Appendix 1:

Assumptions and criteria used in calculation of compliance

Data collected by the contractor needed to be translated into a quantitative assessment of compliance with the Forest Practices Act. Additionally, a determination had to be made of which rules were applicable to a given operation. These assessments and determinations often were difficult, because the collected data were often surrogates for the factors we were interested in. Thus, we had to generate a set of criteria for accomplish these processes. The assumptions and criteria we used for each rule are given below.

Rules:

629-605-170-1a. Written plan if operating within 100 feet of streams and lakes.

Applicability: A written plan code (WP100) is listed by the contractor on the WOS data sheet.

Compliance criteria: A written plan is provided for the operation.

Comments: We may not have a complete set of written plans with which to assess compliance. When analyzing compliance, rules 629-605-170-1a, 629-625-100-2b, 629-625-100-2c, must be assessed together, because they all use the WP100 code. If desired, rule 629-630-700-3 may be assessed separately based on a WP_Yard code, but presently is aggregated with the others.

629-625-100-2b. Written plan if using machinery in Type F or D streams.

Applicability: A written plan code (WP100) is listed by the contractor on the WOS data sheet.

Compliance criteria: A written plan is provided for the operation.

Comments: We may not have a complete set of written plans with which to assess compliance. When analyzing compliance, rules 629-605-170-1a, 629-625-100-2b, 629-625-100-2c, must be assessed together, because they all use the WP100 code. If desired, rule 629-630-700-3 may be assessed separately based on a WP_Yard code, but presently is aggregated with the others.

This is a duplicate of rule 629-625-430-2.

629-625-100-2c. Written plan if building a road in an RMA.

Applicability: A written plan code (WP100) is listed by the contractor on the WOS data sheet.

Compliance criteria: A written plan is provided for the operation.
Comments: We may not have a complete set of written plans with which to assess compliance. When analyzing compliance, rules 629-605-170-1a, 629-625-100-2b, 629-625-100-2c, must be assessed together, because they all use the WP100 code. If desired, rule 629-630-700-3 may be assessed separately based on a WP_Yard code, but presently is aggregated with the others.

629-625-310-2. Road design – End Haul Waste Material

Applicability: A road sheet is filled out for the site. For application-based analysis, n is the number of recorded road segments.

Compliance criteria: No S (sidecast) codes are recorded on slopes exceeding 60% (40% in granitic soils). (These slopes are noted in the SteepSdcastFill column.)

Comments: The current criterion includes units/segments where no steep slopes occur. Originally, the applicability criteria had included a requirement that roadHslope > 60. However, subsequent analysis revealed frequent “S” coding on segments where roadHslope < 60. If the current criterion is too broad, we still might be able to use a roadHslope screen. Currently, S codes occur on segments with recorded roadHslope down to 45.

A more complete applicable population might also be obtained from GIS analysis of steep slopes on operations. However, this might take considerable time. Also, the current applicability analysis does not consider whether there were any granitic soils in the surveys. Both GIS analysis and consideration of granitic soils could increase the applicable population, resulting in a higher calculated compliance rate.

The compliance criteria use the 60%/40% slopes as a surrogate for HLHL.

629-625-310-3. Road Design – Minimize Width.

Applicability. A new road is listed on the roads datasheet. For application-based analysis, n is the number of recorded new roads.

Compliance criteria. Spurs do not exceed 18 feet, collector roads do not exceed 22 feet, and mainlines do not exceed 30 feet in width.

Comments: Applicability is straightforward. However, no damage is necessary to a resource is currently necessary to establish noncompliance. This is inconsistent with guidance and also disproportionate to our in-house view of the importance of the rule.

629-625-310-4. Road Design – Design cut and fill slopes to minimize landslide risk.

Applicability. A new road with slopes exceeding 40% is recorded on the roads datasheet. For application-based analysis, n is the number of recorded new road segments exceeding 40% slope.
**Compliance criteria.** A steep fill (F) is not recorded for any new roads. (The F code would be recorded for slopes exceeding 60%, or 40% on granitic soils.)

**Comments.** A GIS analysis could be performed to narrow the applicable population to those sales containing steep ground. This could be time-consuming, and would likely result in a lower calculated compliance rate.

