Appendix C

Water Quality

In the following appendix, DNR provides additional information regarding the analysis of the No Action and Landscape alternatives. For the Pathways Alternative, refer to the Final Environmental Impact Statement (FEIS).

This page intentionally left blank.

Table of Contents

This page intentionally left blank.

What are Water Resource Inventory Areas?

Major watersheds, known as "water resource inventory areas (WRIA)," have been mapped across Washington State and are used for environmental administration and planning purposes. One WRIA (20-Soleduc/Hoh) is located wholly within the OESF. Two WRIAs (WRIA 19- Lyre/Hoko and 21-Queets/Quinault) are located partially within the OESF.

Use Designations

Table C-1 provides a description of designated uses identified by the Washington State Department of Ecology (Ecology) in 2006. Table C-2 identifies the water bodies with these designated uses in each of the WRIAs located wholly or partially in the OESF. Use designations have not been identified for the Lyre/Hoko area; however, protection of all waters for all use designations is required for surface waters not specifically identified for a particular use (Ecology 2006).

Table C-1: Description of Designated Uses (Ecology 2006)

Use designation	General description
Aquatic life uses	
Char spawning/ rearing	Char spawning and rearing. The key identifying characteristic of this use are spawning or early juvenile rearing by native char (bull trout and Dolly Varden) or use by other aquatic species similarly dependent on such cold water. Other common characteristic aquatic life uses for waters in the category include summer foraging and migration of native char; and spawning, rearing and migration by other salmonid species.
Core summer habitat	Core summer salmonid habitat. The key identifying characteristics of this use are summer (June 15 – September 15) salmonid spawning or emergence, or adult holding; use as important summer rearing habitat by one or more salmonids; or foraging by adult and sub-adult native char. Other common characteristic aquatic life uses for waters in this category include spawning outside of the summer season, rearing, and migration by salmonids.
Recreational uses	
Extraordinary primary contact	Extraordinary quality primary contact waters. Waters providing extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas.
Primary contact recreation	Primary contact recreation means activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

Secondary contact recreation	Secondary contact recreation means activities where a person's water contact would be limited (for example, wading or fishing) to the extent that bacterial infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.
Water supply uses	
Domestic water	Domestic water supply
Industrial water	Industrial water supply
Agricultural water	Agricultural water supply
Stock water	Stock watering
Miscellaneous uses	
Wildlife habitat	Wildlife habitat
Harvesting	Fish harvesting
Commerce/navigation	Commerce and navigation
Boating	Boating
Aesthetics	Aesthetic values

Table C-2: Designated Uses for Waters in the OESF (Excerpted from Table 602, Ecology 2006)

Use designations for fresh waters by water resource inventory area	Aquatic life uses						Recreation uses			Water supply uses				Miscellaneous uses				
	Char spawning/rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex. Primary Contact	Primary Contact	Secondary Conduct	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Water Resource Inventory Area 19 Lyre/Hoko																		
There are no specific water body entries for this Water Resource Inventory Area.																		
Water Resource Inventory Area 20 Soleduc/Hoh																		
Dickey River and tributaries		X						X		X	X	X	X	X	X	X	X	X
Hoh River and tributaries from mouth to South fork Hoh River.		X					X			X	X	X	X	X	X	X	X	X
Hoh River and South fork Hoh River: All waters above the junction.	X						X			X	X	X	X	X	X	X	X	X
Quillayute River		X					X			X	X	X	X	X	X	X	X	X
Soleduc River and tributaries from mouth to Canyon Creek		X					X			X	X	X	X	X	X	X	X	X
Soleduc River and all tributaries above Canyon Creek	X						X			X	X	X	X	X	X	X	X	X
Water Resource Inventory Area 21 Queets/Quinault																		
Clearwater River and the unnamed tributary at lat. 47.7270, long. -124.0361 (Section 26 T26N R11W): all waters (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X

Use designations for fresh waters by water resource inventory area	Aquatic life uses						Recreation uses			Water supply uses				Miscellaneous uses				
	Char spawning/rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex. Primary Contact	Primary Contact	Secondary Conduct	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Kunamakst Creek and the unnamed tributary at latitude 47.7285, longitude -124.0771 (section 26, T26N, R11W): all waters (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Matheny Creek and the unnamed tributary at latitude 47.5592, longitude -123.9538: all waters (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Queets River and tributaries from the mouth to Tshletshy Creek.		X					X			X	X	X	X	X	X	X	X	X
Queets River and tributaries above the junction with Tshletshy Creek	X						X			X	X	X	X	X	X	X	X	X
Quinault River and tributaries from mouth to the junction with the North fork Quinault River.		X					X			X	X	X	X	X	X	X	X	X
Quinault River and North Fork Quinault: all waters (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Salmon River, Middle Fork, and the unnamed tributary at latitude 47.5208, longitude -123.9899: all waters above (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Sams River and the unnamed tributary at latitude	X						X			X	X	X	X	X	X	X	X	X

Use designations for fresh waters by water resource inventory area	Aquatic life uses						Recreation uses			Water supply uses				Miscellaneous uses				
	Char spawning/rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex. Primary Contact	Primary Contact	Secondary Conduct	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
47.6059, longitude -123.8941: all waters above (including tributaries) above the junction.																		
Sollecks River and the unnamed tributary at latitude 47.6937, longitude -124.0133: all waters above (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Staqualeho Creek and the unnamed tributary at latitude 47.6620, longitude -124.0426: all waters above (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X
Tshletshy Creek and unnamed tributary are latitude 47.6585, longitude 123.8668: all waters above (including tributaries) above the junction.	X						X			X	X	X	X	X	X	X	X	X

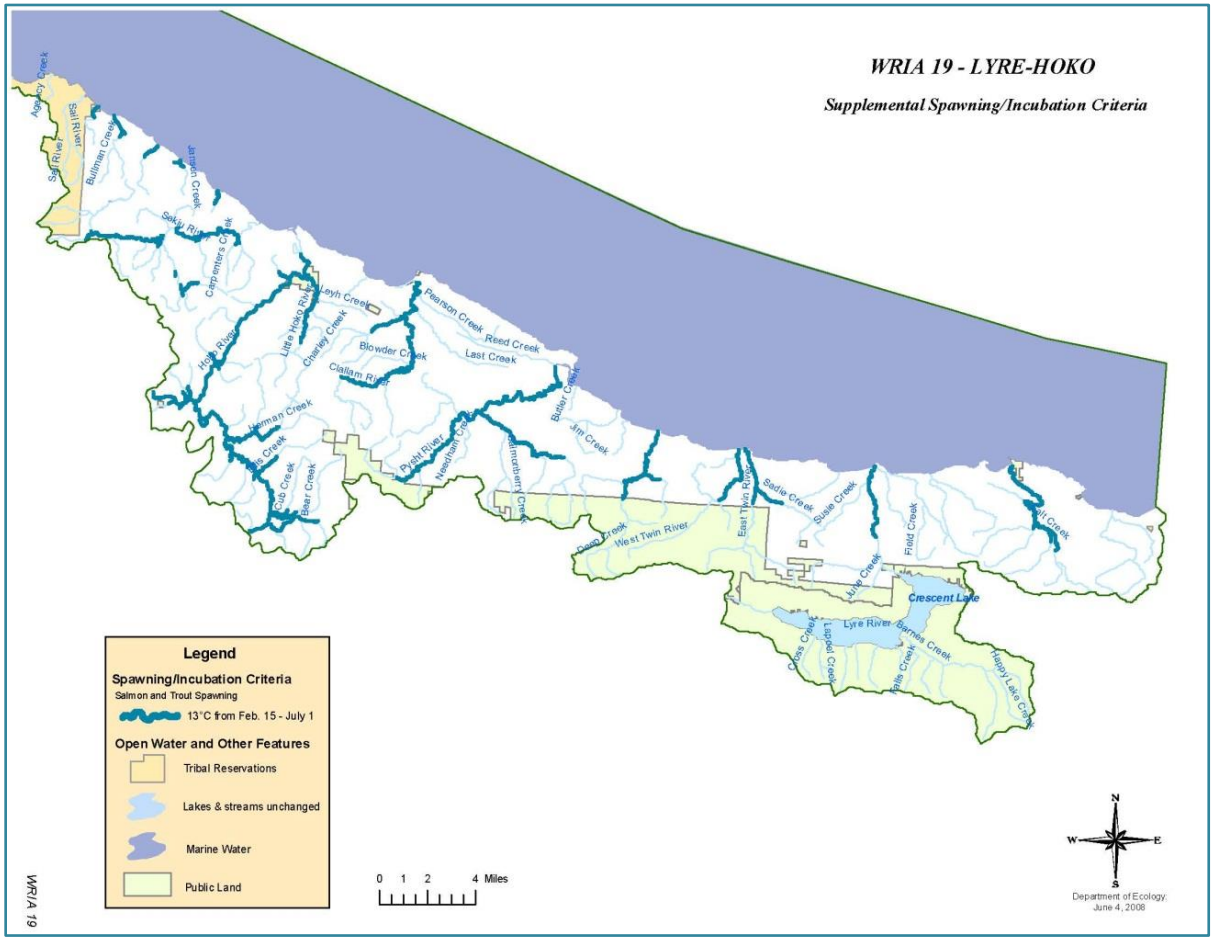
This page left intentionally blank.

