile.

The following on-line data resources are readily available for toxicological endpoint and environmental fate data for pesticides:

1. California Product/Label Database. Department of Pesticide Regulation, California Environmental Protection Agency. (http://www.cdpr.ca.gov/docs/label/labelque.htm#regprods)

2. ECOTOX database. Office of Pesticide Programs, US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/ecotox/)

3. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. Cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University and University of Idaho through Oregon State University, Corvallis, Oregon. (http://extoxnet.orst.edu/pips/ghindex.html)

4. FAO specifications and evaluations for plant protection products. Pesticide Management Unit, Plant Protection Services, Food and Agriculture Organization, United Nations. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/)

5. Human health and ecological risk assessments. Pesticide Management and Coordination, Forest Health Protection, US Department of Agriculture, US Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

6. Pesticide Chemical Fact Sheets. Clemson University Pesticide Information Center. (http://entweb.clemson.edu/pesticid/Document/Labels/factshee.htm)

7. Pesticide Fact Sheets. Published by Information Ventures, Inc. for Bureau of Land Management, Department of Interior; Bonneville Power Administration, U.S. Department of Energy; and Forest Service, US Department of Agriculture. (http://infoventures.com/e-hlth/pesticide/pest-fac.html)
8. Pesticide Fact Sheets. National Pesticide Information Center. (http://npic.orst.edu/npicfact.htm)

9. Pesticide Fate Database. US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/pfate/home.cfm).

10. Pesticide product labels and material safety data sheets. Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/pfa/LUpdateMsg.asp) or multiple websites maintained by agrichemical companies.

11. Registered Pesticide Products (Oregon database). Oregon Department of Agriculture. (http://www.oda.state.or.us/dbs/pest_products/search.lasso)

12. Regulatory notes. Pest Management Regulatory Agency, Health Canada, Ontario, Canada. (http://www.hc-sc.gc.ca/pmra-arla/)

13. Reptile and Amphibian Toxicology Literature. Canadian Wildlife Service, Environment Canada, Ontario, Canada. (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/ratl/index_e.cfm)

14. Specific Chemical Fact Sheet – New Active Ingredients, Biopesticide Fact Sheet and Registration Fact Sheet. U.S. Environmental Protection Agency, Washington, DC. (http://www.epa.gov/pestidides/factsheets/chemical_fs.htm)

15. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. The Invasive Species Initiative. The Nature Conservancy. (http://tnsweeds.ucdavis.edu/handbook.html)

16. Wildlife Contaminants Online. US Geological Survey, Department of Interior, Washington, D.C. (http://www.pwrc.usgs.gov/contaminants-online/)

17. One-liner database. 2000. US Environmental Protection Agency, Office of Pesticide Programs, Washington, D.C.

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	

Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish LC_50:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence ($t_{½}$):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence ($t_{½}$):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Bioconcentration:	**BAF:`** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate (ai lbs/acre – ae basis)	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Cropland/Facilities Maintenance Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]

	Mammals	[1]	[1]
	Fish	[1]	[1]

Justification for Use:	
Specific Best Management Practices (BMPs):	
References:	

Table CP.1 Pesticide Name

Trade Name[a]	Treatment Type[b]	Max Product Rate – Single Application (lbs/acre or gal/acre)	Max Product Rate - Single Application (lbs/acre - AI on acid equiv basis)	Max Number of Applications Per Season	Max Product Rate Per Season (lbs/acre/season or gal/acre/season)	Minimum Time Between Applications (Days)

[a]From each label for a pesticide identified in pesticide use proposals (PUPs), Service personnel would record application information associated with possible/known uses on Service lands.
[b]Treatment type: H – habitat management or CF – cropland/facilities maintenance. If a pesticide is labeled for both types of treatments (uses), then record separate data for H and CF applications.

G.8 Specific Weed Control Plans

G.8.1 Cheatgrass, Downy brome

Priority: Medium: cheatgrass is widely distributed throughout the Protection Island, along roadways, and has invaded remnant native prairie and shrubland communities. Cheatgrass is prolific in dry upland habitat and competes with native plant species in especially disturbed soils such as those found in bluff and grassland habitat, both future restoration sites. It interferes with primary habitat management goals across the landscape, but the infestation is too large to eradicate with available technology.

Description: Cheatgrass is a cool season annual grass that grows from 4 - 30 inches tall, reproducing by seed. Leaf sheaths and flat blades are covered with dense soft hairs. Mature cheatgrass seed heads are slender; 2 - 6 inches long and usually droop to one side. It easily competes with more desirable perennial grasses for moisture because of its fall, winter semi-dormant, and early spring growth habit. Seeds mature in mid to late June and plants dry and cure by the end of June, leading to hazardous fire conditions.

Current Distribution on the Refuge: Cheatgrass is widely distributed throughout Protection Island, portions of Graveyard Spit and unknown on other refuge islands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites and other disturbed soil areas.

Objectives:

a. Monitor all newly seeded areas and other disturbed sites (e.g., remediation areas, wildfire areas, road cuts) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Control cheatgrass to reduce competition with native plants germinating in the spring. Keep cheatgrass to less than 40% of the live vegetation ground cover and prevent it from spreading beyond its original infestation area.
d. Maintain healthy stands of native perennial plants.

Control Options:

The chemical treatment of cheatgrass with an appropriate herbicide provides the most effective control. Currently, glyphosate (Roundup™, Roundup Pro™), Clethodim (Select™) and imazapic (Plateau™) are the herbicides used to control cheatgrass on the Refuge. The identified chemical control agents were selected on their versatility and selectivity in prairie restoration areas (Plateau™ and Select™) and complete control in areas requiring devegetation with minimal risk to groundwater contamination (Roundup™). Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Imazapic (Plateau™) is used in dry upland sites with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Clethodim (Select™) is considered as a selective herbicide for use in grasslands, restoration areas, fence lines and rights of way. Other agents indicated for cheatgrass control but not selected for use are quizalofop, fluazifop-p-butyl, sethoxydim, sulfometuron methyl, and metribuzin. Clethodim is considered less toxic to avian and other wildlife species than other selective grass herbicides (quizalofop, fluazifop-p-butyl, sethoxydim, and metribuzin). Clethodim has a short half life in soil and the EPA considers the chemical a low threat to groundwater quality. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Mechanical control of cheatgrass also is conducted on the Refuge with mixed results. Mowing before seed ripening probably prevents some re-seeding, but oftentimes the plants produce new stems and seeds at the mowed height. Mowing after seed ripening kills adult plants, but dropped seeds are already viable. Repeated mowing during the growing season may be the most effective mechanical treatment, but is very labor-intensive and only practical on small infestations. Mowing is not possible in areas where cheatgrass starts seeding at height too low for the mower, steep slopes, and inaccessible islands. Prescribed burns in the spring or fall also help to control cheatgrass by stimulating native perennial grass growth or top killing seedlings.

The cultural methods (e.g., cover crop) after plowing, discing, etc. often compete with the initial flush of cheatgrass growth and can help improve the control with herbicides before seeding with native perennial species. After restoration, the maintenance of healthy native plant communities and the minimization of disturbance help to prevent the spread of cheatgrass back into the area.

Treatment Schedule: Cheatgrass should be sprayed in the fall or early spring when plants are less than 10 cm tall and actively growing, and non-target plants are dormant.

G.8.2 *Carduus nutans* (musk thistle)

Priority: Medium: musk thistle has a limited distribution throughout the Refuge along roadways, and has invaded remnant native prairie and shrubland communities. Musk thistle is prolific in dry upland habitat and competes with native plant species in disturbed soils such as those found in recently seeded habitat restoration sites. It interferes with primary habitat management goals across the landscape, and the infestation is not too large therefore this species is targeted for eradicate.