The applicability criterion could be changed to include only those units/segments on new roads with a recorded fill code. This would eliminate units/segments without fills, with the likely effect of decreasing the calculated compliance rate.

The compliance criteria use the 60%/40% slopes as a surrogate for HLHL.

629-625-310-5. Stabilize stream crossing fills to prevent fill failure and damage to Waters of the State.

**Applicability.** New and/or reconstructed stream crossings are listed on a Stream Xing datasheet. For application-based analysis, n is the number of new/reconstructed stream-crossings.

**Compliance criteria.** Slumps and/or cracks are not recorded on a stream crossing fill. Additionally, unarmored fills exceeding 80% slope are not recorded.

**Comments.** The applicability appears straightforward, and the chosen criteria appear to be representative indicators of fill stability.

629-625-320-1b. Written plan if stream crossing fill exceeds 15’.

**Applicability:** Surveyor records a fill height exceeding 15’, or query calculates a fill height exceeding 15’ from fill slope and distance data.

**Compliance criteria:** A written plan is provided for the operation.

**Comments:** We may not have a complete set of written plans with which to assess compliance.

629-625-320-1c. Construct stream crossing structures to prevent erosion of fill and channel.

**Applicability.** New or reconstructed stream crossing is recorded on datasheet. For application-based analysis, n is the number of new/reconstructed crossings.

**Compliance criteria:** Gullies are not recorded in the crossing fill.

**Comments:** The compliance criteria only addresses fill erosion, not channel erosion.

629-625-330-2. Do not concentrate drainage water onto landslide-prone areas or steep erodible fill slopes.

**Applicability:** Unit contains segments with recorded road fill. For application-based analysis, n is the number of road segments with a recorded fill.
Compliance criteria. Flow is not directed to an unconsolidated fillslope (U code in flowdirto) when there is a steep fill recorded on the segment.

Comments: The compliance criteria do not directly address the issue of landslide-prone areas.

629-625-330-3. Do not divert water from stream channels to roadside ditches.

Applicability: A stream crossing sheet has been filled out for the unit. For application-based analysis, n is the number of stream crossings.

Compliance criteria: Flow is not diverted from stream to road, (i.e., A DIV code is not recorded in WOSCon).

Comments. None

629-625-330-4. Install drainage structures above stream crossings to reduce sediment delivery to streams.

Applicability: Stream Crossing datasheet filled out. For application-based analysis, n is the number of stream crossings.

Compliance criteria: No sediment delivery within 10’ of streams from ditches or roads. (No issues codes of D or R).

Comments: The 10’ criterion assumes that sediment deposited within that distance will eventually find its way to the stream.

629-625-330-5. Provide drainage when roads cross springs, seeps, wet areas.

Applicability: New roads listed on roads datasheet. For application-based analysis, n would be the number of new road segments.

Compliance criteria: Flow is not directed to road from wet area (FlowDir code not W).

Comments: The applicability criteria tend toward a high calculated compliance rate because some segments may be nowhere near wet areas.

629-330-6. Provide a drainage system to minimize gully erosion on road.

Applicability: New roads listed on roads datasheet. For application-based analysis, n would be the number of new road segments.

Compliance criteria: No gullies connect to waters of the state. (If gully codes present, no code of DI or RR under WOSCon).
**Comments:** None.

629-625-410. Do not place excess construction materials where they may enter waters of the state.

**Applicability:** Both a roads sheet and a WOS sheet has been filled out for the unit. For application-based analysis, n is the number of road segments on units for which a WOS sheet has been filled out.

**Compliance criteria:** If road is within 50 feet, no disturbance to WOS from sidecast, stumps, or road rock.

**Comments.** The applicable population contains units/segments where streams are nowhere near the road. This will increase calculated compliance rate. A GIS analysis could be used to draw the applicable population from streams within a given distance of the road, but would require additional time and would be subject to inaccuracies in the GIS layers.

Another possibility would be to draw the population from streams where Xing/road distance<10’ on the WOS sheet. This is likely to result in a much smaller population, thus lower calculated compliance. Also, stream segments that start >10’ from a road but end <10’ may be recorded as >10’ on the datasheet.