Supplemental Criteria

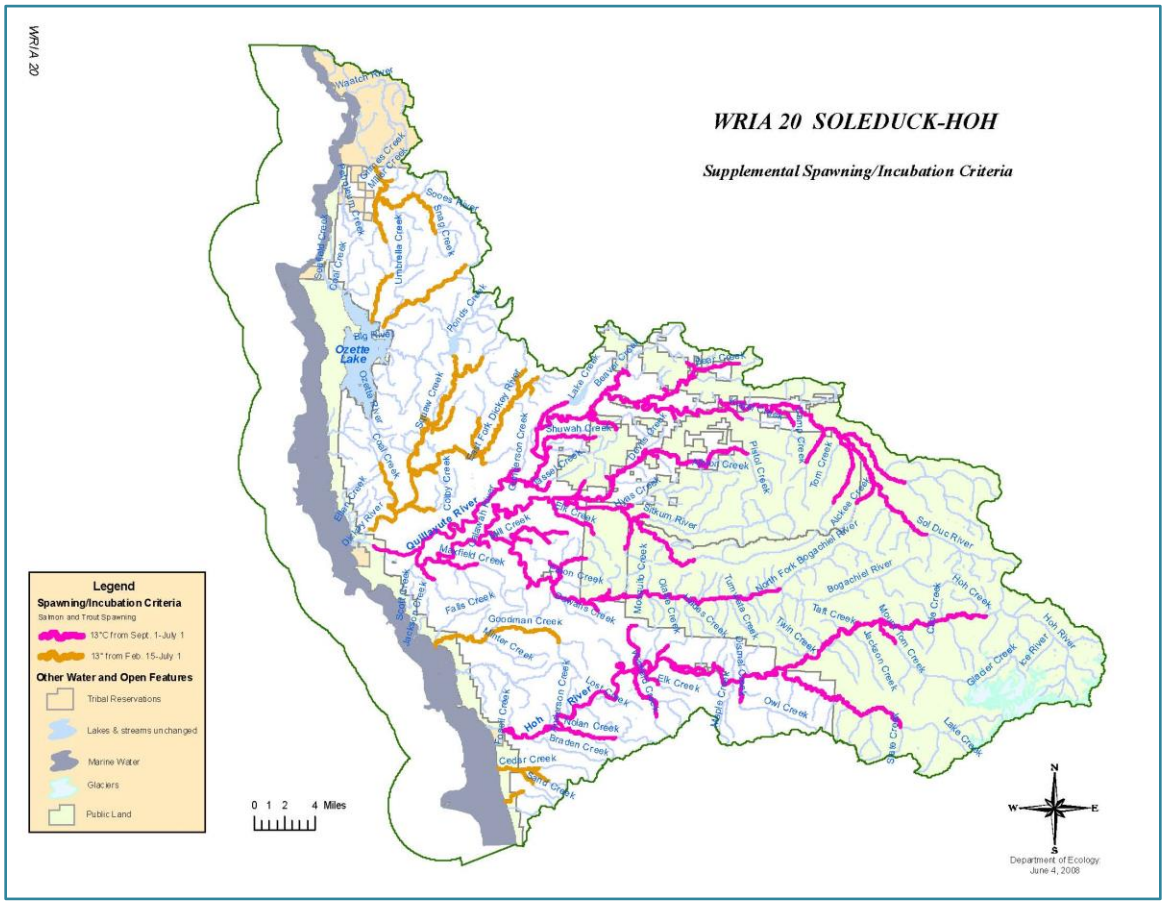
Many rivers and streams in the OESF have supplemental allowable highest 7-day average daily maximum temperatures (refer to "How is Water Temperature Measured" later in this appendix) that are more restrictive than those shown in Table C-2. Refer to Maps C-1 through C-3 for rivers and streams with supplemental restrictions.

Maps C-1 through C-3 were copied from the Washington State Department of Ecology publication *Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species* (Ecology 2011). The public land depicted on these maps include only federally managed public land (national forest and park). State trust lands are not identified on these maps.

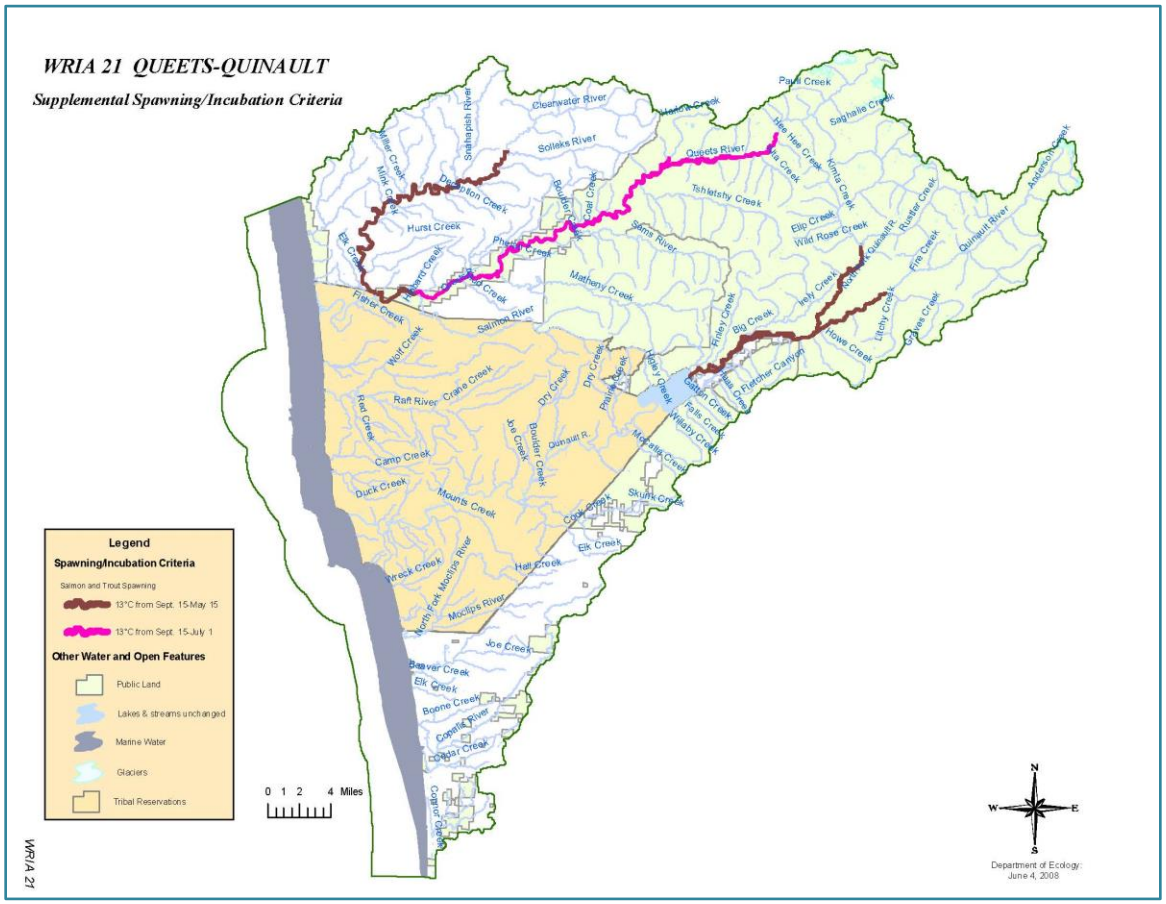
Map C-1: WRIA 19 Supplemental Protections



Map C-2: WRIA 20 Supplemental Protections



Map C-3: WRIA 21 Supplemental Protections



How is Water Temperature Measured?

For water quality, temperature is measured by the 7-day average of the daily maximum temperature[1] of a water body. The maximum 7-day average allowed varies by the aquatic species identified as using a water body (for example native char – bull trout and/or Dolly Varden – or salmon) and what the species is using the water for (for example, spawning and rearing or core summer habitat). The aquatic life uses for rivers and streams in the OESF, and the highest 7-day average daily maximum temperature for each is shown in Table C-3 (Ecology 2006).

Table C-3 Aquatic Life Uses and Highest 7-Day Average Daily Maximum for Waters on the OESF

Use category	Highest 7-day average daily maximum
Char spawning and rearing	12°C (53.6°F)
Core summer Salmonid habitat	16°C (60.8°F)

How is Dissolved Oxygen Measured?

