



Forest Stewardship Plan for the Ecological Restoration of Port Gamble Forest Heritage Park

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With the involvement of community members, park stewards and
stakeholders

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FOREST RESTORATION - VISION FOR PORT GAMBLE FOREST HERITAGE PARK

VISION: The Port Gamble Forest Heritage Park (PGFHP) is an ecologically complex, diverse, and healthy forest that provides optimum wildlife habitat for a wide range of animal species.

Port Gamble Forest Heritage Park currently has a range of forest types from simple monoculture, tree farm plantations, to several complex natural second growth forests. These complex forests serve as reference stands as they support a diverse community of animals, high productivity for plants, and a replenishment of the water cycle. The approach will be to use forest ecosystem restoration, a process that considers the environment as a complex system functioning as a whole. Because this is a park that is extensively used by people, restoration must also consider the social values of the community. Forest ecosystem restoration will rely heavily on partnership with park stewards, as well as private, tribal, local, state, and federal government stakeholders. The ecosystem restoration approach will be to:

- **Work *with* nature:** Work with native plant species that have evolved and adapted to our temperate climate and are competitive and resistant to disease and insects.
- **Enhance forest wildlife habitat:** Structurally diverse forests provide the best habitat for the greatest number of wildlife species. A diverse forest habitat also includes dead and dying tree for snags and large woody debris.
- **Diversify plant species:** Forests comprised of mixed native tree species improve habitat, aesthetics, and the value of both timber and non-timber assets and better support diverse wildlife populations.
- **Recognize the connection between all plants, fungi and animals:** all creatures contribute to a healthy and dynamic forest ecosystem.
- **Protect water as a vital resource:** Healthy, vibrant forest ecosystems are the best and least costly option for maintaining high water quality and for the management of surface and storm water runoff.
- **Consider that human park users are part of the system and critical to the decision making about the future of the park.**

PGFHP Forest restoration Goals

A successfully implemented forest restoration program for the Port Gamble Forest Heritage Park will need to meet four basic goals, established in the 2012 Kitsap County Resolution 169 – Integrated Forest Stewardship Plan, and which are closely related and not mutually exclusive. These program goals are:

- Enhance natural forest ecosystem complexity and health
- Protect and enhance soil, water quality, and fish and wildlife habitat
- Be biologically, socially and economically self-sustaining
- Provide safe, reasonable and appropriate public access to County forestlands

The long range outcome of the forest restoration program is: Kitsap County will realize the full range of benefits and values of the Port Gamble Forest Heritage Park (PGFHP) in a manner consistent with the County's overarching goal of a growing community where natural resources and systems are sustained for the benefit of current and future generations. Because multiple funding sources were used for the acquisition of the Port Gamble Forest Heritage Park, all grant requirements, including two (2) deeds of right to land use, with covenants that must be followed.

PGFHP FOREST ECOSYSTEM RESTORATION STRATEGY

Most of the forest stands in the Port Gamble Forest Heritage Park were densely planted by the previous landowner, Pope and Talbot Lumber Company, and currently lack the vegetative diversity of a naturally developed forest in Western Washington. These dense stands lack significant understory vegetation because of commercial forestry practices which created a dense monoculture which totally shades out forest understory vegetation. The restoration strategy is to

increase the amount of light reaching the forest floor, enhance wildlife habitat and forest health by mitigating these past management practices. This will be accomplished by:

- Non-conventionally (restorative) thinning the over-stocked conifer stands.
- Planting a variety of shade tolerant tree species to improve forest habitat diversity.
- Controlling invasive species and noxious weeds.
- Monitoring and managing areas with diseased and danger trees.

PGFHP contains a high percentage of Douglas fir trees in the early, stem exclusion development stage (20-50 years). This is a critical growth period where these trees are under extreme stress and are vulnerable to root rot and catastrophic fire. Restoration thinning operations will preserve the largest trees, reduce stand density, and improve habitat diversity, tree health, resilience, longevity, and reduce wildfire risk.

WHY USE RESTORATION THINNING?

Restoration thinning is a recommended restoration practice for overstocked conifer plantations including those within riparian and wetland management zones in Western Washington¹. Operationally called variable density thinning (VDT), restorative thinning is specifically recommended for young dense Douglas fir plantations.

Restoration thinning is most beneficial in Douglas fir stands that are less than 50 years of age because of anticipated high growth rates². Unlike conventional thinning, restoration thinning can maintain or accelerate dead wood production¹. This is accomplished by leaving all or most of the dead wood as part of the thinning prescription. The approach is to use VDT to create variation in the forest landscape by selecting strong individual trees, crafting tree clumps, skips and openings that closely mimic natural forest conditions². As much as possible, non Douglas fir tree species in the park will be reserved as leave trees.

Healthy, diverse forests contain dead trees. Properly implemented, restoration thinning will result in sustained stand mortality that will continue to contribute dead wood within the forest uplands, riparian and wetland areas. Thinning prescriptions will also call for the artificial creation of snags. Snags can be potentially hazardous to park patrons in high use areas and require attention. However, downed trees and logs on the forest floor and remote snags provide important food, protective cover, and nesting sites for wildlife and are essential components of a forest ecosystem.

RESOURCE CATEGORY I: FOREST HEALTH

- a) Existing resource condition: As indicated, historic management practices in the park have greatly diminished overall habitat and species diversity. In addition, laminated root rot, pine blister rust, bark beetle infestation, armillaria root rot, and heart rot can be found in many areas of the park. Invasive plant species, notably Scotch broom, Himalayan blackberry, English ivy and holly, infect many areas of the park.
- b) Resources protection measures: Plot analyses have identified areas that need prophylactic care and/or diseased tree removal. Fire risk will also be addressed, see Appendix 5: Fire Risk Reduction.

1 Spies, Thomas, Michael Pollock, Gordon Reeves and Tim Beechie. 2013. Effects of Riparian Thinning on Wood Recruitment: A scientific Synthesis. Science Review Team Wood Recruitment Subgroup, Forest Sciences Laboratory, Corvallis, OR

2 Kerr, Andy, and Derek Churchill. 2012. Ecological Appropriate Restoration Thinning in the Northwest Forest Plan Area. Conservation Northwest, Geos Institute, Klamath-Siskiyou Wildlands Center and Oregon Wild. Seattle, WA.

- c) Stewardship practice recommendations: Measurement and identification of root rot pockets is ongoing. With the help of the Kitsap County Noxious Weed Control Program, staff and stewards will manage invasive species. Refer to Appendix 2: Forest Stand Conditions/Prescriptions for detailed information about the health of individual mapping units (stands) in the park. Pre-commercial and restoration thinning will be employed to diversify the most of the park's pure 30-50 year old Douglas fir stands.

RESOURCE CATEGORY II: FOREST TREE INVENTORY

- a) Existing resource condition: Mapping unit inventory data was provided by Olympic Resource Management. Some minor tree species that were not noted in the inventory do occur in small patches and in riparian areas.
- b) Resources protection measures: Replanting/under-planting has and will continue to occur in areas where it is deemed appropriate. For instance, in a root rot pocket, after diseased trees are removed, resistant species would be planted. Where restoration thinning is done shade tolerant trees will be planted to increase tree diversity. If a meadow is desired, little replanting of trees would occur.
- c) Stewardship practice recommendations: Restoration thinning will be required in most areas of the park due to the nature and condition of the Douglas fir plantations. The ultimate goal of the restoration thinning is to achieve more complex and diverse forest. There are currently seven forest habitat conditions in the park:

CURRENT ECOLOGICAL CONDITION

Twenty-one forest mapping units have been delineated within the Port Gamble Stewardship project area of interest. These units are segmented based on age, species composition and past harvest history (Appendix 1). Walking through the forest, the changes in forest structure are sometimes subtle due to soils change or where human or natural disturbances have occurred. Each stand has been mapped, documented, inventoried and given an ecological classification/habitat listed in the following Table 1:

Table 1 – Forest Ecological Classification/Habitats

Simple Canopy	Trees of uniform age, spacing, height with a single canopy and lacking tree species diversity. Often single species plantations.
Complex or Differentiated Canopy	Trees of different height, age, species and spacing. Canopy stratification to some extent, some mature trees (70-200 years old)
Old Growth - Legacy	Defined as trees 200 years and older. Mix of shade tolerant understory trees and shrubs, decadent trees, snags, logs on the forest floor and canopy stratification
Meadow	Existing open areas, sometimes artificially maintained, as an ecotone for raptors and bats. Size often limited to 1-2 acres.
Hardwood Patch	Clumps of hardwood trees species including Red Alder, Big Leaf Maple, birch, Madrona, cascara, aspen and willow. Patches are small (1/4 to 1 acre) where conifers are removed to benefit wildlife.
Wetlands (WA Forest Practices wetland typing system) – Management Zone (WMZ)	TYPE A: An area of 1/4 th acre or more covered by open water seven consecutive days between April 1 and October 1 st TYPE B: An open area of 1/4 th acre or more that is vegetated with water tolerant plants and or shrubs. Forested Wetland: A wetland with tree crown closure of 70% or more with mature trees.
Riparian - Management Zone (RMZ)	Those areas that interface land to streams. There are multiple unnamed stream, springs and tributaries in the park.

Restoration thinning is recommended for 14 out of 20 map units in the park due to the current overstocked condition of these Douglas fir plantations. Appendix 2 provides specific stand data, describes the current condition and provides a prescription.