The 50’ road distance criterion was used as an arbitrary measure to separate road-related disturbance from harvest-related disturbance, which is covered under a different rule.

629-625-420-1. On new roads, clear channels and ditches of slash and road construction debris.

**Applicability:** Unit has new roads, with ditch or stream culverts present. For application-based analysis, n is the number of new road segments with culverts.

**Compliance criteria:** No blocked culverts result in sediment delivery to WOS (no BXD code in WOSConn).

**Comments:** Older culverts are covered by rule 629-625-600-3. The compliance criteria assume that all culvert blockages will be the result of slash or road construction activities.

629-625-420-2. Provide effective cross drainage on all new roads.

**Applicability.** Units with new roads listed on roads datasheet. For application-based analysis, n is the number of new road segments.

**Compliance criteria:** No new road segments are delivering sediment to a WOS via ditch (DI), drain outflow (DO), or road runoff (RR).

**Comments:** None
629-625-420-5. Remove berms on edges of roads or provide effective drainage through berms.

**Applicability:** Units with new roads listed on roads datasheet. For application-based analysis, n is the number of new road segments.

**Compliance criteria.** No sediment delivery to WOS from berm drainage (BD).

**Comments:** None.

629-625-430-2. Written plan if using machinery in Type F or D streams.

**Applicability:** A written plan code (WP100) is listed by the contractor on the WOS data sheet.

**Compliance criteria:** A written plan is provided for the operation.

**Comments:** We may not have a complete set of written plans with which to assess compliance. When analyzing compliance, rules 629-605-170-1a, 629-625-100-2b, 629-625-100-2c, must be assessed together, because they all use the WP100 code. If desired, rule 629-630-700-3 may be assessed separately based on a WP_Yard code, but presently is aggregated with the others.

This is a duplicate of rule 629-625-100-2b.

629-625-430-5. Construct sediment barriers on temporary crossings.

**Applicability:** Unit contains a temporary stream crossing on a road. This includes crossings with a SegmentType code of T, or with a non-null, non-zero TempXing field. For application-based analysis, n is the number of temporary crossings on roads.

**Compliance criteria:** Temporary crossings have two drainage structures appropriately spaced from stream (inner within 30’, outer depending on stream size), and no sediment delivery to stream from ditches or road surface.

**Comments:** Coding for temporary crossings changed early in survey process. The compliance query is very complex in Access, increasing the possibility for errors.

Survey methodology allows multiple codes on separate lines when there are multiple issues with stream crossings. This can result in the query returning multiple noncompliance answers at a single crossing, hence overstatement of noncompliance. If desired, the query can be modified to give only one answer per crossing.

629-625-440-1. Stabilize exposed, unstable material through seeding.

**Applicability:** Units where new roads with cuts or fills are identified on the roads datasheet. For application-based analysis, n is the number of new road segments with cuts and fills.
**Compliance criteria:** If road cuts or fills are slumping or eroding (SL, ER) along new roads, they are not delivering to streams (WOSCon is null).

**Comments:** None.

629-625-440-3. **Do not incorporate large amounts of organics in fills.**

**Applicability:** Units where new roads with fill are identified on the roads datasheet. For application-based analysis, n is the number of new road segments with fill.

**Compliance criteria:** On new roads, organic waste is not incorporated in road fill (FillCond not WA).

**Comments:** None

629-625-500-2. **Do not locate quarry sites in channels.**

**Applicability:** Units with quarries listed on LQ datasheet and WOS sheet filled out. For application-based analysis, n is the number of quarries in units where WOS sheets have been filled out.

**Compliance criteria:** Quarry is not in channel (Issues not QC).

**Comments:** To date, surveyors have found very few quarries in the compliance audit units.

The current applicable population includes all in-unit WOS, regardless of proximity to quarries. If desired, GIS analysis could be used to reduce this population, but would take extra time.

629-625-500-3. **Prevent quarry-related waste from entering WOS.**

**Applicability:** Units with active quarries listed on LQ datasheet and WOS sheet filled out. For application-based analysis, n is the number of quarries in units where WOS sheets have been filled out.