Dissolved oxygen is measured in milligrams of oxygen per liter of water. For water quality purposes, a minimum 1-day dissolved oxygen level is identified for each aquatic life use type. For rivers and streams in the OESF, the lowest 1-day minimum allowed is 9.5 milligrams dissolved oxygen per liter of water (Ecology 2006).

How is Turbidity Measured?

Turbidity is measured in nephelometric units. Nephelometric refers to the way the instrument, a nephelometer, measures how much light is scattered by suspended particles in the water. The greater the amount of scattering, the higher the turbidity. Therefore, low nephelometric turbidity unit values indicate high water clarity, while high nephelometric turbidity unit values indicate low water clarity. Water quality regulations (Ecology 2006) limit the allowable amount of turbidity by aquatic life type in a river or stream. The maximum turbidity allowed for rivers and streams in the OESF is:

- 5 nephelometric turbidity units over background when the background is 50 nephelometric turbidity unit or less; or
- A 10 percent increase in turbidity when the background turbidity is more than 50 nephelometric turbidity units.

Water Quality Data (303(d) listings) in the OESF

The number of stream miles with a 303 (d) listing by indicator is shown by landscape in Table C-4 and by Type-3 Watershed in Table C-5. The 303(d) list contains those waters that are not meeting water quality standards for which beneficial uses– such as drinking, recreation, and aquatic habitat– are considered impaired.

Table C-4: Stream Miles that Exceed the 303(d) listing on State Trust Lands in the OESF by Landscape[1]

	Stream miles that exceeded 303(d) listing criteria				
Landscape name	Stream miles that exceeded temperature standards	Stream miles that exceeded dissolved oxygen standards	Stream miles that exceeded turbidity (fine sediment) standards	Stream miles that exceeded fecal coliform bacteria standards	Total affected stream miles
Clallam	1.9	--	<.01	--	1.9
Dickodochtedar	0.4	<0.1	--	0.1	0.5

Landscape name	Stream miles that exceeded 303(d) listing criteria				Total affected stream miles
	Stream miles that exceeded temperature standards	Stream miles that exceeded dissolved oxygen standards	Stream miles that exceeded turbidity (fine sediment) standards	Stream miles that exceeded fecal coliform bacteria standards	
Goodman	0.6	--	--	--	0.6
Kalaloch	0.1	--	--	--	0.1
Queets	<0.1	--	--	--	<0.1
Sekiu	1.2	--	--	--	1.2
Sol Duc	0.1	1.2	--	--	1.3
Willy Huel	4.3	--	--	--	4.3
Total	**8.6**	**1.2**	**0.004**	**0.1**	**9.9**

[1]Based on water year 2008 data.

Table C-5: Stream Miles that Exceed the 303(d) listing on State Trust Lands in the OESF by Landscape and Type 3 Watershed[1]

Landscape	Type 3 watershed	Stream miles that exceeded 303(d) listing criteria				Total affected stream miles
		Stream miles that exceeded temperature standards	Stream Miles that exceeded dissolved oxygen standards	Stream miles that exceeded turbidity (fine sediment) standards	Stream miles that exceeded fecal coliform bacteria standards	
Clallam	96	0.54	--	--	--	0.54
	160	<0.01	--	--	--	0.00
	161	<0.01	--	--	--	0.00
	166	0.62	--	--	--	0.62
	167	0.20	--	--	--	0.20
	168	0.03	--	--	--	0.03
	180	0.50	--	--	--	0.50
	183	0.06	--	<0.01	--	0.07
Dickodochtedar	192	--	<0.01	--	--	0.00
	270	<0.01	--	--	--	0.00
	380	0.04	--	--	--	0.04
	440	0.02	--	--	--	0.02
	446	0.06	--	--	--	0.06
	447	0.27	--	--	0.10	0.37
Goodman	479	0.25	--	--	--	0.25
	506	0.32	--	--	--	0.32
Kalaloch	793	0.07	--	--	--	0.07

Landscape	Type 3 watershed	Stream miles that exceeded 303(d) listing criteria				Total affected stream miles
		Stream miles that exceeded temperature standards	Stream Miles that exceeded dissolved oxygen standards	Stream miles that exceeded turbidity (fine sediment) standards	Stream miles that exceeded fecal coliform bacteria standards	
Queets	842	<0.01	--	--	--	<0.01
Sekiu	69	1.18	--	--	--	1.18
	267	<0.01	--	--	--	<0.01
Sol Duc	308	--	<0.10	--	--	<0.01
	309	--	1.06	--	--	1.06
	310	--	0.13	--	--	0.13
	345	0.02	--	--	--	0.02
	408	0.06	--	--	--	0.06
Willy Huel	553	0.56	--	--	--	0.56
	557	0.18	--	--	--	0.18
	562	0.87	--	--	--	0.87
	563	0.50	--	--	--	0.50
	564	<0.01	--	--	--	<0.01
	588	0.03	--	--	--	0.03
	609	0.55	--	--	--	0.55
	635	0.38	--	--	--	0.38
	636	0.40	--	--	--	0.40
	637	<0.01	--	--	--	<0.01
	638	0.86	--	--	--	0.86

[1]Based on Water Year 2008 data

Table C-6 shows the miles of stream with a 303(d) listing for non-DNR lands.

Table C-6: Stream Miles that Exceed the 303(d) listing on Non-DNR lands in the OESF[1].

Land owner	Stream Miles that Exceed 303(d) Criteria for non-DNR Landowners in the OESF						Total miles
	Stream miles that exceeded temperature standards	Stream miles that exceeded dissolved oxygen standards	Stream miles that exceeded turbidity (fine sediment) standards	Stream miles that exceeded fecal coliform bacteria standards	Stream miles that exceeded pH standards	Stream miles that exceeded PCB standards	
National Forest	7.0	--	--	--	--	--	7.0
National	6.3	0.2	--	--	2.3	0.6	9.4

Park							
Private/ Other	86.1	5.4	2.9	2.4	3.0	--	99.8
Tribal	1.9	--	--	--	--	0.8	2.7
Total Miles	**101.3**	**5.6**	**2.9**	**2.4**	**5.3**	**1.4**	**118.9**

[1]Based on Water Year 2008 data

Methods: Calculating Traffic Impact Scores

For the No Action and Landscape Alternatives, a traffic impact score was calculated for all road segments within each landscape on the OESF (Table C-7) using data from the analysis model.

Table C-7: Traffic Scores Based on Average Truck Trips per Day

Average truck trips per day	Traffic score	Average truck trips per day	Traffic score	Average truck trips per day	Traffic score
0	0.00	1.75	0.56	3.5	0.84
0.25	0.12	2	0.61	3.75	0.87
0.5	0.23	2.25	0.66	4	0.90
0.75	0.31	2.5	0.70	4.25	0.93
1	0.39	2.75	0.74	4.5	0.95
1.25	0.45	3	0.77	4.75	0.98
1.5	0.51	3.25	0.81	>=5	1.00

The impact score was calculated by assigning individual scores for each of the following variables: surface type, deliverability, distance, and traffic. Traffic was measured by the average number of truck trips per day over a certain road segment based on the following assumptions:

- 4.5 MBF per truck trip (4,500 board feet);
- Two truck trips per haul (one to the mill, one back to the site);
- Traffic level by ownership assumptions:
    - DNR harvest is as modeled for the No Action and Landscape alternatives;
    - US Forest service harvest level per acre is set to be five percent of what DNR's is;

- Olympic National Park has no harvest (although they have a large amount of recreational traffic, most of their roads are paved); and
- Private forested and tribal forested harvest level is 120 percent of DNR's harvest level.

The score for each variable is:

Surface type:

Paved = 0
Non-paved = 1

Deliverability:

Greater than 300 feet from stream = 0
Less than or equal to 300' from stream = 1

Distance:

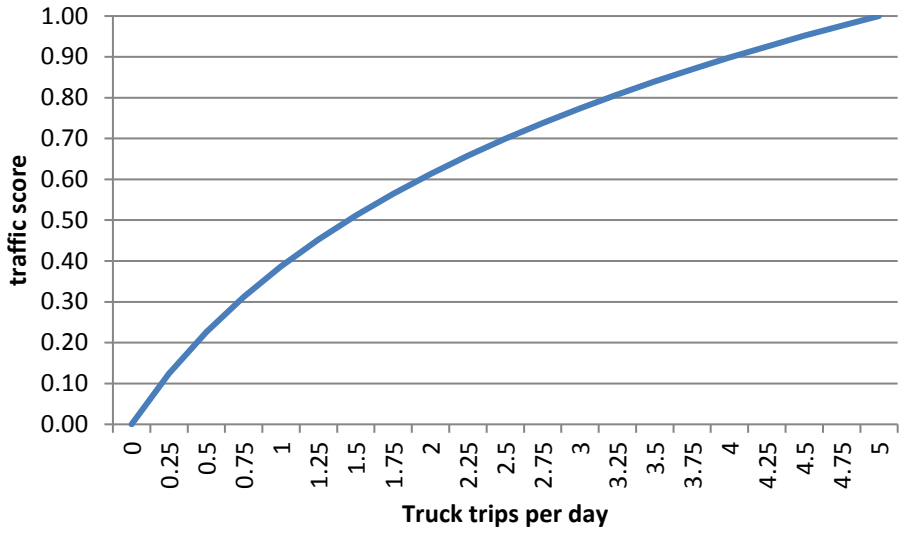
0-100' from stream = 1
100-200' from stream = .67
200-300' from stream = 0.33
Greater than 300' from stream = 0

Traffic in units of truck trips per day averaged over a decade were then assigned traffic scores between zero and one, with higher numbers of truck trips per day having a higher traffic score.