RESOURCE CATEGORY III: PROTECTING SOILS

- a) Existing resource condition: Soils vary greatly throughout the park. Refer to Appendix 3 for Soil Types for specific stand maps and information. This inventory shows that many areas of the park have some of the best known soils for growing large conifers (up to 160 feet of growth in 100 years)
- b) Resources protection measures: Specify the use low ground pressure harvesting equipment to minimize site disturbance and soil compaction during restoration thinning. Monitor and maintain roads, ditches and culverts to protect against erosion. Use only existing roads; no new road construction.
- c) Stewardship practice recommendations: It is recognize that some disturbance of the forest floor and surrounding trees is inevitable during restoration thinning. But all care will be taken to minimize these occurrences by utilizing preexisting forest roads and skid trails. Harvest contractors will be required to use low impact felling and forwarding methods to minimize damage to forest soils.

Restoration thinning will be done using low ground pressure harvesting equipment to minimize site disturbance and soil compaction. Roads, ditches and culverts will be monitored and maintained to guard against erosion. Operations will use only existing roads; no new roads will be constructed. See Appendix 4 – Roads and Culverts.

RESOURCE CATEGORY IV: WATER QUALITY, RIPARIAN, AND WETLAND AREAS

Streams

- a) Existing resource condition: Port Gamble Forest Heritage Park has over 10 miles of streams. Appendix 4 contains a map of these features. Appendix 6 is map of streams and wetlands for the original Shoreline Block.

To improve the accuracy of the historic stream typing by the Washington Department of Natural Resources, Wild Fish Conservancy has mapped all of the streams within the Park (<http://wildfishconservancy.org/>).

- b) Resource protection measures: The Washington Forest Practices Act (FPA) requires riparian buffers, called Riparian Management Zones (RMZs), to protect riparian functions and resources along Type F (fish-bearing), Type Np (non fish-bearing, perennial) and Type Ns (non fish-bearing, seasonal) streams.
- c) Stewardship practice recommendations: Follow the policy adopted by resolution by the Kitsap Board of Commissioner in June 2015: Policy for the Protection and Restoration of Riparian and Wetland Management Zones in Kitsap County Parks.

Wetlands

- a) Existing resource condition: There are wetlands associated with stream channels, groundwater seeps, and enclosed landscape depressions within PGFHP. Many are shrub-dominated wetlands, and there is at least one large open-water wetland, created by a series of beaver dams, associated with a fish-bearing stream, and a forested wetland that is composed of western red cedar and red alder trees. See Appendix 6 – Map of streams and wetlands.
- b) Resource protection measures: The Washington Forest Practices Act (FPA) requires wetland buffers, called Wetland Management Zones (WMZs), to protect wetlands greater than one-half acre with open water (Type A wetlands), and non-forested wetlands greater than one-half acre that are vegetated with water-tolerant plants (Type B wetlands). The FPA does not require a WMZ for forested wetlands. Additional resources protection will be provided to all wetlands in the park, exciding the minimum requirements under Washington FPA rules.
- c) Stewardship practice recommendations: Follow the policy adopted by resolution by the Kitsap Board of Commissioner in June 2015: Policy for the Protection and Restoration of Riparian and Wetland Management Zones in Kitsap County Parks (Appendix 7).

RESOURCE CATEGORY V: FISH AND WILDLIFE HABITAT

- a) Existing resource condition: Only Mapping Units 3, 4, 8, 13, and 18 have large diameter conifers (>20 inches) and are considered priority habitats by the Washington State Department of Fish and Wildlife as well as streams and wetlands. Most of the remaining mapping units are dominated by young, dense, Douglas fir stands. Most riparian and wetland areas are dominated by red alder and big leaf maple.
- b) Resources protection measures: These priority habitats will be left undisturbed. RMZ and WMZ buffers will exclude log extraction operations. Restoration thinning (non-conventional) will be used exclusively outside of the RMZ and WMZ buffers.
- c) Stewardship practice recommendations: The science behind the State's and County's protection of sensitive areas is adequate in most locations; however, we have the luxury of exceeding minimum requirements in the park. It is better to err on the side of caution when sensitive fish and wildlife habitat is at risk. Therefore restoration thinning will be conducted using a cut-to-length (CTL) harvesting system. CTL is ecologically the best harvesting system available; yet is less efficient and produces less net revenue return compared to conventional thinning systems.

RESTORATION THINNING FOR WILDLIFE

Thinning for wildlife involves creating more space between leave trees. The final number of leave trees per acre is based on established thinning guidelines (Table 2) for optimum wildlife habitat enhancement.

The number of leave tree per acre range (100 to 140) will be determined in the field using the average diameter of the leave trees to calculate the relative density (RD) to optimize the desired wildlife habitat condition. Larger trees need more space; and wide-spacing provides increased light to the forest floor stimulating understory plants and creating a more diverse habitat for wildlife.

RD will be used to determine the thinning density or the number of leave trees per acre. The density goal will be an average RD of 35. Leave trees will be sampled and measured to determine the RD using the following guideline and methodology:

Table 2: Thinning guidelines for Wildlife
Relative Density (RD) for Wildlife

Avg. Leave Tree DBH (inches)	Lower Limit – RD 25		Upper Limit – RD 45	
	Trees/Acre (TPA)	Avg. Tree Spacing (Feet)	Trees/Acre (TPA)	Avg. Tree Spacing (Feet)
6	312	11	561	8
7	248	13	446	8
8	203	14	365	10
9	170	16	306	10
10	145	17	261	11
11	126	18	226	12
12	110	19	198	13
13	98	21	176	14
14	88	22	158	15
15	79	23	142	15
16	72	24	129	16
17	65	25	118	17
18	60	26	108	18
19	55	28	100	18
20	51	29	92	19
21	48	30	86	20
22	44	31	80	21
23	42	32	75	21

Relative Density (RD) is a descriptive term that relates to the density of a timber stand to a fully stocked level. An ideal RD for wildlife habitat is between 25 and 45. Mathematically, $RD = \text{Standing Basal Area (BA) in square feet per acre} \div \text{the square root of the quadratic average of DBH in inches}$. The quadratic average is the square root of the average squared diameters. For smaller areas, a simple average DBH can work about as well as the quadratic average in calculating RD. Basal area (BA) is equal to the sum of the cross sectional area of trees at breast height on an acre of land. It is also equal to the BA of the average diameter multiplied by the trees per acre (TPA). To convert tree DBH to BA, square the DBH and multiply by 0.0054. Thus an average tree diameter of 10 inches would have a basal area equal to $(10 \times 10 \times 0.054)$ or 0.54 square feet.

Excerpted from Washington State University Extension EB2000 "Silviculture for Washington Family Forest"³

³ Hanley, Donald P. and David Baumgartner. *Silviculture for Washington Family Forests*. 2005. Washington State University Extension Bulletin 2000. Pullman, WA.

RESOURCE CATEGORY VI: THREATENED AND ENDANGERED SPECIES

- a) Existing resource condition: No endangered species have been noted in the park at this time. However, there are small areas that have been designated by the state as potential marbled murrelet habitat. Coho salmon, a threatened species, exist in the park.
- b) Resources protection measures: Restoring the health of the park forests may provide scarce habitat for endangered or threatened species. Culvert replacement can provide viable, healthy salmon habitat within the park that is under-utilized due to blocking or perched culverts.
- c) Stewardship practice recommendations: As per county policy, restoration thinning is recommended along with the management of diseased trees, under-planting with native tree species and removal of invasive species to improve forest health and to create habitat for endangered or threatened species. The RMAPS will be used to maintain forest roads and replace and repair culverts further protection critical habitat. Other existing forest roads in the park will be abandoned with culverts being removed to restore natural stream flows. This will require extensive resources and inter-agency cooperation.

RESOURCE CATEGORY VII: HISTORIC AND CULTURAL RESOURCES

- a) Existing resource condition: The first humans to enjoy the beauty and natural resources of the North Kitsap Heritage Park were Native Americans, who arrived sometime between 10,000 and 15,000 years ago. While no evidence of Native American habitation has been found in the park, but it is known that the Port Gamble S'Klallam and Suquamish tribes have used the park shoreline and uplands for fishing, gathering and hunting.

Certainly the watersheds would have been crucial to salmonid rearing thousands of years ago. Salmon have been located by Washington Department of Fish and Wildlife (WDFW) in the streams that are crossed by WA State Hwy 104, but inadequate culverts and other obstructions currently block access to the park's beaver ponds, which are part of the headwaters. Ancient tribal members were grateful for the abundance of fish that used to migrate to these streams.

The next groups of humans to use the park were early loggers and pioneers in the 1850's in Kitsap County, taking advantage of homesteading acts to create farms. Hunters, trappers, and local outdoors enthusiasts have taken advantage of the service forest roads to access what is now a public park. Residents in the area recount using the Pope land for various recreational purposes for multiple generations of their families.

- a) Resources protection measures: No evidence of sensitive historical or cultural use has been found in the park. Local Tribes have expressed interest in the management and harvesting of traditional plants and cedar bark.
- b) Stewardship practice recommendations: Metal debris has been found and disturbed land harkening back to the early days of logging in the park. If the debris is innocuous, it is usually left in place as a reminder to visitors of the working forest that once echoed to the sounds of misery whips and double-bit axes. Other debris including garbage and abandoned car tires and parts have been removed by park volunteers. Old growth stumps with spring board notches can be found throughout the park.

