

DECISION NOTICE
and
FINDING OF NO SIGNIFICANT IMPACT
for the
CANYON/NEST PROJECT
ENVIRONMENTAL ASSESSMENT

USDA Forest Service
Black Hills National Forest
Hell Canyon Ranger District
Custer, South Dakota

Introduction

The Canyon/Nest Project Environmental Assessment (EA) documents a No-Action and two Action Alternatives for timber harvest and associated activities in the Canyon/Nest Project Area. I have reviewed the EA and related material, including the analysis and project file, and base my decision upon that review.

The project area is located within the boundaries of the Black Hills National Forest, within Pennington County, SD and Weston County, Wy. The project is located in all or portions of T1N, R1E, Sections 6, 7, 8, 16, 17, 18, 19, 20, 21, 28, 29, 30, and 31 (Canyon); and T1N, R1E, Sections 1, 2, 3, 10, 11, 12; T2N, R1E, Sections 23, 24, 25, 26, 27, 34, 35, 36; T1N, R2E, Sections 5, 6, 7, 13, and 18; T2N, R2E, Section 31; and T 47N, R60W, Sections 27, 28, and 34 in the state of Wyoming. The project is in Management Area 5.1 (Resource Production Emphasis) as designated by the 1997 Black Hills National Forest Revised Land and Resource Management Plan.

Background

The Record of Decision for the Black Hills National Forest 1997 Revised Land and Resource Management Plan (1997 Revised Forest Plan) and accompanying Final Environmental Impact Statement (1996 FEIS) was signed on June 24, 1997 by then Regional Forester Elizabeth Estill. The 1997 Revised Forest Plan and 1996 FEIS provide a programmatic framework for decision-making on the Forest for the next 10-15 years.

A number of groups and individuals appealed the Record of Decision for the 1997 Revised Forest Plan. On October 12, 1999, Deputy Chief James R. Furnish, the reviewing Officer for the Chief of the Forest Service, issued his decision (hereafter referred to as the 1999 Appeal Decision) on three of the appeals. His decision affirmed the Regional Forester's June 24, 1997 decision in part, with instruction for further actions concerning the issues of species viability and diversity, and mining.

In November 1999, a lawsuit was filed against the Forest Service on the implementation of the Veteran Salvage Timber Sale in the Forbes Gulch area of the Beaver Park Roadless Area, within the Black Hills National Forest, challenging certain deficiencies identified in the 1999 Appeal Decision. Settlement negotiations began in November 1999 and were finalized in September 2000.

In order to address the deficiencies identified in the 1999 Appeal Decision, the Forest will amend the 1997 Revised Forest Plan in two phases. The Phase I Amendment, which was signed on May

18, 2001, amends the Forest Plan for the short term (two to five years) until the Phase II process is complete. This amendment revised some of the management objectives, standards, and guidelines in the Forest Plan. The Phase II process will re-evaluate the sufficiency of the 1997 Revised Forest Plan in relation to species viability and diversity. A Decision Notice for the Canyon and Nest Project Areas was signed 9-30-99 and legal notice 10-15-99. This Decision was withdrawn on January 12, 2000 due to questions concerning the sufficiency of documentation in the project record.

This 2002 Canyon/Nest EA documents the original analysis for the Canyon and Nest Project Areas, and the changes to that analysis resulting from the 1999 Appeal Decision, and Phase I Amendment.

Previously a decision was made on June 10, 2002 to implement Alternative B for this Project Area. Two parties appealed this decision to the Regional Forester. After reviewing the Canyon/Nest project record, the appeal deciding officer remanded the decision on September 12, 2002. The Forest Supervisor was instructed to revise and improve the soil and water analysis including a better description of the affected environment, more discussion on BMP effectiveness and better justification to support the conclusions reached.

A new Soils and Hydrology report was completed for this project. This report is appended (Appendix A) to this Decision Notice. It includes a revised discussion of South Dakota BMPs and their effectiveness. Also, the cumulative watershed effects analysis has been recalculated with additional clarification and interpretation of the results. After completing the revised analysis, additional design features were identified to help reduce or eliminate known sources of sedimentation.

This new Soils and Hydrology report amends portions of the Canyon/Nest Environmental assessment. The Affected Environment /Environmental Consequences discussion regarding Soils and Water is replaced by the discussion included in the appended report (Appendix A). I have considered this new information in making my decision.

Purpose and Need

The purpose and need for action in the Canyon/Nest project area is derived from a comparison of existing conditions to the desired future conditions as defined by Goals and Objectives in the Revised Forest Plan. In the Canyon/Nest project area, opportunities to move the area toward desired conditions defined in Goals 1, 2, 3 and 4. Collectively these opportunities comprise the purpose and need.