**Compliance criteria:** Waste is not delivered from the active quarry to the bankfull width of a WOS (BFW) or to a channel leading to the WOS (CTW). Waste under consideration includes overburden (OB), solid waste (SW), or petroleum waste (PW).

**Comments:** To date, surveyors have found very few quarries in the compliance audit units.

The current applicable population includes all in-unit WOS, regardless of proximity to quarries. If desired, GIS analysis could be used to reduce this population, but would take extra time.

629-625-500-4. **Stabilize active quarry surfaces to prevent erosion/landslides.**

**Applicability:** Units with active quarries listed on LQ datasheet and WOS sheet filled out. For application-based analysis, n is the number of quarries in units where WOS sheets have been filled out.

**Compliance criteria:** If landslides occur above or below an active quarry, they do not deliver to a WOS.
Comments: To date, surveyors have found very few quarries in the compliance audit units.

The current applicable population includes all in-unit WOS, regardless of proximity to quarries. If desired, GIS analysis could be used to reduce this population, but would take extra time.

629-625-500-5. Stabilize inactive quarry surfaces to prevent erosion/landslides, dispose of petroleum-related waste, and ensure other waste does not enter WOS.

Applicability: Units with inactive quarries listed on LQ datasheet and WOS sheet filled out. For application-based analysis, n is the number of quarries in units where WOS sheets have been filled out.

Compliance criteria: If landslides occur above or below an inactive quarry, they do not deliver waste to a WOS. Waste under consideration includes overburden (OB), solid waste (SW), or petroleum waste (PW).

Comments: To date, surveyors have found very few quarries in the compliance audit units.

The current applicable population includes all in-unit WOS, regardless of proximity to quarries. If desired, GIS analysis could be used to reduce this population, but would take extra time.

629-625-600-2. Maintain active and inactive roads with a stable surface and an effective drainage system.

Applicability: Unit contains old roads as listed on roads datasheet. For application-based analysis, n is the number of old road segments reported on the sheet.

Compliance criteria: For older roads, no sediment delivery to WOS from ditches (DI), drain outflows (DO), road runoff (RR), or berm drainage (BD).

Comments: Blocked cross drains are covered under 629-625-600-3, rather than here.

629-625-600-3. Maintain drainage structures to diminish likelihood of clogging and washouts.

Applicability: Unit contains old roads as listed on roads datasheet. For application-based analysis, n is the number of old road segments reported on the sheet.

Compliance criteria: For older roads, no sediment delivery to WOS from blocked cross drains.

Comments: Criteria were changed to require sediment delivery to establish noncompliance.

629-625-600-5. Apply road oil, surface stabilizers in a manner that prevents entry to waters of state.

Applicability: Unit contains roads as listed on roads datasheet. For application-based analysis, n is the number of road segments reported on the sheet.

Compliance criteria: There is no connection between an oiled road (OR) and waters of the state.
Comments: The current applicability criteria may over-represent the applicable population. I am not certain if there is any way to extract a class of road that is likely to get oiled from our current data. There were no compliance issues identified in the first 100 sites.

629-630-150-7. Do not locate skid trails straight up/down steep, erodible slopes >100' unless effective drainage is provided.

Applicability: Units for which a WOS sheet is filled out and the unit data sheet indicates that skid trails were present. For application-based analysis, n is the number of WOS segments on units with skid trails.

Compliance criteria: No skid trails are connected to WOS and oriented directly up a steep hillslope for a distance exceeding 100 feet (i.e., no SUC code in SkidIssues).

Comments. Appropriate applicability criteria are difficult to derive because we do not survey all skid trails. The current applicability criteria provide a large population of streams that may or may not be near skid trails. This will tend to diminish calculated noncompliance rates. We could change the criteria to restrict the population to those WOS segments with a non-null Skid35 entry. This would tend to amplify any noncompliance, so we would want to be clear what our sample population was. In the first 100 sites, there were no compliance issues identified. Our criteria seem to differ from guidance, which indicates the 200’ is the critical distance.

629-630-150-8. Install cross ditches on skid trails on steep, erodible slopes.

