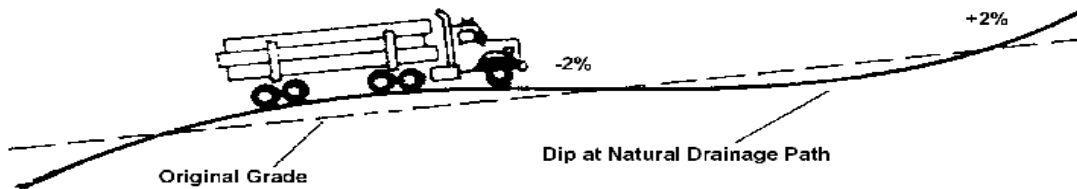


1998 Forest Practices Division Road Maintenance Survey



Rules

WAC 222-24

RCW 76.09 - Forest Practices Act

Board Manual



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Since 1974 the state has regulated forestry activities on state and private lands through the Washington Forest Practice Act. Since then the road maintenance section WAC 222-24-050 (2) & (3) has changed little except for an emphasis statement about natural drainage patterns in wetlands. The act is regulated by the Department of Natural Resources with a focus on protection of public resources on approximately 9.8 million acres of timber lands managed by private, state and county land managers.

Due to the complexity of road influences on public resources the rules are outcome-oriented. The descriptive words of Afunctional ditches and culverts,@ Aminimize erosion,@ and Anot conducive to accelerated erosion@ are used in the rule to describe how a landowner will meet the requirements.

Research and monitoring indicate that surface erosion from roads and landslides contribute significant amounts of sediment to fish bearing streams. The purpose of the survey is to evaluate current rule compliance on a landscape level. Findings will then assist in strategic decisions on rule effectiveness, program direction and future rule development.



Road related resource impacts were noted in the 1991 & 1995 Compliance Surveys conducted by the Field Implementation Committee of TFW. In the recommendations section of the 1995 document it states that lack of road maintenance was the most often cited problem relating to roads. As a result of the survey, a Road Maintenance training program was conducted around the state. This survey re-evaluated the road maintenance issues and effectiveness of the training including assessment of significant compliance issues, which the 1995 survey did not evaluate.

The survey results will assist the forest practices program in establishing priority areas, determining internal and external training needs, increasing consistency of enforcement, helping compliance personnel better identify public resource emphasis areas, and assist with staffing assignments. We have included a sediment budget evaluation and used this and survey findings to assist in writing sediment evaluation assessment for the Forestry module Best Management Practices.

The survey team consisted of two individuals from the Forest Practices Division who have had experience in forest road layout, construction, and maintenance both from the land management and the regulatory perspective. The team reviewed the regulations, watershed analysis road prescriptions, and the Forestry Module concepts. This aided in consistent interpretation of the field conditions. To evaluate resource impacts in a quantitative process was difficult. Surface erosion evaluation techniques used in Watershed Analysis were tested and look very promising for future assessment. The report findings are based primarily on observed physical evidence documented during field inspections. The resource recovery rating was based on the reparability and severity ratings used in the Civil Penalty calculations.

The survey documented significant amounts of sediment entering streams in 70% of the survey areas. This was primarily due to a lack of road maintenance and current rules that do not adequately address sediment delivery. For more details read the individual sections of this report. A summary of the findings of this survey are shown below:

- Landslides were identified in 2 of the survey areas where several delivered large amounts of sediment to flowing waters.
- Approximately 65 percent of the survey areas had direct delivery of sediment from roads to streams.
- Culverts were a problem in 90 percent of the sub-basins
- Watershed analysis and road maintenance plans assist landowners in identifying and correcting resource issues.
- Individual roads can exceed natural sediment input levels by 40 times.
- Ditches were a problem in 66 percent of the sub-basins.
- Commonly used road maintenance techniques are inadequate.

Similar road maintenance issues exist on all roads blind of landowner or governmental control including county and state public roads. Future road construction and maintenance practices need to address sediment related to road surface runoff.

The primary solution is education of land managers and Forest Practices= enforcement personnel. While future rule changes will likely clarify and improve the regulatory inadequacies in rule language, the current rules could provide a much higher degree of protection if a greater emphasis was placed on sediment delivery. The education would include the development of tools to help managers and regulators identify and prioritize road maintenance issues. The list below reflects some steps that could be taken towards achieving this education for better resource protection on road related issues:

- Develop a Forest Road Hazard Protocol form and assessment process for landowners and regulators to use for setting road maintenance priorities.
- Construct roads to reduce public resource impacts. For critical roads in sensitive areas, consider designing a road to minimize damage in the event of a failure. (Designed to consider failure)
- Construct haul roads to minimize long term maintenance and abandonment costs.
- Provide road maintenance training for landowners and regulators that would help them establish annual and long term road construction and management strategies.
- Develop guidance for enforcement personnel relating to recognizing and taking effective enforcement action.
- Recommend changes in rule language during the upcoming FP- rule revision process.

The survey has documented that current road maintenance practices are not meeting FP compliance requirements. This will likely continue until the agency takes action to cause land managers to change the way forest roads are constructed and managed. The steps outlined above would be the first phase of reducing road related resource impacts.

The survey was designed to evaluate road maintenance on a landscape level and capture those specific resource areas which are issues. The selection process was random and the results are traits that you can expect to find in other sub-basins across Washington. The sub-basin review allowed the survey team to look at road maintenance from a strategic planning level. The following elements were reviewed in the selected survey areas:

- Landowner and/or manager compliance with current Forest Practices Rules related to road construction and maintenance.
- The effectiveness of current road related rules in the overall protection of public resources.
- The effectiveness of management decisions such as road closures, road abandonment, and road maintenance plans in reducing resource damage caused by road related issues.
- The effectiveness of the departments enforcement program in identifying and dealing with forest practice enforcement issues.

The data summary shown below reflects this landscape look at current conditions found by the survey team. The road components document the level of compliance for each of the 36 surveyed sub-basins on private and state forest lands.

Data Summary Table for the 36 Sub-basins Surveyed

Road Components Evaluated	Sub-basins In Compliance	Sub-basins of Non-Compliance		
		None	Moderate*	High**
Cut/Fill Slope Stability	17	8	8	3
Road Surface Drainage	7	7	21	1
Ditch Drainage	5	8	22	1
Water Crossing Structures	3	5	26	2
Drainage Maintenance	12	5	17	2
Forest Road Bridge	3	1	3	0
Damage and recovery ratings are from the recovery factors used in the calculation of Civil Penalties. * <u>Moderate</u> = Resource recovery in less than 3 years ** <u>High</u> = Resource recovery taking more than 3 years				

The findings are a reflection of forest practices compliance within a sub-basin not individual miles of forest road. Physical evidence or surface erosion assessment identify those segments that have resource impacts. In some cases where resource damage occurred, landowners were in compliance with the rules, while in other cases there were compliance issues but resource damage had not occurred and enforcement action was not recommended.

It is apparent that many road-related, operational, and resource issues exist. Road maintenance plans currently have too few strategies and regulations. Historically they have not addressed all the issues. They are developed to improve individual sites in a defined area with no established assessment process to evaluate progress or success.

Survey Components

The field survey was the first phase in documenting physical evidence and sediment delivery. Each of the 36 sites was visited. In each sub-basin a majority of all roads were driven or walked. Photo surveys assisted in identifying the priority road segments. The surveyors then compiled physical survey evidence, calculated sediment delivery, determined if there were any road plans in effect for the survey areas, and reviewed enforcement/compliance documents. The second phase involved a forester survey which was a questionnaire related to enforcement, compliance, and road maintenance plans. General forest land information and road density estimates were used to expand the data to statewide estimates. Several county and USFS roads were also included in the survey.

Team Composition

A team made up of personnel from the forest practices division was formed to conduct the initial survey and complete the interim report. The actual road audits initial draft were completed by Roger Ramsdell and Ronn Schuttie. Nikki Housh, Liz Bradford, and Kathy Griffith assisted with compiling data, report editing, and layout and production of the final version of the interim report.