Description: Musk thistle is a biennial which grows up to 6 feet tall. Leaves are dark green, deeply lobed, spiny, and extend onto the stem. Flowers are 11/2 to 3 inches in diameter and are usually deep rose, violet or purple. Musk thistle spreads rapidly to form dense stands that crowd out desirable plants.

Current Distribution on the Refuge: Musk thistle is widely distributed throughout the refuge at low densities but can be especially prolific in disturbed soils.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor all newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species if ground cover is needed.
c. Control musk thistle to reduce competition with native plants germinating in the spring. Keep patches of musk thistle to less than one acre in area and less than 40% of live vegetation cover.
d. Maintain healthy stands of native perennial plants.

Control Options: Mechanical control of musk thistle has been successful in preventing seed production and subsequent spread. Musk thistle is mowed at flowering in habitat restoration sites, along roadways, and in disturbed areas undergoing remediation. Dense stands are often mowed twice when new flowers appear. Repeated mowing during the growing season may be the most effective mechanical treatment, but is very labor-intensive. Small infestations of musk thistle rosettes also are removed by hand digging when labor is available.

The biological control agent, *Rhinocyllus conicus* (seed head weevil) is established in Washington state, but has had limited effect on thistle control and a negative side effect of this bio-controls that it also attacks native thistle species. There are no known native thistle species occurring on any refuge unit. The larvae of this weevil eat the seeds in mature flower heads. This bio-control is probably effective in reducing musk thistle seed production by up to 50% based on casual observation. Infestations of individual plants or widely dispersed individuals would be examined for the presence of the *Rhinocyllus conicus* larvae and adults and left in place if infected. These infected plants can be used as nurseries for the insects with the harvested individuals relocated to larger thistle patches. The chemical treatment of musk thistle with an appropriate herbicide also provides effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™) glyphosate

(Roundup™, Roundup Pro™, Rodeo™), metsulfuron methyl (Escort™) and imazapic (Plateau™) are the herbicides that could be used to control small musk thistle infestations on the Refuge. Aminopyralid is very selective, provides longer control and can be used at lower rates. Glyphosate is soil binding, inexpensive, with low groundwater contamination potential. Imazapic is used in dry upland sites with low leaching potential. Metsulfuron is extremely effective on thistle and common mullein plants. Imazapic and metsulfuron can be broadcast in restoration areas where native grasses and resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

The mechanical methods of plowing, discing, etc., often cause an initial flush of musk thistle rosettes that may be controlled with herbicides before seeding with native perennial species. After restoration, the maintenance of healthy native plant communities and the minimization of disturbance help to prevent the spread of musk thistle back into the area.

Treatment Schedule: Musk thistle should be repeatedly mowed at flowering to prevent seed production and/or sprayed in the rosette stage in fall or late spring during bolting or when desirable non-target plants are dormant. Spraying in the early summer when the plants have bolted or rosettes in the fall are also effective control methods. Other options would be used according to the label recommendations.

G.8.3 Diffuse knapweed

Priority: High: The spread of diffuse knapweed is an increasing problem in many areas in Washington. It is considered one of the most important rangeland weeds in North America. The State of Washington considers this species one of the top ten priority weeds targeted for control, particularly for preventing new infestations. Diffuse knapweed infests disturbed areas where it forms dense colonies in pastures, croplands, waste places, and rights-of-way. It is a prolific seed producer, fast spreading, and highly agonistic with native plants often out competing them.

Description: Diffuse knapweed grows as an annual or short-lived perennial forb. The diffusely branched stems of mature plants are 1 to 2 feet tall, rough to the touch, and tipped with numerous slender, white to purplish flower heads. Prominent yellow bracts with comb-like margin projections subtend the flower. The leaves are pinnately divided near the plant's base; the leaf margins appear entire towards the inflorescence. Flowering occurs from July through September.

Current Distribution on the Refuge: No known infestations are present on any refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of diffuse knapweed plants - targeting for elimination - to reduce competition with native plants and prevent establishment of knapweed and knapweed seed bank. Map and

measure larger infestation patches using geographic information software and a global positioning system device. Treat patches to prevent increase in the infestation area.

d. Maintain healthy stands of native perennial plants.

Control Options: Hand pulling or digging is a feasible control of small infestations and individual plants. The taproot would be removed to at least 2 inches below the ground surface.

Insect species that target diffuse knapweed include the seedhead weevils (*Larinus minutus*), broad-nosed seedhead weevil (*Bangasternus fausti*) are not well established, and seed head fly (*Urophora affinis*), seed head fly (*Urophora quadrifasciata*), and root boring/gall beetle (*Sphenoptera jugoslavica)* are available for mass collections. These insects reduce seed production which assists in slowing or eliminating spread. Biological agents would be an option in areas that are prohibited to other forms of control and pending the availability of the insect. Biological control of diffuse knapweed on the Refuge has not been attempted in the past.

The chemical treatment of diffuse knapweed with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone) glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) would be the herbicides used to control diffuse knapweed on the Refuge. Aminopyralid is very selective, provides longer control and can be used at lower rates. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other recommended chemical treatments for diffuse knapweed are picloram, clopyralid, dicamba, and 2,4-D. The Refuge avoids the use of restricted use pesticides like picloram. Clopyralid is not recommended for use on permeable soils due to potential groundwater contamination. Dicamba has low toxicity for wildlife but is not recommended for use near water. Aquatic formulations of glyphosate currently serve for weed control near water. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Hand removal would be conducted 2 to 3 times during the growing season, the first removal occurring early in the season (June) before bolt. Established areas too large to practically control by hand, or in areas prohibited to chemical control, would be mowed monthly to prevent floret emergence and seed production.

The release of seed head weevils will occur as the leaves of the plants appear in June to the budding stage. Control is less effective if seeds have already formed.

The application of aminopyralid, glyphosate or imazapic would occur once during the growing season (June - November). The most effective time of control is during the rosette or bolt stage before budding. Annual treatment is necessary as long as there is a viable seed source.

G.8.4 Spotted knapweed

Priority: High: The State of Washington considers this species one of the top ten priority weeds targeted for control. Spotted knapweed infests disturbed areas where it forms dense colonies in pastures, croplands, waste places, and rights-of-way. It is a prolific seed producer, fast spreading, and highly agonistic with native plants – often out-competing them. Populations enlarge by peripheral

expansion of existing stands. Biodiversity, livestock and wildlife forage quality are reduced with infestations of spotted knapweed.

Description: Spotted knapweed is a biennial or short-lived perennial forb with a deep taproot. Plants reach 1 to 3 feet with one or more branched stems. The basal leaves vary in morphology from entire to pinnate and elliptical to oblanceolate. The principal stem leaves are pinnately divided. Flowers are primarily light purple (rarely white). Involucral bracts are stiff with a finely branched, dark tip. Flowering occurs from June through September.

Current Distribution on the Refuge: No known infestations are present on any refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., restoration areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat and control 100% of spotted knapweed plants - targeting for elimination - to reduce competition with native plants and prevent establishment of knapweed and knapweed seed bank. Map and measure larger infestation patches using geographic information software and a global positioning system device. Treat patches to prevent increase in the infestation area.
d. Maintain healthy stands of native perennial plants.

Control Options: Hand pulling or digging is a feasible control of small infestations and individual plants. The taproot would be removed to at least 2 inches below the ground surface. Entire plants would be removed from the site to limit the source of available seeds.

