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DRAFT

Travel Analysis Plan

Gifford Pinchot National Forest

May 2015

Contents

Introduction 4
Background 4
Travel Analysis Policy 5
The Analysis Process 7
1. Setting up the analysis 7
2. Describing the situation 7
3. Identifying issues 10
4. Assessing benefits, problems and risks 11
Access Needs 11
Ecological Risks 13
Annual Maintenance Costs 29
5. Describing Opportunities 30
5. Reporting 38
Summary of Desired Future Road System 38
Investments 41
Appendix A 44
Appendix B 48
Appendix C 49
Appendix D 50
Appendix E 51

List of Tables

Table 1. Access Needs for Operational Maintenance Level 1 and 2. 12
Table 2. Road Miles for Individual Aquatic Risk Criterion Rating by Operational Maintenance Level. 14
Table 3. Summary Aquatic Risk Rating by Operational Maintenance Level. 20
Table 4. Road Miles for Terrestrial Risk Criterion Rating by Operational Maintenance Level. 24
Table 5. Summary Terrestrial Risk Rating by Operational Maintenance Level. 27
Table 6. Forest's 5-Year Average Annual Maintenance Funding. 29
Table 7. Cost Analysis of Maintaining the Existing Road System. 30
Table 8. Proposed Open Roads with High Environmental Risks by Operational Maintenance Level. 32
Table 9. Single Purpose Vegetation and Bough Management Roads. 34
Table 10. Operational Maintenance Level 1 and 2 No Access Need Roads. 34
Table 11. Summary Road Recommendations by Operational Maintenance Level. 35
Table 12. Potential Changes to Road System. 39
Table 13. Annual Maintenance Cost of Current Versus Proposed Road System. 39
Table 14. Estimated Capital Costs of Improvement and Decommissioning Work. 41

List of Figures

Figure 1. Map of Aquatic Risk Summary Rating by Road Segment. 21
Figure 2. Map of Terrestrial Summary Rating by Road Segment. 28
Figure 3. Map of Proposed Open Road System. 33

Figure 4. Single Purpose Vegetation and Bough Management Roads. 36
Figure 5. Roads with No Access Needs Recommended for Decommission. 37
Figure 6. Current Versus Proposed Distribution of Operational Maintenance Levels. 38
Figure 7. Access Needs Along a Continuum of Ecological Risk..... 42
Figure 8. The Forest's Recommendation Structure. 43

Introduction

National Forest System roads are important for reasons that are diverse and often personal. Roads get you where you want to go and provide the freedom to explore, harvest and enjoy nature. One of the Gifford Pinchot National Forest's (GPNF) top priorities is providing a safe road system that is responsive to these public needs, as well as environmentally sound, affordable, and efficient to manage. Many roads on the GPNF are at or beyond their designed lifespan. Structural components such as bridges and pavements are failing. When aging roads are not maintained, closures compromise visitor experience and public safety is put at risk. Natural resources also suffer as unmaintained roads can degrade water quality and fish habitat. The cost of our current road system presents another challenge, as budgets for road maintenance has declined.

This travel analysis identifies the issues and opportunities around the GPNF's road system that will enhance land managers' ability to make better decisions related to the road network. The report evaluates the various sources and levels of past road maintenance funding; ensures that the GPNF transportation system provides sustainable access to national forest resources over the short and long term; and, identifies the minimum road system necessary for the safe and efficient travel and for administration, utilization, and protection of National Forest System lands.

To envision a more sustainable road system, the GPNF considered public input, and Forest Service administrative access needs on the forest. Forest staff identified environmental risk criteria for aquatic and terrestrial systems, and overlaid these risk criteria with known access needs. Forest staff then considered the costs of maintaining the current road system and evaluated options to bring maintenance costs in line with projected available funding.

This analysis is not a decision document and will not make site-specific decisions about which roads will be retained or closed. Those decisions are made at the project scale with public input on site-specific situations. Recommendations and findings will instead be used to inform future decisions at the local level. Recommendations and findings are subject to change as new or better information becomes available.

When taken as a whole, the recommendations of this report inform readers concerning the critical issues related to road management on the GPNF. It is our hope that these recommendations will lead to wise choices in road management in the future.

Background

From the 1940s to date, road construction, reconstruction and improvements have primarily been associated with timber management. At the present time, the Gifford Pinchot National Forest has 4,056 miles of road on its network. Of the 4,056 miles, 3,286 are maintained in an open to public travel status.

Road budgets have been steadily declining for the past 20 or more years. Region-wide, the amount of funding for road work including both appropriated funding and work contributed by commercial users is less than 20 percent of what it was 20 years ago. The GPNF estimated a deferred maintenance need of $53.3 million; what it would take to bring the roads back up to standard. The Forest's annual maintenance needs that would be required to keep the road system fully maintained to standard is estimated as $3.2 million. Current levels of funding for annual road maintenance is about $1.4 3 million, a difference of $1.9 million from what would be necessary to keep the road system properly maintained.

Travel Analysis Policy

The predictable deterioration of road infrastructure due to age and the gap between the available maintenance funds and the annual maintenance needs exists in all national forests. In response to these issues, beginning with the 2001 Road Management Rule, regulations were established that require the responsible official on each National Forest System (NFS) unit to "identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of NFS lands" (36 CFR 212.5).

It is expected that each national forest's transportation system will be comprised of a set of roads needed to maximize access needs, minimize environmental risks, and reflect long-term funding expectations.

The minimum road system is defined in 36 CFR 212.5(b)(1) as the road system:

- needed to meet resource and other management objectives adopted in the relevant land and resource management plan;
- meeting applicable statutory and regulatory requirements;
- reflecting long-term funding expectations; and
- minimizing adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

Per the regulations at 36 CFR 212.5(b), the minimum road system is to be identified by the responsible official based on a process that is science-based and that, to the degree practicable, involves a broad spectrum of interested and affected citizens, other state and federal agencies, and tribal governments. Forest Service Manual 7712.4 directs responsible officials to use the Travel Analysis Process (TAP, formerly known as the Roads Analysis Process or RAP) as the science-based approach for identifying the national forest road system.

The specific analytical process for identifying access needs and relative risk rankings to aquatic and terrestrial ecosystems were developed at the Forest level and are explained in detail below under the heading *Gifford Pinchot Travel Analysis Process*.

In order to meet the requirement that a minimum roads system "reflect long-term funding expectations" (36 CFR 212.5(b)(1), the GPNF is relying on direction from the Forest Service's

Pacific Northwest Regional office which has defined this to mean that the *average annual funding* is reasonably in balance with the *average annual cost of routine road maintenance*. [1]

Because the total cost of annual maintenance work for the existing transportation system exceeds the average annual funding capacity of the GPNF, several general scenarios for balancing maintenance with available funding have been studied. These include either reducing the size of the transportation system and/or changing the composition of maintenance levels and standards to a more affordable state.

Throughout the process, the Forest leadership offered multiple public outreach opportunities to gather information about road usage and management. Forest staff summarized public input into themes and issues from questionnaires, comments and discussions. This information contributed to the identification and prioritization of opportunities defined in this report.

Travel analysis is not a decision-making process; it is an assessment of the existing condition of the current road system. It will be used to inform future decisions relating to administration of the forest transportation system and help to identify proposals for changes to travel management direction (FSM 7712).

Specifically, travel analysis will be used to inform:

- Future plan and project-level proposed actions, purpose and need statements, and future decisions pertaining to road construction, reconstruction, decommissioning, and maintenance;
- Road investments at Regional, Forest, and District scales;
- Delivery of National, Regional, and Forest restoration programs for multiple resources; and
- Agency strategies to comply with regulatory requirements, including those associated with the Clean Water Act and the Endangered Species Act.

[1] "Average annual funding" is defined as the average amount of funding available for each NFS unit for routine annual maintenance from appropriations, collection accounts, commercial users, cooperators, and other partners during the 2008-2012 timeframe, plus or minus 20%. It does not include funding from ARRA and CIP. Only the modest amounts specified for "routine maintenance" in Legacy Roads and Trails funding allocations are included.

"Average annual cost of routine road maintenance" means the average yearly need for basic road maintenance. This includes log out, drainage maintenance, erosion control, blading, brushing, traffic signs, etc. It does not include cyclical replacement costs (such as bridge replacement every 50 years, asphalt overlays, etc.), which are covered by funding beyond the individual NFS unit budgets (e.g., Regional Capital Investment Program).

The Analysis Process

The Travel Analysis Process is described in Forest Service Manual 7712 and Forest Service Handbook (FSH) 7709.55, Chapter 20. Travel Analysis considers access needs, environmental risks, and financial considerations. The Forest Service guide, *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System* (1999) provides a six step process to complete a Travel Analysis process:

1. Setting up the analysis
2. Describing the situation (the need for access and environmental risks)
3. Identifying issues (key public and management concerns)
4. Assessing benefits, problems, and risks
5. Describing opportunities and setting priorities
6. Reporting

1. Setting up the analysis

GPNF staff, with guidance from Forest leadership, defined the scope of the analysis and identified sideboards necessary for a thorough analysis. The scope was determined to be forest-wide. Leadership established a team of natural resource specialists to evaluate current ecological risks that roads on the GPNF pose; a team of public affairs specialists to gather input from the public on access interests; and engineers with the experience to contribute costs present and potential future costs of road construction, maintenance and closure/decommission. The core team reviewed previous travel analysis plans from the GPNF including the 2002 *Gifford Pinchot National Forest Roads Analysis*, as well as smaller, watershed- and project-scale roads analyses. The team also defined available data along with information gaps.

2. Describing the situation

From the 1940s to date, road construction, reconstruction and improvements have primarily been associated with timber management. At the present time, the Gifford Pinchot National Forest has 4,056 miles of road on its network. Of the 4,056 miles, 3,286 are maintained in an open to public travel status. There are 393 miles of roads maintained for passenger cars (operational maintenance levels 3, 4 and 5); 2,893 miles of road maintained for high clearance vehicles (operational maintenance level 2); and 770 miles of road that are closed (operational maintenance level 1).

In addition to gathering existing data on the current road network, public outreach activities were conducted to gather information on public access needs in order to increase the understanding of external views about the existing situation. This information helped in identifying key public concerns which were incorporated into the issues. A key to the success of the public outreach process was providing different ways for people to engage in the process.

The GPNF conducted a variety of public outreach activities throughout the Travel Analysis Process. The purpose of outreach activities was to inform the public about the Travel Analysis process, gather input from the public about roads, and provide an interim progress update on the process. The input gathered from the public outreach was used to identify public access needs in order to better describe the existing situation and allowed for identification of key public concerns. The public outreach process provided multiple ways for people to engage in the process. Through a combination of individual meetings and briefings, phone calls, public meetings, and an online questionnaire, input obtained was from a wide range of local residents and stakeholders who use the roads, with the most intensive effort received from the users in the local community. Following is a brief summary of information gathered.

In late 2012, the GPNF along with members of the Pinchot Partners and South Gifford Pinchot Collaborative convened a series of six public meetings to gather information on the roads the public used, activities they were intending, and conditions of roads they observed. This group developed a set of six questions asked at the meetings. Answers were collected at the meetings and from any questionnaire that was received. One hundred twelve people attended this first round of public meetings. At the meeting, the public also had opportunities to provide information on road issues and suggestions for road use, and the GPNF posted a questionnaire on the Forest website, asking for responses before January 1, 2013. The Forest received 128 responses during the initial response period.

During the response period, the Forest staff also received a number of phone calls and letters expressing the need to keep roads open for people with disabilities, hunting, horseback riding, quad opportunities, and access when adjacent landowner's gates are closed. During this period, the Gifford Pinchot Task Force conducted their own online survey which garnered 228 responses. They summarized their survey and provided both the survey results and summary to the Forest leadership for consideration.

Responses gathered from the six public meetings, questionnaires, phone calls and letters were recorded, summarized and made available on the GPNF website for review. General themes from public input were identified by GPNF staff, including the public's strong interest in being kept informed and granted broader public engagement opportunities throughout the process; an interest in partnering/volunteering with road and trail maintenance; the need for emergency access for floods, search and rescue, and fire; access to trailheads and for dispersed recreation activities; access for aging population and people with disabilities; and interest in more OHV riding opportunities on roads and trails. Comments regarding roads-to-trails conversions were mixed, as was concern with decommissioning roads.

Forest staff held four additional meetings in March, 2014, to share updates on the travel analysis process, and what was learned from the information gathered during the public outreach period. Specific roads mentioned by the public and roads accessing specific sites/areas were displayed on maps for public review at the meetings and posted online. Additional input gathered at those

public meetings and questionnaires submitted through December 31, 2014 provided an additional 90 responses to include in the public input roads data set.

The Forest staff received a total of 218 responses. Following are the questions and a summary of the information received from the public:

1. *Do you limit your travel to paved roads to reach your destination areas within the Gifford Pinchot National Forest (GPNF)?*

   Almost all responses were "no" and included a list of activities enjoyed on National Forest lands.

2. *For each of your destination areas, please list the road number(s) used to access the areas and your intended activity (e.g., hiking, hunting, firewood cutting, forest product collection, etc.). If road number is not known, describe your starting location and destination area.*

   Approximately 50% of road miles on the Forest were identified along with the intended activities. Approximately 1500 miles of Maintenance Level II roads were identified through public input.

3. *Please list any roads you may be aware of causing erosion or other resource problems. Use a map to list road number, problem and specific road location details (milepost if known).*

   Only about a third of respondents noted a road that had erosion or resource problems, and those responses only listed 33 roads. Several noted that the road was not causing erosion itself but was itself subject to erosion and needed maintenance or repair.