Data Collection

The field information collected for the selected sub-basins includes data relating to all of the subsections contained in WAC 222-24. It evaluated the effectiveness of road design, construction and maintenance. Each area was also reviewed for problems that related to road stability and potential road surface drainage related to sedimentation problems. To help identify potential sedimentation problems, sediment calculations were made for the survey areas using the same basic format used in the Surface Erosion Module in Watershed analysis.

Timing

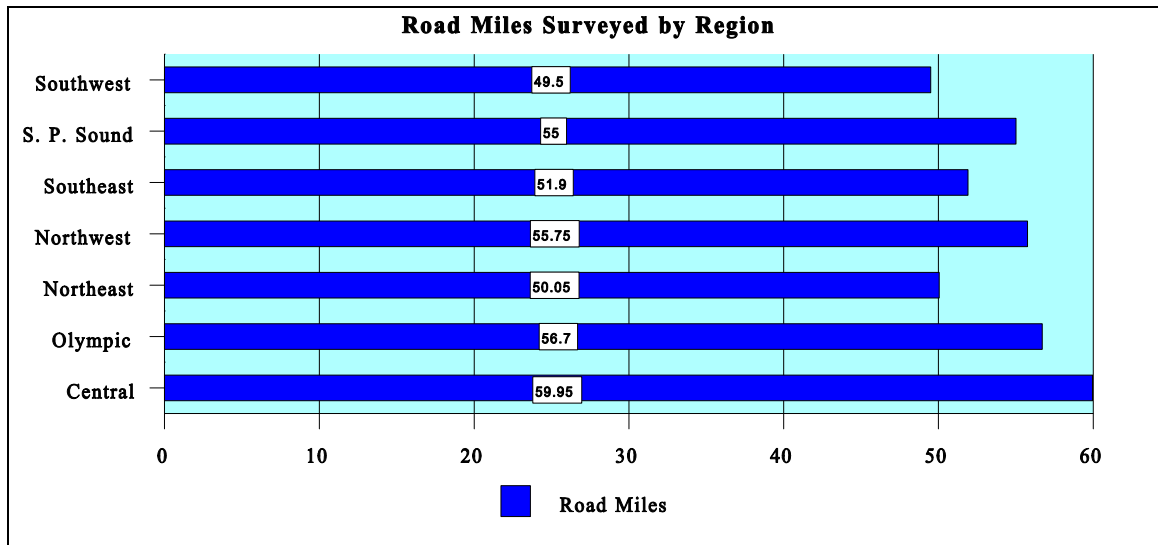
Phase one of the survey was conducted during the summer and fall of 1998. Future surveys should be conducted to evaluate the effectiveness of any new regulations or management practices and to evaluate educational and enforcement efforts over time.

Survey Area Selection Information

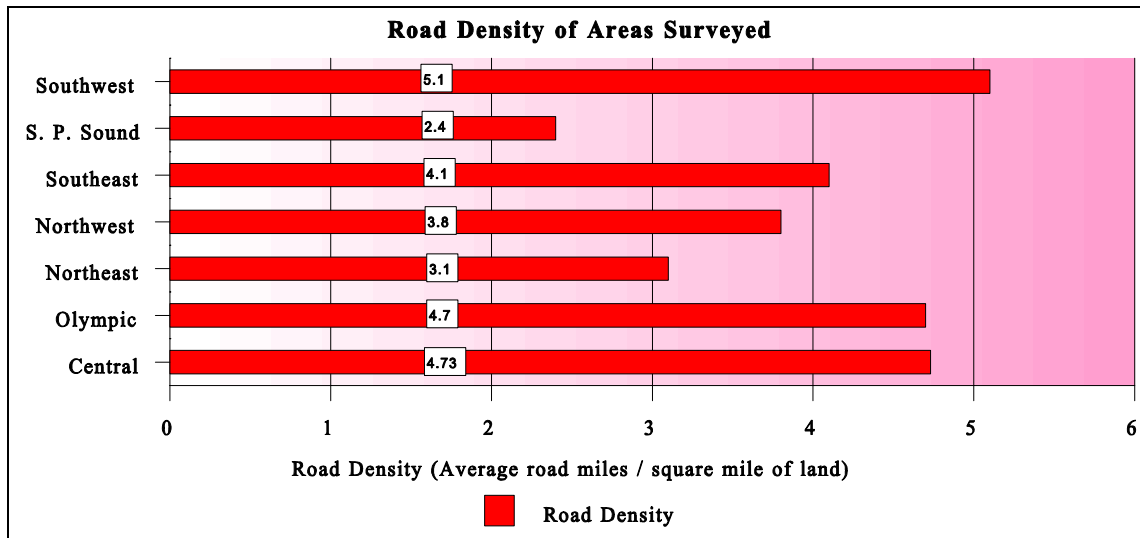
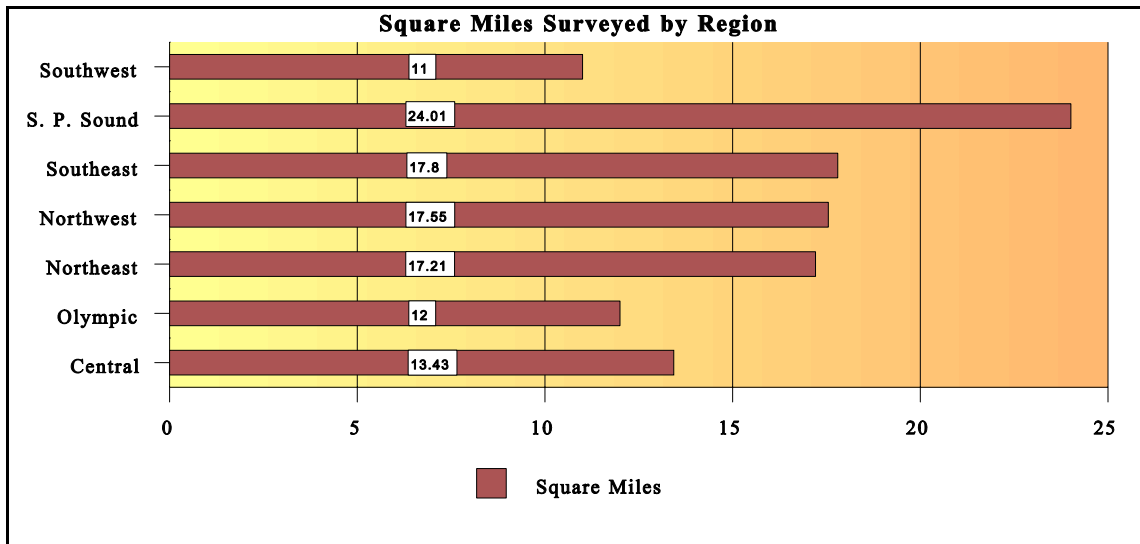
1. Area selection: The team felt it was important to look at sub-basins that met some specific criteria when selecting areas for this survey. Survey areas were selected in locations that were predominantly managed for forestry throughout the state. Selections included a large range of landowners representing medium and large timber companies, small landowners, and public land management agencies. One other consideration was to limit the number of applications for each landowner to two applications per region. Due to the time constraints of the survey we were able to inspect 36 sites, no less than four per region.

The applications were only a means of selecting a general area. Once selected, a representative sub-basin was identified as the sample area and all roads in the sub-basin were surveyed to determine if road construction and maintenance requirements in the forest practices rules were being met.

2. Miles of road surveyed: Of the 36 sites that were surveyed, 23 were from the westside and 11 from the eastside of the state. This amounted to reviewing 379 miles of road on 113 square miles of land. The area and miles of road surveyed for this report are represented in the graph below to better indicate what was surveyed from each region.