Biological control of spotted knapweed is not effective in eliminating stands. Insect larvae are available that target flowers, roots, shoots, and leaves leading to reduced seed production. Two commonly used organisms that target spotted knapweed roots are the sulfur knapweed moth (*Agapeta zoegana*) and the knapweed weevil (*Cyphocleonus achates*). Biological control could be used in new and current infestations that cannot be controlled by hand or chemical treatment.
The chemical treatment of spotted knapweed with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) would be the herbicides used to control spotted knapweed on the Refuge. Aminopyralid is very selective, provides longer control and can be used at lower rates. Other recommended chemical treatments for diffuse knapweed are picloram, clopyralid, dicamba, and 2,4-D. The Refuge avoids the use of restricted use pesticides like picloram. Clopyralid is not recommended for use on permeable soils due to potential groundwater contamination. Dicamba has low toxicity for wildlife but is not recommended for use near water. Aquatic formulations of glyphosate currently serve for weed control near water. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Hand removal would be conducted 2 to 3 times during the growing season, the first removal occurring early in the season (June) before bolt. Established areas too large to practically control by hand, or in areas prohibited to chemical control, would be mowed monthly to prevent floret emergence and seed production.

Selected biological control insect(s) would be, if used, released during the optimal time for both insect and plant to provide the greatest effectiveness for controlling spotted knapweed.

Aminoryralid, glyphosate, or imazapic would be applied once during the growing season (June - November). The most effective time of control is during the bolt to bud stage. Annual treatment is necessary as long as there is a viable seed source.

G.8.5 Meadow Knapweed

Priority: High: The State of Washington considers this species one of the top ten priority weeds targeted for control. Meadow knapweed invades open, disturbed areas. This species forms monotypic stands, suppressing the growth of other vegetation. Reproduction is primarily from seeds and crown.

Description: Meadow knapweed is a perennial growing from a woody root crown, with 20 to 40 inch tall upright stems. Its basal leaves can be up to six inches long and 1.25 inches wide, tapering at both ends. The stem leaves are lance-shaped, stalkless, and sometimes shallowly lobed, while the uppermost leaves are smaller and not lobed. The rose-purple to occasionally white flowers occur in solitary, oval, or almost globe-shaped flower heads at the ends of branches. The light to dark brown involucral bracts are roundish, with a torn, thin, papery margin, or a comb-like, fringed margin. More apparent on outer bracts, the fringes are about equal in width to the central body of the bract. Meadow knapweed flowers from July to September, producing ivory-white to light brown seeds that may or may not have a barely noticeable plume. However, because it is a hybrid, meadow knapweed traits are highly variable.

Current Distribution on the Refuge: No known infestations are present on any refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat and control 100% of Meadow knapweed plants - targeting for elimination - to reduce competition with native plants and prevent establishment of knapweed and knapweed seedbank. Map and measure larger infestation patches using geographic information software and a global positioning system device. Treat patches to prevent increase in the infestation area.
d. Maintain healthy stands of native perennial plants

Control Options:

Removal of the above-ground tissue by mowing or hand-scything weakens the plant, reduces root growth, and prevents seed production, but would not eliminate the infestation.

Biological control with the seed head gall fly, *Urophora quadrifasciata*, has had fair success on meadow knapweed.

The reseeding of disturbed areas is effective in preventing the infestation of meadow knapweed. The chemical treatment of Meadow knapweed with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) would be the herbicides used to control Meadow knapweed on the Refuge. Aminopyralid is very selective, provides longer control and can be used at lower rates. Glyphosate is soil binding, inexpensive, with low groundwater contamination potential. Glyphosate is a nonspecific herbicide and the use of it should be accompanied by seeding, planting, or use in areas where native vegetation is prolific. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Top growth would be removed before bolting during the growing season (June - mid-August) to weaken Russian knapweed plants. Plants that re-emerge (mid-August to September) are smaller and more vulnerable to further top removal and herbicide effect.

Glyphosate would be applied once or twice during the growing season (June - November). Top-growth of Russian knapweed can be controlled by applying herbicide during the bud stage. Root control is achieved by timing applications to the late bud and fall growth stage. Other listed chemical would be used according to the label recommendations.

G.8.6 Bohemian knotweed

Priority: High: The State of Washington considers this species one of the top ten priority weeds targeted for control. The most common invasive knotweeds in western Washington, this species is a hybrid between giant and Japanese knotweed and shares characters of both parent species. It was introduced as an ornamental in its own right but has become very widespread in our region, especially along rivers and roadways. This plant spreads mostly by stem and root fragments and is usually found in disturbed areas such as flood zones and roadsides.

Currently, most Bohemian knotweed plants are males and therefore lack seeds. Recent findings have found that seed-bearing hybrids have appeared, probably indicating a back-cross with giant or Japanese knotweed. The existence of seeding hybrids may allow this plant to spread even more rapidly in the future.

Description: Plants are usually 6.5 to 10 feet tall. Stems are stout, cane-like, hollow between the nodes, somewhat reddish-brown and usually branched. The plants die back above ground at the end of the growing season. However, the dead reddish brown canes often persist throughout the winter. The stem nodes are swollen and surrounded by thin papery sheaths. Leaves can be either spade or heart-shaped, usually more heart-shaped lower down on the stems and more spade-shaped near the branch ends. This variability in leaf shape is one identifying character since the parent species generally have either heart-shaped or spade-shaped leaves.

One key identifying feature is the hairs on the leaf undersides especially along the midvein. Bohemian knotweed has hairs that are short and broad-based (triangular-shaped), compared with long and wavy in giant knotweed and reduced to barely noticeable bumps in Japanese knotweed.

The flowers are small, creamy white to greenish white, and grow in showy plume-like, branched clusters from leaf axils near the ends of the stems. Flower clusters are generally about the same length as the subtending leaf, unlike the shorter flower clusters found on giant knotweed and the longer clusters found on Japanese knotweed. Leaf and flower characters are most reliable when looking near the middle of a branch. The fruit is 3-sided, black and shiny

Current Distribution on the Refuge: Only known infestations are on the Dawley Unit.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat and control 100% of Bohemian knotweed plants - targeting for elimination - to reduce competition with native plants and prevent establishment of knotweed and knotweed seedbank. Map and measure larger infestation patches using geographic information software and a global positioning system device. Treat patches to prevent increase in the infestation area.
d. Maintain healthy stands of native perennial plants

Control Options:

Knotweed is very difficult to eradicate once it has become established. It is, therefore, important to prevent new infestations and eradicate small patches before they spread. Mechanical and chemical control methods can be used on knotweed, often in conjunction with each other. If control is to be effective, the sites must be visited throughout several seasons to further control any new growth.

Removal of the above-ground tissue by mowing or hand-scything weakens the plant, but because of the extensive root system this method is ineffective as a control method especially on larger infestation.

The chemical treatment of Bohemian knotweed by injection with an appropriate herbicide provides relatively effective control. Currently, imazapyr (Arsenal), and glyphosate (Roundup™, Roundup Pro™) would be the herbicides used to control Bohemian knotweed on the Refuge. Imazapyr is similar to glyphosate, has a very low toxicity to most animals, but does remain in the soil longer than glyphosate. Mixing two kinds of herbicides together often improves the effectiveness when compared with using each herbicide individually. By mixing the glyphosate and imazapyr together, we can reduce the total amount of herbicide used. Glyphosate is soil binding, inexpensive, with low groundwater contamination potential. Glyphosate is a nonspecific herbicide and the use of it should be accompanied by seeding, planting, or use in areas where native vegetation is lacking. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Injection of the herbicide is best done at the end of summer August/September during flowering but prior to seed set.