RESOURCE CATEGORY VIII: AESTHETICS AND RECREATION

- a) Existing resource condition: Besides being a sanctuary for wildlife, a valuable aquifer regenerator, and a protected place to grow late seral stage forests, PGFHP provides various opportunities for citizens to enjoy their park. It fills the county's need to provide a more rural setting than those found in some of the smaller, urban parks. While the park is closed to motorized vehicles, many people enjoy riding horses, hiking, and mountain biking. The park is also used by geocachers, mushroom hunters, long-distance runners, hikers and dog walkers.
- b) Resources protection measures: Kiosks have been built at parking and trail access points. All forest roads will be maintained or abandoned according to state standards including culvert replacement or removal for abandoned sections. Since some of the trails are forest roads, maintaining the integrity of the forest will be needed to ensure culverts, water bars and ditches are functioning properly. Trails that have been built are subject to the same standard of public resource protection. Trails in PGFHP are varied and will be built and maintained to trail standards agreed to by Kitsap County Parks Department.
- c) Stewardship practice recommendations: Continue to develop public access and parking at entry points to the park. Some of these old forest roads will be maintained for use during forest restoration thinning projects and for fire safety. Some portions of the forest roads maybe abandoned for use by vehicles and maintained as park trails. Efforts to control invasive and noxious weeds along park trails are a priority and will continue. Stewards will work with Dana Coggon to create an invasive species management plan. PGFHP Stewards have a trails subcommittee which is working to create a trail plan in order to deter un-authorized trail construction.

RESOURCE CATEGORY IX: SPECIAL FOREST PRODUCTS

- a) Existing resource condition: Brush harvesting of salal and evergreen huckleberry provide a source of revenue for Kitsap County Parks, specifically PGFHP projects. Kitsap County maintains a contract with a brush harvesting company, which is up for bid every three years. Following County Policy, Citizens can also harvest mushrooms in the park for personal use.
- b) Resources protection measures: Activities of illegal, non-permitted brush pickers have occasionally caused problems in the park. Litter and debris from pickers will to be managed through the enforcement of guidelines and rules by lease holder and Kitsap County Forester.
- c) Stewardship practice recommendations: One of the best safeguards against illegal brush picking is to have an active contract with a legitimate brush harvesting company. After all, legitimate pickers only make money if the resource their company has paid for is not abused, which often happens in the case of illegal picking. Contractor activities will be monitored for impact on the park environment.

STEWARDSHIP TIMELINE

The goal is to conduct restoration management activities/practices over the entire park over a ten year period. Much of the park would benefit from restoration thinning. Under planting shade tolerant native trees will continue in red alder dominated riparian areas and in areas that have been restoratively thinned.

RESTORATION THINNING OPERATIONS

Kitsap County and its consultant, American Forest Management, work closely together to manage all aspects of the restoration thinning operations including estimating yield projections, selecting subcontractors and marketing the logs. The harvest contractors that work in the park will be selected based on several criteria including their ability to extract the logs with the least amount of disturbance to forest and existing forest road system. Contractors will exclusively use low-impact harvest machinery which will tread lightly on the forest floor. Logs will be harvested using the cut-to-length method which leaves tree slash evenly spread on the forest floor to decay. The slash also serves as a "carpet" for the machinery to drive on thus reducing soil disturbance.

All sensitive areas such as park trails, riparian areas, and wetlands will be marked with boundary tape. Blue paint will be used mark the trees for harvest. Parks staff and stewards will mark 100% of the take trees with the goal of leaving the best and strongest trees which will improve the overall health and habitat of the forest.

To enhance and preserve habitat the contractor will be required to leave snags, avoid disturbing stumps, and large woody debris that exist in the Park. The harvest contractor will also be required to create five snags per acre by topping trees at the maximum height their equipment will reach. Ideally snag trees will be at least 16" in diameter and a minimum of 20 feet tall.

10 Year - Restoration Thinning Schedule

Unit #	Year Scheduled for Thinning	Age (2015)	Unit Acres	Tree Per Acre	Volume Per Acre (MBF)	Estimated Current* Volume (MBF)	Leave Trees per Acre	Estimated Net Acres** Restored	Net Volume*** (MBF)
1	2019	25	35	380	<10	350	150	20	53
2	2019	25	85	380	<10	850	150	50	132
3	NA	80	3	140	35	105	NA	NA	NA
4	NA	80	24	143	35	840	NA	NA	NA
5	2023	29	16	360	10	160	150	12	60
6	2016	32	26	260	5	130	100 to 140	20	80
7	2021	32	10	260	5	50	100 to 140	20	70
8	NA	100	70	96	35	2,450	NA	NA	NA
9	2018	49	20	150	24	480	100	15	225
10	2016	30	20	260	12	240	100 to 140	15	75
11	2023	28	18	300	5	90	150	10	50
12	2017	32	70	360	13	910	150	50	250
13	2017/18	49	146	150	30	4,380	100	120	1,180
14	2016	30	20	260	12	240	100 to 140	15	75
15	2022	25	25	390	5	125	150	25	125
16	2017	31	170	570	14	2,380	160	160	740
17	2020	28	25	320	7	175	150	25	100
18	2016	47	130	220	28	3,640	100	40	400
19	2020	28	10	320	7	70	150	5	25
20	2023	25	18	360	13	234	160	10	50
21	NA	56	3	280	17	51	NA	NA	NA

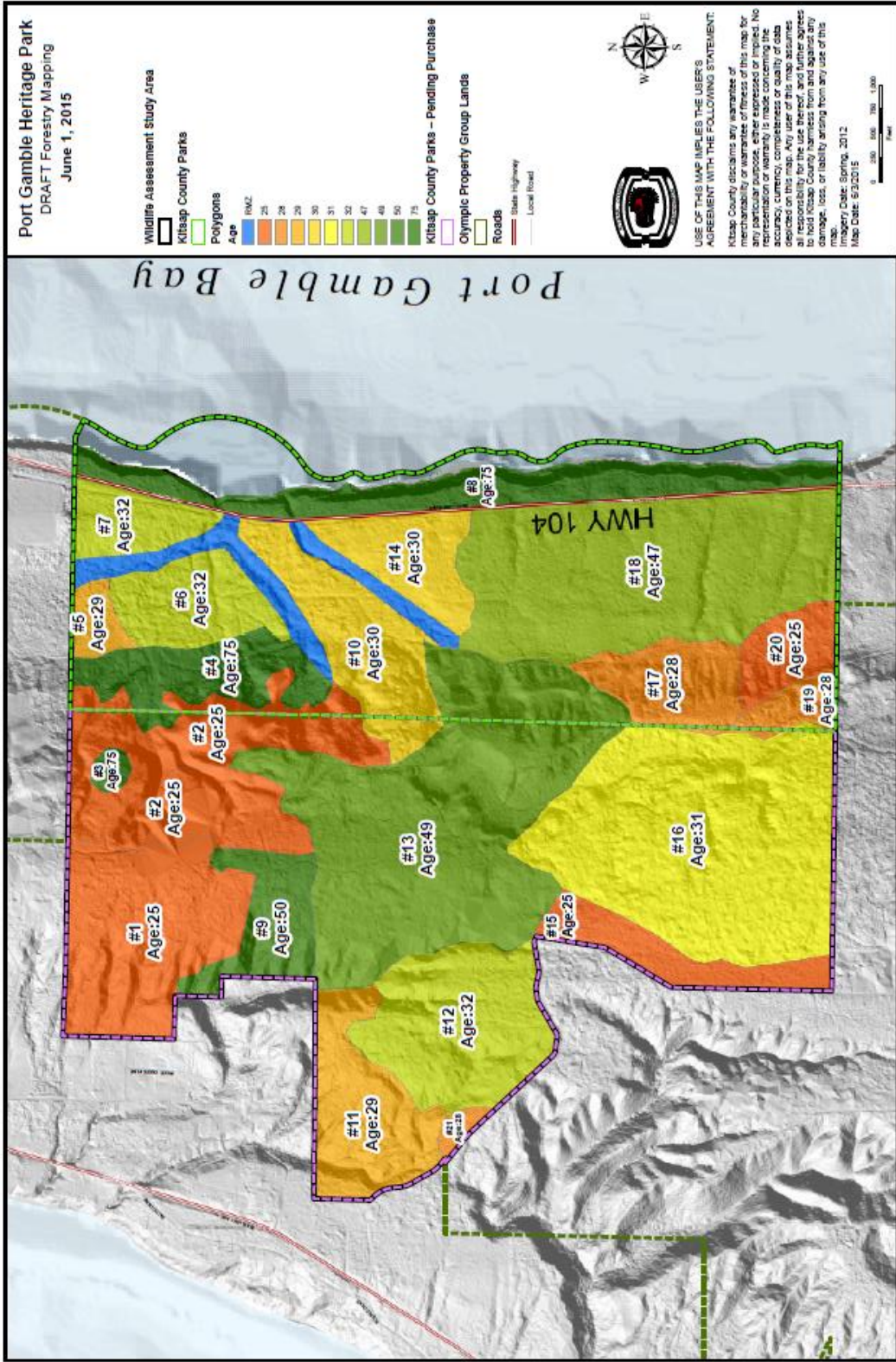
Estimated current volume: 17,950 MBF; anticipated volume from restoration thinning: 3,690 MBF

*Estimated current volume of standing volume in thousands of board feet (MBF).