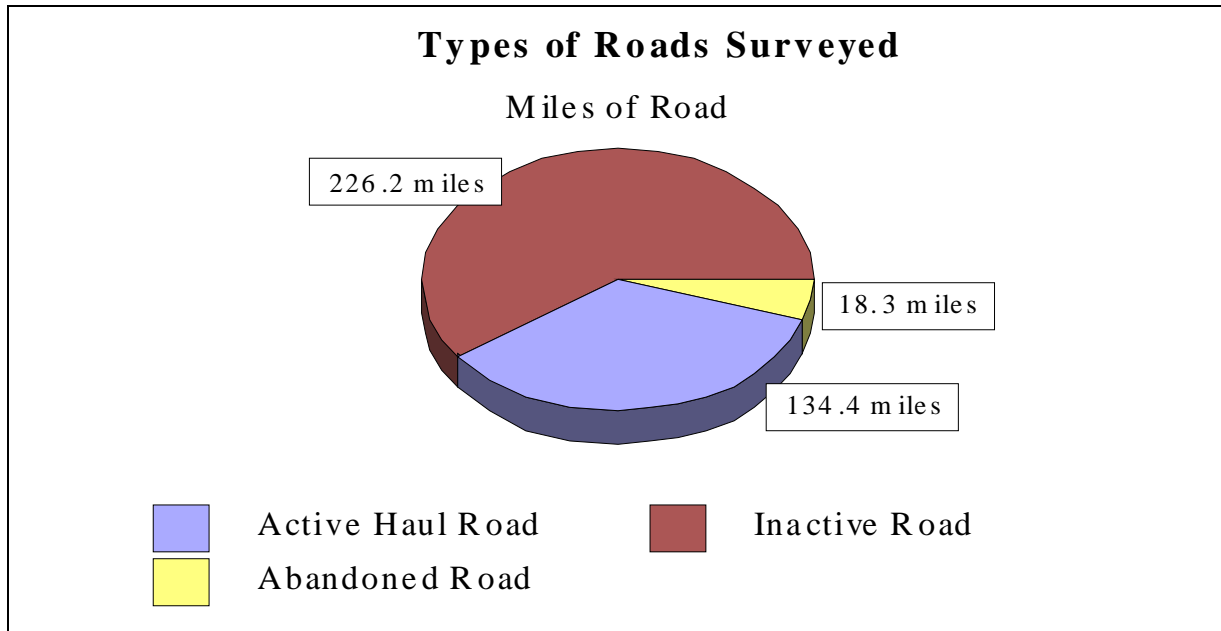


3. Square miles and road densities of survey areas: Once an area was selected, all roads within the area were surveyed. The roads may or may not have directly related to the forest practices application selected. The number of square miles reviewed per region and the approximate road densities of those areas are shown on the graphs below.



4. **Types of roads surveyed:** The roads that were surveyed included all forest roads on the landscape. We classified each road as one of the following three types of road:

- a. Active roads are road segments that are currently being used for ongoing forest management. (See WAC 222-24-050 (2))
- b. Inactive roads are roads that have not had active commercial haul for one or more years. Most inactive roads do have some light vehicle traffic. (See WAC 222-24-050 (3))
- c. Abandoned roads are those roads that have been abandoned in accordance with the procedures shown in WAC 222-24-050 (5).



Orphan roads, which are roads built before 1974 that have not been used or maintained for the conduct of forest practices since 1974, were difficult to identify. Many non-drivable roads had been utilized for sivicultural management activities or forest product hauling since 1974. These roads are included as inactive or abandoned. The survey team did not research and recon the entire sub-basins to search out and identify overgrown roads. Follow-up surveys will address orphan roads.

Cut and Fill Slope Issues

To have stable cut and fill slopes, road builders must be able to design and construct roads in a fashion that provides a stable running surface that is not likely to slump or initiate some type of mass soil movement. The specific issues for cuts and fills that are targeted by this survey are: sidecast stability, fill placement, slopes exceeding 50 percent, cut slope ratio, revegetation, design, construction, and maintenance.

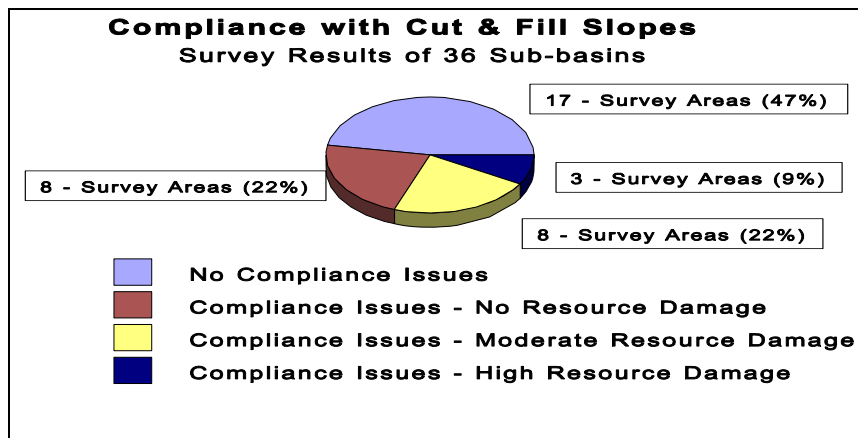
1. **Resource protection requirements relating to cuts and fills:** Road location and design requirements in WAC 222-24-020 requires landowners to fit the road to the topography so that a minimum of alterations to the natural features will occur and where feasible, not to locate roads on excessively steep or unstable slopes, or known slide-prone areas. Where an essential section of road is located in an area that is likely to be slide prone, they are directed to accomplish construction by end hauling, over-hauling, or other special road construction techniques approved by the DNR.

Requirements listed under WAC 222-24-025 directs landowners to use the minimum design standard needed to produce a road sufficient to carry anticipated traffic while keeping subgrade widths to a minimum. In stable areas, suitable material cut during excavation can be used as fill material and unsuitable material should be placed in an appropriate waste deposit area. An appropriate waste deposit area is one that is stable and keeps spoil material from entering typed waters or Type A and B wetlands. Cut and fill slopes should be designed and constructed not to exceed the natural angle of repose for the type of material being removed or used as fill material. Cross-drains, culverts, and other drainage relief features should be constructed to minimize erosion of the road surface and cut and fill slopes and should not discharge directly onto erodible soils or fill slopes unless adequate outfall protection is provided.

According to WAC 222-24-030, roads should be constructed during favorable weather conditions, stumps and logs shall not be placed in the load bearing portion of the fill. Cut and fill slopes should be re-vegetated or otherwise treated by using DNR approved stabilization measures once construction is complete.

Once built WAC 222-24-050 directs landowners to maintain roads to the extent necessary to prevent damage to public resources. This includes road maintenance that minimizes erosion of the surface and subgrade.

2. **Survey results:** This portion of the survey checked the overall stability of cuts and fills by searching existing roads for signs of road surface slumps or cracks, mass soil movement, proper construction techniques on slopes greater than 50 percent, cut slope stability, and cut and fill slope revegetation. The results indicate the majority of the problems relate to signs of instability in fill slopes such as road surface cracks or slumps and other signs of potential mass soil movement that could enter a typed water or Type A or B wetland. A majority of the problem sites had sidecast on fill slopes that exceeded the normal angle of repose on required end haul road segments. Cut slope construction and fill and cut slope revegetation were in compliance in most cases. The following graph indicates the frequency that compliance issues were observed and the level of resource damage that was occurring at the problem sites.



The resource issues relate to direct delivery of mass wasting events into typed waters. Signs of mass soil movement were normally associated with road surface slumps or cracks on slopes exceeding 50 percent. This association was recorded in 11 of the 36 areas surveyed. There was also one site that indicated road surface cracks on slopes in excess of 50 percent that did not have signs of mass soil movement due only to the proximity of less steep slopes. Surveyors recommend corrective action should be taken on all of the above sites. Seventeen of the road systems surveyed showed some problem with over 30 percent at a moderate or high rating.