Specifically, the purpose and need for the Canyon/Nest project is described in section 1.3 of the EA and includes; thinning of overstocked stands to reduce risk of fire or insect infestations, restoring meadows and aspen communities and increasing grass forb structural stages to provide diversity, removing commercial timber in a sustainable manner for commodity use and implementing needed transportation system.

Decision

I have decided to implement Alternative B, as described in Chapter II of the EA (section 2.4.4.2), and incorporating the design features found in the revised hydrology report (Appendix A, attached).

Those design features include repairs to FSR 117 and improvements to stream crossings on Forest System Roads, as well as, measures to provide for long term soil productivity, discussed on page 11 and Tables 6a and 6b of the revised hydrology report. This decision includes the implementation of mitigation measures and management requirements related to the project.

My decision to implement Alternative B is based on information contained in the administrative record, including, but not limited to the EA, the mitigation measures and management requirements described in Chapter II of the EA, and the effects analysis described in Chapter III of the EA (section 3.1 to 3.13) and the revised Hydrology report. Alternative B will harvest approximately 10.4 million board feet of timber over 5,390 acres, retain snags and down wood, treat logging slash, convert 9.3 miles of unclassified roads to Forest System Roads, convert 8.7 miles of unclassified roads to Forest System Roads and close year-round, construct 5.2 miles of new Forest System Road and close year-round, decommission 23.6 miles of unclassified roads, and construct 3.0 miles of temporary roads which would be decommissioned following use.

Pursuant to 36 CFR 219.10(f), this decision results in a site-specific amendment to the 1997 Revised Black Hills National Forest Plan, as amended, for the Nest portion of the project area that is within Management Area 5.1. I have determined that this is a non-significant amendment of the Black Hills National Forest Plan, as amended, because of the site-specific nature of this decision and the limited environmental consequences associated with the reduction of elk winter habitat effectiveness. The amendment would reduce the elk winter Habitat Effectiveness value from the existing 34 percent to 20 percent for the Nest portion of the project area only, and for this project only.

Rationale

In determining which alternative best responds to the purpose and need for action, I first considered whether the proposed activities (timber harvest, travel management adjustments, and prescribed burning) would facilitate achieving the stated objectives defined in the Purpose and Need for the Action. The Forest Plan designated this entire area as a place where wood products, water yield, forage production and other commercial products would be emphasized, while providing for visual diversity, diversity of wildlife and a variety of other goods and services. In addition, numerous open roads should be available for public and administrative access, while closed roads would provide for non-motorized recreation opportunities. Suitable lands in this management area are available for timber harvest and contribute to the allowable sale quantity.

Site specific analysis determined that 1) the area is suitable for timber harvest, 2) many sites are suitable for prescribed burning, and 3) conditions in the area can be improved toward desired future conditions as defined in the Revised Forest Plan, as amended.

Therefore, I feel that timber harvest, prescribed burning and travel management adjustments are appropriate in this area.

Secondly, I considered which of the action alternatives would best meet the Purpose and Need. The differences between these two alternatives is mainly the level of timber harvest with supporting activities such as road work and fuels treatment. Alternative C meets all direction in the Revised Forest Plan, as amended. Alternative B, however, does not meet standard 5.1-3201 regarding elk winter habitat effectiveness (HE) in the Nest area and would require a project specific amendment to reduce elk HE winter values from .34 to .22 to implement. I reviewed information in the project

file to weigh the benefits and costs of proceeding with Alternative B and implementing the Forest Plan amendment. I find that this amendment would not be significant due, in part, to the degree of change from the existing condition of 0.228 to an expected value of 0.221 (less than ½ of 1 percent). In addition, the Nest area is not considered elk winter range due to the relatively high elevation and normally deep snow conditions in normal years. This review of significance can be found in the project file. Therefore, I feel that this site-specific amendment is appropriate in this area, at this time.

I find that the travel management proposals, which includes road construction, reconstruction, conversion of non-system roads to system roads, decommissioning roads, and area closures will provide for adequate administrative and public access. Overall open road density is reduced in either action alternative which will reduce impacts on big game and provide some areas of non-motorized recreation opportunity. Since area closures are included in both action alternatives, the differences are based on access needed for the proposed harvest.

A total of 18 miles of non-system roads will be converted to system roads with 10.1 miles remaining open and 7.9 being closed. These unclassified roads have been utilized as though they were system roads for many years for both administrative and public access. Though I support reducing overall road miles on the Forest, I feel that roads determined to be necessary for access should be converted to system roads to insure proper maintenance occurs, thereby reducing potential sedimentation or other potential impacts.

I'd like to address the proposed area closures specifically. These closures will restrict wheeled traffic to open roads only. Because all existing National Forest System roads currently open will remain open, with the exception of 117.5D, I feel that the benefits these closures will provide is tempered with a minimal impact to users. Therefore, I support the area closures, as proposed.