4. *In the Gifford Pinchot National Forest, do you use roads closed to wheeled-motorized access for non-motorized activities or over-snow activities? If so, what roads closed to wheeled motorized use do you use and for what activities do you use them? For each road you list, give the road number and use (e.g., hiking, hunting, firewood collecting, snowmobiling, etc.).*

   Responses to this question were relatively few, and only about 40% of those respondents named either a specific road or a specific activity. Most indicated interests in either horseback riding/camping or winter activities such as snowmobiling, snowshoeing, and cross country skiing. Several noted that they enjoyed hunting on foot or bike-in hunting on roads closed to wheeled vehicles, but also noted the difficulty of removing game without having a wheeled vehicle nearby. Others noted there were few roads open to wheeled OHVs on the GPNF and that the Forest should open more.

5. *Opportunities to convert roads to trails exist for some roads recommended for closure or decommission, dependent upon resource risks and funding considerations. If there are roads or road segments you would like to have considered for conversion to trails (either motorized or non-motorized), please list specific road and type of activity for which you would use the road.*

   About 40 roads were identified for roads to trails conversion consideration. Responses to this question generally fell into three categories:

   A. Do not close or decommission any roads (majority of responses). Reasons given included: fear of losing access to the Forest (recreation and vegetation management), needs for horse trailers, waste of money and not ecologically sound to decommission.
   B. If you convert a road to a trail ensure it remains open to a specific use (either motorized or non-motorized uses).
   C. Specific suggestions, often emphasizing the value in creating loops for hiking, horseback riding, or ATV/motorcycle riding, a need for easy motorized trails etc.

   Responses not falling neatly in these general groupings noted that there were too many illegal trails already with the Forest not having the resources to maintain its trail system either.

6. *Additional comments?*

   These responses varied widely; appreciation, skepticism, suspicion, and acknowledgement of the process and fiscal challenges.

3. Identifying issues

The analysis team, in conjunction with Forest leadership and the public, identified key, road-related issues.

These issues include:

- The Forest has insufficient funding for annual maintenance. Funding is insufficient to minimize environmental effects, and to prevent roads from becoming impassable for vehicles due to natural regrowth ad erosion processes.
- The desired public use of roads is varied and geographically extensive while the lack of maintenance is resulting in road conditions becoming impassable.
- Many miles of Level 2 roads are not needed all the time, but rather the need for use is during a period when active vegetation or bough management occurs.

The issues were combined with other factors to provide information for the formulation of recommendations for the desired future GPNF road system, as recommended further in this report.

4. Assessing benefits, problems and risks

After identifying the important issues, an interdisciplinary Forest staff examined the environmental, social, and economic aspects of the existing road system. The output from this step is a synthesis of the benefits, problems, and risks of the current road system. It is broken into the subheadings of access needs, ecological risks, and annual maintenance costs.

Access Needs

Access needs (benefits) were identified for each INFRA[2] road segment. Twenty years was the time period used for determining the access needs. Roads that connected to the current Operational Level[3] 3, 4, and 5 road system from the roads that were identified as needed for a particular access were included in each access need. Six Access needs were identified:

1. Vegetation and Bough Management
2. Quarries and Mining Claims
3. Recreation Management
4. Public Interest
5. Communication and other administration needs
6. Rights of way, Easements and Special Uses

Each access need was defined by a specific GIS analysis as follows:

Vegetation and Bough Management: Any road that touches, or is within one-quarter mile of a potential commercially harvestable stand (less than 80 years of age) or touches a potential bough management stand (Appendix Vegetation and Bough Management).

Quarries and Mining Claims: Any road that touches developed or undeveloped quarries plus all roads within areas where active mine claims are established.[4] These quarries are necessary for ongoing maintenance and reconstruction of the road system.

Recreation Management of Developed Sites: Any road that accesses currently managed "recreation sites" recorded in the Forest Service Developed Recreation Corporate Database (NRM Developed Recreation Module). These include sites at all development scales 0-1 (Dispersed and Concentrated Use Area Sites), Development Scale 2 (Primitive Recreation Sites), and Development Scale 3-5 (Developed Recreation Sites) or that accesses area of known "High

[2] INFRA is the Forest Service's corporate database for tracking costs and maintenance needs associated with roads, facilities, bridges, and other infrastructure on the national forest system.

[3] The Forest Service's road system assigns specific standards to roads depending on the road's operational level. Generally, Operational level 3, 4, and 5 roads comprise the major forest arterial road system, with level 5 being the highest maintenance level. Level 1 roads are not open for public use.

[4] The 1988 Rock Resource Management Plan defines developed as an existing source which has been used for at least one entry and Undeveloped as source which has been confirmed through detailed rock source investigation and/or drilling.

public use or interest". In addition, roads that have High public, community, partner or tribal interest were included as identified by District Recreation Staff based on on-the-ground knowledge and dispersed sites/concentrated use area maps. District Line officer approved these additions.

Public Interest Roads: Any road where a specific road number was identified and/or specific road numbers could be derived by identifying most logical route to specific sites or places identified by a member of the public at the meeting or from questionnaires received during public involvement period. Roads identified by the public as used for recreation purposes were considered important in providing access to dispersed recreation opportunities.

Communication and other administration: Any road accessing radio repeaters, and fire administration sites such as lookouts, water sources, guard stations and vantage points.

Rights of Way, Easements and Special Uses: Any road designated in the INFRA database as a Forest Road and Trail Act Cost Share Road (easements), any road designated in the NITC Database as a Separated Right of Way and any road within a section designated with an existing Special Use in the Special Uses Database.

Access for Vegetation and Bough Management included almost all of the Level 1 and 2 roads (Table 1). Public access interests accounted for about 2/3rds of the Level 2 roads. Access to quarries and mining claims includes about 1/3 third of the Level 2 roads.

Table 1. Access Needs for Operational Maintenance Level 1 and 2.

Access Needs Summary	Level 2 (miles)	Level 1 (miles)
Vegetation or Bough Management	2707	608
Quarries and Mining Claims	1110	69
Developed Recreation	450	4
Public Interest	1402	55
Communications and Fire	319	5
Easements	166	2
Rights of Way	234	39
Special Uses	252	48
Current Forest Total	**2893**	**770**

Ecological Risks

Aquatic and terrestrial ecosystem risks were identified for each INFRA segment and six risk criteria were developed for both.

Aquatic Risks

Six risk criteria were developed to assess road effects or risk of effects to the aquatic ecosystems. Two criteria, Sediment Delivery and Mass Wasting, were the same as what was used in the 2002 Gifford Pinchot Roads Analysis. Three criteria were similar to those analyzed in the 2002 *Gifford Pinchot National Forest Roads Analysis*, but a different GIS analysis was used (Fish Culvert Barriers, Stream Crossings, and Riparian Occupancy). One criterion was new, Fish Bearing Crossings. Following is a description of the risk and/or effect to the aquatic ecosystem, the GIS analysis used, and potential mitigations to the risks for each of the six criteria. Results for each criterion are presented in Table 2.

Fish Bearing Crossings – Road segment crosses a fish bearing stream

Description of risk

Roads crossing fish bearing streams pose risk to fish by modifying natural processes resulting in stream habitat degradation, or providing opportunities for fish harassment or poaching. Habitat or fish loss is of particular concern for threatened or endangered species. Habitat degradation examples are floodplain isolation, stream constrictions, or habitat simplification.

Roads crossing fish bearing streams can directly contribute excessive sediment, and/or be the access point to streams for foreign substances such as chemicals or contaminants or non-native aquatic species. Some fish bearing road crossing are desired dispersed recreation sites. The concentrated and prolonged use of some of these sites can result in compacted stream adjacent areas and create readily accessible opportunities for harassment and/or poaching. Poaching is a concern for at-risk species and, and due to lack of State and Forest Service law enforcement capabilities, can continue unabated over many years.

Risk Criteria

High – road crosses the GPNF mapped distribution and/or the critical habitat designated by US Fish and Wildlife Service and National Oceanic and Atmospheric Agency for the Endangered Species Act listed species, Lower Columbia River Coho, Chinook and Steelhead, and Columbia River Bull trout.

Moderate – road crosses the GPNF mapped distribution of non ESA listed fish species

No – road does not cross any mapped fish bearing streams

Mitigations

Improve road surface

Reduce or eliminate traffic
Increase or improve placement of ditch relief culverts
Replace fish bearing stream culverts to simulate the natural channel form
Close/ stabilize or decommission

Table 2. Road Miles for Individual Aquatic Risk Criterion Rating by Operational Maintenance Level.

Maintenance	Criteria Rating	Fish Presence	Fish Barrier	Stream Crossing	Sediment Delivery	Mass Wasting	Riparian Occupancy
Level 5	High	12.0	7.8	15.5	0.0	0.0	11.3
	Mod	3.5	0.0	0.0	15.5	0	0.0
	No Risk	0.0	7.7	0.0	0.0	15.5	4.2
Level 4	High	21.5	32.6	13.0	14.6	64.8	11.3
	Mod	21.5	3.6	57.6	29.8	0.6	29.4
	No Risk	32.8	39.7	5.2	2.4	6.6	35.1
	Not rated				29.0	3.9	
Level 3	High	84.2	76.1	152.5	82.8	195.9	106.2
	Mod	91.6	0.0	128.6	108.0	45.4	47.8
	No Risk	125.1	224.7	19.7	25.3	56.5	146.9
	Not rated				84.7	1.9	
Level 2	High	167.4	327.5	818.2	767.2	890.2	391.3
	Mod	586.2	32.5	1,564.4	1465.3	474.0	395.9
	No Risk	2139.7	2,533.4	510.7	491.1	1,456.4	2106.1
	Not rated				169.7	67.6	
Level 1	High	6.1	12.2	163.8	224.1	109.6	29.0
	Mod	73.2	5.5	299.2	250.8	102.8	45.0
	No Risk	690.6	752.2	306.8	269.8	533.8	695.9
	Not rated				25.1	23.1	

Fish culvert barriers – Road culvert is a barrier to fish migration

Description of risk

Roads blocking fish migration pose risk to the aquatic ecosystem by reducing the viability, sustainability, or productivity of fish populations and reducing the amount of various habitat types (migration, spawning, rearing, refuge, hiding cover) required for all the fish life stages. Long term fish population viability is dependent upon the free exchange of genes between members of the same populations or species. Isolated populations due to barriers pose a risk of reducing genetic diversity and fitness over time. Fish travel significant distances along streams throughout their life, both diurnally and seasonally. Most culverts barriers prevent or restrict upstream migration but can create hazards for fish migrating downstream also. Culvert barriers affect other aquatic organisms i.e. reducing or eliminating nutrients derived from the decomposition of fish after spawning.

Culvert barriers are often caused by undersized culverts constricting streams, increasing velocity above a fish's sustained swimming ability and creating a scour pool below the culvert outlet

which causes an elevation difference greater than what fish are capable of jumping or swimming. Undersized culverts disrupt the natural flow patterns which result in changes to stream characteristics such as flow depth and sediment sorting.

Risk Criteria

Similar to 2002 with updated culvert barrier database including White Salmon River Watershed data

High – Road segment has a culvert barrier blocking 0.1 miles or greater of fish habitat

Moderate- Road segment has a culvert barrier blocking less than 0.1 miles of fish habitat

No Risk- Road does not have a culvert barrier

Mitigations

Replace fish passage barrier culverts
Close/ stabilize or decommission

Stream Crossings – Road segment crosses streams

Description of risk

Road stream crossings pose risks to the aquatic environment because they disrupt aquatic processes. Road stream crossings can affect channel scour, hillslope to stream surface flow routing, sediment routing/sorting, and large wood repositioning and recruitment within streams during peak flows. Streams receive intercepted subsurface flows via ditches directly linked to a road stream crossing and the water flows faster in a ditch than subsurface. At a watershed scale, changes in flow routing can affect downstream accumulation of flow in surface channels influencing the magnitude and timing of peak flows. Road stream crossings often constrict flow and associated sediment movement which through time can result in excessive upstream sediment accumulations and a lack of downstream sediment sorting and transport.

Roads can be a barrier to the movement of large wood from hill slopes to valley bottoms and/or streams. Wood and gravels can become trapped behind culverts reducing delivery of these key aquatic habitat-shaping elements, and increasing risk of road failures. The large wood delivery to streams is a process that through time enables the formation of complex in-stream habitat features upon which fish depend for food, cover, spawning and rearing.

Roads receiving minimal maintenance often have culverts inlets with sediment and wood accumulations partially or fully clogging the culvert or have culverts not functioning properly. Over time, culverts corrode, become plugged, and fail, resulting in inputs of fine sediments, and/or road fill material including the culvert itself, to streams. After a culvert fails, often a stream will have over steepened banks, constrictions from partial blockages or head cutting

within the sediment that had accumulated upstream of the road crossings resulting in extended periods of sediment delivery. At culvert failures, streams can be over widened and devoid of stream shade, resulting in stream warming.

Risk Criteria

Crossings per road segment for road segments less than 1 mile

High- Equal to or greater than 3 stream crossings

Moderate- 1 or 2 stream crossings

No Risk- No crossings

Average Crossings per mile for road segments 1 mile or longer

High- Equal to or greater than 3.0 stream crossings per mile

Moderate- up to 3.0 stream crossings per mile

No Risk- No crossings

Mitigations

Annual maintenance to ensure functioning ditches and culverts
Improve road surface
Reduce or eliminate traffic
Add or improve placement of ditch relief culverts
Replace improperly functioning and/or sized culverts or ditch lines
Close/ stabilize or decommission

Sediment Delivery – Road segment produces sediment from road surface and delivers to streams

Description of Risk

Sediment produced from road surfaces and delivered to streams poses risks to the aquatic ecosystems. Sediment is produced from erosion of an area occupied by a road constructed with native materials and/or surfacing material such as course rock rather than an area occupied by soils covered with native vegetation. Roads are a prominent source of accelerated sediment delivery to anadromous fish habitats in forested watersheds of the Pacific Northwest.