3. **Effectiveness of current rules:** The rules do address the issues that cause most stability problems. Required road construction (plan and profile) design on steep slopes is necessary to help minimize exposed soils, ensure proper location, and define the extent of construction limits. Road maintenance plans should be required in areas where landowners have existing roads with indicators of slumps and mass soil movement that would directly impact public resources.

4. **Section summary and recommendations:** The majority of road miles surveyed were in compliance with FP Rules however, problem areas did exist in half of the sub-basins. Rule revisions and improved road construction techniques on unstable slopes have nearly eliminated this issue on newly constructed roads. When they do occur, effective road maintenance strategies must be in place to identify and minimize occurrences of mass soil movement. Existing perched sidecast within second rotation harvest areas is an issue and has the potential to fail when trees are removed. These areas must be evaluated during harvest or road maintenance plan development and compliance efforts need to continue to target existing problem areas for enforcement and repair.

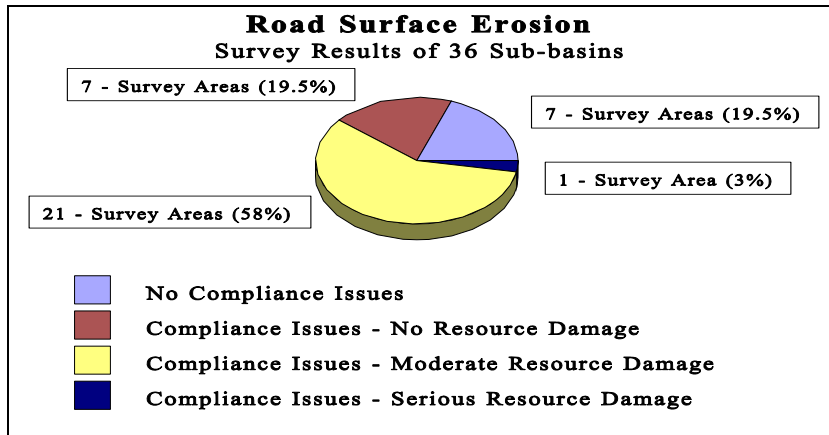
Road Surface Erosion

An important issue relating to the quality of water in managed forest ecosystems is that of the management of road surface runoff. Water from the road surface, especially on roads that are in use throughout the year, is a major contributor to in-stream sediment loads. High amounts of in-stream sediment impacts water quality and fish habitat as well as other downstream uses. The specific issues for road surface erosion that were targeted by this survey are: adequate surfacing and placement, crowning, inslope/outslope, surface drainage, and maintenance.

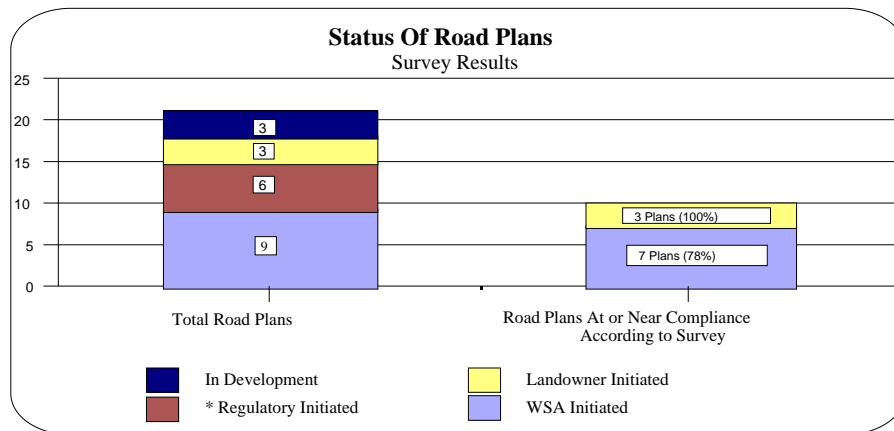
1. **Resource protection requirements relating to road surface erosion:** WAC 222-24-050(2)(b) requires that the road surface be maintained to minimize erosion on active roads. Additionally, the concept of applying haul restrictions and/or seasonal use should be added to current practices to address geographic areas where rock sources break down easily into fine sediments. A simple process is needed to rate rock for hardness and percent of fines for road segments designed for year-around haul. Rock hardness and percent fines also needs to be incorporated into the Watershed analysis surface erosion module.

WAC 222-24-050(3)(a) states the road surface on inactive roads shall be crowned, outsloped, water barred or otherwise left in a condition not conducive to accelerated erosion or interrupt water movements within wetlands. The intent is to reduce erosion, potential resource impacts and maintain natural drainage patterns. While the current practices generally encourage landowners to maintain clean ditches and functional culverts with a crowned road to meet rule compliance, more consideration should be given to the other strategies listed in the rule. The use of outsloping, water bars, and drivable dips on inactive and active roads in areas where these strategies could be effective, would satisfy regulatory requirements and lessen the need for reconstruction or continual maintenance of ditches and cross-drains.

2. **Survey results:** The survey results indicate 75 percent of the sub-basins had compliance issues with 61 percent having resource issues. Grading, drainage, seasonal use, rock hardness, percent fines, and regular maintenance were all road factors related to the condition of surveyed roads. The following graph reflects the state of compliance for the survey sites. Surface drainage was the most common issue documented.



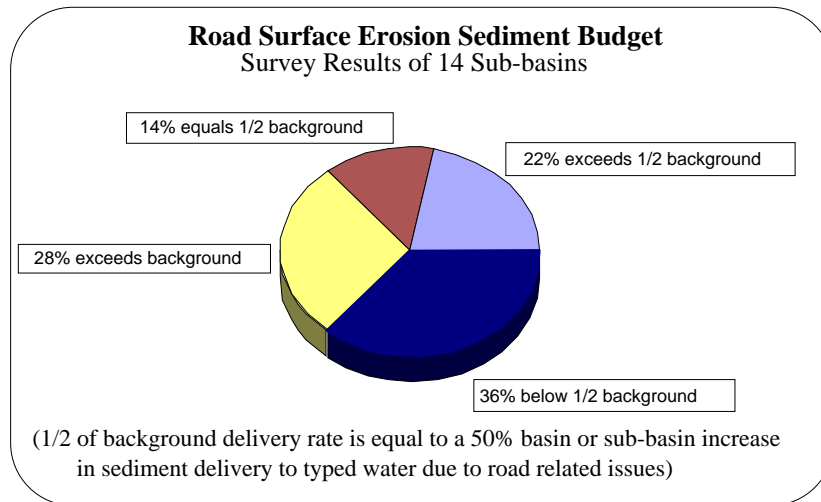
3. **Road maintenance plans:** The road maintenance and abandonment plans appear to assist landowners in identifying issues. Progressive road maintenance occurred in several areas directly associated with watershed analysis or road maintenance plans. Road maintenance planning and scheduling associated with road plans has improved as a result of the training program conducted in 1995. The graph below displays the number of plans, initiator, and sub-basins in rule compliance.