Traffic scores are calculated as; $\ln(TTPD + 1)/\ln(6)$

These variables and scores were used to select roads that are the highest known contributors of sediment (unpaved roads within 300 feet of a stream); to recognize that the further a road segment is from a stream the less likely it is to contribute sediment to that stream (100 foot distance bands); and to distribute a score from zero to one based on average truck trips per day and the levels of impact described by Dubé and others (2004) (high = an average of more than 5 log trucks per day, moderate = an average of one to five log trucks per day, and low = an average of less than one log truck per day) (refer to Chart C-1).

Chart C-1: Traffic Score Distribution



DNR combined the scores for each input variable to get a single score for each road segment using the following equation:

Traffic impact score for each segment = surface type x deliverability x (distance + traffic)/2

DNR calculated the length-weighted sum for each analysis unit using the following equation:

Traffic impact miles per analysis unit = Sum of (Road segment traffic impact score x road segment length in miles)

Then, to allow comparison between analysis units, DNR normalized by stream miles per analysis unit:

Traffic impact miles per stream mile = traffic impact miles per analysis unit / stream miles per analysis unit

For each analysis unit, DNR calculated an overall traffic impact score on a scale of 0 to 100 by assigning values using the following methods:

- If traffic impact miles per stream miles =0, impact score = 0;
- If traffic impact miles per stream miles is between 0.01 and 0.3, score = traffic impact miles per stream mile / 0.3 * 100);
- If traffic impact miles per stream miles > 0.3, impact score = 100.

With 0.3 selected based on the work by the Gallo and others (2005), DNR determined that a riparian road density of 0.3 miles/mile of stream in an analysis unit is the level at which impact levels are high.

Traffic impacts are then quantified by impact level as follows:

- If the score is greater than 67, traffic impacts are high;

- If the score is between 33 and 67, traffic impacts are medium; and
- If the score is less than 33, traffic impacts are low.

Road Category Definitions and Mileage by Landscape

Road Status

Road status is defined as active, closed, decommissioned, abandoned (according to forest practices standards), orphaned, pending abandonment, or unknown.

Table C-8 shows the miles of road by status on state trust lands on the OESF. The majority of these roads are active. Definitions of the road status categories and the miles of road by road status for each landscape are shown in Tables C-9 and C-10.

Table C-8: Miles of Road by Road Status on State Trust Lands in the OESF

Road status	Miles and percent of road on State Trust Lands in OESF
Active	1,630 (89%)
Closed	5 (<1%)
Decommissioned	120 (7%)
Abandoned	24 (1%)
Orphaned	10 (<1%)
Pending abandonment	16 (1%)
Unknown	19 (1%)
Total	**1,824 (100%)**

Table C-9: Road Status Definitions

Status	Definition
Active	A road that is open to traffic and actively used.
Closed	A road that is not accessible by vehicle because of a physical blockage intended to prevent use at the beginning of the road but has not had culverts or other drainage features removed.
Decommissioned	A road that has been made impassable to vehicle traffic, has had all culverts and other drainage features removed, but that is expected to be reconstructed in the future for management purposes.
Forest practices abandoned	A road that has been decommissioned to forest practices standards, has been certified as having had all hydrologic connections removed, and is not expected to be reconstructed in the future.

Status	Definition
Orphaned	A road or railroad grade that the forest landowner has not used for forest practices activities since 1974.
Pending abandonment	A road that has been abandoned to forest practices standards and certification that all hydrologic connections have been removed has been requested but not yet received.
Unknown	A road for which no status type has been identified in the DNR road database.

Table C-10: Road Miles in each Status by Landscape

Landscape name	Active	Closed	Decom-missioned	Forest Practices abandoned	Orphaned	Pending abandon-ment	Unknown	Total
Clallam	103	0	14	2	2	0	0	121
Clearwater	307	0	22	0	1	0	0	331
Copper Mine	161	1	5	0	1	0	0	168
Dickodochtedar	178	0	13	5	0	0	0	197
Goodman	143	2	17	0	1	0	1	164
Kalaloch	120	1	12	1	1	0	4	140
Queets	158	0	14	1	0	0	0	173
Reade Hill	44	0	0	0	0	0	0	45
Sekiu	71	0	4	0	2	0	6	82
Sol Duc	114	0	3	2	8	0	2	129
Willy Huel	230	0	17	0	0	0	4	252
TOTAL	**1,630**	**5**	**120**	**10**	**16**	**0**	**19**	**1,800**

■ Road Surface Type

Roads are also categorized by the type of road surface. Road surface types are asphalt, chip seal, crushed aggregate, native soil, other, pit run, and unknown. Table C-11 shows the miles of forest road by surface type on state trust lands on the OESF. The most common road surface type is pit run. The second most common surface type is "other." It is assumed that roads categorized as "other" are not paved. There are also a small amount of roads with the surface type "unknown." It is also assumed that these roads are not paved.

Table C-11: Miles of Road by Surface Type on State Trust Lands in the OESF

Road surface type	Miles and percent of road on State Trust Lands in OESF
Asphalt	114 (6%)
Chip Seal	1 (<1%)
Crushed aggregate	223 (12%)
Native soil	203 (11%)

Road surface type	Miles and percent of road on State Trust Lands in OESF
Other	431 (24%)
Pit run	821 (46%)
Unknown	8 (<1%)
Total	**1,800[1] (100%)**

[1]The total miles of road is less than shown in Table C-4 because it does not include abandoned roads.

Roads with an asphalt or chip seal surface are considered to be paved roads. Paved roads do not generate sediment from surface erosion. Drainage features associated with paved roads can generate sediment however. The remaining surface types are unpaved and unpaved roads contribute the greatest amount of road related sediment to streams (Potyondy and Geier 2011). When combined the unpaved roads make up 94 percent of the roads on state trust lands on the OESF. Definitions of road surface types and the miles of road by surface type for each landscape are shown in Tables C-12 and C-13.

Table C-12: Road Surface Type Definitions

Road surface type	Definition
Asphalt	A road surfaced with asphalt concrete which is a mixture of pitch-like asphalt and aggregate particles.
Chip seal	A road surface treatment that combines a layer(s) of asphalt with a layer(s) of fine aggregate.
Crushed aggregate	A road surfaced with gravel and with few fines, dust, or dirt on the surface
Native soil	Roads that have not had any gravel or other surfacing applied to them.
Other	A road with a surface that was not considered to be asphalt, chip seal, crushed aggregate, native soil, or pit run. It is assumed that these roads are not paved.
Pit run	Roads with poor quality or very worn gravel surfaces with lots of fines or dust.
Unknown	A road for which no surface type has been recorded in the DNR database. It is assumed these roads are not paved.

Table C-13: Road Miles in Each Surface Type by Landscape

Landscape name	Asphalt	Chip Seal	Crushed aggregate	Native soil	Other	Pit run	Unknown	Total
Clallam	2	0	34	5	45	34	1	121
Clearwater	43	0	14	52	38	184	0	331
Copper Mine	16	0	2	36	35	79	0	168
Dickodochtedar	2	1	24	17	38	115	2	197
Goodman	3	0	5	3	104	48	1	164
Kalaloch	5	0	27	5	41	62	0	140
Queets	13	0	0	54	24	81	0	173
Reade Hill	1	0	1	3	8	32	0	45
Sekiu	2	0	32	1	21	24	2	82
Sol Duc	10	0	45	2	52	19	0	129
Willy Huel	17	0	39	25	27	143	1	252
Total	114	1	223	203	431	821	8	1,800

This page left intentionally blank.

Road Maintenance and Abandonment Plan Accomplishment Summaries

Table C-14 was derived from the 2015 road maintenance and abandonment plan accomplishment reports and reflects work accomplished through calendar year 2015.