Roads are capable of promoting overland flow by capturing and concentrating precipitation runoff thereby increasing the erosive power and transport capability of overland flow. Mobile sediments are produced during precipitation events from erosion of a road surface and the associated cut and fills slopes. Through time from washing processes, fine particulates migrate from wetted subgrades to the road surface also. Road surfaces differ in the inherent erodibility

due to the bedrock or parent material on which they are constructed. Erosion from the surface of the road is lessened with surfacing material. For example, roads that have been paved produce far less sediment than roads with native surfaces.

The amount of sediment delivered to streams from roads is dependent on both the road erosion and the mechanisms of sediment delivery from a road to a stream. Sediment from roads can be delivered by surface runoff directly to streams in close proximity and by ditches that carry sediment-laden water directly or indirectly to streams. Ditches are drained at some spacing along roads either by ditch relief culverts or by culverts and bridges at stream crossings. Not all ditch relief culverts deliver sediment to streams because they discharge to non-channeled and forested slopes where water can infiltrate into the ground and/or sediment can be filtered and dropped out of suspension onto the forest floor.

Forest roads receiving minimal maintenance, continue to slowly deteriorate and produce fine sediment. During periods of runoff, some of these fines make their way to ditches or nearby streams. Roads receiving minimal maintenance will tend to have rills and gullies forming on the road surface which increases sediment produced from roads. Course and fine sediment produced from roads that reaches streams are considered in excess to the sediment regime under which aquatic ecosystems evolved. Excessive course road sediment in streams can cause scour, cover quality spawning gravels and be coarser and larger than the natural substrates of the streams. The excessive fine sediment's negative effects include turbidity, shallowing of pools, and fine sediments covering and/or filling interstitial spaces between spawning gravels. The biological results of these negative effects include shifts in macro-invertebrate populations which serve as a food source to fish, reduced spawning success, and increased mortality of egg and alevins from suffocation. High, prolonged turbidity events cause gill irritation leading to reduced feeding and increased susceptibility to diseases, and/or clogged gills causing mortality.

Risk Criteria

same as 2002 based on one part of the Washington State DNR Model (Washington Forest Practices Board Manual: Standard Methodology for Conducting Watershed Analysis, Version 3.0, November 1995). Additional description of methodology is available in the project files.

High- relative High rate of sediment delivery from road surfaces to streams

Moderate- relative low rate of sediment delivery from road surfaces to streams

No Risk- No delivery to streams (no stream crossings and road not near stream)

Mitigations

Improve road surface
Reduce or eliminate traffic
Add ditch relief culverts

Improve placement of ditch relief culverts
Replace improperly functioning and/or sized culverts or ditch lines
Close/ stabilize or decommission
Wet season closure

Mass Wasting – Road segment crosses known landslides or potentially unstable soils

Description of Risk

Mass wasting features and potentially unstable soils in themselves, occur naturally and provide positive inputs to the aquatic ecosystem. These areas can deliver significant quantities of soil, rock and trees to streams typically during High runoff or saturated soil conditions. Roads crossing mass wasting features and to a lesser degree potentially unstable soils, pose a risk to the aquatic environment as roads can 1) initiate the movement, 2) change the character of the material, or 3) disrupt the movement in the case of small debris flows. Roads can initiate mass wasting movements by locally ponding/retaining excessive water and/or saturated soils thereby destabilizing hill slopes. Roads can change the character of the material when the landslides includes the road as the landslide travels through a road prism, incorporating road surface materials and/or culverts, and often depositing them into streams, diminishing the natural beneficial inputs from a landslide to a stream. In the case of small debris flows, roads can interrupt debris flow, preventing the soil, rock and trees from reaching a stream.

Debris flows originating from a road tend to have less large wood contributions to streams. The addition of gravels without large wood to low gradient streams can result in short term detrimental effects, such as channel aggradation or widening, pool filling, and fine sediment deposition on spawning gravels.

Forest roads receiving minimal maintenance in areas where mass wasting or potentially unstable soils exist tend to accumulate more soil and rock in culvert inlet areas and consequently have higher risk of culvert failures.

Risk Criteria

Same as 2002:

High- Road segment crosses known previous landslides

Moderate- Road segment crosses potentially unstable soils

No Risk- Road segment does not cross previous landslides or potentially unstable soils

Mitigations

Install dips to encourage landslide material and or water to be transported across road at desired locations rather than affecting larger road prism area

Annual clearing of culvert inlets in areas with mass wasting features or potentially unstable soils
Close/ stabilize or decommission

Riparian Occupancy - Road segment is within Riparian Reserve for stream, lakes, ponds and wetlands

Description of risk

Long road segments within riparian reserves decrease the function of the riparian ecosystem. Roads that are positioned in close proximity and parallel to a stream can constrict a stream thus impeding channel migration, increasing or changing location of bank erosion and the processes of aggradation and deposition. Riparian vegetation is interrupted when long road segments occur within riparian areas reducing shade, leaf fall, and riparian invertebrates, and decreasing habitat for riparian and aquatic species.

Risk Criteria

High-Road segment is within Riparian Reserve for 0.3 contiguous miles or greater

Moderate-Road segment is within Riparian Reserve for 0.2-0.29 contiguous miles

No Risk – Road segment is not within Riparian Reserve for stretches over 0.19 miles

Mitigations

Annual maintenance to ensure functioning ditches and culverts
Improve road surface
Reduce or eliminate traffic
Re-align contiguous miles away from stream
Increase ditch relief culverts
Close/ stabilize or decommission

Aquatic Risk Summary Rating

A summary aquatic risk rating was given to each road segment and based on summing each criterion rating, with a High given 3 points and a Moderate given 2 points (Table 3). No points were given to a No Risk rating. For the summary rating, a score of 15 or greater was considered a High and meant that at least 3 of the criterion scored a High. A score of 4-14 was considered a Moderate Aquatic Risk. A score of 0-3 was considered a Low Aquatic Risk and meant that only one individual criterion could be rated as High. Many of the high aquatic risk roads were close to the major rivers (Figure 1).

Table 3. Summary Aquatic Risk Rating by Operational Maintenance Level.

Maintenance Level	Aquatic Summary Rating	Miles
Level 5	High	11.3
	Moderate	4.2
	Low	0.0
Level 4	High	44.7
	Moderate	2.6
	Low	28.5
Level 3	High	166.2
	Moderate	67.2
	Low	67.3
Level 2	High	825.0
	Moderate	891.4
	Low	1,176.9
Level 1	High	74.1
	Moderate	190.7
	Low	505.1

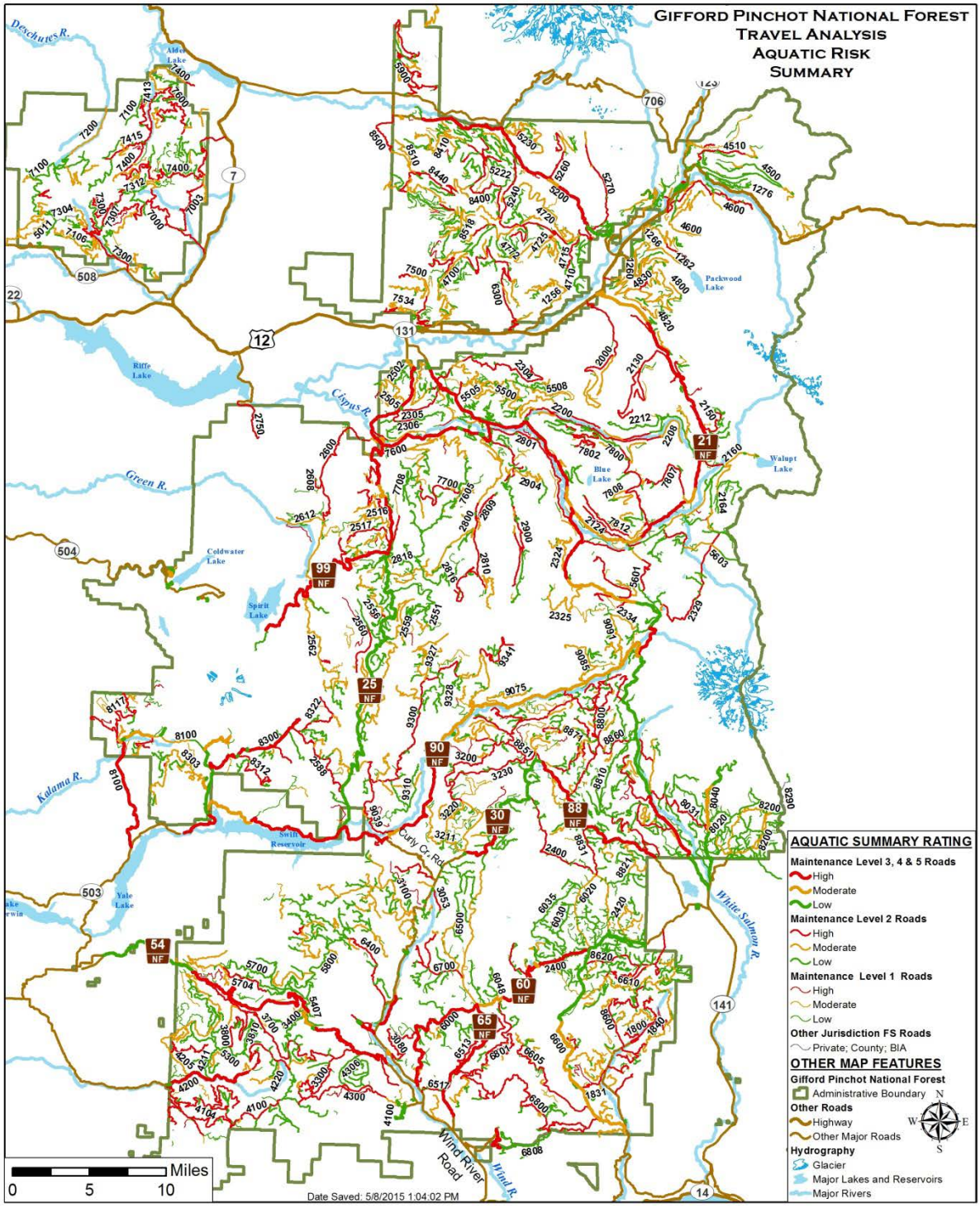

Figure 1. Map of Aquatic Risk Summary Rating by Road Segment.

Terrestrial Risk

GPNF staff identified six risk criteria to assess road effects on wildlife and habitat. There have been many studies on the effects of human activities related to forest roads, which show wildlife and wildlife habitat are affected by roads and human use of the roads. Some criteria were based on the Forest Plan for the GPNF, which identified elk, deer, and mountain goat as management indicator species. It designated elk and deer biological winter range, and mountain goat summer and winter range. The Northwest Forest Plan amended the forest plan for the GPNF, and designated late successional reserves (LSRs) for the northern spotted owl and other late successional species. Additional criteria were developed from the USFWS critical habitat designation for marbled murrelet and northern spotted owl.

Roads or road segments were rated based on a density rating within the special habitats or areas analyzed. We considered factors including :

- Road segments within or providing access to related forest plan management allocations such as winter range, summer range, LSRs;
- Road segments providing public access to areas used by wildlife during critical periods such as reproduction, rearing, and wintering;
- Road segments providing access to rare or unique habitats such as meadows, wetlands, and caves,

The evaluation criteria placed roads in risk categories of High, Moderate and Low (Table 4).

Elk winter and summer range:

Description of Risk

The Travel Analysis for the wildlife program mitigates negative effects of road-related human activities on elk distribution in forested ecosystems. The Forest Plan sets specific road density standards for elk and deer. Roads and adjacent habitat were also evaluated as discussed below.

Roads and adjacent habitat are easily buffered and represent a consistent response by elk rather than road density. The buffering completed in this analysis is similar to the analysis which was completed in the Westside Elk Model. A distance band from a road rather than the traditional road density method was used to evaluate habitat effectiveness in relation to roads. The analysis completed for this process identified High quality elk habitat in winter and summer range and identified High risk roads to be either seasonally closed or permanently closed. The 2012 Gradient Nearest Neighbor vegetation layer provides the best vegetation information available for the GPNF. Studies have shown that elk avoid areas near open roads; open roads also increase vulnerability to mortality from hunter harvest. In areas of higher road density, elk exhibit higher levels of stress and increased movement rates. Roads also facilitate the spread of invasive non-native plants, which reduces habitat quality.

Risk Criteria

Road is within Elk winter and summer range with a road density of:

High: greater than 2.6 mi / mi^2
Medium: between 1.71and 2.59 mi / mi^2
Low: less than 1.70 mi / mi^2

Mitigations

A number of the habitats require a seasonal road closure for protection from human disturbance. This could be accomplished through a seasonal gate which is closed to prevent harassment during critical winter months or spring calving season.

For most of the roads the following could apply:

Reduce traffic
Eliminate traffic – gate seasonally
Close/ stabilize or decommission

Mountain goat summer and winter range

Description of Risk

Mountain goats are sensitive to human disturbance. They may habituate to human disturbance in some areas, but where disturbance is unpredictable; mountain goats tend to be alarmed by it. Potentially adverse effects of disturbance on mountain goats included altered movements, range abandonment, increased vulnerability to predation, increased human access for hunting, and increased stress. High stress levels associated with disturbance have been suggested as a cause of decreased birth and recruitment rates and reduced winter survival in mountain goat populations. High stress levels may also cause a reduction in an individual's ability to fend off parasites, bacterial infections, and other diseases.

This analysis identified key winter ranges, travel corridors, mineral licks, and birthing sites to protect the sites by minimizing human-related disturbances. Maintaining low road density and closing access with enforcement could reduce human activities in mountain goat habitats. The mountain goat is a Management Indicator Species in the Forest Plan and the road density for these risk criteria came from the Forest Plan.