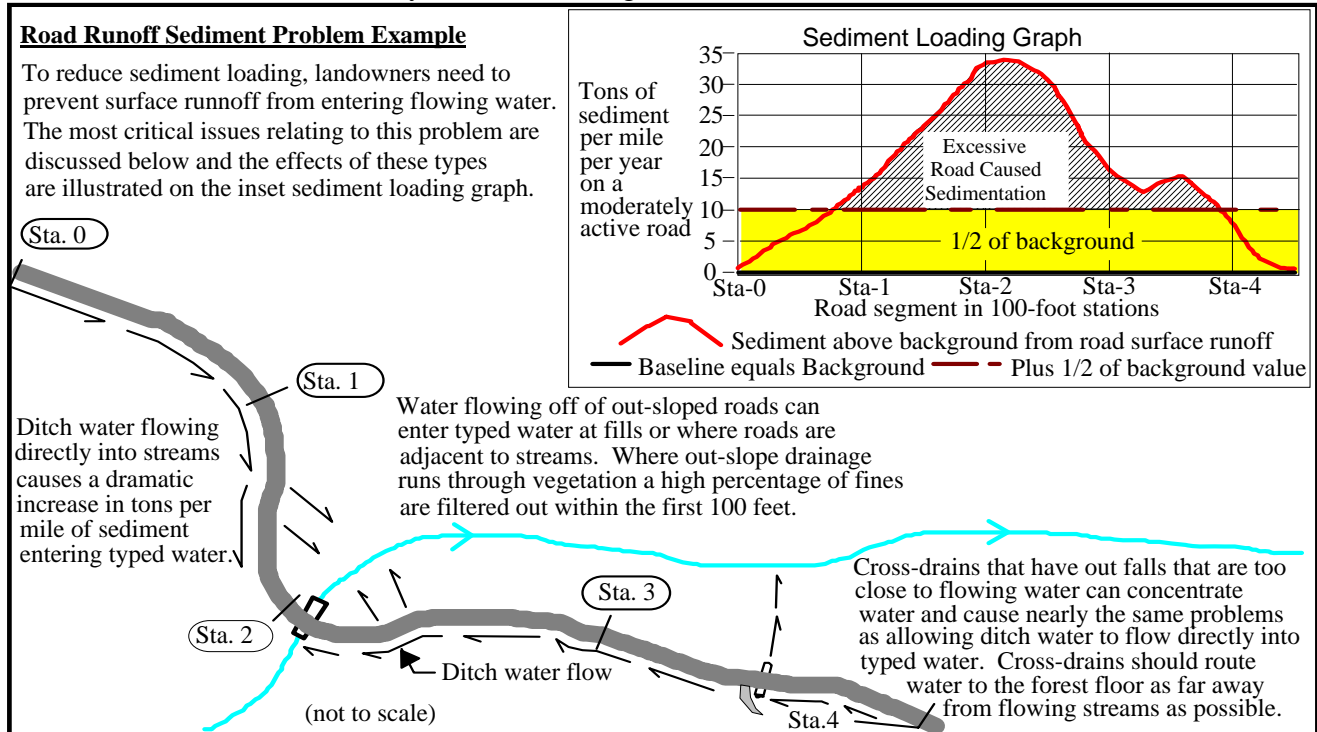
* (Surveyors did not have the information needed to rate the compliance of regulatory road plans)

4. **Surface erosion assessment methods:** Road maintenance plans need a common road surface assessment format for landowners to use in operational decisions and prioritizing road segments. BMP=s or rules addressing assessment are needed. We evaluated the two following techniques to assess road surface erosion.
- a. The basin or sub-basin approach comes directly from the Surface Erosion Module assessment process used in Watershed Analysis. It was modified slightly to only document those segments of roads that deliver.

This technique was used on 14 sub-basins (2 per region). Nine sub-basins presently equaled or exceeded half of background. Road sediment delivery varies based on quality of surfacing material, seasonal haul periods, and loads hauled per day. In watershed analysis half of background would receive at least a moderate hazard call. This technique allows land managers to consider various options. Considerations can include harvest planning, seasonal haul, surfacing, and road location. These calculations are useful as a relative measure of sediment input and should only be used as indicators to help set maintenance priorities.



b. The road segment approach utilizes the same calculation techniques as found in AA@ above but applies the calculations to individual segments of road. These calculations should be used as relative measures upon which priorities can be set based on which roads are delivering the greatest input of sediments compared to background levels. The graph below reflects how sediment loading can be affected when ditch water from road surface runoff directly enters a flowing stream.



c. The two following examples will demonstrate how we used these calculations:

Example one - Reconstruction of 3,200 feet of road costing \$70,000. Culvert spacing was improved to 180 feet with six inches of additional rock surfacing. The road parallels the stream at a distance of 10 to 60 feet. Ditch water energy was reduced with a slight sediment reduction but still near 100 percent delivery. Sediment delivery was calculated at 34 tons per mile at a moderate haul level, 340 tons per mile at heavy haul level. Half of background calculated out at 10 tons per mile for the basin. The landowner's action met the current direction of the Forest Practices rules but did not address sediment delivery resource issues.

Example two - Reconstruction of 3 miles of mainline road. Forty culverts were improved or replaced with 26 of these involving delivery to typed streams. The landowner complied with the current rules but the unreasonable risk to the resource remains due to sediment delivery. Calculations indicated there was still 73 tons/mile for moderate haul and 450 tons per mile for heavy haul for 0.75 miles of the 3 mile section with half of background calculated at 9 tons per road mile for the basin.

Both examples involved progressive landowners and regulators trying to satisfy the rule requirements, but it was apparent that risks to public resources still existed despite the efforts of land managers and regulators.

The forest practice rules direct landowners to solutions as outlined in the rules or board manual. These calculations can assist the landowner and regulator in evaluating unreasonable risk to public resources. Field foresters assisted in the development of these techniques. **Additional BMP=s or Rules are needed to address sediment delivery.**

5. **Effectiveness of current rules:** The current rules are subjective and inadequate. The amount of fines (sediment) on the surface of the road is addressed indirectly in the statements minimize or not conducive to accelerated erosion. The rules address the issues without defining a set of standard expectations. There is not a standard process for landowners and regulators to use to assess or identify success and failures relating to resource protection. This leads to varying compliance expectations throughout the state for landowners, regulators and the general public.
6. **Section summary and recommendations:** The ideal circumstance is to transport the drainage and surface fines onto the forest floor. Twenty-two sub-basins had physical evidence of related resource issues. Outsloping or reinforced drivable water dips should be first priority and will work on any inactive and on some active roads. This would reduce sediment delivery considerably and reduce the emphasis on cross drain culverts.

Rock hardness and percent of fines in the surfacing material need to be included in the road BMPs. Surface fines were observed on many roads and exceeded several inches on a number of sites. Seasonal haul should be a requirement on individual road systems. There is currently no accepted method to assess and determine what constitutes significant amounts of sediment delivery for a given road segment. Success and progress could actually be monitored through the assessment process used in this survey. The survey team recommends an accepted assessment process be developed and included in the forestry module.

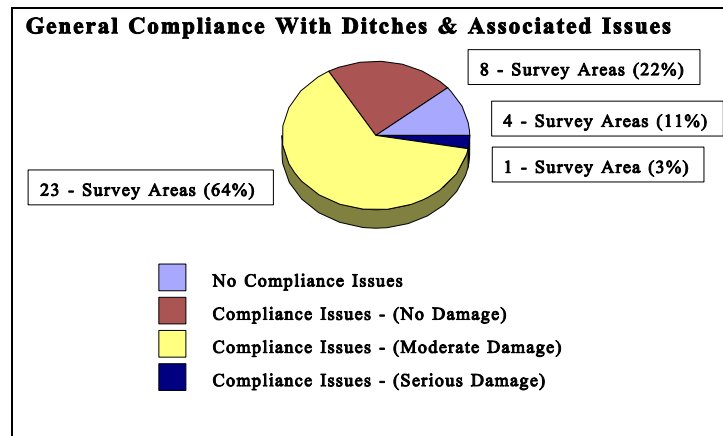
Ditches and Associated Issues

FOREST ROAD COMPONENTS

Surface drainage relief is an important factor in maintaining water quality in areas where they are required to route road surface run off to the forest floor. The rules relating to ditch construction and maintenance are designed to provide for water routing without significantly adding to sediment loading of the streams. The specific issues for ditches that are targeted by this survey are: adequate size and placement, proper water routing, functionality, design, construction, and maintenance.