Table C-14: Summary of Road Maintenance and Abandonment Plan Accomplishments

Landscape name	Fish passage barriers removed[1]	Miles of fish habitat gained	Miles of road abandoned	Number of completed projects	Number of projects remaining	Percentage of projects completed
Clallam	14	4.3	3.1	211	42	83%
Clearwater	48	16.0	0.6	176	153	53%
Copper Mine	20	6.4	3.1	180	135	57%
Dickodochtedar	56	24.0	2.6	605	131	82%
Goodman	44	14.8	0.8	260	102	72%
Kalaloch	25	10.2	0.7	209	49	81%
Queets	23	6.0	1.3	229	56	80%
Reade Hill	15	19.9	0.8	82	0	100%
Sekiu	3	3.3	1.9	79	134	37%
Sol Duc	17	11.9	0.7	104	0	100%
Willy Huel	31	8.3	12.7	258	20	93%
Total	296	125.1	28.3	2,393	822	74%

[1] Removed altogether or removed and replaced with a structure that allows fish passage.

DNR's Road Maintenance Priorities

■ Forest Roads Guidebook, 2nd Edition, Section 3.11.20: Maintenance Priorities

Maintenance priorities start with protecting human life, public resources are next, followed by business partners, and last general public access.

1. Provide for safe travel.

    a). Visibility: dust and brush control.

b). Stability of road surface: fill failures at stream crossings and along the shoulders of roads or fills showing signs of instability are a high priority for removal or repair.

c). Remove slumping dirt, fallen timber, limbs and stumps from the slopes or roadway.

d). Provide a suitable travel surface.

(1). Control surface water runoff so that is flows in an even, unconcentrated manner.

(2). Maintain a tractable surface for season of use.

e). Inspect bridges and promptly complete maintenance.

2. Maintain the structural integrity of the road prism and clearing width.

a). Maintain slope lines as constructed.

b). Remove slides from ditches and roadways.

c). Remove overhanging material from the cut slopes.

d). Stabilize road prisms to avoid mass wasting into aquatic systems.

3. Prevent violations of environmental regulations, including forest practices where applicable.

4. Maintain functioning drainage.

a). Keep culverts clean and functioning.

b). Keep ditches and drainage channels at outlets and inlets of culverts clear of obstructions and functioning as intended.

5. Control sediment delivery.

a). Maintain sediment traps, settling ponds, catch basins and check dams.

b). Armor and vegetate in ditches where appropriate.

DNR's Road Maintenance Standards

1. Maintain infrastructure to a level that protects the environment and trust assets.

2. Keep access roads at a standard suitable for their intended use.

a). Maintain active commercial haul roads at a level that allows safe, non-abusive operation of haul vehicles at speeds consistent with design.

b). Maintain roads used for forest management or agriculture at a level that allows safe non-abusive operation of administrative vehicles.

c). Maintain roads used for public access to recreational facilities at a level that provides for public safety and accommodates public traffic to the extent feasible using ORV and other funding sources.

3. Repair bridges, culverts, cattle guards, fences and other road structures to the condition required by the construction specifications.

4. Cuts and fills

   a). Be careful not to deposit material from slides or other sources requiring removal into streams or at locations where it will erode into streams or watercourses.

   b). Slide materials and debris shall not contaminate the surface material.

   c). Replace fills to appropriate slopes with selected material or as directed (refer to *Section 3.6.80 Fill Slope Ratio*).

5. Surface

   a). Water may be required to control dust and to retain fines in surface rock during hauling and grading operations.

   b). Do not grade roads that are too wet or too dry.

   c). Make sure not to grade desirable surface material off the roadway.

   d). Replace surface material when it is lost or worn away.

   e). Remove berms except as directed.

   f). Grade and shape the road surface, turnouts and shoulders to the original crown, inslope or outslope design.

   g). Potholes and ruts are typically too deep to ―blade out‖. Ripping the road section then grading and compacting binds better and creates a uniform surface.

6. Vegetation control

   a). Mechanical or chemical methods are acceptable alternatives.

   b). Schedule vegetation control to minimize costs and keep roads open and safe to travel.

7. Culvert maintenance

   a). Replace failing structures prior to incurring resource damage.

   b). Clean catch basins.

   c). Maintain headwalls.

   d). Rebuild energy dissipaters.

e). Flush out sediments.

f). Provide minimum soil cover.

g). Mark inlets if needed.

8. Ditches

a). Keep ditches free of debris and fully functioning.

(1). Clean ditches only when needed to prevent unnecessary erosion.

b). Do not undercut the cut slope near the ditch line.

c). Reshape catch basins and headwalls as needed.

d). Do not remove more vegetation from the ditch than is needed to keep the water moving.

9. Snow plowing

a). Avoid plowing snow when possible.

b). Leave a minimum of 4 inches of snow on the road to protect gravel surfacing.

c). Punch holes frequently in snow berms to allow melting snow to flow off the road onto stable, vegetated slopes.

d). Avoid creating a snow trough that will channel water down the middle of the road during freeze, thaw, and rain conditions.

(1). Waste snow on to the side slope, if possible, instead of creating large snow berms.

(2). This approach also contributes to the road becoming drivable sooner after the spring thaw has passed.

e). Where possible, blade waterbars and ditch-outs into the snow to allow for drainage.

10. Maintenance work during high water flow on streams or in saturated soil conditions can only occur during emergencies.

Comparison Between Objectives and Rules

Table C-15 provides a comparison of the comprehensive road maintenance plan objectives contained in the *State Trust Lands Habitat Conservation Plan* (HCP) and the current forest practices road construction and maintenance rules.

Table C-15. Comparison of HCP Comprehensive Road Maintenance Plan Objectives and Current Forest Practices Road Construction and Maintenance Rules

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
1.Annual inventory of road conditions	WAC 222-24-051 *Large forest landowner road maintenance schedule. All forest roads must be included in an approved road maintenance and abandonment plan by July 1, 2006. This includes all roads that were constructed or used for forest practices after 1974. Inventory and assessment of orphan roads must be included in the road maintenance and abandonment plans as specified in WAC 222-24-052(4). *(5) Road maintenance and abandonment plans must include: Ownership maps showing all forest roads, including orphan roads; planned and potential abandonment, all typed water, Type A and B Wetlands that are adjacent to or crossed by roads, stream adjacent parallel roads and an inventory of the existing condition; and Detailed description of the first years' work with a schedule to complete the entire plan within the performance period; and Standard practices for routine road maintenance; and Storm maintenance strategy that includes prestorm planning, emergency maintenance and post storm recovery; and Inventory and assessment of the risk to public resources or public safety of orphaned roads; and The landowner or landowner representative's signature. *(9) Each year on the anniversary date of the plan's submittal,

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	landowners must report work accomplished for the previous year and submit to the department a detailed description of the upcoming year's work including modifications to the existing work schedule. The department's review and approval will be conducted in consultation with the departments of ecology and fish and wildlife, affected tribes, and interested parties. The department will: Review the progress of the plans annually with the landowner to determine if the plan is being implemented as approved; and The plan will be reviewed by the department and approved or returned to the applicant with concerns that need to be addressed within forty-five days of the plan's submittal. Additional plans will be signed by the landowner or the landowner's representative.
2. Maintain existing roads to minimize drainage problems and stream sedimentation.	WAC 222-24-051 *Large forest landowner road maintenance schedule All forest roads must be included in an approved road maintenance and abandonment plan by July 1, 2006. This includes all roads that were constructed or used for forest practices after 1974. Inventory and assessment of orphan roads must be included in the road maintenance and abandonment plans as specified in WAC 222-24-052(4). *(3) Plans will be submitted by landowners on a priority basis. Road systems or drainages in which improvement, abandonment or maintenance have the highest potential benefits to the public resource are the highest priority. Based upon a "worst first" principle, work on roads that affect the following are presumed to be the highest priority: Basins containing, or road systems potentially affecting, waters which either contain a listed threatened or endangered fish species under the federal or state law or a water body listed on the current 303(d) water quality impaired list for road related issues. Basins containing, or road systems potentially affecting, sensitive geology/soils areas with a history of slope failures.