G.8.7 Canada thistle

Priority: Low to Medium: The priority for controlling this species is dependent upon location. The State of Washington considers this species widespread and detrimental to agriculture. Canada thistle can form monocultures, crowding out desirable species. Extensive horizontal roots give rise to shoots. This species infests roadsides, pastures, cropland, disturbed areas, and riparian areas. The dense growth pattern and spiny leaves of Canada thistle deters passage and consumption by wildlife.

Description: Canada thistle is a colony-forming perennial forb. Stems reach 1 to 4 feet with branching tops. Flowers are purple with spineless bracts. The leaves are irregularly lobed and tipped with tiny spines. Flowering occurs July through August.

Current Distribution on the Refuge: Canada thistle is widely distributed on the Protection Island, Dawley Unit, and patchy on Dungeness found in various soil types and vegetation communities. This species tends to invade re-seeded restoration areas.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Canada thistle control applied to keep infestations to less than 1 acre in area and weedy species comprising 40% or less of live vegetation cover.
d. Maintain healthy stands of native perennial plants.

Control Options: The nature of the Canada thistle infestations on the Refuge makes it impossible to control with simple hand methods. The removal of shoots by mowing is a viable option. The continued removal of above ground photosynthetic tissue has been shown to weaken plants and limit their spread through carbohydrate starvation.

Biological control offers many insects and a few nematodes, and the American Goldfinch has been reported to feed on various parts of Canada thistle. Most of these do very little damage. Three insects from Europe have been studied for biological control: *Altica carduorum* Guer (flea beetle), a leaf feeder, has not established itself well. Adults of the beetle *Ceutorhynchus litura* F. eat young thistle shoots, but do little damage. The fly, *Urophora cardui* L. is the most promising biological control agent. Eggs are laid in the terminal buds and galls develop which divert nutrients and stress the plant. Many microorganisms have been found associated with Canada thistle, but no potential biocontrol agents are known.

The chemical treatment of Canada thistle with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™, Rodeo®) and imazapic (Plateau ®) are the herbicides used to control Canada thistle on the Refuge. Aminopyralid is very selective, provides longer control, can be used at lower rates, and be applied near water. Glyphosate is soil binding, inexpensive, with low groundwater contamination potential. Glyphosate is a nonspecific herbicide and the use of it should be accompanied by seeding, planting, or use in areas where native vegetation is prolific. Imazapic (Plateau™) is used in dry upland sites and on soils

with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other herbicides that are shown to be effective on Canada thistle are picloram, clopyralid, and 2,4-D. The Refuge avoids the use of restricted use pesticides like picloram. Clopyralid is not recommended for use on leachable soils. 2,4-D would be used on the Refuge with its effectiveness monitored and the use expanded to possibly replace imazapic in some capacities. As with all herbicides, 2,4-D has been detected in groundwater although the sources of contamination are associated with inappropriate use and spillage. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Hand pulling or digging of plants in the rosette stage is effective for small infestations. Monthly mowing or scything of bolted plants in moist soil areas or areas with a high water table (riparian/wetlands) are effective in limiting spread.

The stem-and-shoot gadfly would be released in June through July for new and existing invaded wetland areas where chemical and mechanical controls are not feasible.

Chemical control would occur in spring and fall, 1-2 times per season (June-October), particularly in the fall when shoot to root translocation is highest. This species is sensitive to moisture content or drought stress. Application of pesticide should occur when moisture condition is higher.

G.8.8 Bull thistle

Priority: Low to Medium: The priority for controlling this species is dependent upon location. Bull thistle grows in moist to dry areas, particularly in loamy or clay soils. It is a rapidly proliferating transient species in disturbed, open sites. Native vegetation and wildlife habitat value are compromised by infestation.

Description: Bull thistle is a biennial forb with a rosette forming the first year. A short tap root supports a 2 to 5 foot many-branched stem during the second year. The leaves are pinnately lobed, prickly, with a cottony underside. The involucre of the light purple flower is covered with long spines. Flowering occurs from July through September.

Current Distribution on the Refuge: Bull thistle has not produced major infestations on the Refuge.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Control Bull thistle to reduce competition with native plants by preventing seed production and keeping infestations to less than 1 acre and less than 40% of live vegetation cover.
d. Maintain healthy stands of native perennial plants.

Control Options: Small stands of Bull thistle would be mowed, scythed, or hand cut to remove the bolted but not flowered stem. Hand cutting would include removing the stem and root crown.

The bull thistle seed head gall fly (*Urophora stylata*) is effective in reducing stand density. Control of seed production is effective where the population of gall flies is high. This control method is not recommended for small infestations.

The chemical treatment of Bull thistle with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™, Rodeo™) and imazapic (Plateau™) are the herbicides used to control Bull thistle on the Refuge. Aminopyralid is very selective, provides longer control, can be used at lower rates. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Mechanical and hand removal would occur during bolt but before flowering (late June - July). Late bolting plants need removal before flowering to prevent seed formation. Herbicides would be applied 1 -2 times during the growing season (April - November). Application would occur during the rosette stage or after mowing or scything.

G.8.9 Field bindweed

Priority: Low to Medium: Field bindweed is highly competitive species with prodigious powers of regeneration from roots and rhizomes. Bindweed can survive a wide range of environmental conditions, but disturbed soil is a necessity for invasion. Bindweed is a threat to the regeneration of native vegetation.

Description: Field bindweed is perennial forb growing as a climbing and prostrate vine that forms dense mats. The taproot is deep, forming an extensive root system. The leaves are sagittate; flowers are bell-shaped and pink to white. Blooming occurs from June until frost.

Current Distribution on the Refuge: Bindweed is widely spread on Protection Island and unknown in other areas of the Refuge.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Control field bindweed to reduce competition with native plants by keeping any infestation at less than 40% of live vegetation cover.
d. Maintain healthy stands of native perennial plants.

Control Options: Mechanical and hand methods of control are impractical and ineffective due to the species' distribution and ability to regenerate from severed roots and rhizomes.

The chemical treatment of field bindweed with an appropriate herbicide provides relatively effective control. Currently, glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) are the herbicides used to control field bindweed on the Refuge. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other herbicides indicated for field bindweed control are picloram, dicamba, and 2,4-D. The uses of restricted use pesticides like picloram are avoided at the Refuge. Dicamba has low wildlife toxicity but is not for use near water. Aquatic formulations of glyphosate and 2,4-D fill that niche. 2,4-D would be used at the Refuge. Its effectiveness would be monitored and the herbicide would be considered as a replacement for imazapic in some situations. As with all herbicides, 2,4-D has been detected in groundwater although the sources of contamination are associated with inappropriate use and spillage. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

The field bindweed moth and the field bindweed mite have not been used to control field bindweed at the Refuge. These agents have not established well in the Pacific Northwest.

Treatment Schedule: Herbicides would be applied one to two times during the growing season (June - November). The period of highest chemical effectiveness is in the early flowering stage. Invaded sites would be monitored to determine the local variation in conditions that lead to the plants' flowering time. Multiple year applications may be necessary.

The field bindweed moth and field bindweed mite would be released to heavily infested bindweed sites during the early growing season (June through August). The release of bioagents would be dependent on the insects' availability.

G.8.10 St. Johnswort

Priority: Low to medium: St. Johnswort invades disturbed sites along roadsides, over-grazed pastures and range, and waste places. It prefers dry, sandy to gravelly soil. St. Johnswort forms a deep, laterally spreading root system that forms new plants vegetatively from root buds. Dense growth of these plants inhibits regeneration of native species.