1. **Resource protection requirements:** WAC 222-24 indicates that roads are required to be outsloped or ditched as needed to provide for proper surface drainage to protect public resources. Properly constructed ditches are not a part of the running surface of the road and must be maintained in a fashion that will carry peak flow events to cross-drains and other water routing features while not adding a significant sediment load to flowing water. Run off from ditches greater than 300 feet in length should not directly enter a flowing Type 1, 2, or 3 water. Ditch maintenance applies to active and inactive roads.
2. **Survey results:** The survey results indicate that approximately 67 percent of the sub-basins have ditch related compliance and resource damage issues. The problems that were found were not necessarily violations of the forest practices rules, and not all road construction or maintenance violations resulted in resource damage. The graph below summarizes the number of sub-basins that had ditch related compliance issues and the number of times ditch related compliance issues were causing resource damage within a sub-basin.



The most common cause of resource damage from ditches was associated with inadequate cross-drain spacing. This occurred most frequently in areas with steep road grades or in rain-on-snow zones (refer to state rain-on-snow map). If other parts of the drainage system are under designed or poorly constructed, the ditches tend to suffer. One example was a site that was surveyed in the rain-on-snow zone in western Washington where cross-drain structure spacing met the minimum requirements in the rules, but significant signs of ditch erosion still occurred due to the amount of water flowing during peak flow events. A maximum relief drainage spacing of about 300 feet or at every 20-foot elevation change would likely provide adequate resource protection in most cases. Fewer cross-drains would be required in areas where landowners could demonstrate that a wider spacing would adequately protect resources.

3. **Effectiveness of current rules:** The rule does not adequately protect public resources because of the emphasis on road ditch requirements. The language emphasize ditch lengths based on pre-determined cross-drain spacing requirements. The prescribed cross-drain spacing often allows culverts to be spaced too far apart which in turn contributes to excessive erosion during high flow events. In areas where ditches were constructed properly and adequate cross-drain structures exist, the rule requirements meet the goals of resource protection. Assessment of other types of surface water management options must be emphasized when considering new construction, inactive road maintenance, and prior to re-establishing ditches in places where problems exist.
4. **Section summary and recommendations:** The survey found 24 areas where water routing through ditch processes contributed sediment directly to flowing water. There are tens of thousands of miles of man made waters (ditches) that intercept natural drainage patterns across the landscape. Ditches are important and should be required for year around haul roads where other drainage options are not likely to be effective. Outsloping and use of drivable dips and/or water bars should be a preference on all inactive and some active roads.

Seeps and intermittent streams were documented flowing directly into the ditches, and in some cases being routed for distances up to 1,500 feet. This is not generally as frequent a problem as drainage relief spacing and can be resolved by the addition of drainage structures. Many older roads do not have ditches or do not meet current forest practice standards. Drainage on many of these roads flowed along the running surface and delivered directly to typed waters.

Natural drainage interception was also a common occurrence. Recent research from University of Washington water resource report number 155 indicates this may increase flows equal to rain-on-snow and harvest influences. Ditches collect and transport water creating essentially man made streams. The water volume collected within a 500-foot segment of ditch delivering into a 1,000-foot stream can cause a significant resource impact.

Various means of routing water to the forest floor or construction of maintainable sediment traps must be used to reduce or eliminate sediment movement. Landowners should outslope, water-bar, or construct drivable dips on roads that are not in use year around to minimize the need for ditches and related maintenance issues. Several unmaintained ditch segments were associated with road failures and mass wasting events. Where truck traffic interferes with ditch runoff, timber haul should be restricted to dry periods. Landowners need to take action to locate areas and correct road systems where ditch run-off is directly entering typed water.

Stream Crossings and Drainage Relief Structures

The natural hydrologic processes are easily affected by drainage structures. Bridges and culverts within the natural channel must adequately handle storm events to minimize the in-stream impacts. The size, spacing and type of drainage structure is important in maintaining our water quality and natural drainage patterns. The specific issues for drainage structures that are targeted by this survey are: adequate spacing, size, placement, functional inlets/outlets, approach drainage, design, construction, and maintenance.



1. Resource protection requirements for crossing structures:

WAC 222-24-050(2)(a) states culverts and ditches be kept functional on all active roads to the extent necessary to prevent damage to public resources. This implies functioning is the primary consideration in evaluating public resource damage. The two examples used in the road surfaced section had functioning culverts and ditches. Resource damage was still occurring and not adequately addressed in current rule requirements.

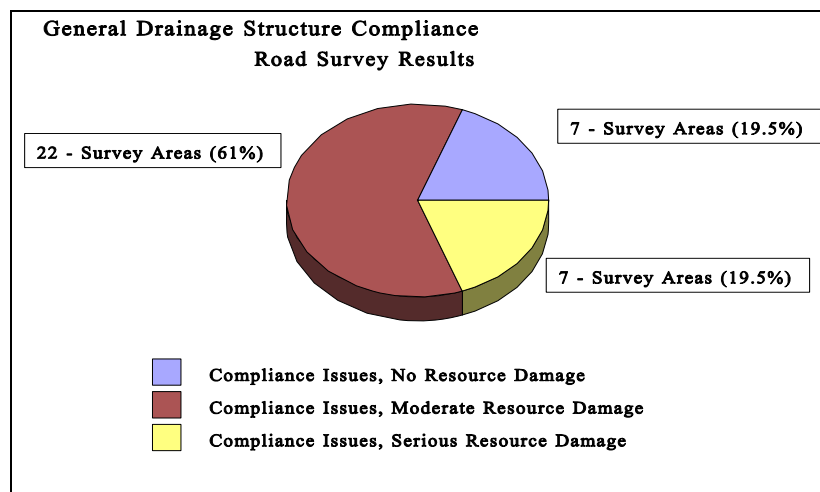
WAC 222-24-050(3)(a) states the landowner shall clear or repair ditches and culverts known or should know to be non-functional and causing or likely to cause material damage to public resources from inactive roads. This implies repair and clean existing ditches and culverts.

WAC 222-24-050(4) states based on physical evidence the department will require additional or larger culverts or other drainage improvements. This statement like much of the rule selects culverts first. The determination based from physical evidence implies resource damage is occurring. This section needs assessment associated with required improvements.

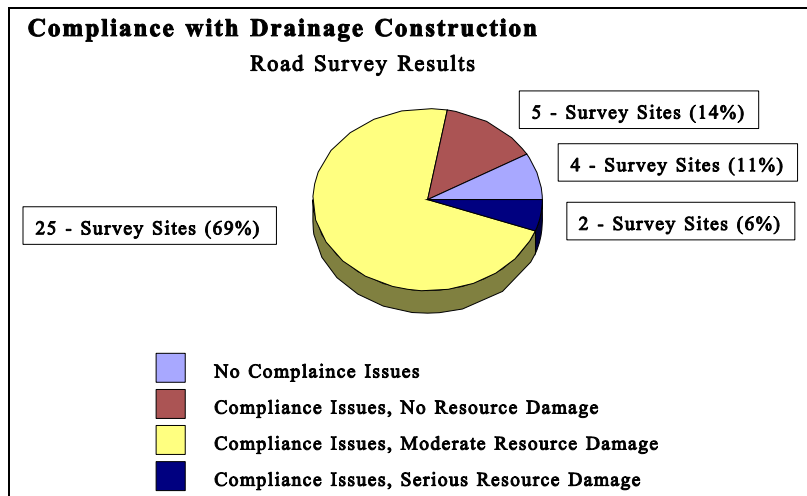
2. **Survey results:** This section was combined under the term drainage structures. The rules lead us into categories such as culverts where the term drainage structures is more appropriate. The following categories: drainage construction (reconstruction), maintenance, and fish passage were used to document the findings.

The graph below and those on the following page reflects the state of compliance for all drainage structure issues except fish passage. Fish passage is dealt with as a separate item in paragraph 4 of this section.

General drainage structure compliance is shown on the first graph of this page. It indicates compliance with rules relating to design, installation, and maintenance of stream crossings and drainage relief structures. This would include culverts, cross-drains, water bars, and drivable dips. All of the areas surveyed had some issues relating to this section of the rules.