Applicability: Units for which a WOS sheet is filled out. For application-based analysis, n is the number of WOS segments reported on the sheet.

Compliance criteria: No skid trails are connected to WOS and oriented obliquely up a steep hillslope for a distance exceeding 100 feet (i.e., no SSC code in SkidIssues).

Comments. Appropriate applicability criteria are difficult to derive because we do not survey all skid trails. The current applicability criteria provide a large population of streams that may or may not be near skid trails. This will tend to diminish calculated noncompliance rates. We could change the criteria to restrict the population to those WOS segments with a non-null Skid35 entry. This would tend to amplify any noncompliance, so we would want to be clear what our sample population was. In the first 100 sites, there were no compliance issues identified.

629-630-200-3. Written plan if building landings within an RMA.

Applicability: Landings are recorded in the RMA (Issues = LR) on the LQ datasheet.

Compliance criteria: A written plan is provided for the operation.

Comments. We may not have a complete set of written plans with which to assess compliance. Through the first 100 sites, very few landings were built in the RMA. We may need to aggregate this with other written plan rules when assessing compliance.
629-630-200-4. Do not incorporate large amounts of organics in landing fills.

**Applicability:** Landings are recorded in the unit. For application-based analysis, n is the number of recorded landings.

**Compliance criteria:** No stumps/slash/logs are identified in the landing fill (i.e., Issues not LF).

**Comments:** None.

629-630-300-2. Construct water diversions in skid trails to keep sediment from entering WOS.

**Applicability:** Units for which a WOS sheet is filled out. For application-based analysis, n is the number of WOS segments reported on the sheet.

**Compliance criteria:** Skid trail on gentle slopes is not connected to a WOS (i.e., no SOOTH code under Issues).

**Comments.** Appropriate applicability criteria are difficult to derive because we do not survey all skid trails. The current applicability criteria provide a large population of streams that may or may not be near skid trails. This will tend to diminish calculated noncompliance rates. We could change the criteria to restrict the population to those WOS segments with a non-null Skid35 entry. This would tend to amplify any noncompliance, so we would want to be clear what our sample population was. In the first 100 sites, there were no compliance issues identified.

629-630-300-4. Maintain effective drainage on landings during and after use.

**Applicability:** Landings are recorded in the unit. For application-based analysis, n is the number of recorded landings.

**Compliance criteria:** Landing does not drain to WOS (W).

**Comments:** None

629-630-400-1: Place harvest-related waste material where it won't enter waters of the state.

**Applicability:** Unit contains WOS sheet or LQ sheet. In application-related analyses, n is the number of stream segments + landings.

**Compliance criteria:** There is no landing-related waste in the bankfull width or on slopes>60%. Waste of concern for landings includes sidecast, overburden, stumps, and slashpiles. Also, there is no sidecast or stumps in WOS >50’ from road, and no slashpiles in streams and lakes.

**Comments.** The applicability criteria includes both units containing WOS, and those without WOS, but having landings. That is because this rule can get tripped by both WOS and LQ queries. The steep slope criterion for landings does not reference proximity to WOS.
Multiple waste types may trip this rule multiple times at a given location. This could result in overstatement of noncompliance. If desired, the query could be reset to only allow one noncompliance at a given GPS point.

629-630-400-3. Remove petroleum waste from forest.

**Applicability.** Landings or active quarries are recorded in the unit. For application-based analysis, n is the number of recorded landings and active quarries.

**Compliance criteria:** No petroleum waste (PW) is recorded at the landing or quarry.

**Comments:** None.

629-630-400-4. Dispose of metal so that waste material does not enter WOS.

**Applicability:** Unit contains WOS. For application-based analysis, n is the number of recorded WOS segments.

**Compliance criteria:** No metallic waste (MW) from recent harvest activities is recorded in WOS.

**Comments:** None

629-630-600-3b. Do not allow slash to accumulate in waters where they impair water quality or increase likelihood of mass debris movement.

**Applicability.** Unit contains type N streams, ¼ acre wetlands, and/or lakes. For application-based analysis, n is the number of recorded WOS segments meeting these criteria.