Description: St. Johnswort is a perennial shrub-like forb. The stems produce numerous branches and reach 1 to 3 feet high. Leaves are up to one inch long, opposite, entire, and contain numerous transparent dots. Flowers are yellow arranged in open, flat-topped cymes.

Current Distribution on the Refuge: St. Johnswort has not been identified on any of the refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of St. Johnswort plants - targeting for elimination - to reduce competition with native plants and stop the spread of infestations.
d. Maintain healthy stands of native perennial plants.

Control Options: Small infestations of new plants can be pulled by hand or dug out.

Glyphosate (Roundup® and Roundup Pro®) is effective in controlling St. Johnswort. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Other herbicides indicated for effective St. Johnswort control are picloram and 2,4-D. The use of restricted use pesticides such as picloram is avoided on the Refuge. 2,4-D is planned for use on the Refuge to control various broadleaf noxious weeds and its use for St Johnswort control could be considered in the future. As with all herbicides, 2,4-D has been detected in groundwater although the sources of contamination are associated with inappropriate use and spillage. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Biological control of St. Johnswort with the Klamath weed beetle (*Chrysolina quadrigemina*) has been very effective in North America. Two foliage beetles, *Chrysolina hyperici* and *C. quadrigemina* were released in California from 1945 to 1946, and established within two years. A root-boring beetle *Agrilus hyperici* and a leaf bud gall-forming midge *Zeuxidiplosis giardi* were released in 1950 to help the Chrysolina spp. Recently released in the state and established is the moth *Aplocera plagiata.* Due to the success of these beetles in controlling St. Johnswort, their continued use for established and new infestations is the preferred method of control.

Treatment Schedule: Removal and disposal of plants would be done in early spring (before flower formation).

Spot spraying with glyphosate (Roundup® and Roundup Pro®) before flowering can be an effective control method if repeated applications are made. Bolting and flowering occur early and continue through late summer (June - September). Patches need to be monitored for newly sprouted plants throughout the summer.

The release of Klamath weed beetles would be made in July to new or non-beetle infested areas. Beetles (if available) established in an area on the Refuge would be harvested and used as colonizers.

G.8.11 Dalmatian toadflax

Priority: High: Dalmation toadflax is an aggressive, colony-forming invasive. This species is opportunistic in invading disturbed sites, but it can also press into established vegetation communities in good condition. Native communities and restored sites may be jeopardized by the creeping expansion of Dalmation toadflax adventitious root buds. Competition between natives and toadflax may make the community more vulnerable to other invasive species. Dalmation toadflax produces a toxic substance and is unpalatable to livestock and wildlife.

Description: Dalmation toadflax is a perennial forb reaching up to 3 feet in height. Reproduction is by seed and underground root stalks. Leaves are alternate and variable in shape - ovate to lanceolate. Leaves and stems are robust, glaborous with whitish or bluish cast. Flowers grow at the axils of the upper leaves. The spurred-flower is yellow with an orange center. Flowers bloom late June through October.

Current Distribution on the Refuge: Currently, no islands are known to have any infestation, but Dungeness Spit has a small patch located on Graveyard Spit. That site has been treated for several years by hand-pulling.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of Dalmation toadflax plants - targeting for elimination - to reduce competition with native plants.
d. Maintain healthy stands of native perennial plants.

Control Options: Hand pulling individual plants before seed set decreases seed production. Scything or mowing of stands before seed set is also effective. These methods do not kill the plant, but over time with repeated pulling, the population would be reduced.

The chemical treatment of Dalmation toadflax with an appropriate herbicide provides relatively effective control. Currently, glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) are the herbicides used to control Dalmation toadflax on the Refuge. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Glyphosate is appropriate for spot treatments, but its broad specificity precludes broadcast applications. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Biological control using a defoliating moth is well-established in Washington and reportedly provides good control.

Treatment Schedule: The removal of above ground portions of the plant before seed set would be done in April through July. The seeds are long-lived; annual removal of plants for up to ten years is necessary to deplete the seed bank.

Applications of glyphosate and imazapic would be made one to two times per growing season (April - November). Fall applications are particularly effective in decreasing the available stored carbohydrates in the roots.

G.8.12 Yellow toadflax

Priority: High: Yellow toadflax is an aggressive, colony-forming invasive. This species is opportunistic in invading disturbed sites, but it can also press into established vegetation communities in good condition. Native communities and restored sites may be jeopardized by the creeping expansion of yellow toadflax adventitious root buds. Competition between natives and toadflax may make the community more vulnerable to other invasive species. Yellow toadflax produces a toxic substance and is unpalatable to livestock and wildlife.

Description: Yellow toadflax is a perennial forb, 1 to 2 feet, with pale green, alternate, linear leaves. The base of the branched stem is woody. Stems and leaves are pale green. Flowers are spurred and yellow with an orange center.

Current Distribution on the Refuge: No known infestations exist on refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of yellow toadflax plants - targeting for elimination - to reduce competition with native plants.
d. Maintain healthy stands of native perennial plants.

Control Options: Hand pulling individual plants before seed set decreases seed production. Scything or mowing of stands before seed set is also effective. These methods do not kill the plant.
The chemical treatment of yellow toadflax with an appropriate herbicide provides relatively effective control. Currently, glyphosate (Roundup™, Roundup Pro™) and imazapic (Plateau™) are the herbicides used to control yellow toadflax on the Refuge. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Glyphosate is appropriate for spot treatments, but its broad specificity precludes broadcast applications. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: The removal of above ground portions of the plant before seed set would be done in April through July. The seeds are long-lived; annual removal of plants for up to ten years is necessary to deplete the seed bank.

Applications of glyphosate and imazapic would be made one to two times per growing season (April - November). Fall applications are particularly effective in decreasing the available stored carbohydrates in the roots.

G.8.13 Scotch thistle

Priority: Low to Medium: Scotch thistle aggressively invades disturbed and moist areas. This thistle, due to its size and spinous leaves, presents a passage barrier. Infestation decreases the value and area of wildlife habitat. Scotch thistle seeds have a water-soluble germination inhibitor that facilitates its own propagation and expansion along irrigation canals and other wet areas. Scotch thistle reproduces by seed.

Description: Scotch thistle is biennial forb that grows to 12 feet high. Leaves are large, green, and spiny. Fine hairs give the leaves a cottony appearance. First-year rosettes are 10 to 12 inches in diameter. Leaves of the mature plant may be two feet in length with a prominent white mid-rib. Flower heads are numerous and terminal. Flowers are 1 to 2 inches in diameter, pale purple to red in color.

Current Distribution on the Refuge: No known infestations exist on refuge lands.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, other disturbed soil areas, and riparian and other moist areas.

Objectives:

a. Monitor known infestation sites, riparian and moist areas, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Control Scotch thistle to reduce competition with native plants by keeping infestations to less than 1 acre and less than 40% of live vegetation cover.
d. Maintain healthy stands of native perennial plants.

Control Options: Mechanical treatment would include hand pulling or cutting of individual plants and small stands. The taproot would be cut 1-2 inches below the ground surface. Scything and mowing would be options for larger stands. The removal of the top material before flower production decreases the number of seeds available for spreading and propagation. Preventing flowering by mechanical means in conjunction with herbicide application for root killing is most effective in eliminating and controlling Scotch thistle.

The chemical treatment of Scotch thistle with an appropriate herbicide provides relatively effective control. Currently, aminopyralid (Milestone), glyphosate (Roundup™, Roundup Pro™), imazapic (Plateau™), and metsulfuron methyl (Escort®) are the herbicides used to control Scotch thistle on the Refuge. Aminopyralid is very selective, provides longer control and can be used at lower rates. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Glyphosate is appropriate for spot treatments, but its broad specificity precludes broadcast applications. Imazapic (Plateau™) is used in dry upland sites and on soils with low leaching potential. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Metsulfuron methyl is very effective for thistle and mullein control and is the preferred treatment in restoration areas with a high infestation level. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Mechanical treatment would target plants before flowering (April to mid-June).