**Net acres restored takes into account wetland/riparian buffers, steep slopes and hardwoods.

***Restoration Thinning would result in the removal of between 20 – 30 percent of the standing volume.

APPENDIX 1: MAP UNITS



APPENDIX 2: CURRENT FOREST - CONDITIONS/PRESCRIPTIONS

Map Unit #	Species	Age	Acres	Trees/Acre
1	Douglas Fir	30	TBD	400+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100++	140	< 10		0

Unit Description Simple Canopy

This stand is a young dense Douglas fir plantation in the stem exclusion stage of forest development. One of the last areas clear-cut in the park and reforested into Douglas fir, this unit with its high site index is ready for restoration thinning.

Unit Prescription

Implement restoration thinning in 5 to 10 years to release the biggest and best trees.

Map Unit #	Species	Age	Acres	Trees/Acre
2	Douglas fir	25	TBD	400+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100++	140	<10		

Unit Description Simple Canopy

This stand is a young dense Douglas fir plantation in the stem exclusion stage of forest development. One of the last areas clear-cut in the park and reforested into Douglas fir, this unit with its high site index is ready for restoration thinning.

Unit Prescription

Implement restoration thinning in 5 to 10 years to release the biggest and best trees.

Map Unit #	Species	Age	Acres	Trees/Acre
3	W Hem./Douglas fir	80	3	60

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
80 to 100	124	35	W Hemlock	40

Unit Description Complex Canopy

This unit is a circle of trees that was left when the unit around it was clear cut in 1989. It is dominated by reasonably healthy, western hemlock and Douglas fir estimate to be 80 years old. It is a small legacy unit.

Unit Prescription

Monitor the health and vigor of this unit for potential hazard tree risks. In an effort to diversify this unit, under plant western red cedar to create a new canopy cohort.

Map Unit #	Species	Age	Acres	Trees/Acre
4	WH/RA/WRC/DF	80	24	143

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	130	35	WH/RC	10

Unit Description Complex Canopy

This unit is dominated by reasonably healthy, western hemlock, Douglas fir and red alder estimate to be 80 years old. It is a small legacy second growth unit that provides good wildlife habitat due to the wide tree spacing, available dead wood and the development of multiple canopies. The red alder is old and decadent and continues to create openings in the forest.

Unit Prescription

Monitor the health and vigor of this unit for potential hazard tree risks. In an effort to diversify this unit, under plant western red cedar to create a new canopy cohort.

Map Unit #	Species	Age	Acres	Trees/Acre
5	Douglas fir	29	16	360

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	118	10	0	0

Unit Description Simple Canopy

Unit 5 is the typical Douglas fir plantation found throughout PGFHP. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

Unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 8.5 inches. This spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under planting of cedar to create 2nd canopy would add much needed species diversity and horizontal structure.

Map Unit #	Species	Age	Acres	Trees/Acre
6	Douglas fir	32	26	260

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	109	5	0	0

Unit Description Simple Canopy

Unit 6 is a typical Douglas fir plantation in PGFHP. Invasive plants, Himalayan blackberry and Scotch broom are thriving in small open areas and adjacent access Forest Roads/tails. Established trees are healthy and vigorous. . Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

Unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 8.5 inches. This spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under planting of cedar to create 2nd canopy would add much needed species diversity and horizontal structure.

Map Unit #	Species	Age	Acres	Trees/Acre
7	Douglas fir	32	10	260

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	109	5	0	0

Unit Description Simple Canopy

Unit 7 is the typical Douglas fir plantation found throughout PGFHP. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. In the area between Spine Line and Arbutus Trails, there is tree diversity, included many Madrone, and a healthy understory. Unit provides below average wildlife habitat.

Unit Prescription

Unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 10 inches. This spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant cedar and hemlock to create 2nd canopy adding much needed species diversity and vertical stand structure.

Map Unit #	Species	Age	Acres	Trees/Acre
8	RC/DF/GF/RA	100	70	96

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	126	35	RC, Grand fir	60

Unit Description Complex Canopy

Unit 8, is the along the shoreline of Port Gamble Bay and contains the oldest stand of second growth in PGFHP. Western red cedar and Douglas fir are in equal quantity and mixed with a significant amount of grand fir and declining red alder. Units provides above average wildlife habitat.

Unit Prescription

Since this unit is within the Shoreline Management Zone and has a natural designation, restoration and protection are the primary objectives. Invasive plant control and under planting shade tolerant native tree species to replace the declining red alder is the priority.

Map Unit #	Species	Age	Acres	Trees/Acre
9	DF/WH/Mixed	49	20	150

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	129	24	RC/WH	40

Unit Description Complex Canopy

Unit 9 is similar to unity 13 in that both were established at the same time at planted with Douglas fir. The difference is that this unit provides above average wildlife habitat due to its more complex canopy. Multiple canopy layers provide both horizontal and vertical structure and could serve as a future reference stand for the park.

Unit Prescription

Unit needs only to be monitored for disease. The average diameter of trees is over 15 inches with many tree exceeding 20 inches DBH.

Map Unit #	Species	Age	Acres	Trees/Acre
10	Douglas fir	30	20	260

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	140	12	0	0

Unit Description Simple Canopy

Unit 10 has steep slopes, yet is the typical Douglas fir plantation found throughout PGFHP. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

Steep slopes maybe a limitation. The unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 12 inches. This spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant of cedar and hemlock to create 2nd canopy would add much needed species diversity and vertical canopy structure.

Map Unit #	Species	Age	Acres	Trees/Acre
11	Red alder	28	18	300+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	108	5	0	0

Unit Description Simple Canopy

Unit 11 has steep slopes and after the last harvest was planted with Douglas fir which was out competed by naturally seeded red alder. Red alder cover 90 percent of the unit and are providing valuable wildlife habitat.

Unit Prescription

The priority would be to under-plant red cedar and western hemlock to replace the red alder in 30 to 60 years.

Map Unit #	Species	Age	Acres	Trees/Acre
12	Douglas fir	32	70	360

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	116	13	0	0

Unit Description Simple Canopy

Unit 12 is nearly 100 percent conifer with Douglas fir occupying 90 percent of the area. This is a monoculture Douglas fir plantation like others located throughout PGFHP. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

Except for riparian and wetland areas, the unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 13 inches. Improved spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; and begin providing enhanced wildlife habitat. Under plant of cedar and hemlock to create 2nd canopy would add much needed species diversity and vertical canopy structure.

Map Unit #	Species	Age	Acres	Trees/Acre
13	Douglas fir	49	146	150

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	129	30	RC/WH	10

Unit Description Simple Canopy

Unit 13 is an older, well stocked Douglas fir plantation that was likely thinned 20 years ago resulting in significant understory vegetation. The canopy has closed enough that the few established shade tolerant trees, cedar and hemlock saplings, have limited light for growth. With the high single canopy this stand provide can only meet the needs of a limited number of wildlife species.

Unit Prescription

The unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 20 inches. Increased tree spacing would reduce competition, improve tree vigor and allow more light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant of cedar and hemlock would help create 2nd canopy would add much needed species diversity and vertical canopy structure. Deciduous areas with few conifers should be

Map Unit #	Species	Age	Acres	Trees/Acre
14	Douglas fir	30	20	260

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	140	12	-	-

Unit Description Simple Canopy

This stand is occupied by typical Douglas fir plantation found throughout PGFHP. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

Steep slopes maybe a limitation. The unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The average diameter of leave trees would be approximately 12 inches. This spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant of cedar and hemlock to create 2nd canopy would add much needed species diversity and vertical canopy structure.

Map Unit #	Species	Age	Acres	Trees/Acre
15	Douglas fir	25	25	390

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	115	5	-	-

Unit Description Simple Canopy

Unit 15 is a densely stocked Douglas fir plantation. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

The unit needs restoration thinning (VDT) leaving between 100 and 140 trees per acre. The restoration thinning should be delayed for 6 to 10 years. The goal would be have a average leave tree diameter of 12 to 13 inches. Increased tree spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant of cedar and hemlock to create 2nd canopy would add much needed species diversity and vertical canopy structure.

Map Unit #	Species	Age	Acres	Trees/Acre
16	Douglas fir	31	170	570
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	131	14	-	-

Unit Description Simple Canopy

Unit 15 has some steep slopes, and is a densely stocked Douglas fir plantation. Overstocked, this unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

The unit needs restoration thinned (VDT) leaving between 100 and 140 of the biggest trees. The average diameter of leave trees would be approximately 12 inches. The increased spacing would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Under plant of cedar and hemlock to create 2nd canopy would add much needed species diversity and vertical canopy structure.

Map Unit #	Species	Age	Acres	Trees/Acre
17	Douglas fir	28	25	320
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	108	7	-	-

Unit Description Simple Canopy

Unit 15 has steep slopes, and is a densely stocked Douglas fir plantation. Western hemlock has natural seeded in adding to the overstocked condition. This unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

The unit needs to be pre-commercially thinned to between 150 and 190 trees per acre. Additional space between trees would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Restoration thinning would be scheduled 10 years out to further develop the desired ecological structure.

Map Unit #	Species	Age	Acres	Trees/Acre
18	DF/RA/RC	47	130	220
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	140	28	grand fir/red cedar	30

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Map Unit #	Species	Age	Acres	Trees/Acre
19	D fir	28	10	320
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	108	7	-	-

Unit Description Simple Canopy

Unit 19 has steep slopes, and is a densely stocked Douglas fir plantation. Western hemlock has natural seeded in adding to the overstocked condition. This unit has vast areas where there is little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

The unit needs to be pre-commercially thinned to between 150 and 190 trees per acre. Additional space between trees would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Restoration thinning would be scheduled 10 years out to further develop the desired ecological structure.