**Compliance criteria:** Slash cover does not exceed 50% in type N stream reaches of less than 10% gradient. Slash ponding and slash erosion does not occur in type N stream reaches of any gradient, nor in lakes or wetlands exceeding ¼ acre. Slash piles are not within wetlands.

**Comments:** In practice, surveys often occurred under dry conditions and slash ponding was called by visualizing different flow conditions.

629-630-600-3c. Place slash above high water levels.

**Applicability:** Unit contains WOS. For application-based analysis, n is the number of recorded WOS segments.

**Compliance criteria:** Slash is not within 10’ of the channel’s bankfull width (i.e., WOSDisturb not SP10).

**Comments:** None.

629-630-700-3.2. Written plan if operating within 100 feet of streams and lakes.

**Applicability:** A written plan code (WP_Yard) is listed by the contractor on the WOS data sheet.
Compliance criteria: A written plan is provided for the operation.

Comments: Rule 629-630-700-3 presently is assessed together with those units having a WP100 code, but may be assessed separately if desired and if sample size permits.

629-630-700-4. In certain WOS types, swing yarded material free of ground in aquatic areas and riparian areas.

Applicability: Units having WOS with cable corridors, other than small N streams and nonsignificant wetlands. For application-based analysis, n is the number of WOS segments meeting these criteria.

Compliance criteria: Cable corridor does not cause soil disturbance within 20’ of WOS bankfull width (i.e., CableCorridor not CYS).

Comments: This rule appears to apply to significant wetlands and lakes, but the field guide for contractors says to record cable corridors for “all streams”.

629-630-800-2. Do not operate ground-based equipment in stream channels.

Applicability. Unit contains streams. For application-based analysis, n is the number of recorded stream segments.

Compliance criteria: On stream segments greater than 10 feet from the road, no tracks (TR) are observed in the stream channel.

Comments: The 10’ criterion is an arbitrary division between road-related and harvest-related machine activity.

Stream segments are of unequal length. Thus, population size determined from number of stream segments may yield arbitrary results. This applies to other rules that rely on counts of stream segments, as well. An approach standardized to stream segment length would be possible, but would take extra time.

629-630-800-4a. Construct temporary crossings so they pass flows and minimize erosion/sedimentation.

Applicability: Unit contains a temporary stream crossing. This includes crossings with a SegmentType code of T, or with a non-null, non-zero TempXing field. For application-based analysis, n is the number of temporary crossings.

Compliance criteria: The temporary crossing does not result in streamflow alteration (SFA), stream erosion (SE), or sidecast ponding (SCP).

Comments: Coding for temporary crossings changed early in survey process.
Survey methodology allows multiple codes on separate lines when there are multiple issues with stream crossings. This can result in the query returning multiple noncompliance answers at a single crossing, hence overstatement of noncompliance. If desired, the query can be modified to give only one answer per crossing.

629-630-800-4e. Remove temporary stream crossings.

**Applicability:** Unit contains a temporary stream crossing. This includes crossings with a SegmentType code of T, or with a non-null, non-zero TempXing field. For application-based analysis, n is the number of temporary crossings.

**Compliance criteria:** The temporary crossing is recorded as successfully removed according to acceptable standards (TempXing not XNR).

**Comments:** Coding for temporary crossings changed early in survey process.

There is substantial overlap between 629-625-430-5 and this rule. I have placed the analysis relative to stream crossing removal in this heading, so that 629-625-430-5 can be devoted to drainage structures, which is also contained in that rule.

Survey methodology allows multiple codes on separate lines when there are multiple issues with stream crossings. This can result in the query returning multiple noncompliance answers at a single crossing, hence overstatement of noncompliance. If desired, the query can be modified to give only one answer per crossing.

629-630-800-6. After yarding, construct sediment barriers on stream crossing approaches.

**Applicability.** Skid trail crosses stream in unit (Crossing Type = S in streamxing table). For application-based analysis, n is the number of skid trails crossing streams.

**Compliance criteria:** Functional drainage structures are in place at appropriate distances from stream and there is no sediment delivery to WOS from skid trail. Appropriate distances include a structure within 30’, and a second barrier at the end of the RMA for Large and Medium streams.