Risk Criteria

Road is within mountain goat summer and winter range with a road density of:

High – greater than 0.7 mi / sq. mi
Low –between 0 and 0.69 mi / sq. mi

Mitigations

Reduce traffic – seasonally close
Eliminate traffic
Close/ stabilize or decommission

Table 4. Road Miles for Terrestrial Risk Criterion Rating by Operational Maintenance Level.

Maintenance	Criteria Rating	Elk Range	Mt Goat Range	Northern Spotted Owl	Marbled Murrelet	Rare and Unique Habitats	General Forest Species
Level 5	High						
	Mod	7.8					15.5
	Low	7.7					
			15.5	15.5	15.5	15.5	
Level 4	High	1.4		25.7			49.6
	Mod	19.9		42.6			21.1
	Low						5.1
	Not within	54.5	75.8	7.5	75.8	75.8	
Level 3	High	40.2		52.4	16.3	7.8	55.9
	Mod	72.3	5.8	101.0			149.2
	Low	14.9				10.2	95.7
	Not within	173.4	295.0	147.4	284.5	282.8	
Level 2	High	283.9	66.0	708.2	428.9	11.9	705.9
	Mod	380.4	18.8	785.4	14.8	4.6	1274.6
	Low	36.5		78.8		42.8	912.7
	Not within	2192.5	2808.5	1321.0	2449.6	2834	
Level 1	High	72.3	14.5	137.0	67.1	2.7	139.4
	Mod	71.7	1.3	156.6			336.6
	Low	5.3		7.7		9.8	293.9
	Not within	620.5	754.1	468.5	702.8	757.4	

Rare or unique habitats

Description of Risk

These habitats include wet meadows, marshes, bogs, mesic meadows or habitats with sensitive or candidate species. These habitats are at risk from road effects from human disturbance. A wet meadow which has traditionally had dispersed camping in or around the meadow is at risk from the disturbance from vehicles, dispersed camping locations, and an increase in introduced, non-native plants introduced. This analysis evaluated roads in or adjacent to these sites (one half mile surrounding the rare or unique habitat) . In high road density the risk is greater for increased modification of the sites.

Risk Criteria

Road is within Rare or unique habitats with a road density of:

High: greater than 2.6 mi / mi^2
Medium: between 1.71 and 2.59 mi / mi^2
Low: less than 1.70 mi / mi^2

Mitigations

Reduce traffic - seasonally close
Eliminate traffic
Close/ stabilize or decommission

Northern Spotted Owl Late successional Reserve and Marbled Murrelet critical habitat

Description of Risk

Roads and road systems could potentially fragment NSO and MM habitat and lead to increased corvid populations due to dispersed camping and human occupancy. For marble murrelet the following short and long term conservation actions are recommended 1.) Maintain potential and suitable habitat in large contiguous blocks; 2.) Maintain and enhance buffer habitat surrounding occupied habitat; 3.) Minimize nest disturbances to increase reproductive success. Long term conservation actions include increasing the amount and quality of suitable nesting habitat; and decreasing fragmentation of nesting habitat by increasing the size of suitable stands. Roads that intersect or fragment the habitat were also identified as high risk roads.

Risk Criteria

Road is within northern spotted owl late successional reserve and marbled murrelet critical habitat with a road density of:

High – greater than 2.6 mi / sq. mi
Medium – between 1.71 and 2.59 mi / sq. mi
Low- less than 0-1.70 mi / sq. mi

Mitigations

Reduce traffic -seasonally close
Eliminate traffic
Close/ stabilize or decommission

General wildlife species including black bear

Description of Risk

The "Life Requisite Values" for wildlife species: food availability, escape potential, and denning suitability depend on distance from roads and patch size (or conterminous forest). Closure and removal of roads has been found to effectively provide wildlife security and increase the amount of available wildlife habitat. Reducing road density will provide an increased amount of available habitat on the landscape.

Risk Criteria

Road is within Rare or unique habitats with a road density of:

High – >3 mi / sq. mi
Medium – >2 - <3 mi / sq. mi
Low- <2 mi/ sq. mi

Mitigations

Reduce traffic - seasonally close
Eliminate traffic
Close/ stabilize or decommission

A number of the habitats require a seasonal road closure for protection from human disturbance. This could be accomplished through a seasonal gate which is closed to prevent harassment during critical winter months or denning, nesting or spring calving season.

Terrestrial Risk Summary Criteria

All the terrestrial risk criterion are related to a road density within a certain area for a particular species, set of species and special habitats. For most of these individual criteria, the road density attributing to a High risk was greater than 2.6 road miles per square mile area (Figure 2). The exceptions being the mountain goat summer and winter range high density rating was greater than 0.7 road miles per square mile area. A high summary terrestrial risk rating was assigned to a road if it was rated High in one or all of the following individual criterion: mountain goat range, elk range, marbled murrelet, northern spotted owl, or in or adjacent to rare and unique habitats.

The low summary terrestrial risk rating was assigned to a road if it was not partially or completely in mountain goat range, or within elk range, marble murrelet, spotted owl, rare and unique habitats areas or was within a subwatershed with a low road density (greater than 2mi./sq.mi.). The moderate summary terrestrial risk rating was all other combinations (Table 5).

Table 5. Summary Terrestrial Risk Rating by Operational Maintenance Level.

Maintenance Level	Terrestrial Summary Rating	Miles
Level 5	High	0.0
	Moderate	15.5
	Low	0.0
Level 4	High	25.7
	Moderate	48.6
	Low	1.5
Level 3	High	147.6
	Moderate	105.4
	Low	47.8
Level 2	High	1,174.5
	Moderate	1,354.8
	Low	364
Level 1	High	276.7
	Moderate	368.5
	Low	124.7

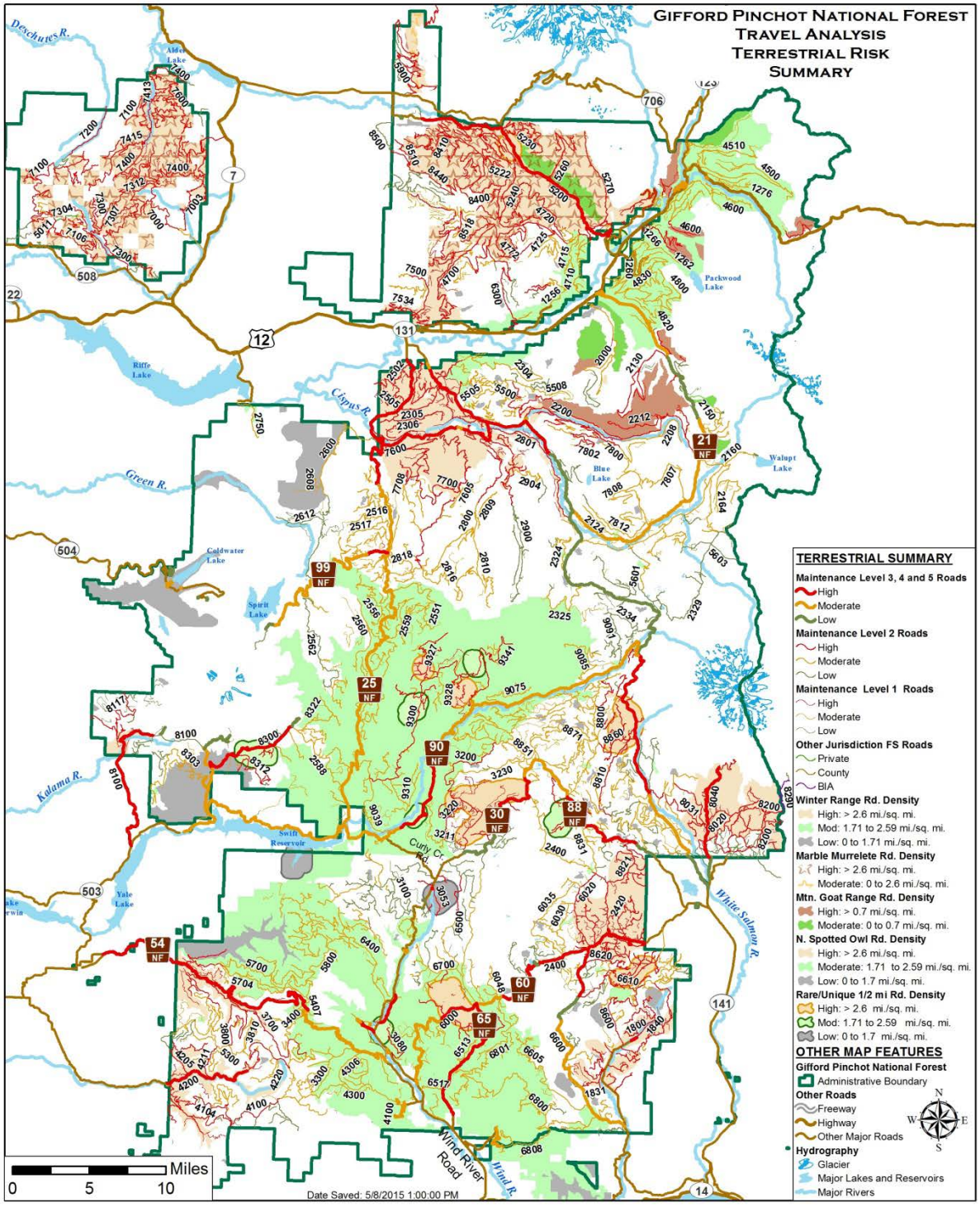

Figure 2. Map of Terrestrial Summary Rating by Road Segment.

Annual Maintenance Costs

Road budgets have been steadily declining for the past 20 plus years. Region-wide, the amount of funding for road work including both appropriated funding and work contributed by commercial users is less than 20 percent of what it was 20 years ago. Consequently, many roads do not get the maintenance treatments needed and are falling into a state of disrepair. The GPNF estimated a deferred maintenance need of $53.3 million; what it would take to bring the roads back up to standard. The Forest's annual maintenance needs that would be required to keep the road system fully maintained to standard is estimated as $3.2 million (Appendix F). Current levels of funding for annual road maintenance is about $1.3 million, a difference of $1.9 million from what would be necessary to keep the road system properly maintained (Table 6).

Table 6. Forest's 5-Year Average Annual Maintenance Funding.

BLI	Forest Operational Budget					5 Year Average	% to Rd Mtc	Average Mtc Budget
	2011	2012	2013	2014	2015			
CMRD	1,001,200	1,198,945	1,008,000	872,000	821,000	980,229	35%	$343,080
CMLG	344,000	354,141	308,000	143,000	323,000	294,428	23%	$67,718
CWF2	521,555	270,588	374,000	267,000	400,000	366,629	100%	$366,629
CWFS	0	49,000	37,000	38,000	40,000	32,800	100%	$32,800
Title II	401,135	240,479	108,500	148,000	100,000	199,623	100%	$199,623
Purchaser Perf Mtc	106,197	170,161	497,257	345,135	373,584	298,467	100%	$298,467
Retained Receipts	0	0	0	0	57,000	11,400	100%	$11,400
								$1,319,717
5YR Ave Mtc Budget	Range			*Amount for appropriated funds:*				$1,021,250
	-20%	+20%		*Amount from commercial Users:*				$298,467
$1,319,717	$1,055,773	$1,583,660						

Given the gap between available funding for road work and the cost to maintain the road system fully to standard, it is not be possible to balance the size of the road system with the cost of maintaining all roads fully to standard and still meet resource management needs or public interests. Instead, to meet the TAP requirement to "reflect long-term funding expectations", a reasonable balance will be established between 'the average annual funding' and 'the average annual cost of routine road maintenance'. The estimated cost of the current maintenance intensity on the current road system is $1.6 million (**Table 7**).

Table 7. Cost Analysis of Maintaining the Existing Road System.

OPML	Severity	$/mi	Miles	% / ML	Total
5	High	$3,451	20	71%	$70,321
	Medium	$2,626	8	29%	$21,856
	Low	$2,576			
ML 5 Subtotal:			***29***	***100%***	***$92,177***
4	High	$2,236	50	59%	$110,815
	Medium	$2,236	3	3%	$6,408
	Low	$2,236	32	38%	$70,673
ML 4 Subtotal:			***84***	***100%***	***$187,896***
3	High	$1,735	171	55%	$296,009
	Medium	$1,477	69	22%	$101,795
	Low	$1,477	69	22%	$101,795
ML 3 Subtotal:			***309***	***100%***	***$499,599***
2	High	$1,034	159	6%	$164,615
	Medium	$389	159	6%	$61,862
	Low	$245	2,576	89%	$630,823
ML 2 Subtotal:			***2,894***	***100%***	***$857,301***
1	High				
	Medium	$25	770	100%	$19,188
	Low				
ML 1 Subtotal:			***770***	***100%***	***$19,188***
			4,086		**$1,656,161**

5. Describing Opportunities

Access needs, environmental risk criteria and initial annual maintenance cost analysis were synthesized to identify opportunities that could go into future NEPA analysis and decisions. The cost analysis was used initially to set context for critically examining "the necessity" of road system changes, be part of the information to formulate opportunities, and be re-evaluated after the synthesis produced recommendations for changes. Investment costs to transition the current road system into the potential future road system and certain deferred maintenance costs (surface, culvert or bridge replacements) were also identified and recognized that they would come from other sources than annual road maintenance funds.

Alternative strategies on how to synthesize the access needs, environmental risks and annual maintenance costs were considered. The synthesis strategy being proposed was presented to the public at several locations in May of 2015 and the reporting document was available for review and comment until June 30, 2015.

The synthesis strategy Forest staff developed reduced the number of Level 2 (open) roads to focus limited annual road maintenance funds and road improvement investments on roads planned to remain open into the future. Additionally, recommendations to maintain Level 2 roads that were rated as high aquatic risk is proposed. Level 2 roads having intermittent access needs are recommended to be put into a closed status.