Map Unit #	Species	Age	Acres	Trees/Acre
20	D fir	25	18	360
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	104	13	-	-

Unit Description Simple Canopy

Unit 15 has steep slopes, and is a densely stocked Douglas fir plantation. Overstocked, this unit has vast areas with little or no understory vegetation and the competition for light, moisture and nutrients causes the entire plantation to be stressed and increasingly vulnerable to attack by diseases, insects and fire. Unit provides below average wildlife habitat.

Unit Prescription

The unit needs to be pre-commercially thinned to between 150 and 190 trees per acre. Additional space between trees would reduce competition, improve tree vigor and allow light to reach the forest floor; stimulate the reestablishment of understory vegetation; begin providing enhanced wildlife habitat. Restoration thinning would be scheduled 10 years out to further develop the desired ecological structure.

Map Unit #	Species	Age	Acres	Trees/Acre
21	R Cedar/R Alder	56	3	280
% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	114	17	-	-

Unit Description Simple Canopy

Unit 15 has steep slopes, and is a well stocked mixed stand of Western red cedar and red alder. This unit provides above average wildlife habitat.

Unit Prescription

Monitor and if needed, under-plant additional red cedar and western hemlock to replace the declining red alder over the next 20 years.

10 Dystric Xerorthents: 45 to 70 percent slopes. This deep, moderately well drained to somewhat excessively drained soil are on the sidewalls of entrenched streams and shorelines. Formed mainly in glacial till, but some are formed in sandy and gravelly outwash. Areas a long and narrow with most slopes are about 65 percent. The vegetation is conifers and hardwoods.

18, 19 & 20 Indianola loamy sand: 0 to 6, 6 to 15, and 15 to 30 percent slope respectively. This deep, somewhat excessively drained soil is found on the forest road uplands of the park. Formed in sandy glacial outwash, the primary vegetation is conifers. Some of the most fertile areas in the park, these soils have a site index* of 131 for Douglas fir and 95 for red alder.

21 Indianola-Kitsap Complex: 45 to 70 percent slope, this soil is located in the southwest corner of the park off Bay Ridge. Formed in glacial outwash and glacial lake sediment, the primary vegetation is conifers and hardwoods. Very productive soil and suited to Douglas fir and fed alder. Site index* is 131 for Douglas fir and 99 for red alder. Due to the steepness of slope, this area of the park will be “skipped” in terms of restoration thinning.

22 Kapowsin gravely ashy loam: 0 to 6 percent slopes, this is a moderately deep moderately well drained soil on forest road uplands and terraces. Formed in glacial till, are found in relatively small amounts, with less than 5 acres in the park. Native vegetation found on this soil is conifers and hardwoods. A very productive soil, Douglas fir has a site index* of 159.

30 & 31 Kitsap silt loam: 14 to 30, and 30 to 45, percent slope respectively. This is a deep, moderately well drained soil on terraces in the central area of the park. This very fertile soil formed in glacial lake sediment on the side slopes of terraces. Vegetation is conifers and hardwoods with a Douglas fir site index of 164 and site index* for red alder of 102.

32 McKenna gravely loam: 0 to 6 percent slopes, this moderately deep over compact glacial till, poorly drained soil was formed in glacial till. Found on uplands in low lying depressions and along drainage ways. Native vegetation is hardwoods, conifers, sedges, and grasses. Poor drainage limits the suitability of this soil to water-tolerant trees such as red alder, western red cedar and hemlock.

39, 40 & 41 Poulsbo gravely sandy loam: 0 to 6, 6 to 15, and 15 to 30 percent slope respectively. This moderately deep, moderately well drained soil is on forest road uplands and is formed in glacial till. Native vegetation is conifers and hardwoods. Well suited to Douglas fir and has a site index* of 161.

42 & 43 Poulsbo-Ragnar complex: 0 to 6, and 6 to 15 percent slope respectively, these soils are on forest road uplands and terraces in the park. The formed in glacial till and glacial outwash this soil supports native vegetation consisting of mixed stands of conifers and hardwoods. Well suited to Douglas fir, Poulsbo soil has a site index* of 171 for Douglas fir.

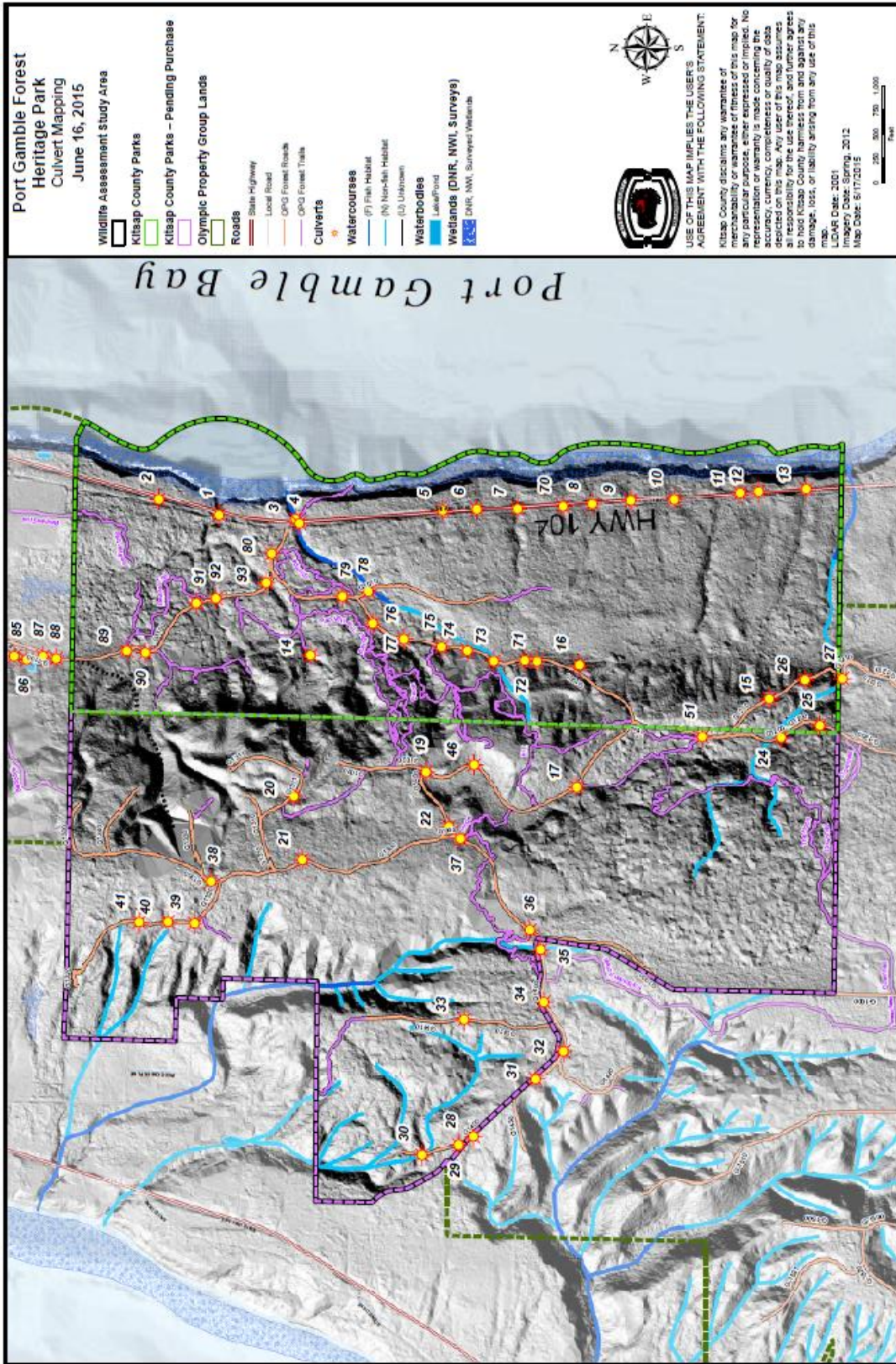
44 & 46 Ragnar fine sandy loam: 0 to 6 and 15 to 30 percent slope respectively. This is a deep, well-drained soil on terraces and uplands and was formed in glacial outwash. Native vegetation is conifers and hardwoods with a site index* for Douglas fir of 167.

47 Ragnar-Poulsbo complex: 15 to 30 percent slope. The soils of this complex are on forest road uplands and are formed in glacial till and glacial outwash. Native vegetation is a mixed stand of conifer and hardwoods. Ragnar soils are well suited to Douglas fir, western red cedar, hemlock and red alder. Douglas fir has a site index* of 139; The Poulsbo portion of the soil complex has a site index of 161 for Douglas fir.

* Site index is the height of a dominant example of the titled tree species in 100 years.

** USDA Natural Resources Conservation Service – Online Web Soil Survey.

APPENDIX 4: FOREST ROADS, RMAP'S & CULVERT INVENTORY



FOREST ROADS

Owners of forestland are responsible for properly constructing and maintaining forest roads to protect fish habitat and water quality. Kitsap County has inherited the forest roads in the PGFHP that were constructed by Pope Resources for commercial timber operations. In order to keep these forest roads, most which are also used as trails, we must comply with state law. The Forest and Fish law is part of the Forest Practices Regulations of Washington State. The intent of the law is the reduction of silt pollution and runoff into streams and rivers. Forest road prisms are hard on streams when forgotten culverts become plugged creating wash out forest roadbeds, and deposit tons of silt in streams.