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	Road systems or basins where other restoration projects are in progress or may be planned coincident to the implementation of the proposed road plan. Road systems or basins likely to have the highest use in connection with future forest practices. *(4) Based upon a "worst first" principle, road maintenance and abandonment plans must pay particular attention to: Roads with fish passage barriers; Roads that deliver sediment to typed water; Roads with evidence of existing or potential instability that could adversely affect public resources; Roads or ditchlines that intercept groundwater; and Roads or ditches that deliver surface water to any typed waters
3. Stabilize and close access to roads that no longer serve a management function or that cause intractable management or environmental problems.	WAC 222-24-051 *Large forest landowner road maintenance schedule. All forest roads must be included in an approved road maintenance and abandonment plan by July 1, 2006. This includes all roads that were constructed or used for forest practices after 1974. Inventory and assessment of orphan roads must be included in the road maintenance and abandonment plans as specified in WAC 222-24-052(4). WAC 222-24-052 Road maintenance *(3) Abandoned roads. An abandoned road is a road which the forest landowner has abandoned in accordance with procedures of (a) through (e) of this subsection. Roads are exempt from maintenance under this section only after (e) of this subsection is completed. Roads are outsloped, water barred, or otherwise left in a condition suitable to control erosion and maintain water movement within wetlands and natural drainages; Ditches are left in a suitable condition to reduce erosion;

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	The road is blocked so that four wheel highway vehicles cannot pass the point of closure at the time of abandonment; Water crossing structures and fills on all typed waters are removed, except where the department determines other measures would provide adequate protection to public resources; and The department shall determine whether the road has been abandoned according to procedures of this subsection. If the department determines the road is properly abandoned, it must notify the landowner in writing within thirty days that the road is officially abandoned.
4. Assure sound construction of any new roads	WAC 222-24-030 Road construction. (1) Right of way timber shall be removed or decked in suitable locations where the decks will not be covered by fill material or act as support for the fill or embankment. *(2) In permanent road construction, do not bury: Loose stumps, logs or chunks if they will contribute more than 5 cubic feet in the load-bearing portion of the road. Any significant amount of organic debris within the top 2 feet of the load-bearing portion of the road. Excessive accumulation of debris or slash in any part of the load-bearing portion of the road fill. (3) Compact fills. During road construction, fills or embankments shall be built up by layering. Each layer shall be compacted by operating the tractor or other construction equipment over the entire surface of the layer. Chemical compacting agents may be used in accordance with WAC 222-38-020. *(4) Stabilize soils. Erodible soil disturbed during road construction and located where it could reasonably be expected to enter the stream network must be seeded with noninvasive plant species. The use of local area native species, adapted for rapid revegetation is preferred. Treatment with other erosion control measures may be approved by the department. *(5) Channel clearance. Within 50 feet upstream from a culvert

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	inlet clear stream channel of all debris and slash generated by the operations that reasonably may be expected to plug the culvert prior to the removal of equipment from the vicinity, or the winter season, whichever is first. (See the board manual, section 4 for debris removal guidelines.) *(6) Drainage. All required ditches and drainage structures shall be installed concurrently with the construction of the roadway. Uncompleted road construction to be left over the winter season or other extended periods of time shall be drained by outsloping or drainage structures. Water bars and/or dispersion ditches may also be used to minimize eroding of the construction area and stream siltation. Water movement within wetlands must be maintained. *(7) Moisture conditions. Construction shall be accomplished when moisture and soil conditions are not likely to result in excessive erosion and/or soil movement, so as to avoid damage to public resources. *(8) End haul/sidecasts. End haul or overhaul construction is required where significant amounts of sidecast material would rest below the 100-year flood level of any typed water, within the boundary of a Type A or Type B Wetland or wetland management zones or where the department determines there is a potential for mass soil failure from overloading on unstable slopes or from erosion of side cast material causing damage to the public resources. *(9) Waste disposal. When spoil, waste and/or other debris is generated during construction, this material shall be deposited or wasted in suitable areas or locations and be governed by the following: Spoil or other debris shall be deposited above the 100-year flood level of any typed waters or in other suitable locations to prevent damage to public resources. The material shall be stabilized using the recommended schedule and procedures found in the board manual, section 3. All spoils shall be located outside of Type A and Type B Wetlands and their wetland management zones. Spoils shall not be located within the boundaries of forested wetlands without

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	written approval of the department and unless a less environmentally damaging location is unavailable. No spoil area greater than 0.5 acre in size shall be allowed within wetlands. (See WAC 222-24-015, Construction in wetlands.)
5. Guarantee that additional new roads are built only where no other operationally or economically viable option exists for accessing management areas by existing roads or alternative harvest methods (e.g. full suspension yarding)	WAC 222-24-020 Road location and design. (1) Fit the road to the topography so that a minimum of alterations to the natural features will occur. (2) Except for crossings, new stream-adjacent parallel roads shall not be located within natural drainage channels, channel migration zones, sensitive sites, equipment limitation zones, and riparian management zones when there would be substantial loss or damage to fish or wildlife habitat unless the department has determined that other alternatives will cause greater damage to public resources. Proposals with new stream-adjacent parallel roads will require an on-site review by an interdisciplinary team. The appropriate federal representative(s) will be invited to attend the interdisciplinary team to determine if the proposal is in compliance with the Endangered Species Act. *(3) Roads shall not be constructed in bogs or low nutrient fens. *(4) Roads shall not be located in wetlands if there would be substantial loss or damage to wetland functions or acreage, unless the department has determined that alternatives will cause greater damage to public resources. *(5) Minimize the number of stream crossings. *(6) Where stream crossings are necessary: Design stream crossings to minimize alterations to natural features; Locate and design culverts to minimize sediment delivery; and Whenever practical, cross streams at right angles to the main channel. *(7) Avoid duplicative roads by keeping the total amount of construction to a minimum. Use existing roads whenever

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	practical and avoid isolating patches of timber which, when removed, may require unnecessary road construction. *(8) All new road construction on side slopes that exceed 60 percent, which have the potential to deliver sediment to any typed water or wetland must utilize full bench construction techniques, including end hauling, over hauling or other special techniques. The department may waive the full bench construction requirement if a site review is conducted and the absence of delivery potential to any typed water or wetlands is determined. (9) Use the minimum design standard that produces a road sufficient to carry the anticipated traffic load with reasonable safety. *(10) Subgrade width should average not more than 32 feet for double lane roads and 20 feet for single lane roads, exclusive of ditches, plus any additional width necessary for safe operations on curves and turnouts. Where road location in wetlands is unavoidable (see WAC 222-24-015 (1)(b)), minimize subgrade width. (11) Balance excavation and embankments so that as much of the excavated material as is practical will be deposited in the roadway fill sections. Where full bench construction is necessary, design suitable embankments so that the excavated material may be end hauled to appropriate deposit areas. (12) Cut and fill slopes must be designed and constructed in a manner that will assure a high likelihood of remaining stable throughout the life of the road. *(13) All roads shall be outsloped or ditched on the uphill side and appropriate surface drainage shall be provided by the use of adequate drainage structures such as: Cross drains, ditches, drivable dips, relief culverts, water bars, diversion ditches, or other such structures demonstrated to be equally effective. *(14) Drainage structures shall not discharge onto erodible soils, or over fill slopes unless adequate outfall protection is provided. *(15) Relief culverts installed on forest roads shall meet the following minimum specifications: (See the board manual,

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	section 3 for culvert spacing.) Be at least 18 inches in diameter or equivalent in western Washington and 15 inches in diameter or equivalent in eastern Washington. Be installed in a manner that efficiently captures ditchline flow and passes it to the outside of the road. *(16) Ditch diversion. Where roadside ditches slope toward any typed water, or Type A or B Wetland, a ditch relief structure must be located as close to the stream crossing or wetland as possible so it drains off before reaching the stream. On stream-adjacent parallel roads, relief culverts shall be located at maximum distances from stream channels to minimize sediment delivery. The relief structure must allow the sediment to be deposited onto the forest floor and not carry surface water or sediment into the stream channel or wetland. *(17) Outslope the road surface where practical. Where outsloping is not practical, provide a ditch with drainage structure on the inside of the road, except where roads are constructed in rock or other materials not readily susceptible to erosion. *(18) Crown or slope the road to prevent the accumulation of water on the road surface. *(19) Install rock armor headwall inlets on all stream-crossing culverts where the stream gradient above the crossing is greater than 6 percent. *(20) Install rock armored headwalls and rock armored ditchblocks for drainage structure culverts located on erodible soils or where the affected road has a gradient greater than 6 percent. *(21) Install drainage structures at locations where seeps and springs are known or discovered during construction to route accumulated surface water across the road prism. The water from the seeps and springs must be returned to the forest floor as close to the point of origin as reasonably practicable. *(22) The department may require additional information for proposed road construction as part of a complete application,

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
	including: A map with detailed topographic information showing the location and alignment of the road in relation to all typed water and wetlands as required in WAC 222-16-035; Location, size, alignment and number of water crossing and drainage structures; Detailed plans for bridges, large culverts or other complex elements of the proposal; and Other information identified by the department.
6. Minimize road density	WAC 222-24-020 Road location and design. *(7) Avoid duplicative roads by keeping the total amount of construction to a minimum. Use existing roads whenever practical and avoid isolating patches of timber which, when removed, may require unnecessary road construction.
7. Prioritize roads for decommissioning, upgrading, and maintaining	WAC 222-24-051 *Large forest landowner road maintenance schedule. All forest roads must be included in an approved road maintenance and abandonment plan by July 1, 2006. This includes all roads that were constructed or used for forest practices after 1974. Inventory and assessment of orphan roads must be included in the road maintenance and abandonment plans as specified in WAC 222-24-052(4).

Comprehensive road maintenance plan objectives, HCP	Applicable road construction and maintenance rules per Chapter 222-24 WAC
8. Identify fish blockages caused by stream crossings and prioritize their retrofitting or removal.	WAC 222-24-051 *Large forest landowner road maintenance schedule. *(4) Based upon a "worst first" principle, road maintenance and abandonment plans must pay particular attention to: Roads with fish passage barriers; Roads that deliver sediment to typed water; Roads with evidence of existing or potential instability that could adversely affect public resources; Roads or ditchlines that intercept groundwater; and Roads or ditches that deliver surface water to any typed waters.