Herbicides would be applied before bolting in the spring (April to June), possibly in conjunction with mechanical control, or to rosettes in fall (September -November).

G.8.14 Common cordgrass

Priority: High: The State of Washington considers this species one of the top ten priority weeds targeted for control, particularly for preventing new infestations. Cordgrass is an aggressive species that regenerates from large rootstocks. Excessive proliferation of cordgrass can lower the groundwater level, reduce the amount of surface water, reduce habitat for wildlife dependent on open water, reduce bird use by as much as 50%, reduce and interfere with water flow through drainages.

Description: Cordgrass is a perennial grass with stems reaching 7 feet. The stems have a waxy coating. Leaves are flat, 1/4 to 3/4 inch wide. The leaves lack auricles and have ligules that consist of a fringe of hairs. The leaf blades, which may be flat or inrolled, are 5 to 12 mm broad and may be persistent or falling. The flowers occur in numerous, erect, contracted panicles, which consist of closely overlapping spikelets in two rows on one side of the rachis. Reproduction is by seed, rhizomes, tillering, and rhizome fragments. The panicle is 3 to 8 inches long, initially compact but opening upon maturity.

Current Distribution on the Refuge: The only known infestation of common cordgrass is on Graveyard Spit on Dungeness NWR.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants and established native communities in disturbed moist soil, riparian, and wetland environments.

Objectives:

a. Monitor known infestation sites - riparian, wetland, and moist areas for significant adverse effects on water flow and wildlife habitat.
b. Seed disturbed sites with native species.
c. Control common cordgrass to reduce competition with native plants and significantly altering the environment. Treatment applied to keep infestation to less than 40% of live vegetation cover and prevent infestations from increasing in area.
d. Maintain healthy stands of native perennial plants.

Control Options: Mowing infestations can contain growth, limit seed set, and eventually kill the plants. To be effective, clones must be mowed repeatedly, beginning with initial spring green-up and continued until fall die-back. For clones under 10 feet in diameter, one to three mowings during the growing season may be effective. Larger clones need to be mowed nine to ten times over two seasons for eradication. In some cases, mowing would be required for a third or fourth year (Spartina Task Force 1994).

Chemical control with glyphosate (Rodeo®) would be used on the Refuge for effective control of common cordgrass. Glyphosate is soil binding, inexpensive, a low threat to groundwater quality, and used to target numerous weed species. This chemical formulation is approved for aquatic application. All chemicals would be used in accordance with label recommendations.

Treatment Schedule: Data from herbicide trials in Willapa Bay suggest chemical control is best performed when the plants carbohydrate stores are lowest. Treatment would be conducted 1 to 2 times per season - once in the summer (June - August) and/or once in the spring (May) (Norman and Patten 1995).

G.8.15 Himalayan blackberry and Evergreen blackberry

Priority: High: Although widespread in Washington and control in not required, these species are highly invasive and difficult to control. Therefore it is important to protect wilderness areas as well as areas being restored to native vegetation.

Description: A robust, thicket forming shrub with stout arching canes with large stiff thorns. They can grow up to 15 feet tall; canes to 40 feet long. They bloom in the spring and the flowers are small, white to pinkish with five petals and Himalayan blackberry leaves are palmately compound with large, rounded to oblong, toothed leaflets usually in groups of 5 on main stems, while Evergreen blackberry (also known as cut-leaf blackberry) has deeply incised leaflets. They can be distinguished from the native trailing blackberry (*Rubus ursinus*) by its tall, arching reddish-brown canes, much more robust plants, rounder leaflets (or deeply incised leaflets for evergreen blackberry), and larger fruits and flowers

Current Distribution on the Refuge: Known infestations exist on the Dawley Unit and Protection Island. Currently, it is unknown distribution or densities of either of these species on any of the other refuge islands.

Measurable Objectives and Goal: Prevent further spread into newly seeded native restoration sites, along other ditches or other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of blackberry plants - targeting for elimination - to reduce competition with native plants.
d. Maintain healthy stands of native perennial plants.

Control Options: Mechanical control includes hand pulling of small infestations, mowing or herbicide larger patches.

The chemical treatment of blackberries with an appropriate herbicide provides relatively effective control. Currently, glyphosate (Roundup™, Roundup Pro™), would be used on the Refuge. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Glyphosate is appropriate for spot treatments. Metsulfuron methyl is very effective for thistle, mullein control and blackberry is the preferred treatment in restoration areas with a high infestation level. This chemical can be broadcast in restoration areas where the establishment of native grasses and herbicide resistant native broadleafs are essential for restoration success. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Cultural control of blackberries is an important control method. The key to controlling spread is by decreasing seed production in established patches, and/or preventing the cane tips or nodes from touching the ground to produce "daughter" plants. Methods that assist in these control strategies are minimizing soil disturbance, maintaining healthy native vegetation, control seed formation with a combination of mechanical and chemical techniques.

Treatment Schedule: The pulling can be done anytime. Mowing or cutting midsummer allow plant to grow back 18 inches then treat with herbicide is the preferred method.

Chemical application would occur during the Fall (Sept Oct.).

G.8.16 English Ivy

Priority: Low: Although widespread in western Washington and control in not required, this specie is highly invasive but fortunately not too difficult to control. Therefore it is important to protect wilderness areas as well as areas being restored to native vegetation.

Description: Evergreen vine that can trail along the ground or grow vertically up trees, fences, walls and hillsides. Most common type of growth lacks flowers and has dull green, lobed leaves with light veins that grow alternately along trailing or climbing stems. Leaf shape and size varies between varieties from deeply to shallowly lobed and from small, narrow leaves to large, broadly shaped leaves. Mature form of growth has shiny, unlobed leaves that grow in dense, whorl-like clusters and produce umbrella-like groups of small yellow-green flowers in the fall, followed by dark purple-black berries in the late winter or early spring.

Current Distribution on the Refuge: Only known infestations exist on Matia Island and the Dawley Unit.

Measurable Objectives and Goal: Prevent further spread into newly seeded native restoration sites, along other ditches or other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., remediation areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat 100% of ivy plants - targeting for elimination - to reduce competition with native plants.
d. Maintain healthy stands of native perennial plants.

Control Options: Mechanical control includes hand pulling and cutting of vines or herbicide larger patches.

The chemical treatment of ivy with an appropriate herbicide provides relatively effective control. Currently, glyphosate (Roundup™, Roundup Pro™), would be used on the Refuge. Glyphosate is soil binding, inexpensive, and a low threat to groundwater quality. Glyphosate is appropriate for spot treatments. Other chemicals would be added as needed and be approved at the required level. All chemicals would be used in accordance with label recommendations.

Cultural control of ivy is an important control method. The key to controlling spread is by decreasing seed production in established patches, and/or preventing the vegetative spreading of the plants. Methods that assist in these control strategies are minimizing soil disturbance, maintaining healthy native vegetation, control seed formation with a combination of mechanical and chemical techniques.

Treatment Schedule: The pulling can be done anytime. Mowing or cutting midsummer allow plant to grow back 18 inches then treat with herbicide is the preferred method. Cutting vines and treating stems with herbicide or foliar in spring are good alternatives.

Chemical application would occur during the Spring or Fall.