The goal is to keep most of the existing forest roads in the park for natural resource management, and use as trails: providing access for people with disabilities, running trails, and access routes for ingress/egress during emergencies. In order to do this we must comply with the law by having approved RMAPs check list in accordance with the small landowner rules. The accompanying map and tables show locations of existing forest roads and culverts (Tables 2 & 3), their size and condition.

Table 2: Attributes for Shoreline Culverts

Number	Culvert type	Dia. (in)	Length (ft)	Drop @ Outlet (ft)	Trail Condition	Culvert Condition	Other Conditions
1	Box	36	*		Adequate	Adequate	Functioning
2	Corrugated Metal	20	21.0		Adequate	Adequate	Functioning
3	Box	36	*		Adequate	Adequate	Functioning
4	Round Concrete	14	50.0		Adequate	Adequate	Functioning
5	Round Concrete	14	*		Adequate	Adequate	Functioning
6	Round Concrete	14	*		Adequate	Adequate	Clogged
7	Round Concrete	18	*		Adequate	Adequate	Functioning
8	Round Concrete	18	*		Adequate	Adequate	Clogged
9	Round Concrete	18	*		Adequate	Marginal	Functioning
10	Round Concrete	18	*		Adequate	Adequate	Functioning
11	Round Concrete	18	*		Adequate	Adequate	Functioning
12	Round Concrete	18	*		Adequate	Marginal	Clogged
13	Round Concrete	18	*		Adequate	Adequate	Functioning
14	Corrugated Metal	24	20.0	1.0	Marginal	Adequate	Functioning
15	Corrugated Metal	12	30.0		Adequate	Adequate	Functioning
16	Corrugated Plastic	18	29.0		Marginal	Adequate	Functioning
25	Corrugated Plastic	18	28.0		Adequate	Adequate	Functioning
26	Corrugated Plastic	18	28.0		Adequate	Inadequate	Functioning
27	Corrugated Plastic	18	45.0		Adequate	Adequate	Functioning
70	Round Concrete	18	*		Adequate	Adequate	Functioning
71	Corrugated Metal	18	31.5		Adequate	Adequate	Functioning
72	Corrugated Plastic	18	31.5		Adequate	Adequate	Functioning
73	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
74	Corrugated Plastic	18	24.0		Adequate	Adequate	Functioning
75	Corrugated Plastic	18	30.5	2.0	Adequate	Adequate	Functioning
76	Corrugated Plastic	18	30.0	1.0	Adequate	Adequate	Functioning
77	Corrugated Metal	12	34.0		Adequate	Adequate	Functioning
78	Corrugated Metal	12	38.3		Adequate	Adequate	Functioning
79	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
80	Corrugated Plastic	18	31.0		Adequate	Adequate	Functioning
89	Corrugated Plastic	18	29.5		Adequate	Adequate	Functioning
90	Corrugated Plastic	24	30.5		Adequate	Adequate	Functioning
91	Corrugated Plastic	18	31.5		Adequate	Adequate	Functioning
92	Corrugated Metal	36	45.0	3.0	Marginal	Adequate	Functioning
93	Corrugated Metal	36	49.0		Marginal	Adequate	Functioning

*Unable to measure

Table 3: Attributes for pending purchase area culverts.

Number	Culvert type	Dia. (in)	Length (ft)	Drop @ Outlet (ft)	Trail Condition	Culvert Condition	Other Conditions
17	Corrugated Plastic	18	29.0		Adequate	Adequate	Functioning
19	Corrugated Plastic	18	32.0		Adequate	Adequate	Functioning
20	Corrugated Plastic	18	31.0		Adequate	Adequate	Functioning
21	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
22	Corrugated Metal	12	31.0	0.5	Adequate	Adequate	Functioning
24	Corrugated Plastic	18	31.0		Adequate	Adequate	Functioning
28	Corrugated Plastic	18	31.0		Inadequate	Adequate	Functioning
29	Corrugated Metal	12	30.0		Inadequate	Adequate	Functioning
30	Corrugated Plastic	24	31.0		Inadequate	Adequate	Functioning
31	Corrugated Plastic	18	30.0		Marginal	Adequate	Functioning
32	Corrugated Metal	12	25.0		Marginal	Inadequate	Clogged
33	Corrugated Plastic	18	30.0		Inadequate	Adequate	Functioning
34	Corrugated Plastic	18	29.0		Marginal	Adequate	Functioning
35	Corrugated Plastic	18	39.0		Adequate	Adequate	Functioning
36	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
37	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
38	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
39	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
40	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
41	Corrugated Plastic	18	30.0	0.5	Adequate	Adequate	Functioning
46	Corrugated Plastic	18	30.0		Adequate	Adequate	Functioning
51	Corrugated Metal	12	19.0		Adequate	Adequate	Functioning

*Unable to measure

FOREST ROAD MAINTENANCE ABANDONMENT PLAN (RMAP)

There are approximately 6 miles of forest roads within the project area that will need to be maintained or formally abandoned. Public use of motorized vehicles is not allowed in the park. The only motorized traffic on the forest roads will be authorized maintenance vehicles (tractors, graders etc.), contractor vehicles (brush pickers and harvest contractors for example) and emergency vehicles. Where possible, runoff will be quickly returned to the forest floor as sheet flow by emphasizing out-sloping.

The following activities are necessary under DNR RMAPs rules.

1. An inventory of all park culverts will be maintained. This inventory has been completed.
2. GPS coordinates will be noted for each culvert. This has been completed
3. Culvert location monuments/markers will be placed at each culvert crossing be tall enough to be visible from the forest road prism and be inscribed with a unique ID #.
4. Forest road prism culvert inspection will occur each August/September to prepare for winter rains.
5. Ditches along all maintained forest roads shall be freed from obstructions that impede water flow.
6. Moss, duff, and grasses in ditches should remain undisturbed: for added water energy distribution, water absorption, and head cut reduction.
7. Forest roads shall be sloped so that water is directed to the forest floor. See WAC 222-24
8. Where beaver activity is present, frequent checks must be made to prevent washouts.
9. As forest roads are needed for scheduled forest restoration thinning projects, they will be prepared to withstand use by trucks or other equipment.
10. When forest road segments are no longer needed will be abandoned as prescribed under FPA rules.

Culverts to be replaced

Culverts that block fish passage must be removed or replaced with bridges or arched culverts. The goal is to ensure stream crossings allow fish passage for all life stages of fish. Culverts can sometimes block juvenile fish by creating a strong laminar flow that prevents upstream migration of Coho and Steelhead smolt. Culverts block returning adult salmon when they are perched higher than the fish can jump. Replacement culverts must be a minimum of 18" in diameter.

Currently, anadromous fish are present in the eastern and northern areas of the park, and the potential exists for them to utilize the park's wetland habitat. There is likely chum, sea run cutthroat, steelhead and Coho in the Port Gamble Bay that borders the park.

All forest roads and culverts need annual maintenance. Maintenance typically consists of clearing and cleaning culverts and ditches of debris and vegetative growth. Graded forest road surfaces restore the proper movement of water off the forest road surface and to prevent rutting and head cuts. Forest roads and culverts should be inspected before the fall rainy season and after any periods or record rainfall. A spring inspection will help identify problems that need attention during summer dry season.

There are four (4) culverts in the subject property that are not functioning. These culverts only need maintenance.

APPENDIX 5: FIRE RISK REDUCTION

Fire Risk Reduction Strategies for NKHP

The objective of fire risk mitigation in the park is to reduce the potential for a crown fire. Because we cannot control the weather or change the topography of the park we are left with control and distribution of fire fuels as our only viable option for reducing the intensity of a fire. If successful, this strategy would not prevent fire, which is a natural part of the environment, but reduce the fire's intensity by limiting it to a ground fire or surface fire. Reducing the potential for a fire to occur and creating a defensible space are other options that are compatible with long range goals and objectives for this park.

Ground fires: least damaging and limited to duff with no visible flames (smoldering)

Surface fires: produce a flame front and can be destructive

Crown fires: most destructive with flames spreading from tree crown to tree crown

Recognition of the role of fire in maintaining natural ecosystems (4)

Historical records show that wildfires have been a part of the natural environment for many centuries before the arrival of Europeans. A single fire that occurred on the Olympic Peninsula circa 1700, burned from near the Elwha southerly to the Hood Canal as far south as Belfair. Wildfires create new forests and contribute to the diversity of plants and habitats.

Integrating Fire Management with Ecosystem Management

In addition to increasing plant and habitat diversity, employing Variable Density Thinning (thinning from below) reduces the potential for a crown fire by increasing the spacing between tree crowns. Thinning from below canopy retains larger more vigorous and fire resistant trees and raises the base of tree crowns reducing ladder fuels.

“The common denominator is fuel (5)

- Reduce surface fuels.
- Increase the height to the base of tree crowns.
- Increase spacing between tree crowns.
- Keep larger trees of more fire-resistant species.
- Promote more fire-resistant forests at the landscape level by reducing fuels both vertically and horizontally.”