*Indicates a section of the Washington Administrative Code that has been revised since 2003.

Stream Crossings and Proximity

Tables C-16 and C-17 provide the number of stream crossings on state trust lands for each landscape in the OESF and the percentage of the road network on state trust lands in the OESF that are located within 300 feet of a stream.

Table C-16: Number of Road Stream Crossings in Each Landscape

	Stream type						
Landscape name	**1**	**2**	**3**	**4**	**5**	**9***	**Total**
Clallam	0	0	24	15	156	1	196
Clearwater	12	2	58	59	465	18	614
Copper Mine	6	3	28	14	233	9	293
Dickodochtedar	4	5	54	59	167	4	293
Goodman	4	2	43	27	152	0	228
Kalaloch	3	3	66	52	186	6	316
Queets	2	2	30	27	82	13	156
Reade Hill	0	0	19	8	60	0	87
Sekiu	2	0	5	16	86	0	109
Sol Duc	1	2	42	34	102	19	200
Willy Huel	8	8	95	164	311	7	593
Total	42	27	464	475	2,000	77	3,085

*Stream type unknown

Table C-17: Percent of Road Network Within 300 feet of a Stream by Stream Type

	Stream type						
Landscape name	**1**	**2**	**3**	**4**	**5**	**9***	**Total**
Clallam	0.6%	0.4%	7.8%	5.0%	30.0%	4.1%	47.9%
Clearwater	2.6%	0.2%	4.7%	3.6%	43.5%	0.5%	55.1%
Copper Mine	3.5%	1.0%	5.0%	2.7%	52.6%	0.3%	65.2%
Dickodochtedar	0.9%	1.4%	7.8%	5.4%	27.5%	0.7%	43.7%
Goodman	1.5%	0.4%	8.5%	5.0%	38.6%	0.1%	54.1%
Kalaloch	1.9%	1.5%	9.8%	7.5%	38.6%	0.5%	59.8%
Queets	0.6%	0.4%	5.6%	3.1%	12.1%	0.7%	22.5%
Reade Hill	1.4%	1.8%	12.3%	3.0%	45.5%	0.0%	63.9%
Sekiu	2.9%	0.0%	3.5%	5.4%	34.9%	0.6%	47.4%
Sol Duc	3.5%	0.5%	9.8%	5.8%	14.8%	1.8%	36.2%
Willy Huel	2.3%	1.5%	8.6%	13.6%	24.9%	0.2%	51.1%
Total	2.0%	0.8%	7.2%	5.8%	33.0%	0.8%	49.6%

*Stream type unknown

This page left intentionally blank.

Traffic Impact Scores

Table C-18 shows the traffic impact score for each of the landscapes in the OESF by decade for the No Action and Landscape alternatives. The cells highlighted in green indicate decades in which traffic impact scores are low for a particular landscape. The remaining traffic impact scores are all in the medium range.

Table C-18: Traffic Impact Scores at the Landscape Level

Landscape name	No Action Alternative by decade										Landscape Alternative by decade									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Clallam	52	50	50	52	52	51	51	51	52	50	52	50	51	52	52	51	51	51	51	51
Clearwater	23	24	24	23	25	25	25	24	24	24	23	24	24	24	25	25	25	25	24	24
Copper Mine	39	39	38	38	39	39	39	40	39	39	39	39	39	38	39	39	40	39	40	39
Dickodochtedar	53	53	54	54	54	54	54	54	53	54	53	54	53	54	54	54	54	54	54	54
Goodman	39	39	40	40	40	40	39	40	39	39	39	39	40	40	40	40	39	40	39	39
Kalaloch	38	38	38	38	38	39	38	38	39	38	38	38	39	37	39	39	38	39	39	39
Queets	32	32	31	33	32	33	33	32	33	33	32	32	32	33	33	33	33	32	33	32
Reade Hill	33	30	32	32	32	33	31	32	31	31	33	31	32	31	33	33	31	32	32	31
Sekiu	65	65	65	65	66	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
Sol Duc	29	28	28	29	29	29	29	28	29	28	29	28	28	29	29	29	29	29	29	28
Willy Huel	30	30	30	28	30	31	30	30	30	30	30	30	31	29	29	30	31	30	30	30

This page left intentionally blank.

Truck Trips per Day and Road Miles by Projected Traffic Level

DNR: Current Conditions

Table C-19 shows the long-term decadal average of log truck trips per day associated with DNR harvest activities as projected by the analysis model. It is important to note that when road segments were categorized as high, medium, and low all log truck traffic was included in the determination, not only that attributable to DNR. Table C-20 shows the current miles of roads and the percent of total road miles for each projected traffic level category for all ownerships within the landscapes on the OESF.

Table C-19: Current Long-Term Average Truck Trips per day on low, Medium, and High Projected Traffic Level Roads in the OESF

Landscape name	DNR truck trips per day on low projected traffic level roads	DNR truck trips per day on medium projected traffic level roads	DNR truck trips per day on high projected traffic level roads	Total DNR truck trips per day
Clallam	50 (8%)	106 (18%)	450 (74%)	606
Clearwater	77 (27%)	211 (73%)	0	289
Copper Mine	36 (9%)	75 (19%)	282 (72%)	393
Dickodochtedar	41(18%)	32 (15%)	150 (67%)	223
Goodman	41(37%)	67 (61%)	1 (1%)	110
Kalaloch	33 (26%)	51 (41%)	40 (33%)	123
Queets	62 (37%)	82 (49%	24 (14%)	169
Reade Hill	23 (27%)	60 (71%)	2 (3%)	85
Sekiu	17 (16%)	34 (32%)	55 (52%)	105
Sol Duc	41 (17%)	115 (48%)	86 (35%)	242
Willy Huel	69 (22%)	89 (29%)	151 (49%)	309
Total	**490 (18%)**	**922 (35%)**	**1,241 (47%)**	**2,653**

Table C-20: Current Miles and Percent of Road Miles by Projected Traffic Level Category on all Ownerships in the OESF

Landscape name	Miles of road (and percent) by projected traffic level			Total
	Low projected traffic level	Medium projected traffic level	High projected traffic level	
Clallam	517 (87%)	56 (9%)	22 (4%)	595
Clearwater	329 (97%)	10 (3%)	0	339
Copper Mine	281 (90%)	21 (7%)	11 (3%)	313
Dickodochtedar	727 (88%)	65 (8%)	37 (4%)	829
Goodman	350 (89%)	39 (10%)	6 (2%)	395
Kalaloch	288 (88%)	28 (8%)	11 (3 %)	327
Queets	210 (95%)	10 (5%)	2 (1%)	222
Reade Hill	98 (88%)	10 (9%)	4 (3%)	112
Sekiu	872 (87%)	72 (7%)	53 (5%)	997
Sol Duc	577 (90%)	53 (8%)	11 (2%)	641
Willy Huel	287 (91%)	21 (7%)	8 (2%)	316
Total	**4, 536 (89%)**	**384 (8%)**	**164 (3%)**	**5,084**

Traffic Over the Entire Analysis Period

Table C-21 shows the total number of truck trips related to DNR management activities projected by the analysis model for each landscape by alternative (No Action and Landscape) over the 100-year analysis period. Tables C-22 to C-32 show the number of truck trips related to DNR management activities per decade for each landscape.

Table C-21: Total and Percent of DNR Long-Term Average Truck Trips per day on low, Medium, and High Projected Traffic Level Roads in the OESF over the Entire 100-year Analysis Period by Alternative (No Action and Landscape)

Landscape name	No Action Alternative				Landscape Alternative			
	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Total
Clallam	431	1,072	4,378	5,880	458	1,099	4,757	6,314
	7%	18%	74%		7%	17%	75%	
Clearwater	1,023	2,189	1,428	4,640	1,105	2,300	1,548	4,953
	22%	47%	31%		22%	46%	31%	
Copper Mine	467	909	4,388	5,765	517	868	4,975	6,360
	8%	16%	76%		8%	14%	78%	

Landscape name	No Action Alternative				Landscape Alternative			
	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Total
Dickodochtedar	675	775	3,014	4,465	693	844	3,204	4,741
	15%	17%	68%		15%	18%	68%	
Goodman	604	1,065	685	2,354	660	1,054	807	2,522
	26%	45%	29%		26%	42%	32%	
Kalaloch	425	635	976	2,037	433	689	1,122	2,245
	21%	31%	48%		19%	31%	50%	
Queets	694	1,451	1,006	3,151	686	1,569	1,108	3,363
	22%	46%	32%		20%	47%	33%	
Reade Hill	207	288	17	512	227	302	18	546
	40%	56%	3%		41%	55%	3%	
Sekiu	318	664	1,047	2,028	326	732()	1,124	2,182
	16%	33%	52%		15%	34%	51%	
Sol Duc	498	782	1,428	2,708	501	883	1,563	2,946
	18%	29%	53%		17%	30%	53%	
Willy Huel	598	1,002	2,147	3,747	645	1,107	2,346	4,098
	16%	27%	57%		16%	27%	57%	
Total	**5,942**	**10,831**	**20,514**	**37,287**	**6,252**	**11,448**	**22,571**	**40,270**
	16%	**29%**	**55%**		**16%**	**28%**	**56%**	