**Comments:** The query is complex in Access.

629-630-800-8. Minimize skid-trail-related soil exposure within RMAs, and do not locate skid trails within 35 feet of F and D streams.

**Applicability:** Type D or F streams present in unit. For application-based analysis, n is the number of D and F stream segments.

**Compliance criteria:** No skid trails are recorded within 35’ of type F or D streams, and there is no recorded sediment contribution to these streams. (Skid35 more than 35, or is unrecorded, and no SOTH code under SkidIssues.)
Comments: F and D streams are generally standardized to 200’ segments. Therefore, variations in population size because of arbitrary stream segment length should be minimal.

An approach based on number of skid trails is not possible because we do not have an inventory of skid trails. We only record the presence of skid trails if they are within 35 feet of stream, or otherwise are providing a problem to streams.

Currently, the query only addresses F and D streams. One portion of the rule seems to imply that adequate filtration be provided to all waters of the state, not just F/D. Thus, it may be appropriate to modify the SOTH portion of the query to include all stream types, in which case the applicable population would be modified accordingly.

629-640-100-2b. Retain all trees within 20 feet of high water level on Type F streams.

Applicability: All units containing type F streams. For application-based analysis, n is the number of Type F stream segments.

Compliance criteria: No stumps are recorded within 20’ of Type F stream. (Stumps20=0)

Comments: F streams are generally standardized to 200’ segments. Therefore, variations in population size because of arbitrary stream segment length should be minimal.

629-640-200-2b. Along D, and L-M N streams, retain all trees within 20 feet of high water level.

Applicability: All units containing Type D or Large or Medium Type N streams. For application-based analysis, n is the number of stream segments meeting these type criteria.

Compliance criteria: No stumps are recorded within 20’ of Type D or Large/Medium Type N stream. (Stumps20=0)

Comments: Type D and Large/Medium Type N streams are generally standardized to 200’ segments. Therefore, variations in population size because of arbitrary stream segment length should be minimal.

629-645-030-1. Protect soil from disturbance in significant wetlands and their RMAs.

Applicability: All units containing significant wetlands. For application-based analysis, n is the number of significant wetlands.

Compliance criteria: No machine tracks are found in significant wetlands (SWL). (No WOSDisturb code of TR where WOSType is SWL).

Comments: No SWL have been reported in compliance audit surveys.

The compliance criteria use machine tracks as a surrogate for all forms of disturbance. I do not know if there are significant operational disturbances that wouldn’t leave tracks.
629-655-000-2a. Protect soil from disturbance in non-significant wetlands >1/4 acres.

Applicability: All units containing non-significant wetlands exceeding ¼ acre. For application-based analysis, n is the number of these wetlands.

Compliance criteria: No machine tracks are found in non-significant wetlands exceeding ¼ acre. (No WOSDisturb code of TR where WOSType is W¼).

Comments: The compliance criteria use machine tracks as a surrogate for all forms of disturbance. I do not know if there are significant operational disturbances that wouldn’t leave tracks.

629-655-000-3. Protect soil and vegetation along small wetlands, springs, and seeps.

Applicability: All units containing wetlands less than ¼ acre. For application-based analysis, n is the number of these wetlands.

Compliance criteria: No machine tracks are found in non-significant wetlands less than ¼ acre. (No WOSDisturb code of TR where WOSType is W<¼).

Comments: The compliance criteria use machine tracks as a surrogate for all forms of disturbance. I do not know if there are significant operational disturbances that wouldn’t leave tracks.

629-660-040-1. Do not divert water from streams.

Applicability: Streams are present on unit. For application-based analysis, n is the number of stream segments plus the number of landings.

Compliance criteria: No channelization, relocation, or diversion is recorded along the stream caused by logging machinery (WOSDisturb not CR). Also, no landings in the channel or altering stream course (LQ sheet, Issues not LCD).

Comments: Small Type N stream segments are of unequal length. Thus, population size determined from number of stream segments may yield arbitrary results. This applies to other rules that rely on counts of stream segments, as well. An approach standardized to stream segment length would be possible, but would take extra time.