Following these principles accomplishes three goals:

4 Fire Management for the 21st Century, James K Agee. Creating a Forestry for the 21st Century Kohm/Franklin
5 PNW 618 A Pacific Northwest Extension Publication. Oregon State University, University of Idaho, Washington State University
June 1, 2016

1. Reduces the intensity of a fire, making it easier for firefighters to suppress.
2. Increases the odds that the forest will survive a fire. Small trees, shrubs, and other understory vegetation may be injured or killed, but larger trees in the stand will only be scorched, and soil damage also will be reduced.
3. Reduces the extent of restoration activities needed, such as replanting or erosion control measures.

Specifics:

1. Access.

Maintain access for firefighting personnel and equipment.

2. Fuel Reduction Zones

Reduce fuel loading along trails by chipping or scattering. Control Scotch broom along existing service forest roads and the power line right-of-way.

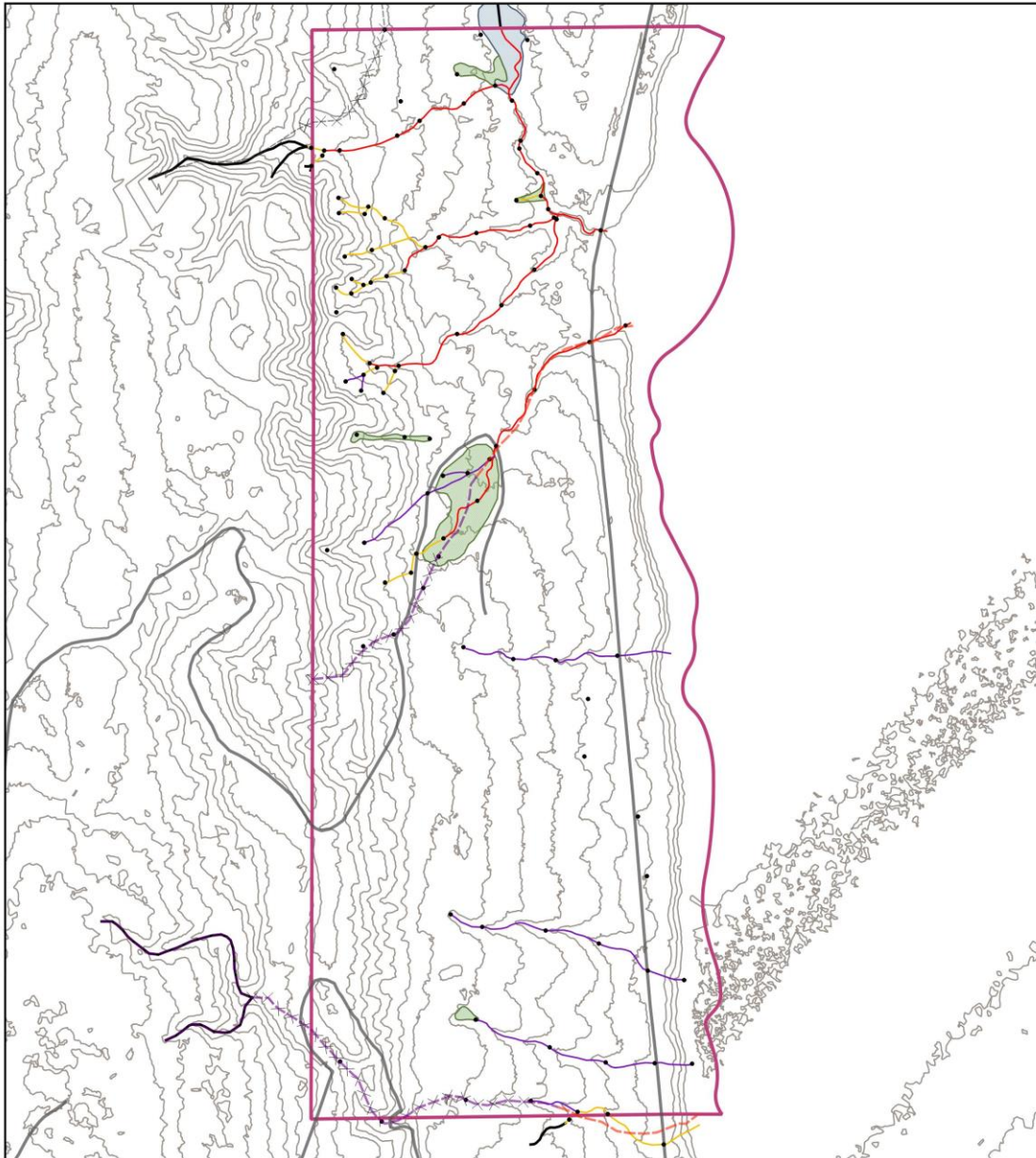
3. Shaded Fuel Breaks

Take advantage of topography and enhance moist areas by removing dead wood and ladder fuels while leaving groundcover to increase moisture retention reducing the potential for a fire.

4. Mineral Soil Firebreaks

Maintain a minimum of 30 foot crown separation across existing forest roads and reduce fuels (noxious weeds and dead wood).

APPENDIX 6 - STREAMS/WETLANDS



DNR_tics	WFC Points	WFC Stream	wchydro	WFC Waterbody	wbhydro
+	.	Np	F	LA	LA
— 20ft contour	•	Ns	N	WT	WT
— DNR_trans	•	U	S		TRS
	xxx	NOCH	U		



0 750 1500 ft

APPENDIX 7 – POLICY FOR THE PROTECTION AND RESTORATION OF RIPARIAN AND WETLAND MANAGEMENT ZONES IN KITSAP COUNTY PARKS

The Kitsap County Forest Stewardship program is conducting restoration thinning in County parks within 200 feet of streams and wetlands; for that reason it is important to establish a program specific policy for the protection and restoration of riparian and wetland management zones (RMZ/WMZ).

Non-conventional thinning in overstocked stands is a recommended practice within riparian and wetland management zones in Western Washington⁶. The Kitsap County Forest Stewardship program exclusively uses non-conventional thinning. Operationally called variable density thinning (VDT), this type of ecological restoration thinning is specifically recommended for young dense Douglas fir plantations and advances the forest health and habitat goals of the Kitsap County Forest Stewardship program.

Why Use Ecological Restoration Thinning?

Restoration thinning is most beneficial in young (typically less than 50 years of age) dense conifer stands because of anticipated high growth rates². Unlike conventional thinning, restoration thinning can maintain or accelerate dead wood production¹. This is accomplished by leaving all or most of the dead wood as part of the thinning prescription. The approach is to use VDT to create variation in the forest landscape by crafting tree clumps, skips and openings that closely mimic natural forest conditions⁷. Additionally, all non Douglas fir tree species in the management zones are reserved as leave trees.

Healthy, diverse forests contain dead trees. Properly implemented, VDT will result in continued stand mortality that will continue to contribute dead wood to streams and wetlands. Thinning prescriptions will also call for the artificial creation of snags. Studies show that ninety-five percent of near-stream wood inputs come from within 82 to 148 feet of a stream; shorter distance occur in young, shorter stands and longer distances occur in older and taller stands¹. Therefore RMZs will increase over time.

The Washington Forest Practices Rules do address the RMZ and WMZ requirements for Western Washington, but given the ecological health and habitat goals for county parks, the Forest Stewardship Program elects to increase protection for both wetlands and riparian areas. The Kitsap County Forest Stewardship Program policies for RMZ and WMZ are to be followed unless a site specific adaptive management prescription is approved by the Forest Stewardship

⁶ Spies, Thomas, Michael Pollock, Gordon Reeves and Tim Beechie. 2013. Effects of Riparian Thinning on Wood Recruitment: A scientific Synthesis. Science Review Team Wood Recruitment Subgroup, Forest Sciences Laboratory, Corvallis, OR.

⁷ Kerr, Andy, and Derek Churchill. 2012. Ecological Appropriate Restoration Thinning in the Northwest Forest Plan Area. Conservation Northwest, Geos Institute, Klamath-Siskiyou Wildlands Center and Oregon Wild. Seattle, WA.

Committee and the Kitsap County Community Forester. Under no circumstance can the WMZ or RMZ be less than what is required under the Washington Forest Practice Rules.

Wetland Management Zones

In Kitsap County Parks, all wetlands are important regardless of their size and will be protected by a minimum buffer, with no harvest or use of equipment within the wetland management zone. Within wetland management zones all restoration thinning will be limited to low-impact harvest systems, specifically a cut-to-length (CTL) harvest system.

The WMZ will be measured horizontally from the edge or the point where the non-forested wetland becomes a forested wetland as determined by the method described in the Forest Practices Board Manual, Section 8 – Guidelines for Wetland Delineation. The delineation shall be of an average width as described per wetland type in the red columns. Forest Practices require that the WMZ not be less than the minimum nor more than the maximum (as shown in the red columns of Table A).

For Kitsap County Parks, the minimum WMZ for Type A and B wetlands (blue column of Table A) is basically equal to the WA FPA average width; thereby providing twice the protection. In WMZ's that exceed the KC Parks Minimum width, a total of 100 to 140 leave trees per acres greater than six inches dbh will remain; fifty of which will be greater than twelve inches dbh including 10 trees greater than twenty inches dbh, where they exist.

For Kitsap County Parks, Type B wetlands under ¼ acre and all forested wetlands will be protected with the no-harvest WMZ widths shown in the blue column of Table A.

Table A: Policy for Wetland Management Zone (WMZ) Protection

Forest Practices – Wetland Type with buffers showing additional park requirements.