G.8.17 Scotch Broom

Priority: High: The State of Washington considers this species as a Class B Noxious weed, and control is recommended. Scotch broom infests disturbed areas, along roadsides, pastures, and open areas where it forms dense colonies. It reproduces by seeds, which can remain viable for up to 60 years. Populations enlarge by peripheral expansion of existing stands forming monocultures. Biodiversity, livestock and wildlife forage quality are reduced with infestations of scotch broom. Seed are toxic to livestock and horses.

Description: Scotch broom is a perennial evergreen shrub with a deep taproot. Plants reach 3 to 10 feet tall with many branched stems. There are relatively few leaves that are simple in the upper part of the plant and the lower parts are 3 leaflets and deciduous. Flowers are primarily yellow, but may be tinged with red or purple. They are an irregular shaped pea-like flower about ¾ of an inch long. Flowering occurs from April to June.

Current Distribution on the Refuge: Only known infestation is at the Dawley Unit of the Refuge Complex.

Measurable Objectives and Goal: Prevent competition with newly seeded native plants in habitat restoration sites, along roadways, and other disturbed soil areas.

Objectives:

a. Monitor known infestation sites, newly seeded areas, roadways, and other disturbed sites (e.g., restoration areas, wildfire areas) depleted of native perennial plants.
b. Seed disturbed sites with native species.
c. Treat and control 100% of scotch broom plants - targeting for elimination - to reduce competition with native plants and prevent establishment of Scotch broom or its seed bank. Map and measure larger infestation patches using geographic information software and a global positioning system device. Treat patches to prevent increase in the infestation area.
d. Maintain healthy stands of native perennial plants.

Control Options: Hand pulling or digging using a weed wrench is a feasible control of small infestations and individual plants. The taproot would be removed to at least 2 inches below the ground surface. Entire plants would be removed from the site to limit the source of available seeds or removed prior to seed set.

Biological control of scotch broom is limited with a few domestic animals browsing the young stems. Two introduced insects; the twig-mining moth and the seed weevil eat only Scotch broom. They have been released in western Clallam County but their effectiveness in controlling Scotch broom has not yet been established.

The chemical treatment of scotch broom with an appropriate herbicide provides relatively effective control. Currently, triclopyr (Garlon ^{TM}), or glyphosate (Roundup^{TM}, Roundup Pro^{TM}) would be the herbicides used to control Scotch broom on the Refuge.

Treatment Schedule: Hand removal would be conducted 2 to 3 times during the growing season, the first removal occurring early in the season (March) well before flowering. Established areas too large to practically control by hand, or in areas where injury to surrounding vegetation prohibits broad scale application with chemical control, a cut and stump treatment would be used.

Selected biological control insect(s) would be, if used, released during the optimal time for both insect and plant to provide the greatest effectiveness for controlling Scotch broom.

Triclopyr or glyphosate would be applied once before the flowering season (April-June). Annual treatment is necessary as long as there is a viable seed source.

G.8.18 Other Future species

Oxeye Daisy, Tansy Ragwort, and Spurge Laurel
These are species currently not known to occur on the Refuge but are known to occur in surrounding areas. These include Purple Loosestrife, Russian knapweed, Garlic Mustard, Japanese Knotweed, and Lawnweed. Others may be added as additional information becomes available and new invaders are documented.

Table G-5. Summary of invasive plant species and possible control methods to be used, Washington Maritime National Wildlife Refuge Complex

Species	Priority	Mechanical	Biological	Chemical	Cultural
Blackberries	Low-Medium	X		X	
Bull thistle	Low-Medium	X		X	
Canada thistle	Low to Medium	X	Stem-and-shoot gallfly (*Urophora cardui*)	X	
Cheatgrass	Medium	X		X	X
Dalmatian and yellow toadflax	High	X		X	

Diffuse, spotted, Russian, and meadow knapweed	High	X	Broad-nosed seedhead weevil, Sulfur knapweed moth, Knapweed weevil, Knapweed flowerhead weevil	X	
Field bindweed	Low to Medium		Field bindweed moth, Field bindweed mite	X	
Scotch Broom	High	X		X	
Leafy spurge	High		Brown-legged spurge flea beetle, Amber spurge flea beetle	X	
Musk thistle	Medium	X	Seed head weevil, Musk thistle weevil	X	
Common cordgrass	Medium to High	X		X	
Russian knapweed	High	X		X	
Scotch thistle	Medium to High	X		X	
St. Johnswort	Medium to High		Klamath weed beetle		

G.9 Non-native Mammal Control

The animals referred to under this category are the non-native predators (rats, red fox, dogs, and cats) and the herbivore (European rabbit). All of these can be controlled using one or more methods. Currently, only rabbits are known to exist on a limited number of islands and in low numbers, but expanding. For initial population control traps would be the preferred method followed by shooting then poison bait. Any method used would be to eradicate the population in the quickest, most humane, and least impact to other potential non-target animals.

G.10 References

AgDrift. 2001. A user's guide for AgDrift 2.04: a tiered approach for the assessment of spray drift of pesticides. Spray Drift Task Force. Macon, MO.

ATSDR (Agency for Toxic Substances and Disease Registry) U.S. Department of Health and Human Services. 2004. Guidance manual for the assessment of joint toxic action of chemical mixtures. U.S. Department of Health and Human Services, Public Health Service, ATSDR, Division of Toxicology. 62 pp. (+ appendices).

Baehr, C.H. and C. Habig. 2000. Statistical evaluation of the UTAB database for use in terrestrial nontarget organism risk assessment. Presentation at the American Society for Testing and Materials (ASTM) Tenth Symposium on Environmental Toxicology and Risk Assessment, April 2000, Toronto, Canada.

Baker, J. and G. Miller. 1999. Understanding and reducing pesticide losses. Extension Publication PM 1495. Iowa State University Extension. Ames, IA. 6 pp.

Barry, T. 2004. Characterization of propanil prune foliage residues as related to propanil use patterns in the Sacramento Valley, CA. Proceedings of the International Conference on Pesticide Application for Drift Management. Waikoloa, HI. 15 pp.

Battaglin, W.A., E.M. Thurman, S.J. Kalkhoff, and S.D. Porter. 2003. Herbicides and transformation products in surface waters of the midwestern United States. Journal of the American Water Resources Association (JAWRA) 39(4):743-756.

Beyer, W.N., E.E. Connor, and S. Gerould. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management 58:375-382.

BLM (Bureau of Land Management). 2007. Vegetation treatments using herbicides on Bureau of Land Management Lands in 17 western states Programmatic EIS (PEIS). Bureau of Land Management. Washington, D.C. 539 pp.

Brooks, M.L., C.M. D'Antonio, D.M. Richardson, J.B. Grace, J.E. Keeley, J.M. DiTomaso, R.J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. BioScience 54:77-88.

Butler, T., W. Martinkovic, and O.N. Nesheim. 1998. Factors influencing pesticide movement to ground water. Extension Publication PI-2. University of Florida, Cooperative Extension Service. Gainesville, FL. 4 pp.

Calabrese, E.J. and L.A. Baldwin. 1993. Performing ecological risk assessments. Chelsea, MI: Lewis Publishers.

Center, T.D., J.H. Frank, and F.A. Dray, Jr. 1997. Biological control. Pages 245-263 in: D. Simberloff, D.C. Schmitz, and T.C. Brown, eds. Strangers in paradise: impact and management of nonindigenous species in Florida. Washington, D.C.: Island Press.

Coombs, E.M., J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Jr. 2004. Biological control of invasive plants in the United States. Corvallis, OR: Oregon State University Press.

Cox, R.D. and V.J. Anderson. 2004. Increasing native diversity of cheatgrass-dominated rangeland through assisted succession. Journal of Range Management 57:203-210.