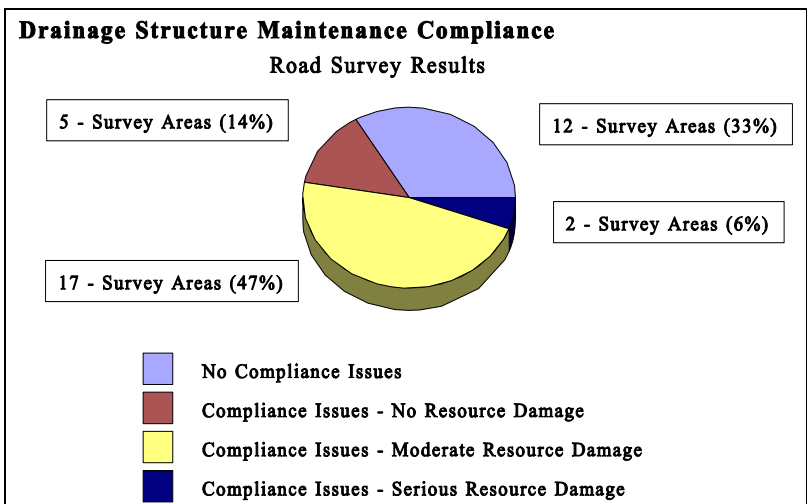


The rule identifies drainage structures as having a construction component. The first graph on this page reflects compliance for this component. The areas reviewed for the construction component includes culvert size, cross-drain spacing, installation, and type of structure used.



Thirty three sub-basins had drainage structure construction compliance issues. Twenty-eight had associated resource issues. Culvert (cross-drain) size, spacing and installation was the highest documented occurrence of compliance issues in the total survey.

Drainage structure maintenance involves maintaining approaches, debris and sediment traps, and functional inlets and outlets. The graph on the right reflects the level of maintenance on all types of drainage structures except bridges which are discussed in paragraph three on the following page.



Twenty-four sub-basins had drainage maintenance compliance issues. Nineteen had associated resource issues. The highest documented maintenance issue in this category was related to functional inlets.

3. **Bridges:** Approximately seven bridges were surveyed. Four of these had compliance issues with three having associated resource issues. The common issue was road approach drainage with direct sediment delivery to a typed stream. Mostly this was caused by ditches that were emptying directly into flowing streams without being routed to the forest floor or through a sediment trap.



4. **Fish passage:** Fish Passage was noted where obvious problems existed including issues relating to the salmonid and stream type emergency rules. The documented fish passage issues were limited by the amount survey time, and the ability of the surveyors to accurately assess fish passage problems. The survey team feels these results are a conservative estimate of the number of fish passage problems in the survey areas. Of the 36 survey areas covering 72,320 acres, 25 percent were identified as having fish passage issues. Two sites had two blockages and one area had three blockages where fish passage was an issue. These appear to be more concentrated in southwest Washington and the Olympic peninsula. Most sites had a vertical drop (see [Fish Passage Design at Road Culverts](#) by Department of Fish and Wildlife) or had more than a two percent gradient. Juvenile fish passage issues are difficult to identify. Road BMP=s using a simple assessment procedure and site rating need to be written and included in the redraft of the Forest Practices Board Manual.

5. **Effectiveness of the rule:** The rule as written is ineffective. It emphasizes the use of culverts and ditches as the primary means of addressing hydrology issues but does not adequately address sedimentation. Historically the Forest Practices rules have educated and required managers and regulators to address these issues without offering a clear set of management objectives. The 1991-1995 FIC road survey results indicated that there were similar problems and unless we consider changes, we can expect similar results in the future.

The current rules promote high cost maintenance structures that are subject to regular storm event damage and subsequent resource impacts. The road maintenance plans promote tactics and scheduling on individual structures but do not address long term strategies to determine success or failure. The rules need to address all drainage structures not just ditches and culverts. We need to question the effectiveness of the rule, because presently the solution is the problem.

6. **Section summary and recommendations:** On a landscape level you can expect to find drainage issues in 66 percent of the sub-basins due to drainage structures. We visualize a culvert with a clean inlet and armored outlet. Now consider a culvert spacing of 900 feet on 350 miles of road. This equals approximately 2,053 culverts within the survey areas. This is near 350,000 culverts statewide and a total length of near 3,250 miles of culvert (average 30 ft culvert) in the ground. Its important we reevaluate current rules and historical practices prior to requiring the installation of miles of additional culverts. Drainage structures had the highest number of compliance issues.

The survey team recommends that the use of drainage structures needs to emphasize long term strategies that promote functionality with minimal maintenance. We need to change the culvert emphasis and consider ideas such as constructing secondary roads with outsloped surface drainage, drivable dips, and alternative structures that are designed to prevent or minimize resource damage when they fail.

General Road Location and Construction

Reconstruction of an existing road system is not clearly defined within the current Forest Practice rules. Many inactive undrivable roads are opened by removing the vegetation, grading the surface and rocking. Locations can involve riparian zones, wetlands and other sensitive sites.

In some instances Forest Practice applications are not filed. It has been implied these reconstructed roads are regulated within the road maintenance rules. The opportunity exists to address a reconstruction review process within the forestry module.

The audit identified several sub-basins where parallel streams or potentially unstable areas were within or near existing road locations. An accepted assessment process would allow managers and regulators to make better informed decisions. Example #1 & 2 pages 9 & 10 of the surface erosion section are examples needing assessment to make economic and resource protection decisions. Example #1 is a road parallel to a stream and in example #2 is a mid slope location. These roads may have been eliminated considering the resource issues and harvest planning considerations.

Presently the tools available are not widely accepted to quantify issues and make landscape harvest decisions such as eliminating road systems. The survey team documented road locations and construction that had associated resource impacts. Several of these roads had haul route alternatives. Additional assessment information and research would be necessary for the survey team to make landscape harvest decisions. The watershed analysis process is currently in place to assist with landscape decisions.

Questions from the Road Survey

The following questions and answers were issues and topics that surfaced during the course of the survey.

1. Are the rules protecting resources?
Yes, but there are instances where rules give a sense of false security. The surface erosion examples found resource damage when the landowner was in compliance with the current rules and board guide lines.
2. How much sediment is entering streams from roads?
Sixty-four % of the sub-basins equaled or exceeded 2 background sediment levels. The team compiled sediment calculations for 14 of the 36 sub-basins surveyed. Of those 14 sub-basins, nine sub-basins showed a road related addition of in-stream sediment that equaled or exceeded one half of the background rate.
3. What areas within road maintenance should we concentrate on?
The cut and fill section has the highest potential for significant one-time events but sections related to drainage have the highest frequency of recorded resource issues. Road maintenance plans need to address both of these issues in a manor that prioritizes the maintenance needs based on estimated sediment delivery potential.
4. What do we need to establish a road risk protocol?
An assessment protocol for resource damage that allows landowners and foresters to easily evaluate sediment input.
5. Do we need additional internal training?
Yes, first we need to develop standard expectations and a set list of knowledge skills and abilities (KSA=s). The list of KSA=s can be used to develop courses for continued education.
6. Do we need external training?
Yes, similar the to question above! Landowners need to have this training available to help them evaluate future road maintenance needs and priorities.
7. What can we quantify?
Currently most compliance is based on physical evidence. Road surface assessment processes require scientists or experts to complete. Adopting a process into the BMP=s would provide an assessment tool to landowners.
8. Have the compliance issues changed since the survey last summer?
The compliance issues had one common factor, WATER! This winter has seen record amounts of rainfall which has caused stability and sedimentation problems to increase throughout the state.