Wetland Type	Acres	WA FPA Maximum Width	WA FPA Average Width	WA FPA Minimum Width No Harvest	KC Parks Minimum Width No Harvest
A (including bogs *)	Greater Than 5	200'	100'	50'	100'
A (including bogs *)	.5 to 5	100'	50'	50'	100'
A (Bogs only)	.25 to .5	100'	50'	25'	50'
B	Greater than 5	100'	50'	25'	50'
B	0.5 to 5	No WMZ	No WMZ	25'	50'
B	0.25 to 0.5	No WMZ	No WMZ	25'	50'
B	< 0.25	No WMZ	No WMZ	No WMZ	50'
Forested	n/a	No WMZ	No WMZ	No WMZ	50'

The columns highlighted in red represent WMZ no harvest zones under Forest Practices; the blue columns specify the Kitsap County Forest Stewardship Program WMZ policy for enhanced wetland management zone protection in Kitsap County Parks.

Riparian Management Zones

Decisions regarding Riparian Management Zone (RMZ) are more complicated than WMZ's as there are many options based on the presence or absence of: fish, cultural resources, threatened or endangered species, seasonal or perennial stream flow and stand age and density. Generally, rules in the Washington Forest Practices law protect fish bearing waters (Type F and S) quite well. The 4a Option (Tables B), no harvest within the inner zone or a small landowner "Alternative Plan" (Table C) will be used by the Forest Stewardship Program for the young plantation stands bordering streams in Kitsap County Parks.

The Kitsap County Forest Stewardship Program manages park forests for forest health and wildlife, as opposed to previous management for fiber production. With the exclusive use of restoration thinning (thinning from below), and leaving more trees per acre than the required minimums, the prescription will significantly preserve forest hydrology and provide for the recruitment of deadwood. By more than doubling the leave trees, required under Forest Practices Rules, beyond the no harvest in the Inner Zone (Option 4a in Tables B) there is no need to increase the core and inner zone buffers.

The columns highlighted in red represent FPA no harvest zones; blue columns indicate the Kitsap County Forest Stewardship Program policy for enhanced riparian management zone protection in Kitsap County Parks.

Tables B: Policy for Type S/F Stream Protection - No-Harvest Inner Zone

Type "S" (Shoreline) and "F" (Fish bearing) Streams

4a No Inner Zone Harvest - Buffer Width by Site Class (Stream <10 feet)

Site Class	WA FPA Core Zone No Harvest	WA FPA Inner Stream < 10' No Harvest	Total Buffer Width No Harvest	WA FPA Outer Zone TPA Minimum	Kitsap County Forest Stewardship Program Outer Zone Average TPA
I	50'	83'	133'	20	100 to 140
II	50'	63'	113'	20	100 to 140
III	50'	43'	93'	20	100 to 140
IV	50'	23'	73'	20	100 to 140
V	50'	10'	60'	20	100 to 140

4a No Inner Zone Harvest - Buffer Width by Site Class (Stream > 10 feet)

Site Class	WA FPA Core Zone No Harvest	WA FPA Inner Stream > 10' No Harvest	Total Buffer Width No Harvest	WA FPA Outer Zone TPA Minimum	Kitsap County Forest Stewardship Program Outer Zone Average TPA
I	50'	100'	150'	20	100 to 140
II	50'	78'	128'	20	100 to 140

III	50'	55'	105'	20	100 to 140
IV	50'	33'	83'	20	100 to 140
V	50'	18'	68'	20	100 to 140

Table C: Policy for Type S/F Stream Protection Using Alternate Plan

Small Landowner Alternate Plan – Type S & F Stream Fixed Width, No Harvest, by Site Class

Site Class	WA FPA - No Harvest Core Zone	Kitsap County Forest Stewardship Program - Minimum No Harvest Core Zone	Kitsap County Forest Stewardship Program Average TPA For Outer Zone
I	145'	145'	100 to 140
II	118'	118'	100 to 140
III	101'	101'	100 to 140
IV	82'	82'	100 to 140
V	75'	75'	100 to 140

Both perennial and seasonal streams need protection. Because the Kitsap County Forest Stewardship Program manages park forests for ecological diversity and wildlife, restoration thinning will significantly enhance forest hydrology and provide for the recruitment of deadwood into Type Np and Ns streams. The blue column in Table(s) D indicate the buffer widths for Type Np and Ns streams under the Kitsap County Integrated Forest Stewardship Policy for Kitsap County Parks.

Tables D: Policy for Np/Ns Stream Protection No-Harvest Buffer

Type “Np” (Non-Fish Perennial) Streams

From S or F Stream Length of Np Stream	WA FPA- No Harvest Width Np	Kitsap County Forest Stewardship Program – Minimum No Harvest Buffers
Length > 1000, First 500'	50'	50'
Length <1000, First 300'	50'	50'
Length < 300'	50'	50'
Beyond 1,000'	0' with 30' ELZ	50'
All Sensitive Sites	50 to 56'	50 to 60'

Type “Ns” (Non-Fish Seasonal) Streams

WA FPA- No Harvest Buffer Width for Ns Stream	WA FPA Type Ns Restriction	Kitsap County Forest Stewardship Program Buffer Minimum No Harvest Buffer
0'	30' ELZ	50'

Thinning for Wildlife in Wetlands and Riparian Management Zones

The number of leave trees per acre for all restoration thinning in and adjacent to riparian and wetland management zones is base on established thinning guidelines for optimum wildlife habitat enhancement.

The trees per acre range (100 to 140) will be determined in the field using the average diameter of the leave trees to calculate the relative density (RD) too optimize the desired wildlife habitat condition. Large trees need more space, more space means more light on the forest floor stimulating understory plants thereby creating diverse habitat for wildlife.

RD will be used to determine the thinning density or the number of leave trees per acre. The density goal will be an average RD of 35. Leave trees will be sampled and measured to determine the RD using the following guideline and methodology (Table E):

Table E: Thinning guidelines for Wildlife

Relative Density (RD) for Wildlife

Avg. Leave Tree DBH (inches)	Lower Limit – RD 25		Upper Limit – RD 45	
	Trees/Acre (TPA)	Avg. Tree Spacing (Feet)	Trees/Acre (TPA)	Avg. Tree Spacing (Feet)
6	312	11	561	8
7	248	13	446	8
8	203	14	365	10
9	170	16	306	10
10	145	17	261	11
11	126	18	226	12
12	110	19	198	13
13	98	21	176	14
14	88	22	158	15
15	79	23	142	15
16	72	24	129	16
17	65	25	118	17
18	60	26	108	18
19	55	28	100	18
20	51	29	92	19
21	48	30	86	20
22	44	31	80	21
23	42	32	75	21

Relative Density (RD) is a descriptive term that relates to the density of a timber stand to a fully stocked level. An ideal RD for wildlife habitat is between 25 and 45.

Mathematically, $RD = \text{Standing Basal Area (BA) in square feet per acre} \div \text{the square root of the quadratic average of DBH in inches}$.

The quadratic average is the square root of the average squared diameters. For smaller areas, a simple average DBH can work about as well as the quadratic average in calculating RD.

Basal area (BA) is equal to the sum of the cross sectional area of trees at breast height on an acre of land. It is also equal to the BA of the average diameter multiplied by the trees per acre (TPA). To convert tree DBH to BA, square the DBH and multiply by 0.005454.

Thus an average tree diameter of 10 inches would have a basal area equal to $(10 \times 10 \times 0.005454)$ or 0.5454 square feet.

Excerpted from Washington State University Extension
EB2000 "Silviculture for Washington Family Forest"⁸

⁸ Hanley, Donald P. and David Baumgartner. Silviculture for Washington Family Forests. 2005. Washington State University Extension Bulletin 2000. Pullman, WA.

GLOSSARY - Policy for the Protection and Restoration of Riparian and Wetland Management Zones in Kitsap County Parks

Type “A” Wetland	An area of ½ acre or more covered by open water seven consecutive days between April 1 st and October 1 st . This includes forested and non forested bogs that are greater than ¼ acre.
Type “B” Wetland	An open area of ¼ acre or more that is vegetated with water tolerant plants and/or shrubs.
Forested Wetland	A wetland with a tree crown closure of 30% or more, if trees are mature.
Type “S” Stream	Shorelines of Washington State
Type “F” Stream	Streams lakes and ponds that are used by fish, amphibians, wildlife and drinking water
Type “Np”	Perennial, year round stream flow (sometimes below the surface).
Type “Ns”	Seasonal streams
ELZ	Equipment limitation zone on type Np/Ns streams
Bogs	A unique wetland with peat or muck to 16 inches or more and vegetation, such as sphagnum moss, Labrador Tea, Bog Rosemary and other hydrophilic plants, requiring acidic soils. True bogs are rare on the landscape and Included here as bogs are Poor Fens for purposes of Forest Practices.
Conventional Thinning	Thinning that spaces the leave trees out as equally as possible and is designed as a method to produce the highest quality wood for the subsequent final harvest.
Non Conventional Thinning	Thinning where the smallest trees are removed first, thinning from below leaving the largest trees and clumps of trees along with skips and small openings; thereby creating a highly varied forest landscape.
DBH	The diameter of a tree at breast height (4.5 feet)
Riparian Zone	The area adjacent to streams, lakes and ponds.

Relative Density

A descriptive term that relates to the density of a timber stand to a fully stocked level. An ideal RD for wildlife habitat is between 25 and 45.