Driver, C.J., M.W. Ligotke, P. Van Voris, B.D. McVeety, B.J. Greenspan, and D.B. Brown. 1991. Routes of uptake and their relative contribution to the toxicologic response of northern bobwhite (*Colinus virginianus*) to an organophosphate pesticide. Environmental Toxicology and Chemistry 10:21-33.

Dunning, J.B. 1984. Body weights of 686 species of North American birds. Western Bird Banding Association. Monograph No. 1. Cave Creek, AZ: Eldon Publishing.

EXTOXNET. 1993. Movement of pesticides in the environment. Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, University of Idaho,

University of California – Davis, and the Institute for Environmental Toxicology, Michigan State University. 4 pp.

Fletcher, J.S., J.E. Nellessen, and T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kanaga) nomogram, and instrument for estimating pesticide residue on plants. Environmental Toxicology and Chemistry 13:1381-1391.

Hasan, S. and P.G. Ayres. 1990. The control of weeds through fungi: principles and prospects. Tansley Review 23:201-222.

Huddleston, J.H. 1996. How soil properties affect groundwater vulnerability to pesticide contamination. EM 8559. Oregon State University Extension Service. Corvallis, OR. 4 pp.

Kerle, E.A., J.J. Jenkins, and P.A. Vogue. 1996. Understanding pesticide persistence and mobility for groundwater and surface water protection. EM 8561. Oregon State University Extension Service. Corvallis, OR. 8 pp.

Masters, R.A. and R.L. Sheley. 2001. Invited synthesis paper: principles and practices for managing rangeland invasive plants. Journal of Range Management 54:502-517.

Masters, R.A., S.J. Nissen, R.E. Gaussoin, D.D. Beran, and R.N. Stougaard. 1996. Imidazolinone herbicides improve restoration of Great Plains grasslands. Weed Technology 10:392-403.

Maxwell, B.D., E. Lehnhoff, and L.J. Rew. 2009. The rationale for monitoring invasive plant populations as a crucial step for management. Invasive Plant Science and Management 2:1-9

Mineau, P., B.T. Collins, and A. Baril. 1996. On the use of scaling factors to improve interspecies extrapolation to acute toxicity in birds. Regulatory Toxicology and Pharmacology 24:24-29.

Moody, M.E. and R.N. Mack. 1988. Controlling the spread of plant invasions: the importance of nascent foci. Journal of Applied Ecology 25:1009-1021.

Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An invasive species assessment protocol: evaluating non-native plants for their impact on biodiversity. Version 1. NatureServe, Arlington, VA. 40 pp.

Mullin, B.H., L.W. Anderson, J.M. DiTomaso, R.E. Eplee, and K.D. Getsinger. 2000. Invasive plant species. Council for Agricultural Science and Technology Issue Paper (13):1-18.

Oregon State University. 1996. EXTOXNET-Extension Toxicology Network, Pesticide Information Profiles. Oregon State University. Corvallis, OR.

Pfleeger, T.G., A. Fong, R. Hayes, H. Ratsch, and C. Wickliff. 1996. Field evaluation of the EPA (Kanaga) nomogram, a method for estimating wildlife exposure to pesticide residues on plants. Environmental Toxicology and Chemistry 15:535-543.

Pope, R., J. DeWitt, and J. Ellerhoff. 1999. Pesticide movement: what farmers need to know. Extension Publication PAT 36. Iowa State University Extension, Ames, IA, and Iowa Department of Agriculture and Land Stewardship, Des Moines, IA. 6 pp.

Ramsay, C.A., G.C. Craig, and C.B. McConnell. 1995. Clean water for Washington—protecting groundwater from pesticide contamination. Extension Publication EB1644.Washington State University Extension. Pullman, WA. 12 pp.

SDTF 2003 (Spray Drift Task Force 2003). 2003. A summary of chemigation application studies. Spray Drift Task Force. Macon, MO.

Spartina Task Force. 1994. Spartina Management Program: Integrated Weed Management for Private Lands in Willapa Bay, Pacific County, Washington. Unpublished report prepared for the Noxious Weed Board and County Commissioners, Pacific County, Washington.

Teske, M.E., S.L. Bird, D.M. Esterly, S.L. Ray, and S.G. Perry. 1997. A user's guide for AgDRIFTTM 1.0: a tiered approach for the assessment of spray drift of pesticides. Technical Note No. 95-10. CDI. Princeton, NJ.

Teske, M.E., S.L. Bird, D.M. Esterly, T.B. Curbishley, S.L. Ray, and S.G. Perry. 2002. AgDRIFT®: a model for estimating near-field spray drift from aerial applications. Environmental Toxicology and Chemistry 21: 659-671.

Urban, D.J. and N.J. Cook. 1986. Ecological risk assessment. EPA 540/9-85-001. U.S. Environmental Protection Agency, Office of Pesticide Programs. Washington, D.C. 94 pp.

USEPA (U.S. Environmental Protection Agency). 1990. Laboratory test methods of exposure to microbial pest control agents by the respiratory route to nontarget avian species. EPA/600/3-90/070. Environmental Research Laboratory. Corvallis, OR. 82 pp.

USEPA. 1998. A comparative analysis of ecological risks from pesticides and their uses: background, methodology and case study. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency. Washington, D.C. 105 pp.

USEPA. 2004. Overview of the ecological risk assessment process in the Office of Pesticide Programs, US Environmental Protection Agency: endangered and threatened species effects determinations. Office of Pesticide Programs. Washington, D.C. 101 pp.

USEPA. 2005. User's guide TREX v1.2.3. Available at: http://www.epa.gov/oppefed1/models/terrestrial/trex_usersguide.htm.

USEPA. 2012. Technical overview of ecological risk assessment risk characterization; approaches for evaluating exposure; granular, bait, and treated seed applications. Available at: http://www.epa.gov/oppefed1/ecorisk_ders/toera_analysis_exp.htm. Accessed July 5, 2012.

USFS (U.S. Forest Service). 2005. Pacific Northwest Region invasive plant program preventing and managing invasive plants final environmental impact statement. U.S. Forest Service. Portland, OR. 359 pp.

USGS (U.S. Geological Survey). 2000. Pesticides in stream sediment and aquatic biota—current understanding of distribution and major influences. USGS Fact Sheet 092-00. US Geological Survey. Sacramento, CA. 4 pp.

Washington State Noxious Weed Board. 2010. Common cordgrass (*Spartina angilca*). Available at: http://www.nwcb.wa.gov/detail.asp?weed=129. Accessed June 18, 2012.

Washington State Noxious Weed Board. 2010. Dalmatian toadflax (*Linaria dalmatica* ssp. *dalmatica*). Available at: http://www.nwcb.wa.gov/detail.asp?weed=85. Accessed June 18, 2012.

Washington State Noxious Weed Board. 2010. Oxeye daisy (*Leucanthemum vulgare*). Available at: http://www.nwcb.wa.gov/detail.asp?weed=84. Accessed June 18, 2012.

Washington State Noxious Weed Board. 2010. Lawn burweed (*Soliva sessilis*). Available at: http://www.nwcb.wa.gov/detail.asp?weed=125. Accessed June 18, 2012.

Wauchope, R.D., T.M. Buttler, A.G. Hornsby, P.M. Augustijn-Beckers, and J.P. Burt. 1992. The SCS/ARS/CES pesticide properties database for environmental decision making. Reviews of Environmental Contamination and Toxicology 123:1-155.

Woods, N. 2004. Australian developments in spray drift management. Proceedings of the International Conference on Pesticide Application for Drift Management. Waikoloa, HI. 8 pp.

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