Previously in 2011, Forest leadership scrutinized and reviewed the Level 3-5 road system and made a decision to have 392.1 miles of operational maintenance level 3, 4 and 5 roads for which the Forest Service has jurisdiction. No changes to the maintenance level 3-5 roads are recommended.

For Level 2 (open) and Level 1 (closed) roads, the synthesis rationale kept the same maintenance level those roads that had more than one access need identified which accounted for 61% of the Level 2 roads (1776.9 miles) and 17 % of Level 1 roads (130.3 miles) and will be referred to as Multiple Purpose Roads.

With the exception of the Vegetation and Bough Management access need, a small number of roads with relatively low miles were identified to have only one access need. Following is an explanation of why these few roads with only one identified access need were added to the Multiple Purpose Road set.

Only a small number of roads had a single access need for one of the following: Recreation Management, Quarries and Mining Claims, Communication and Fire Administration, and Easements or Rights Away and involved relatively few miles (18.6 miles, <1% of the Level 2 roads). These access need are neither intermittent nor predictable so these roads are recommended to remain in a Level 2 status. Similarly few Level 1 roads with single access needs for Recreation Management, Quarries and Mining Claims, Communication and Fire Administration, and Easements or Rights Away were identified, involving relatively few miles (8.5 miles, 1%), and the recommendation is to leave them as Level 1 (closed) roads.

Level 2 roads identified as needed by the public, having no other access need identified was limited to 8.2 miles, and will remain Maintenance Level 2. Upon close review, these roads were determined to be either needed for recreation management or used to access known dispersed recreation areas. One Level 1 road (FR 8000200, 0.1 miles in length) was identified as needed by the public and no other access needs were identified, and the recommendation is to leave them as Level 1 (closed) roads.

Since the special uses analysis was coarse (included all roads within the township, range and section that was specified for the Special Use location), the single purpose special use roads (7.3 miles of Level 2 and 11.5 miles of Level 1) can be brought forward into subsequent NEPA where a finer scale analysis of the need for vehicular access for the special use permits could be conducted. This analysis may result in dropping the access need for a Special Use for some roads.

The combination of the Multiple Purpose Roads and the single access needs roads for Recreation Management, Quarries and Mining, Communication and Fire Administration, and Easements or Rights Away, Public Interest and Special Uses combined to equal 1,818 miles of Level 2 roads, and comprise approximately 63% of the current Level 2 system. These roads, along with the Level 3-5 roads, are recommended as the Proposed Open Road System, which means they would be retained in an open status (Figure 3).

Investments to reduce environmental risks for the Proposed Open Road System would focus on roads that had a High Aquatic Summary or High Terrestrial Summary risk rating (Table 8).

Table 8. Proposed Open Roads with High Environmental Risks by Operational Maintenance Level.

Maintenance Level	High Aquatic Risk (miles)	% of total	High Terrestrial Risk (miles)	% of total
5	11.3	73	0.0	0
4	44.7	59	25.7	34
3	166.2	55	147.6	49
2	687.0	24	803.1	28

HIGH Aquatic summary rating includes road segments which have one or more of the following risks.

1) crosses GPNF mapped distribution and/or US Fish and Wildlife Service and National Oceanic and Atmospheric Agency critical habitat designation for Endangered Species Act listed species, Lower Columbia River Coho, Chinook and Steelhead, and Columbia River Bull trout.
2) has a culvert barrier blocking 0.1 miles or greater of fish habitat
3) has 3 or more stream crossings (road segment less than 1 mile) OR have 3.0 stream crossings per mile (road segments 1 mile or longer)
4) has relative High rate of se0diment delivery from road surfaces to streams
5) crosses known previous landslides, and/or
6) is within Riparian Reserve for 0.3 contiguous miles or greater.

Investment activities to reduce aquatic risks include 1) fish culvert barrier replacements, 2) right-sizing or replacement of 3 or more culverts, 3) road surfacing improvements, 4) dips to encourage landslide material to deposit or transport across a road segment at a preferred location or 5) small sections of re-alignments away from streams. Costs for these mitigations can be estimated from the deferred maintenance costs identified in INFRA. Adding ditch relief culverts and other treatments to reduce aquatic risks can be identified on a site specific basis.

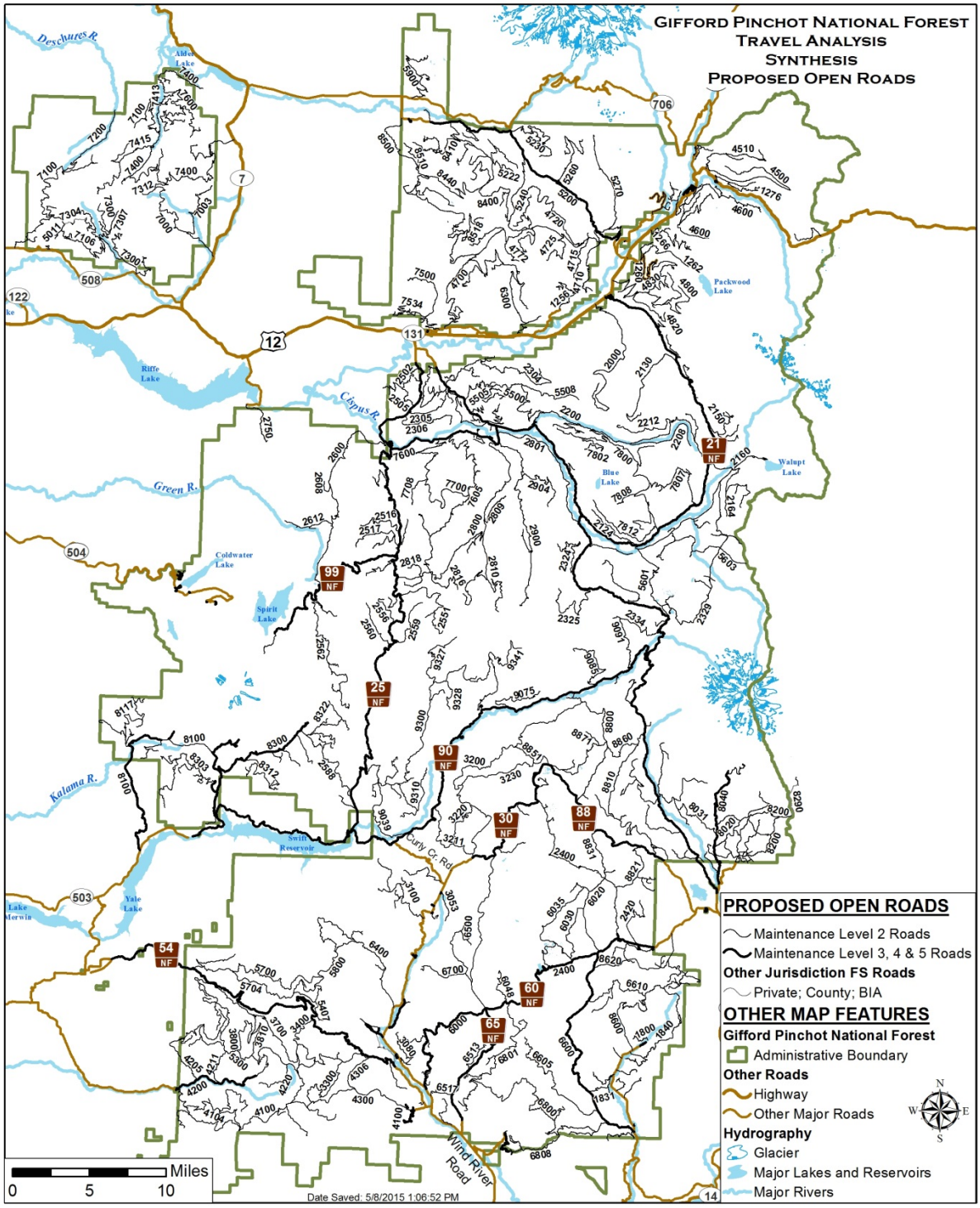

Figure 3. Map of Proposed Open Road System.

High terrestrial summary rating includes road segments contributing to 0.7 road miles per square mile in goat summer and winter range, or contributing to 2.6 miles per square mile or greater in Elk Range, Marbled Murrelet circles, Northern Spotted Owl habitat using LSR boundaries, or in or Adjacent to Rare and Unique Habitats. For open roads, the mitigation of Terrestrial risks used are wildlife seasonal closures or treatments to reduce traffic. Currently gates are used to create seasonal wildlife closures to mitigate terrestrial habitat risks.

Roads with only the Vegetation and Bough Access needs, called Single Purpose Vegetation and Boughs roads (959.9 miles, 33% of Level 2 roads) are recommended to be reduced to a Level 1 road status through time (Figure 4). These roads will be used during the period when vegetation and bough management is active and then returned to a closed status. The costs estimated to change these roads to a Level 1 status averages $9,000/mile. Roads rated as HIGH in the Aquatic Risk Summary or Terrestrial Risk Summary and dependent spur roads will be those roads within this group prioritized for changing to Level 1 (Table 9). The estimated cost for these is closer to $20,000/mile because the High aquatic risk roads have more treatment recommended prior to considering it stabilized and closed. The environmental risk rating and timing of the vegetation and bough management period will influence the priority in which this group of roads is analyzed in a NEPA process and/or treated on the ground. Transitioning roads from a Level 2 (open) status to Level 1 (closed) status is expected to occur after the roads are used for the Vegetation and Bough Management planned in the next two decades.

Table 9. Single Purpose Vegetation and Bough Management Roads.

Maintenance Level	Total	High Aquatic Risk	High Terrestrial Risk	Both High Aquatic and Terrestrial Risk
2	959.9	133.2	323.2	63.8
1	486.2	51.5	166.9	21.7

Only 115.8 miles of Level 2 roads (<1%) and 132.9 miles of Level 1 roads did not have any access needs identified and will be recommended for decommissioning (Figure 5). The priority for treatment will be those rated with a High Aquatic or Terrestrial Summary rating (Table 10).

Table 10. Operational Maintenance Level 1 and 2 No Access Need Roads.

Maintenance Level	Total	High Aquatic Risk	High Terrestrial Risk	Both High Aquatic and Terrestrial Risk
2	115.8	4.7	48.2	3.0
1	132.9	7.6	54.4	5.8

Approximately 637 of the current 769.9 miles of Level 1 (closed) roads are recommended to remain as Level 1 roads. Treatments to reduce aquatic and terrestrial risks will be identified and brought forward during NEPA analysis.

A Summary of the miles within each Operational Maintenance Level from the synthesis strategy is presented in .

Table 11. Summary Road Recommendations by Operational Maintenance Level.

Maintenance Level	Recommendation	Miles
Level 5	Multiple Purpose	15.5
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 4	Multiple Purpose	75.8
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 3	Multiple Purpose	300.8
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 2	Multiple Purpose	1817.3
	Single Purpose Vegetation and Bough Management	959.9
	No Access Need	115.8
Level 1	Multiple Purpose	276.7
	Single Purpose Vegetation and Bough Management	368.5
	No Access Need	124.7

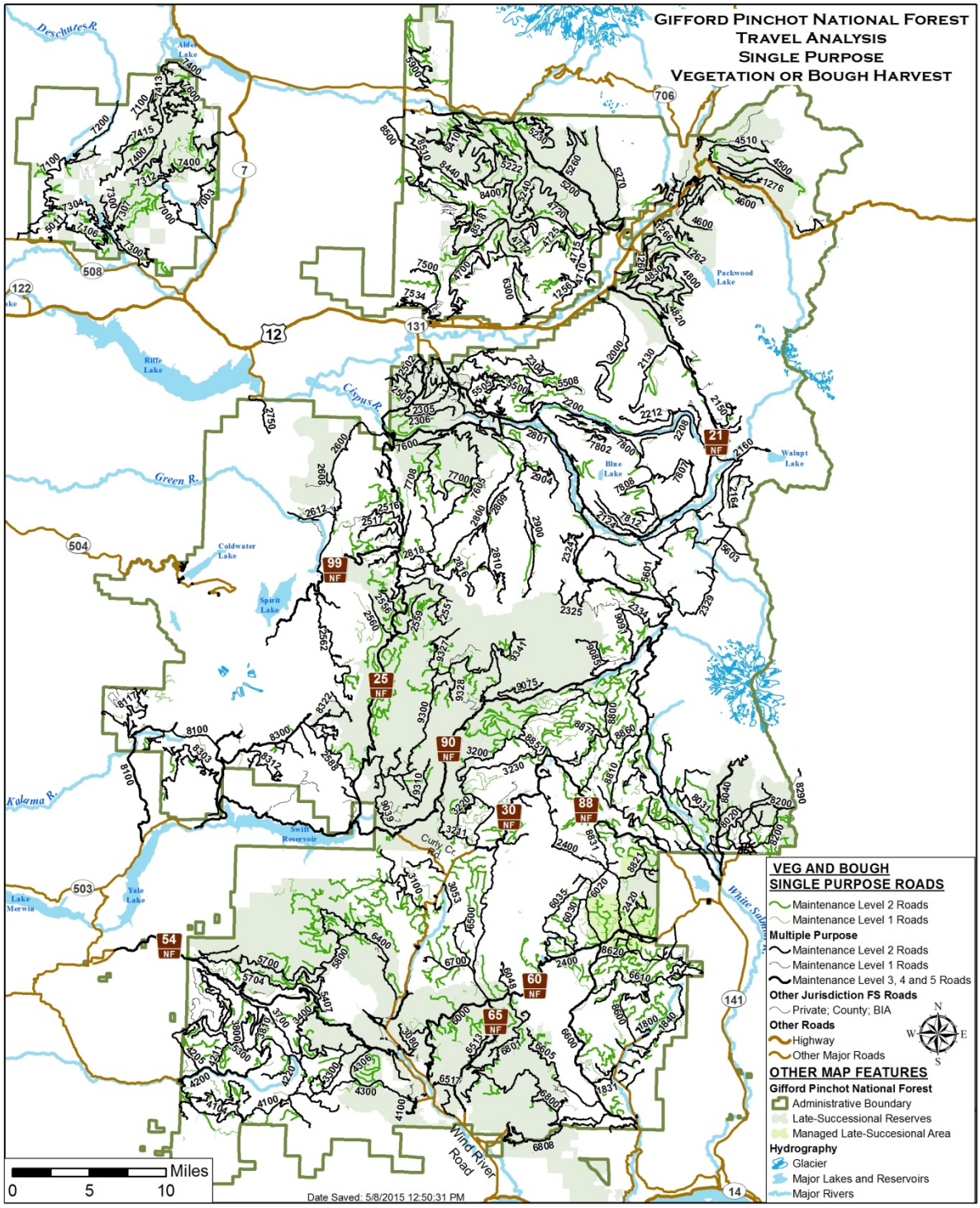

Figure 4. Single Purpose Vegetation and Bough Management Roads.