Table C-22: Clallam Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Lansdcape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	50	106	450	606	47	145	458	650
2	21	82	173	277	31	73	221	325
3	34	108	305	447	47	105	396	548
4	52	122	433	606	47	128	473	648
5	53	123	630	806	51	114	743	908
6	43	107	553	703	49	104	569	722
7	47	121	543	712	45	127	468	640
8	48	95	462	605	49	91	567	707
9	49	139	557	745	49	113	531	693
10	33	68	272	373	41	99	331	472
Total	**431**	**1,072**	**4,378**	**5,880**	**458**	**1,099**	**4,757**	**6,314**

Table C-23: Clearwater Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	77	211	0	289	80	204		284
2	100	221	0	320	103	266	10	380
3	96	180	0	276	101	200	99	399
4	46	81	0	127	92	183	144	420
5	130	247	552	929	124	234	337	695
6	116	225	409	750	129	180	334	643
7	115	247	115	476	104	243	112	459
8	112	298	0	410	138	226	197	561
9	112	261	83	456	122	215	315	652
10	119	219	270	607	112	349		461
Total	**1,023**	**2,189**	**1,428**	**4,640**	**1,105**	**2,300**	**1,548**	**4,953**

Table C-24: Copper Mine Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	36	75	282	393	35	69	266	370
2	46	96	312	453	47	106	347	500
3	30	99	269	398	39	42	564	644
4	24	30	87	142	39	76	284	399
5	59	77	846	981	52	111	560	723
6	62	69	690	821	55	118	642	815
7	44	114	466	624	66	120	485	671
8	66	124	544	733	60	82	621	764
9	64	123	473	660	70	81	643	793
10	37	101	420	559	54	65	562	680
Total	**467**	**909**	**4,388**	**5,765**	**517**	**868**	**4,975**	**6,360**

Table C-25 Dickodochtedar Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	41	32	150	223	44	38	141	224
2	45	41	187	273	53	61	268	381
3	64	87	364	514	49	50	254	353
4	87	132	395	614	81	131	381	593
5	60	68	285	414	80	100	414	594
6	102	132	441	676	104	142	532	778
7	82	67	360	509	71	72	249	392
8	73	90	318	481	83	109	405	598
9	53	50	245	348	66	67	301	434
10	69	75	269	413	62	74	258	394
Total	**675**	**775**	**3,014**	**4,465**	**693**	**844**	**3,204**	**4,741**

Table C-26: Goodman Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	41	67	1	110	33	47	1	81
2	26	36	10	73	57	62	78	196
3	89	188	151	427	71	133	104	309
4	79	106	104	288	72	142	113	326
5	57	136	89	282	75	168	111	354
6	66	141	67	274	90	116	97	303
7	75	96	95	266	66	78	77	221
8	75	108	112	295	73	125	116	315
9	60	86	45	190	58	111	46	215
10	37	100	11	148	64	73	64	201
Total	**604**	**1,065**	**685**	**2,354**	**660**	**1,054**	**807**	**2,522**

Table C-27: Kalaloch Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	33	51	40	123	32	48	55	134
2	36	49	78	162	38	60	90	188
3	46	56	105	207	48	66	155	269
4	36	48	34	118	20	32	59	111
5	29	63	117	209	44	78	111	233
6	61	78	142	281	58	83	126	267
7	46	71	138	255	45	61	124	230
8	40	59	101	200	48	98	130	276
9	55	87	136	278	53	97	169	319
10	44	74	85	202	46	68	104	218
Total	**425**	**635**	**976**	**2,037**	**433**	**689**	**1,122**	**2,245**

Table C-28: Queets Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	62	82	24	169	61	88	24	173
2	65	96	69	230	64	93	70	227
3	45	95	19	159	55	128	79	262
4	78	223	68	369	72	180	72	324
5	68	154	102	324	70	214	150	434
6	83	133	282	498	70	145	196	411
7	70	180	117	367	58	218	137	413
8	71	184	127	382	75	173	126	374
9	74	161	114	348	90	180	146	416
10	79	142	85	306	71	149	108	328
Total	**694**	**1,451**	**1,006**	**3,151**	**686**	**1,569**	**1,108**	**3,363**

Table C-29: Reade Hill Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	23	60	2	85	23	66	2	92
2	5	2	0	7	12	5	0	17
3	29	19	0	48	28	23	1	52
4	30	40	6	76	22	20	4	45
5	25	23	0	49	26	59	3	89
6	18	78	2	98	24	58	1	83
7	19	6	1	26	22	10	1	34
8	20	41	3	63	22	35	2	58
9	19	7	1	27	27	16	2	45
10	18	12	1	31	22	10	1	33
Total	**207**	**288**	**17**	**512**	**227**	**302**	**18**	**546**

Table C-30: Sekiu Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	469	622	3,377	4,468	468	623	3,377	4,468
2	466	625	3,377	4,468	461	631	3,377	4,468
3	456	635	3,377	4,468	453	622	3,393	4,468
4	470	621	3,377	4,468	459	632	3,377	4,468
5	445	637	3,386	4,468	446	645	3,377	4,468
6	462	629	3,377	4,468	454	637	3,377	4,468
7	456	635	3,377	4,468	457	634	3,377	4,468
8	451	641	3,377	4,468	456	635	3,377	4,468
9	450	641	3,377	4,468	452	639	3,377	4,468
10	450	641	3,377	4,468	459	632	3,377	4,468
Total	**4,577**	**6,326**	**33,775**	**44,677**	**4,565**	**6,330**	**33,782**	**44,677**

Table C-31: Sol Duc Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	166	190	1,111	1,468	160	179	1,128	1,468
2	179	177	1,111	1,468	180	176	1,111	1,468
3	169	188	1,111	1,468	178	179	1,111	1,468
4	163	177	1,128	1,468	157	182	1,128	1,468
5	159	180	1,128	1,468	157	181	1,130	1,468
6	163	176	1,128	1,468	162	176	1,130	1,468
7	165	174	1,128	1,468	162	177	1,128	1,468
8	166	174	1,128	1,468	167	172	1,128	1,468
9	161	178	1,128	1,468	161	178	1,128	1,468
10	173	183	1,111	1,468	172	184	1,111	1,468
Total	**1,664**	**1,798**	**11,216**	**14,678**	**1,657**	**1,785**	**11,236**	**14,678**

Table C-32: Willy Huel Landscape, DNR Average Daily Truck Trips by Decade and Projected Traffic Level Type for No Action and Landscape Alternatives

	No Action				Landscape			
Decade	Low projected traffic level roads	Medium projected traffic level Roads	High projected traffic level Roads	No Action total	Low projected traffic level roads	Medium projected traffic level roads	High projected traffic level roads	Landscape total
1	43	84	70	198	43	87	67	198
2	46	90	62	198	43	80	75	198
3	49	92	57	198	44	82	72	198
4	54	99	45	198	47	97	54	198
5	42	80	75	198	52	89	57	198
6	40	33	125	198	42	84	72	198
7	44	81	72	198	40	41	117	198
8	43	80	75	198	44	79	75	198
9	44	97	57	198	42	84	72	198
10	45	95	57	198	46	80	72	198
Total	**450**	**832**	**695**	**1,976**	**441**	**803**	**732**	**1,976**

References

Dubé, K., A. Shelly, J. Black, and K. Kuzis. 2010. Washington Road Sub-basin Scale Effectiveness Monitoring First Sampling Event (2006-2008) Report. Cooperative Monitoring, Evaluation and Research Report CMER 02-801. Washington Department of Natural Resources. Olympia, Washington.

Gallo, K. S.H. Lanigan, P. Eldred, S.N. Gordon, and C. Moyer. 2005. Northwest Forest Plan The First 10 Years (1994-2003): Preliminary Assessment of the Condition of Watersheds. U.S. Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-647. September, 2005.

Potyondy, J.P., and T.W. Geier. 2011. Watershed Condition Classification Technical Guide. United States Department of Agriculture, Forest Service, FS-978. July, 2011.

Washington State Department of Ecology. 2011. Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species. Publication Number 06-10-038. Washington Department of Ecology, Olympia, WA.

Washington State Department of Ecology. 2006. Water Quality Standards for Surface Waters of the State of Washington: Amended November 20, 2006. Publication Number 06-10-091. Washington State Department of Ecology, Olympia, WA.

---

[1] 7-day average of the daily maximum temperatures is the arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.