The applicability criteria includes both units containing WOS, and those without WOS, but having landings. That is because this rule can get tripped by both WOS and LQ queries. In principle, any landing that could trigger this rule should have a WOS sheet filled out unless the affected WOS was outside the unit, so the current criteria may inflate population size. However, a criterion that only included WOS resulted in noncompliant segments exceeding population size on individual units for at least one of these landing-related rules.
629-660-040-2. Do not add soil or rock to any streams, or remove soil or rock from these streams.

**Applicability:** Streams are present on unit or landings are present on the unit. For application-based analysis, n is the number of stream segments and landings.

**Compliance criteria:** No channelization, relocation, or diversion caused by logging machinery is recorded along the stream (WOSDisturb not CR). Also, no material is added or removed from channel to create landing (LQ sheet, Issues not LCAR).

**Comments:** Small Type N stream segments are of unequal length. Thus, population size determined from number of stream segments may yield arbitrary results. This applies to other rules that rely on counts of stream segments, as well. An approach standardized to stream segment length would be possible, but would take extra time.

The applicability criteria includes both units containing WOS, and those without WOS, but having landings. That is because this rule can get tripped by both WOS and LQ queries. In principle, any landing that could trigger this rule should have a WOS sheet filled out unless the affected WOS was outside the unit, so the current criteria may inflate population size. However, a criterion that only included WOS resulted in noncompliant segments exceeding population size on individual units for at least one of these landing-related rules.


**Applicability:** Units containing new or reconstructed stream crossings. For application-based analysis, n is the number of these crossings.

**Compliance criteria:** Recorded culvert size is larger than the minimum size calculated from Tech Note #5 formulas.

**Comments:** There are several possible sources of uncertainty in the calculations used to derive minimum culvert size. Acreage draining to the culvert is estimated using visual GIS-assisted interpretation of topographic lines. In some cases, the source DEMs for these lines have been resampled to provide better (e.g., 10 foot) resolution, but these resampled lines are still subject to inaccuracies in the source data. The peak flow 50-year recurrence interval was interpolated using as per Tech Note 5. However, there are some points in the state that are open-ended (i.e., do not have two differing isolines to interpolate between) and special assumptions had to be made in these cases. Finally, the formula is complex, which could lead to errors in the Excel spreadsheet, although I believe that the formula has been transmitted correctly. On the Excel spreadsheet, I built in flagging formulas to detect when a calculated value was close to the pass/fail boundary. Guidance notes that if fill failure risk is low, undersized culverts are allowed to remain.

629-630-800-4c. Provide a written plan for temporary crossing fills exceeding 8 feet in height.

**Applicability:** Surveyor records a fill height exceeding 8’, or query calculates a fill height exceeding 8’ from fill slope and distance data.
Compliance criteria: A written plan is provided for the operation.

Comments: We may not have a complete set of written plans with which to assess compliance. Additionally, the formulas to calculate fill height is somewhat difficult to construct in Access, resulting in potential errors. Tests so far indicate that the current formula is correct. This requirement can be waived for a type N stream.

629-640-200-6. Retain understory vegetation within 20 feet of certain small N streams.

Applicability: All units containing small N streams that also meet the criteria of FPR Table 5. For application-based analysis, n is the number of Type N stream segments that meet these criteria.

Compliance criteria: No understory or nonmerchantable vegetation is removed from within 20 feet of streams meeting criteria of FPR Table 5 (i.e., no N codes for Veg10).

Comments: The analysis for Table 5 criteria would require GIS-based acreage calculations, and could be time consuming. I performed this analysis for those stream segments with an N code for Veg10 and all of these passed because the contributing watersheds were smaller than specified by Table 5 criteria. Ideally, the population of applicable units would be determined using GIS basin size analysis for all 200 units. However, this would be extremely time consuming. Current analysis methods overestimate the applicable population, but the bottom line is that there are no compliance issues.

Small Type N stream segments are of unequal length. Thus, population size determined from number of stream segments may yield arbitrary results. This applies to other rules that rely on counts of stream segments, as well. An approach standardized to stream segment length would be possible, but would take extra time.