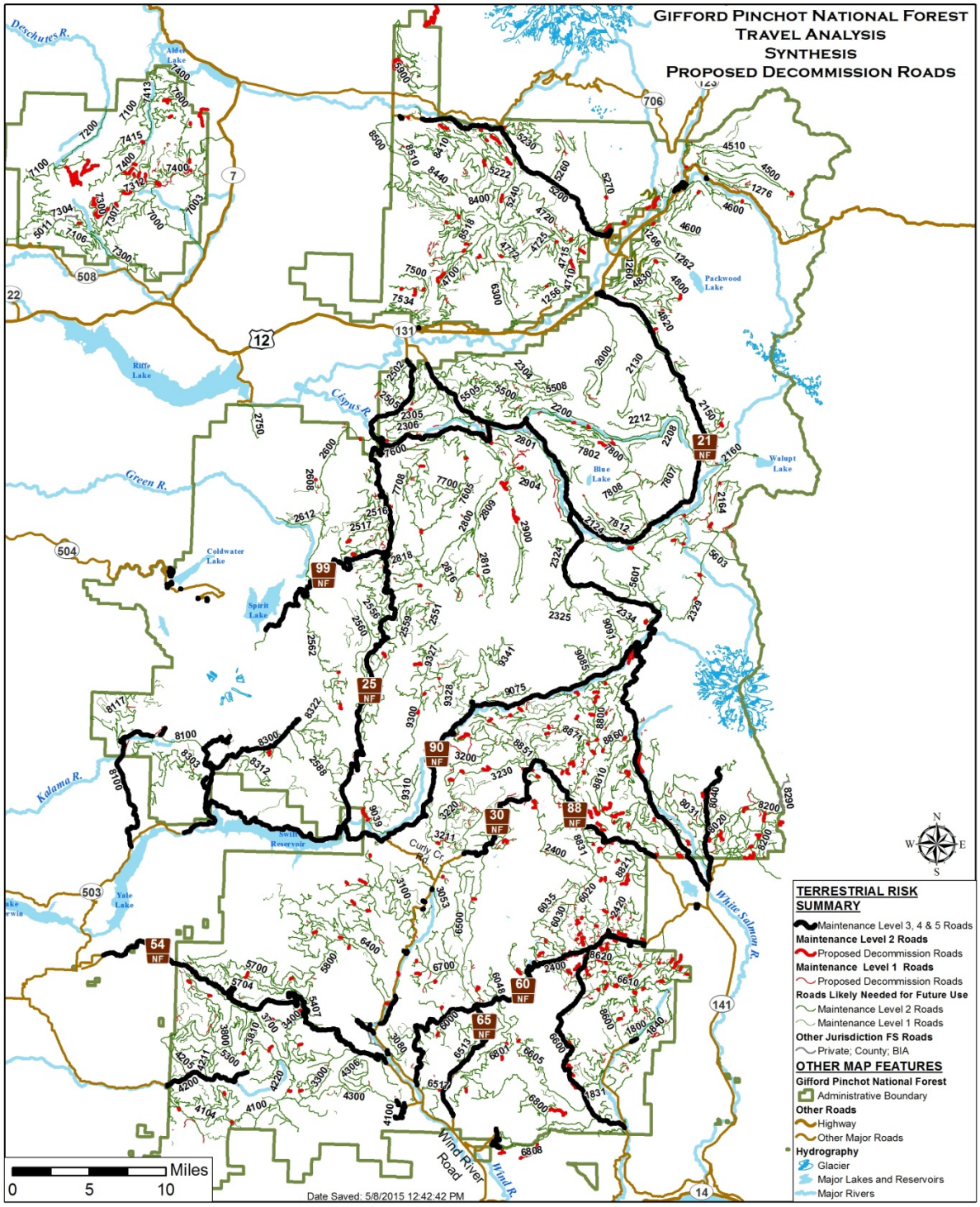

Figure 5. Roads with No Access Needs Recommended for Decommission.

5. Reporting

Summary of Desired Future Road System

The goal of the proposed strategy was to keep the same level of roads managed for passenger car use, and to convert Level 2 roads with the single access need of vegetation and bough management to a Level 1 status, as vegetation and bough management is intermittent in nature. Stabilizing and closing the Level 2 roads will address the aquatic and terrestrial risks associated with these roads. Roads where no access needs were identified will be decommissioned, reducing the associated terrestrial and aquatic risk of those roads. Additionally, culvert and ditch maintenance is recommended for all high aquatic risk Level 2 roads, as this is an inexpensive and effective way to reduce aquatic risks. This strategy will provide similar road conditions for Forest visitors who travel in low-clearance passenger cars (PC) to visit developed recreation sites (Figure 6). The strategy will change the road conditions for Forest visitors who travel on high clearance vehicles (HC) roads in that some will be in an improved condition resulting from more Level 2 roads getting culvert and ditch clearing while other Level 2 roads would have little to no maintenance, resulting in a continuation of transitioning into a state of disrepair and/or eventually becoming impassable.

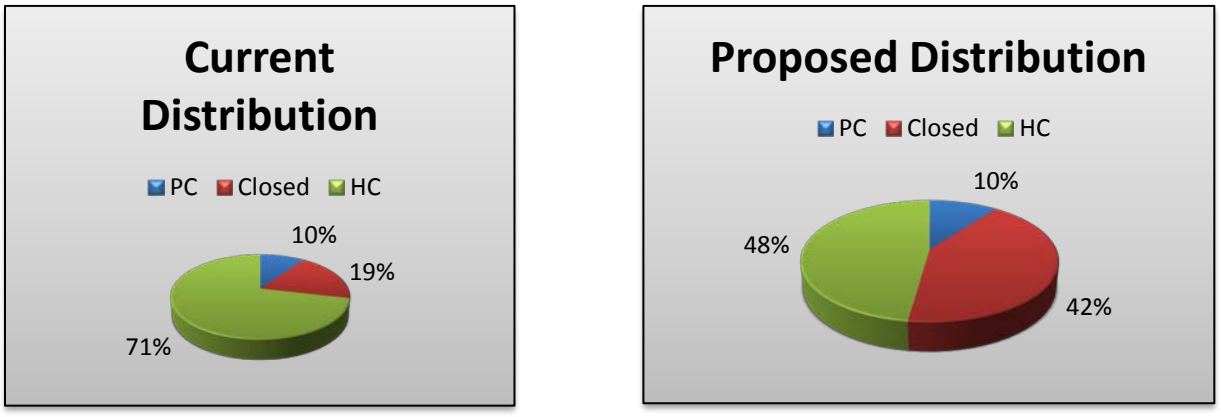

Figure 6. Current Versus Proposed Distribution of Operational Maintenance Levels.

When, and if all of the Single Purpose Vegetation and Bough Level 2 Roads were closed and put into a Level 1 status and roads that did not have any access needs identified were decommissioned, the Proposed Open Road System would have 2,211 miles, a reduction of 1,075 miles (Table 12). The overall road system, (open and closed) would be 249 miles smaller than the existing road system.

Table 12. Potential Changes to Road System.

Category	Road Miles		
	Before	After	Difference
Overall size of transportation system (open and closed roads)	4,056	3,807	-249
Overall Open Road System (ML 2-5)	3,286	2,211	1,075
Roads Maintained for Passenger Cars (ML 3-5)	393	393	0
Roads Maintained for High Clearance Vehicles only (ML2)	2,893	1,818	1,075
Closed Intermittent Service Project Roads (ML1)	770	1,596	+826

Comparing the costs of annual maintenance is currently being accomplished within the funds received with the Proposed Road System given all the Recommendations of the Travel Analysis are implemented indicates an increase in annual maintenance costs. The increased annual maintenance cost results from the increased Level 2 miles that will be maintained (Table 13). This desired future roads system does not reflect decreasing long term appropriated funding expectations but does reflect the trend of high Timber Sale Purchaser performed road maintenance and road use deposits and the trend of addressing aquatic risks from roads using retained receipts. The scenario also decreases the non-quantified costs of unmaintained culvert replacements. The cost of keeping up the proposed road system would be about $2.0 million dollars per year, which is about 24% higher than the current maintenance costs are estimated at and would be about 42% higher than the 5-year average annual amount received ($1.3 million) as shown in the previous Table 6.

Table 13. Annual Maintenance Cost of Current Versus Proposed Road System.

Cost of Existing Road System					
OPML	**Severity**	**$/mi**	**Miles**	**% / ML**	**Total**
5	High	$3,451	20	71%	$70,321
	Medium	$2,626	8	29%	$21,856
	Low	$2,576			
ML 5 Subtotal:			***29***	***100%***	***$92,177***
4	High	$2,236	50	59%	$110,815
	Medium	$2,236	3	3%	$6,408
	Low	$2,236	32	38%	$70,673
ML 4 Subtotal:			***84***	***100%***	***$187,896***
3	High	$1,735	171	55%	$296,009
	Medium	$1,477	69	22%	$101,795
	Low	$1,477	69	22%	$101,795
ML 3 Subtotal:			***309***	***100%***	***$499,599***

2	High	$1,034	159	6%	$164,615
	Medium	$389	159	6%	$61,862
	Low	$245	2,576	89%	$630,823
ML 2 Subtotal:			***2,894***	***100%***	***$857,301***
1	High				
	Medium	$25	770	100%	$19,188
	Low				
ML 1 Subtotal:			***770***	***100%***	***$19,188***
			4,086		**$1,656,161**

Cost of Proposed Road System					
OPML	**Severity**	**$/mi**	**Miles**	**% / ML**	**Total**
5	High	$3,451	21	71%	$71,056
	Medium	$2,626	8	29%	$21,085
	Low	$2,576			
ML 5 Subtotal:			***29***	***100%***	***$92,141***
4	High	$2,236	49	59%	$110,421
	Medium	$2,236	3	3%	$6,385
	Low	$2,236	32	38%	$70,421
ML 4 Subtotal:			***84***	***100%***	***$187,896***
3	High	$1,735	171	55%	$296,009
	Medium	$1,477	69	22%	$101,795
	Low	$1,477	69	22%	$101,795
ML 3 Subtotal:			***309***	***100%***	***$499,599***
2	High	$1,034	826	45%	$854,147
	Medium	$389	892	49%	$346,439
	Low	$245	109	6%	$26,732
ML 2 Subtotal:			***1,819***	***100%***	***$1,227,319***
1	High				
	Medium	$25	1,596	100%	$39,772
	Low				
ML 1 Subtotal:			***1,596***	***100%***	***$39,772***
			3,837		**$2,047,058**

Investments

Investment costs for road improvements, road closures and decommissions address the aquatic and terrestrial risks. Funding for this type of work generally comes though other programs such as capital investment programs, Legacy Roads and Trails funding, Federal Highway programs, partnerships with outside groups and agencies, etc. The estimated costs to close stabilize, decommission, or improve amount to approximately $14 million, and does not include the cost of replacing fish migration barrier culverts (Table 14).

Table 14. Estimated Capital Costs of Improvement and Decommissioning Work.