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9. Is there a definable difference between type of landowners?
The initial findings did not identify a definable difference between types of landowners. Most of the problems noted were common to all types of forest land owners.
10. Are the road maintenance plans being implemented?
It appears that areas with road maintenance plans are being maintained better than areas without plans. There will be additional data collected in follow up audit interviews to specifically address road plan compliance.
11. Is there a noticeable difference in road maintenance standards in areas with road maintenance plans?
Yes, road maintenance plans help focus regulators and land managers on resource issues.
12. Do the audit surface erosion findings match Watershed Analysis surface erosion reports and surveys?
Yes, the findings are consistent with the number of sediment hazard calls within areas that were evaluated under Watershed Analysis.
13. Do landowners who have participated in watershed analysis have a higher standard of road maintenance outside the watershed analysis boundaries?
No, areas surveyed indicated that landowners did not routinely apply watershed analysis standards to other sub-basins.
14. How many fish passage issues exist statewide?
If we expand the survey findings to the entire state there could potentially be 1,750 sites with existing fish passage issues on state and private forest land. This survey addresses only obvious issues such as excessive outfall drop and culvert gradients greater than two percent.
15. Are landowners maintaining the road surface and prisms adequately enough to limit sediment inputs and minimize hydrology changes?
No, drainage is influenced by the amount of runoff and duration. The number of audit areas not meeting drainage standards indicates that continual maintenance is required to protect water quality.
16. Are the rules adequate?
No, they focus on maintenance and historical practices such as ditch and cross drain culverts to meet rules. We need to determine what best protects the resource. (See surface erosion examples on pages 9 and 10 and discussion section for more detailed information.)
17. What affects do ditches have on runoff?
Natural drainage interception was also found to be a common occurrence within sub-basins. The rules have created man made waters across the landscape (ditches). The

changes can be significant if the length of ditch delivering to a typed water modifies the hydrology.

18. Do ditches deliver to typed waters?

Yes, the issue is the length of ditch segment delivering to the typed water. The surface erosion module attempts to quantify sediment delivery amounts and was used to assess the significance of ditch inputs.

19. How far are ditches carrying water?

The audit has documented road surface and ditch lengths carrying water in excess of 1,500 feet.

20. Is sediment being captured in troughed roads and delivered to typed streams?

Yes, this is a common eastside road characteristic referred to as troughed road (concaved road surface) captures and transports water considerable distances. Sediment capture was also found on the westside with flat gradient roads on slopes less than approximately 20%.

21. Do roads show active sidecast failure?

Yes, a number of the survey areas had existing failures primarily on slopes in excess of 50%.

22. Do roads show signs of active sidecast movement?

Yes, eleven survey sites had various degrees of sidecast movement.

23. Are there wood puncheon fills still in place?

Yes, there were seven audit areas with wood puncheon culverts and all had associated resource issues.

24. Are drainage structures adequate for major events?

No, not all culverts are presently adequate. This is not surprising when you consider there are approximately 350,000 culverts on state and private lands. We need to reevaluate the strategy of passing storm events using drainage structures. Given time most structures will fail, shouldn't we design a structure to fail with minimal resource impacts rather than just pass 50 and 100 year events.

25. Are there drainage alternatives available?

Yes, historically culverts are preferred and the rule reinforces this choice. Outsloping and drivable dips on inactive roads in most cases would reduce the level of maintenance needs and resource issues.

26. Are the drainage structure rule requirements different in the rain-on-snow zone?

Yes, several sub-basins had identified rain on snow zones. These were definable by physical evidence and resource issues. The intervals of drainage structures should not exceed 300 feet horizontally or at 20-foot elevation changes.

County and USFS Roads

Several forest roads located on other governmental entities were surveyed. We observed many issues with eastside remote county roads. Many of the county roads paralleled year around streams. Sediment budgets for these segments are well above half of background levels per mile. USFS roads were about average for resource issues and maintenance practices. The same historical road maintenance practices occurred on all roads blind of entity control or landowner, leading us to similar findings as documented in the audit.

Land-use Issues

Many of the audit areas had other land uses within the evaluation area. This creates a logistical issue on authority and responsible party. We completed the evaluations without emphasizing parcel ownership. This initial report was not designed to identify differences between industry, non-industrial private landowners, and other land uses.

Future Discussion Topics

The following recommendations leave room for discussion which is the audit teams intent.

1. We have approximately 350,000 culverts state wide with a number of compliance issues. The remedy in many cases is to add additional pipes to reduce sediment delivery and natural drainage interception. We must consider preferred outcomes prior to adding additional BMP=s or rules.
2. We have improved on our historical practices considerably by higher frequency of maintenance, improved road surface and drainage. However, the surface erosion examples show that additional rock or drainage is not enough in some instances. The rules and historical practices will need to change in these areas in order to protect public resources.
3. Are specific Issues predictable? In several cases there was no difference in topography, maintenance levels, or maintenance operators but there was noticeable differences in the magnitude and numbers of compliance issues. The differences were geology, rain on snow and soils. This makes it difficult to standardize road maintenance recommendations.
4. Cuts and fills: Thirty percent of the sub-basins surveyed had sidecast failure resource impact issues. Road abandonment occurs on a number of these sites without any apparent design. Reconstruction and harvest plans must include design and end hauling for areas with perched sidecast. Removal must be a high priority due to mass wasting event damage that can far exceed sediment erosion background delivery rates.

5. Road Surface - Twenty-two sub-basins had physical evidence of related resource issues.

Outsloping or reinforced drivable water dips should be first priority and can work on any road. This would reduce sediment delivery considerably and reduce the need for cross drain culverts. The surface erosion assessment is usable to determine general sediment budgets and assist in prioritizing road segments. Success and progress could actually be monitored through this assessment process.

6. A rock hardness and percent of fines rating system needs to be included in the road BMP>s. Surface fines were observed on many roads and exceeded several inches in depth on a number of sites. Seasonal haul should be a requirement on many road systems.
7. Ditches: 1,000's of miles of man-made waters (ditches) intercept natural drainage patterns across the landscape. Ditches are important and should be required for year around haul roads. Outsloping and drivable dips should be a preference on all inactive roads. Several inactive/abandoned roads had functional ditches remaining, intercepting natural flows and delivering to typed waters.
8. Many roads have ditch related resource impacts as shown by the 22 sub-basins having compliance issues. It is expensive to maintain ditches. Assessment of other options should occur prior to reestablishing thousands of miles of ditch line.
9. Drainage structure construction: The rules require culverts to pass storm events. Currently if a culvert washes out it is replaced with a larger one. Landowners should also consider designing structures to cause less damage to public resources in the event of a failure. Examples of this could include the use of spawning gravel for fill in gravel deficient streams or reinforced low water crossings to reduce the likelihood of damn break flood events.
10. Presently the rules suggest additional structures primarily culverts when the problems are already related to culverts. Historic practices with progressive managers are still not addressing all resource damage (see road surface erosion examples on pages 9 and 10). Increasing harvest yarding distances and eliminating mid slope roads is a solution that must be considered.
11. Drainage Structure Maintenance: Continual maintenance is required if culverts are used to satisfy drainage requirements. Progressive maintenance is expensive. The rules must include strategies to meet resource needs rather than fixed remedies.
12. Road maintenance plans appear to help regulators and land mangers to focus on maintenance needs. The current road maintenance plan incorporates schedules and areas where maintenance will occur. Plans are lacking desired outcomes: such as monitoring, reporting, and overall strategies. The next several years will establish maintenance plans on all the 61,000 miles of state and private forest roads. We need to consider desired outcomes, - the ideas to get there will follow.

13. The salmonid issues have established large areas to focus road maintenance activities. The DNR with a TFW partnership has prioritized areas for road maintenance plans. The survey team proposes development of a road risk protocol matrix. The information is available to assist in developing the risk matrix that will assist in prioritizing 1) WAU=s, 2) sub-basin areas, and 3) assist with the development of Forestry module BMP=s.
14. Future survey topics: There are 69 remaining survey areas that have not been visited. Additional assessment and emphasis on information will assist in answering additional questions. Is there a difference between landowner types? What areas of a road maintenance plan are in or out of compliance? This initial survey will help focus on specific road maintenance items and generate discussion for follow up visits. There are plans for road maintenance surveys to continue. Priority topics will be the road risk matrix development, consistency issues, landowner differences, new maintenance strategies, sediment assessment process and westside outslope road evaluations.