Category	Miles	Cost / Mile	Total Cost
Estimated Cost to put roads in storage	826	9,000	$ 7,434,000
Estimated Cost to decommission roads	249	11,000	$ 2,739,000
Estimated Cost for improvement work	809	5,200	$ 4,206,800
			$14,379,800

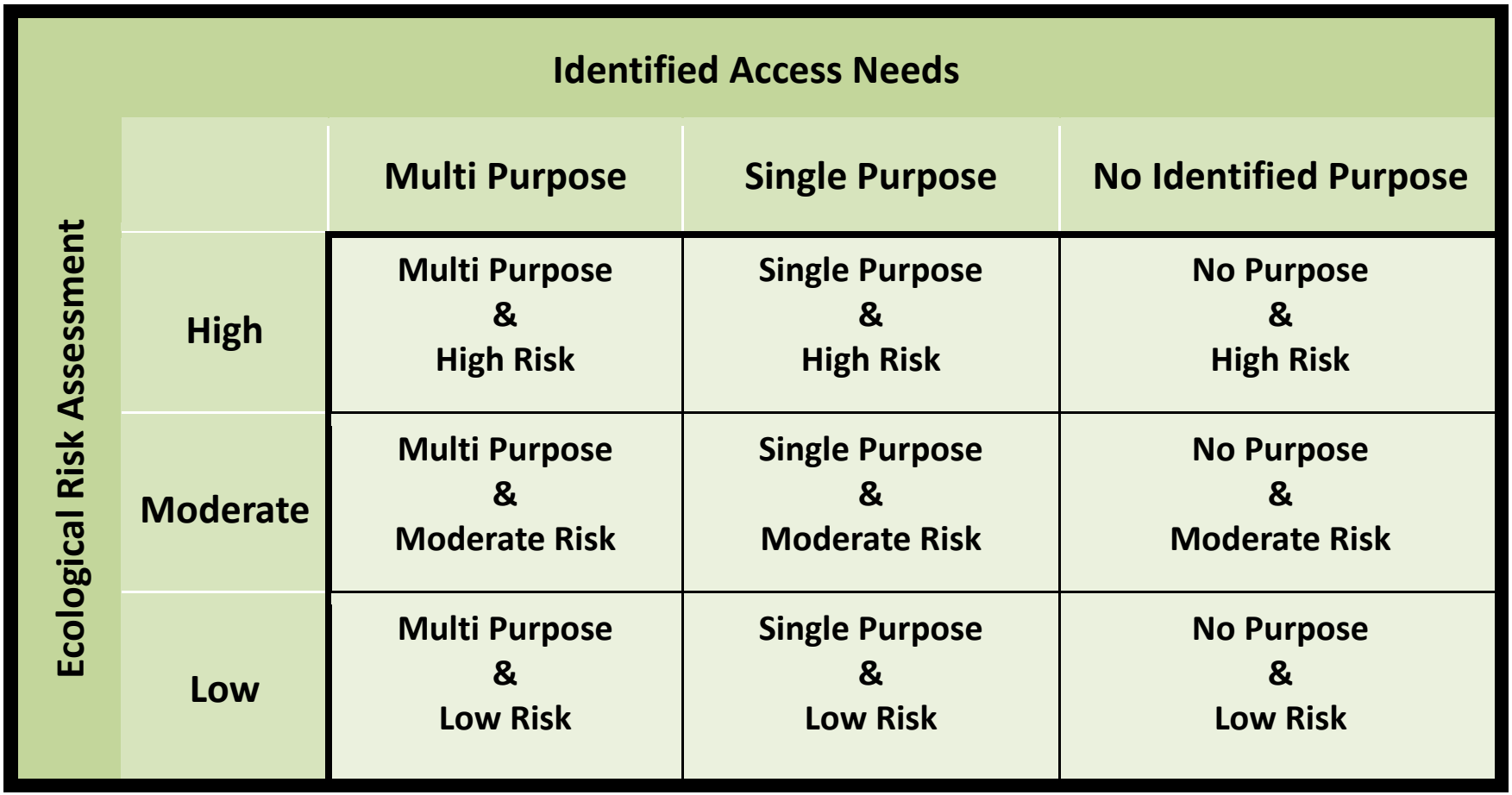

Figure 7. Access Needs Along a Continuum of Ecological Risk.

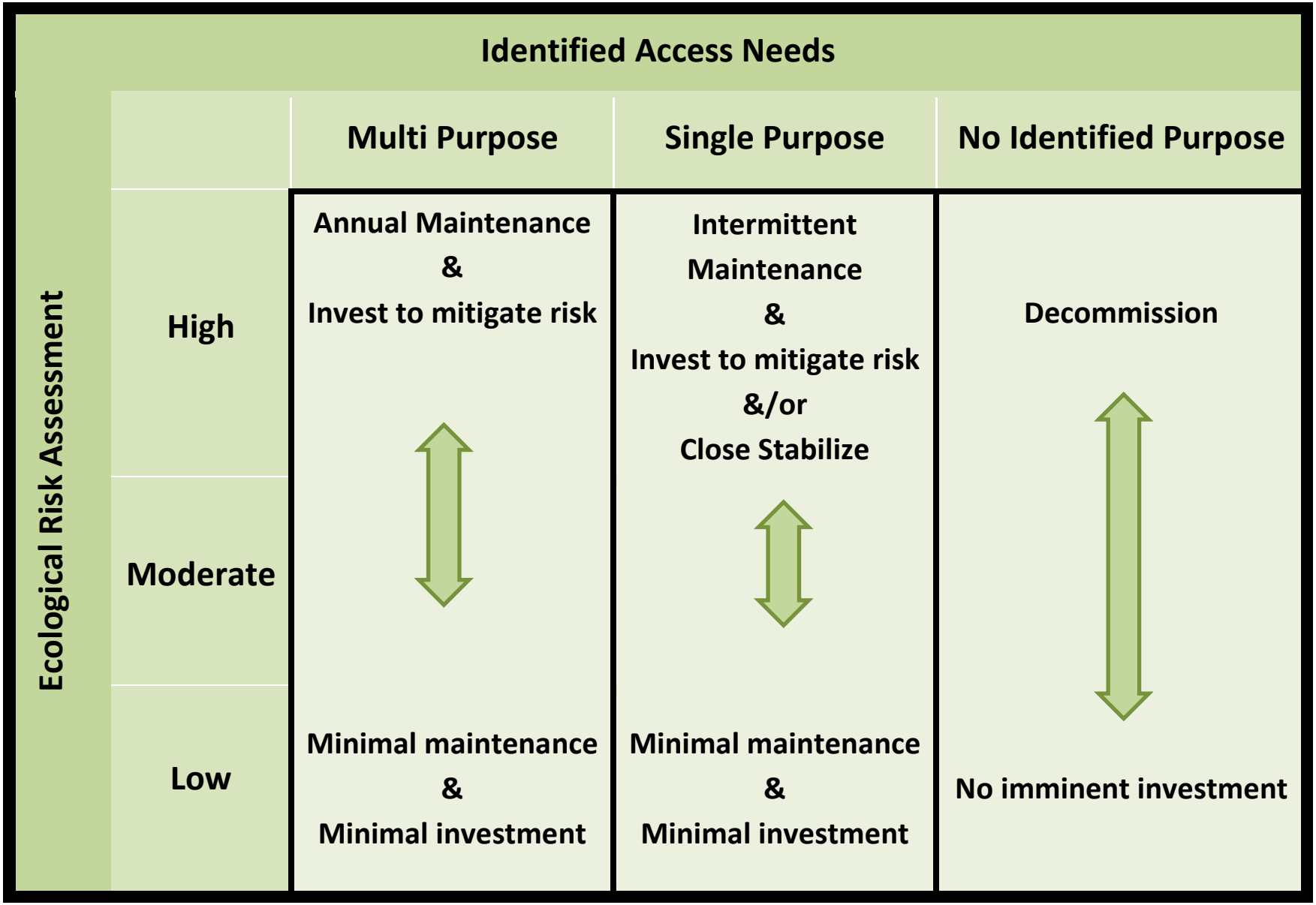

Figure 8. The Forest's Recommendation Structure.

Appendix A

Vegetation Management – Commercial and Non-commercial access criteria

Identification: Manipulating vegetation cover is a means to affect forest structure and composition to meet Forest Plan goals and objectives. Modifications to vegetation cover are done to:

- Improve health and vigor of the vegetation
- Alter risk to catastrophic events
- Alter vertical structure
- Alter horizontal structure
- Alter species composition
- Alter ecological function
- Alter physiological function
- Provide for forest products

Where and what types of modifications are allowed, are largely driven by land allocations within the Gifford Pinchot National Forest Land and Resource Management Plan and the Northwest Forest Plan. Vegetation management varies from areas where natural processes dominate to areas where active manipulation is obvious.

At present, there are approximately 900,000 acres that could potentially have some sort of vegetation management activity. Vegetation management, for the purposes of this analysis, could be any form of active management that pertains to altering the vegetation on a site (a stand), ranging from pulling or cutting unwanted vegetation by hand to regeneration following a timber harvest. Treatments may involve manual labor, mechanized equipment; prescribe fire, aerial or any combination thereof.

Generally, road access is needed to areas where potential vegetation management will occur. Often heavy equipment is needed and if products are to be removed, a transportation system designed to handle the product is required. The current road system, plus any additional roads that might be identified as needed in the future, provide access to most of these stands. Additional roads can become permanent or can be temporary; required only to facilitate the treatment of the stand. The stands are also the locations for the collection of various special forest products.

Most vegetation treatments that occur on the Forest result in forest product removals. The Forest annually issues over 13,000 special forest product permits and about 30 forest product contracts (TIM). This does not include our 5-10 annual large timber sales. Currently the Forest is treating about 2000-2500 acres/year via commercial timber sales, selling about 35,000 Mbf/year. An additional 1,000 – 3,000 acres/year are treated through stand improvement prescriptions. This level of harvesting is only about one-half the average annual commercial harvest level allowed under the land and management resource plan (LMRP) as modified by the Northwest Forest Plan

(NWFP) which is 65 MMbf/year probable sale quantity (PSQ). The Forest therefore needs to consider maintaining a transportation system with a capacity to accommodate the PSQ.

Non-commercial stand improvement (SI) treatments occur on a significant number of acres each year that are not primarily designed to produce timber in the year of treatment. They include: stand density reductions for botanical product enhancements, elk and deer forage improvement, stand health and vigor improvements, stand structure alterations, riparian zone modifications, meadow enhancements, special and rare habitat treatments, invasive plant treatments, fuels treatments, and prescribe fire. Most of the lands these treatments occur on will be available for commercial harvests, at a later date.

The majority of special forest products permits that are issued utilize areas that have had vegetation management in the past or the permits are in the location of, or are part of, a current vegetation management activity. Therefore, the Vegetation Management issue will also be used to evaluate access needs for special forest products in order to avoid a similar analysis.

Much of the 900,000 acres are either scheduled for, or based on their current condition, are likely to receive some kind of vegetation management treatment within the next twenty years. They may also be used for special forest products collection both contract and/or permits. Twenty years was the time period used for determining access needs. Vegetation management treatments considered included timber harvesting, planting, release, non-commercial thinning, pruning, fuels reduction, prescribed burning, and fertilization. These activities can produce timber commodities as well as special forest products.

Criteria were developed based on whether a road would be needed over the next 20 years for forest product sales or non-harvesting treatments. If a road was only be needed for the purpose of reviewing stand condition or the length of the road accessing a stand is less than ¼ mile in length, then the road was considered to not be needed for vegetation management.

The need for a road identified for vegetation management presumes a safe road to transport timber products with large equipment. This access need was considered also to be adequate for special forest products removal.

Vegetation treatments where the removal of products is not anticipated requires a lower design for access so a road would not necessarily need to be open and maintained all the time. Some special forest products may require the use of large equipment for loading and removal but would not need to be open all the time.

Evaluation Criteria:

The Highest potential use will dictate the maintenance and design criteria; e.g. timber haul roads need to be a higher standard than a bough sale access or an access to treat a meadow.

The following criteria relate to access needs for vegetation management without regard to its design standard or maintenance level. Roads not meeting any of the criteria will be rated as not needed for vegetation management.

Any road that touches, or is within one-quarter mile of a stand listed in the vegetation action plan database as 1) a potential commercially harvestable stand, 2) potential stand for commercial harvest but currently does not meet age or size requirements (are <35 years of age), or 3) has been identified for a potential treatment not requiring a removal of a product but needing access for heavy equipment, would be rated as a Vegetation Access need. (Applies to stands currently listed as "candidate" stands, or stands listed as late Successional Reserve (LSR) harvestable or Managed LSR harvestable that are between 35 and 80 years of age). Any road that accesses bough production stands or stands with planned restoration activities for botanical products not identified in the vegetation action plan.

Forest Products, Forest Botanical Products – Commercial and Personal Use

Identification: Over the last 20 years demand for traditional and non-traditional forest products has increased.

Special forest products include, but are not limited to, firewood, post and poles, wildflowers, mushrooms, moss, nuts, seeds, boughs and Christmas trees. For purposes of this section, the term 'forest botanical product' means any naturally occurring mushrooms, fungi, flowers, seeds, roots, bark, leaves, and other vegetation (or portion thereof) that grow on National Forest System lands. Neither of these two groups includes 'timber'.

In simpler terms, forest products are now broken down into either convertible or non-convertible products. Convertible products are all the products that can be converted to a cubic volume of solid wood fiber; e.g. timber, fuelwood, post, poles, chips, etc. Non-convertibles are all other types of non-wood vegetative products, and include the botanical products. Christmas trees are classed as a non-convertible.

There are four types of collection allowed on the Forest:

1. Tribal Use: Traditional noncommercial gathering by Native Americans affiliated with a federally recognized tribe.
2. Incidental Use: On-site product consumption/use; usually associated with recreation activities.
3. Personal Use: Collection of materials for personal use/consumption, not for sale or resale after any intermediate processing.
4. Commercial Use: Collection of materials for the primary purpose of sale, resale, or use in manufacturing process resulting in a finished product that will be sold.

There are several types of products that are or have been gathered or harvested off the Forest:

1. Wood Products – timber, post, poles, biomass, chips,
2. Fruiting bodies – cones, berries, nuts, fungi, mushrooms, etc.
3. Cuttings – salal, boughs, beargrass, Christmas trees, etc.
4. Collecting – stumps, bark, driftwood, mosses, lichens, etc.
5. Transplants – live trees, ferns

Other than edible berries for personal use, a permit is required to remove all forest products from the GPNF. Nearly 13,000 permits and 30 contracts are issued annually for special forest products on the GPNF, yielding approximately $850,000/year in revenues. In addition, nearly 2,300 free-use permits are issued with an estimated value of $59,000/year; which does not include edible berry free use. Overall the total value of the botanical products removed annually from the GPNF is somewhere around $1,000,000/year.

Road access is a key factor in determining where forest products are harvested. Many of the products are located at higher elevations and where previous vegetation work has occurred.

Objective: Retain road access to areas that are presently or predicted to be important sources of special forest products.

The analysis of the vegetation management issue was considered to adequately identify most roads needed for special forest products.

Criterion 1) Roads that access an area generally used for special forest products will be rated as **High need** for retention. All other roads will be rated as low need.

Appendix B

Table of Access Needs for each INFRA Road Segment - example

Road Number	BMP	EMP	Vegetation and Bough	Quarry and Mining Claims	Recreation Management	Public Interest	Communications, Admin	Rights of Way	Easements	Special Uses
1200169	0.0	0.1								Yes
1200185	0.0	0.4	Yes							
1200200	0.0	0.5	Yes							
1200201	0.0	0.2								
1249000	0.0	0.1		Yes						Yes
1249000	0.1	0.4		Yes						Yes
1256000	3.1	3.2	Yes	Yes						
1256000	3.2	8.9	Yes	Yes						
1256000	8.9	11.2	Yes							
1256100	0.0	1.4	Yes							
1256105	0.0	0.2								
1256110	0.0	0.9	Yes							
1256110	0.9	1.1	Yes							
1256450	0.0	0.2	Yes							
1260000	1.2	5.8	Yes	Yes	Yes	Yes	Yes			Yes
1260013	0.4	1.4	Yes							Yes
1260022	0.0	1.8	Yes			Yes				Yes
1260030	0.0	0.4	Yes							Yes
1260035	0.0	0.1								Yes
1260043	0.0	0.3	Yes							Yes
1260047	0.0	0.1								Yes
1260049	0.0	0.7	Yes	Yes						Yes
1260053	0.0	0.4	Yes							Yes
1260066	0.0	1.3	Yes							
1262000	0.0	2.4	Yes			Yes				
1262000	2.4	4.6	Yes			Yes				
1262019	0.0	0.4	Yes							
1262022	0.0	1.2	Yes							
1262029	0.0	0.8	Yes							Yes
1262049	0.0	0.1	Yes							
1264000	0.0	0.1						Yes		
1266000	0.0	6.0	Yes		Yes	Yes				Yes
1266000	6.0	7.7	Yes		Yes	Yes				
1266014	0.0	0.3	Yes							Yes
1266020	0.0	0.4	Yes							Yes
1266020	0.4	0.5								
1266023	0.0	0.2								Yes
1266028	0.0	0.6	Yes							Yes
1266037	0.0	0.2	Yes							
1266041	0.0	2.1	Yes							
1266069	0.0	0.9	Yes							
1266070	0.0	0.3	Yes							
1266405	0.0	0.2								
1268011	0.0	0.5								Yes
1270000	0.0	1.0	Yes	Yes						Yes

Appendix C

Table of Aquatic Risk Ratings for each INFRA Road Segment- example

Road Number	BMP	EMP	Length	Stream Crossing	Fish Presence	Fish Barrier	Sediment Delivery	Mass Wasting	Riparian Occupancy	Aquatic Summary
1200169	0.0	0.1	0.1	Low	Low	Low	Low	Low	Low	0
1200185	0.0	0.4	0.4	Low	Low	Low	Low	Low	Low	0
1200200	0.0	0.5	0.5	Low	Low	Low	Low	Low	Low	0
1200201	0.0	0.2	0.2	Low	Low	Low	Low	Low	Low	0
1249000	0.0	0.1	0.1	Low	Low	Low	Not Rated	Not Rated	Low	0
1249000	0.1	0.4	0.2	Low	Low	Low	Not Rated	Not Rated	Low	0
1256000	0.0	3.1	3.1	High	Low	Low	Not Rated	Not Rated	Moderate	5
1256000	3.1	3.2	0.1	Low	Low	Low	Moderate	Moderate	Low	4
1256000	3.2	8.9	5.7	Moderate	Low	Low	Moderate	Moderate	Low	6
1256000	8.9	11.2	2.3	Moderate	Low	Low	Moderate	Moderate	Low	6
1256100	0.0	1.4	1.4	Moderate	Low	Low	Moderate	Moderate	Low	6
1256105	0.0	0.2	0.2	Low	Low	Low	Low	Low	Low	0
1256110	0.0	0.9	0.9	Moderate	Low	Low	Moderate	Low	Low	4
1256110	0.9	1.1	0.3	Low	Low	Low	Not Rated	Not Rated	Low	0
1256450	0.0	0.2	0.2	Low	Low	Low	Low	Low	Low	0
1260000	0.0	1.2	1.2	Moderate	High	Low	Not Rated	Not Rated	Low	5
1260000	1.2	5.8	4.6	Moderate	Moderate	Low	Moderate	Low	Low	6
1260013	0.0	0.4	0.4	Low	Low	Low	Not Rated	Not Rated	Low	0
1260013	0.4	1.4	1.0	Moderate	Moderate	Low	Moderate	Low	Low	6
1260022	0.0	1.8	1.8	Moderate	Low	Low	Moderate	Low	Low	4
1260030	0.0	0.4	0.4	Low	Low	Low	Low	Low	Low	0
1260035	0.0	0.1	0.1	Low	Low	Low	Low	Low	Low	0
1260043	0.0	0.3	0.3	Low	Low	Low	Low	Low	Low	0
1260047	0.0	0.1	0.1	Low	Low	Low	High	Low	Low	3
1260049	0.0	0.7	0.7	High	Low	Low	Moderate	Low	Low	5
1260053	0.0	0.4	0.4	Low	Low	Low	Low	Low	Low	0
1260066	0.0	1.3	1.3	High	Low	Low	Moderate	Low	Low	5
1262000	0.0	2.4	2.4	Moderate	Low	Low	Moderate	High	Low	7
1262000	2.4	4.6	2.2	High	Low	Low	Moderate	Low	Moderate	7
1262019	0.0	0.4	0.4	Low	Low	Low	Low	Low	Low	0
1262022	0.0	1.2	1.2	Moderate	Low	Low	Moderate	Low	Moderate	6
1262029	0.0	0.8	0.8	Moderate	Low	Low	Moderate	Low	Low	4
1262049	0.0	0.1	0.1	Moderate	Low	Low	Not Rated	Not Rated	Low	2
1264000	0.0	0.1	0.1	Low	Low	Low	Not Rated	Not Rated	Low	0
1266000	0.0	6.0	6.0	Moderate	Low	Low	Moderate	Moderate	Low	6
1266000	6.0	7.7	1.7	Moderate	Low	Low	Moderate	Low	Low	4
1266014	0.0	0.3	0.3	Moderate	Low	Low	Moderate	Low	Low	4
1266020	0.0	0.4	0.4	Moderate	Low	Low	Moderate	Low	Low	4
1266020	0.4	0.5	0.2	Low	Low	Low	Moderate	Low	Low	2
1266023	0.0	0.2	0.2	Moderate	Low	Low	Moderate	Low	Low	4
1266028	0.0	0.6	0.6	Low	Low	Low	Moderate	Low	Low	2
1266037	0.0	0.2	0.2	Low	Low	Low	High	Moderate	Low	5
1266041	0.0	2.1	2.1	High	Low	Low	High	High	Low	9
1266069	0.0	0.9	0.9	Moderate	Low	Low	High	Moderate	Low	7
1266070	0.0	0.3	0.3	Low	Low	Low	Not Rated	Not Rated	Low	0
1266405	0.0	0.2	0.2	Low	Low	Low	Low	Low	Low	0
1268000	0.0	0.1	0.1	Low	Low	Low	Not Rated	Not Rated	Low	0
1268011	0.0	0.5	0.5	Low	Low	Low	Moderate	Low	Low	2
1270000	0.0	1.0	1.0	High	High	Low	Moderate	Low	Moderate	10
1270000	1.0	2.6	1.6	Moderate	Low	Low	Moderate	Low	Low	4
1270000	2.6	4.3	1.7	High	Low	Low	Moderate	Low	Low	5
1270016	0.0	0.7	0.7	Moderate	Low	Low	High	Low	Moderate	7
1270019	0.0	0.1	0.1	Low	Low	Low	Low	Low	Low	0
1270020	0.0	0.3	0.3	Low	Low	Low	Low	Low	Low	0
1270024	0.0	0.6	0.6	High	Low	Low	High	Low	Low	6
1270032	0.0	0.4	0.4	Moderate	Low	Low	Moderate	Low	Low	4
1270047	0.0	0.3	0.3	Moderate	Low	Low	High	Low	Low	5

Appendix D

Table of Terrestrial Risk for each INFRA Road Segment- example

Road Number	BMP	EMP	Elk Range	Mt Goat Range	N Spotted Owl	Marbled Murrelet	General Forest Species	Rare and Unique	Terrestrial Summary
1200169	0.0	0.1			Moderate		Low		Moderate
1200185	0.0	0.4			Moderate		Low		Moderate
1200200	0.0	0.5			Moderate		Low		Moderate
1200201	0.0	0.2			Moderate		Low		Moderate
1249000	0.0	0.1					Low		Low
1249000	0.1	0.4					Low		Low
1256000	3.1	3.2	Moderate				Low		Moderate
1256000	3.2	8.9	Moderate				High		Moderate
1256000	8.9	11.2			High		High		High
1256100	0.0	1.4			High		High		High
1256105	0.0	0.2					High		Moderate
1256110	0.0	0.9					Low		Low
1256110	0.9	1.1					Low		Low
1256450	0.0	0.2					Low		Low
1260000	1.2	5.8			Moderate		High		Moderate
1260013	0.4	1.4			Moderate		High		Moderate
1260022	0.0	1.8			Moderate		High		Moderate
1260030	0.0	0.4			Moderate		High		Moderate
1260035	0.0	0.1			Moderate		High		Moderate
1260043	0.0	0.3			Moderate		High		Moderate
1260047	0.0	0.1			Moderate		High		Moderate
1260049	0.0	0.7			Moderate		High		Moderate
1260053	0.0	0.4			Moderate		High		Moderate
1260066	0.0	1.3			Moderate		Low		Moderate
1262000	0.0	2.4			Moderate		Low		Moderate
1262000	2.4	4.6			Moderate		Low		Moderate
1262019	0.0	0.4			Moderate		High		Moderate
1262022	0.0	1.2			Moderate		Low		Moderate
1262029	0.0	0.8			Moderate		High		Moderate
1262049	0.0	0.1			Moderate		Low		Moderate
1264000	0.0	0.1					High	High	High
1266000	0.0	6.0		High	Moderate		Low		High
1266000	6.0	7.7		High	Moderate		Low		High
1266014	0.0	0.3			Moderate		Low		Moderate
1266020	0.0	0.4			Moderate		Low		Moderate
1266020	0.4	0.5			Moderate		Low		Moderate
1266023	0.0	0.2			Moderate		Low		Moderate
1266028	0.0	0.6			Moderate		Low		Moderate
1266037	0.0	0.2			Moderate		Low		Moderate
1266041	0.0	2.1		High	Moderate		Low		High
1266069	0.0	0.9		High	Moderate		Low		High
1266070	0.0	0.3			Moderate		Low		Moderate
1266405	0.0	0.2			Moderate		Low		Moderate
1268011	0.0	0.5			Moderate		Low		Moderate
1270000	0.0	1.0			Moderate		Low		Moderate

Appendix E

Maintenance Level Recommendations for each INFRA Road Segment-example

Road Number	BMP	EMP	Length	Operational Maintenance Level	Recommendation
1200169	0.0	0.1	0.1	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1200185	0.0	0.4	0.4	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1200200	0.0	0.5	0.5	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1200201	0.0	0.2	0.2	1 - BASIC CUSTODIAL CARE (CLOSED)	No Access Need
1249000	0.0	0.1	0.1	3 - SUITABLE FOR PASSENGER CARS	Multiple Purpose
1249000	0.1	0.4	0.2	3 - SUITABLE FOR PASSENGER CARS	Multiple Purpose
1256000	3.1	3.2	0.1	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1256000	3.2	8.9	5.7	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1256000	8.9	11.2	2.3	2 - HIGH CLEARANCE VEHICLES	Single Purpose Veg and Boughs
1256100	0.0	1.4	1.4	2 - HIGH CLEARANCE VEHICLES	Single Purpose Veg and Boughs
1256105	0.0	0.2	0.2	2 - HIGH CLEARANCE VEHICLES	No Access Need
1256110	0.0	0.9	0.9	2 - HIGH CLEARANCE VEHICLES	Single Purpose Veg and Boughs
1256110	0.9	1.1	0.3	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1256450	0.0	0.2	0.2	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1260000	1.2	5.8	4.6	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1260013	0.4	1.4	1.0	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1260022	0.0	1.8	1.8	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1260030	0.0	0.4	0.4	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1260035	0.0	0.1	0.1	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1260043	0.0	0.3	0.3	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1260047	0.0	0.1	0.1	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1260049	0.0	0.7	0.7	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1260053	0.0	0.4	0.4	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1260066	0.0	1.3	1.3	2 - HIGH CLEARANCE VEHICLES	Single Purpose Veg and Boughs
1262000	0.0	2.4	2.4	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1262000	2.4	4.6	2.2	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1262019	0.0	0.4	0.4	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1262022	0.0	1.2	1.2	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1262029	0.0	0.8	0.8	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1262049	0.0	0.1	0.1	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1264000	0.0	0.1	0.1	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1266000	0.0	6.0	6.0	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1266000	6.0	7.7	1.7	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1266014	0.0	0.3	0.3	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1266020	0.0	0.4	0.4	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1266020	0.4	0.5	0.2	2 - HIGH CLEARANCE VEHICLES	No Access Need
1266023	0.0	0.2	0.2	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1266028	0.0	0.6	0.6	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose
1266037	0.0	0.2	0.2	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1266041	0.0	2.1	2.1	2 - HIGH CLEARANCE VEHICLES	Single Purpose Veg and Boughs
1266069	0.0	0.9	0.9	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1266070	0.0	0.3	0.3	1 - BASIC CUSTODIAL CARE (CLOSED)	Single Purpose Veg and Boughs
1266405	0.0	0.2	0.2	1 - BASIC CUSTODIAL CARE (CLOSED)	No Access Need
1268011	0.0	0.5	0.5	1 - BASIC CUSTODIAL CARE (CLOSED)	Multiple Purpose
1270000	0.0	1.0	1.0	2 - HIGH CLEARANCE VEHICLES	Multiple Purpose