I believe that Alternative B, in entirety, best responds to the purpose and need for action. Alternative B responds to all six objectives for the proposal. Alternative B allows for the implementation of timber harvest, while providing for the protection of wildlife species, and restores aspen communities, grass/forb areas, and meadows. It also implements the needed transportation system for the Canyon/Nest area.

DETAILS OF ALTERNATIVE B

Alternative B includes the following:

Canyon Area – Table 1

Vegetation Management / Harvest Prescriptions

About 2,660 acres would be managed through various harvest prescriptions to meet the objectives.

1. Thin Overstocked Stands through: Overstory Removal with Seed-Cut Shelterwood (85 acres), Seed-Cut Shelterwood (180 acres), Prep-Cut (155 acres), Overstory Removal with Prep-Cut (40 acres), Seed-Cut with Patch Clearcut (169 acres), and Pre-commercial Thinning (454 acres) prescriptions.

2. Restore and maintain Meadows through: Meadow Restoration (14 acres) and Pine Encroachment (50 acres) prescriptions.
3. Increase Grass/Forb Structural Stage within Forested Stands through: Patch Clearcut (241 acres), Defer with Patch Clearcut (185 acres), and Overstory Removal with Patch Clearcut (36 acres) prescriptions.
4. Remove Commercial Timber through: all prescriptions mentioned in 1 and 3, except pre-commercial thinning, and overstory removal (1,051 acres), resulting in about 5.3 million board feet (MMBF) of commercial volume towards the ASQ.
5. As a result of these vegetation management activities, about 2,660 acres would require follow-up fuels treatments (lop and scatter, machine pile, and/or jackpot to broadcast burning) to keep fuel levels at or below Forest Plan Standards.

Table 1. Summary for Canyon Portion of the Project Area, Alternative B.

PROJECT AREA SUMMARY (Canyon Portion)		
Total Acres Treated – 2,660 acres	Area Closure – Entire Project Area (5,329 acres)	
Open Road Density – 2.2 miles/square mile	Total Existing Road Closing or Decommissioning – 21.1 miles	
Total Road Construction * – 19.3 miles	Total Road Reconstruction – 3.8 miles	
Projected Volume – 5.3 MMBF		
Harvest Methods (acres)		
Tractor – 1,641	Tractor/Cable - 232	Cable/Skyline – 333
Silvicultural Prescriptions (acres)		
Patch Clearcut – 241	Primarily Deferred with Patch Clearcut – 185	Overstory Removal – 1,051
Overstory Removal w/ Seed-Cut Shelterwood – 85	Seed-Cut Shelterwood – 180	Prep-Cut Shelterwood – 155
Overstory Removal w/ Patch Clearcut – 36	Overstory Removal w/ Prep-Cut Shelterwood – 40	Seed-Cut Shelterwood w/ Patch Clearcut – 169
Meadow Restoration – 14	Pine Encroachment – 50	Pre-commercial Thin – 454 **
Post-harvest Fuels Treatments (acres)		
Lop and Scatter (L&S) – 1,630	L&S with Machine Pile & Burn – 63	
Whole Tree Yard, L&S, Jackpot Burn to Broadcast Burn – 967		
Road Treatments (miles)		
Construct/Convert Unclassified Roads to National Forest System Roads (FSR) – 7.9		
Construct/Convert Unclassified Roads to FSR and Close Year-round – 5.7		
New Construction of FSR and Close Year-round – 4.4		
Decommission Unclassified Roads – 15.4		
Construct Temporary Roads and Decommission Following Activities – 1.3		

* – Total Road Construction includes: 1) conversion of unclassified roads to FSR (13.6 miles), 2) construction of FSR roads (4.4 miles), and 3) Construction of Temp Roads (1.31 miles)

Note – The acres of Pre-commercial Thin (PCT) shown here are for sites where PCT is the only vegetative treatment. It does not include the acres of stands with an Overstory Removal (OR) (or combination of OR with another prescription) that are to be thinned post-sale. All OR treatments would receive a post-sale PCT treatment. This would amount to an additional 1,217 acres of PCT.

Transportation System / Access Management

1. Establish an area closure within the project area – all roads and off-roads would be closed to all public motorized wheeled vehicles unless posted open for public use (i.e. snowmobile and administrative use would not be prohibited).
2. Maintain all existing National Forest System roads (FSR), about 10.9 miles, as open to all wheeled vehicles.
3. Construct/Convert about 7.9 miles of existing unclassified road to FSR and maintain their open status to the public.
4. Construct/Convert about 5.7 miles of existing unclassified road to FSR and close them to public wheeled vehicle use.
5. Construct about 4.4 miles of FSR and close them to public wheeled vehicle use.
6. Construct about 1.3 miles of Temporary road and decommission following proposed activities.
7. Decommission about 15.4 miles of unclassified roads.
8. Reconstruct about 3.8 miles of existing road (FSR) for use to implement the proposed vegetation treatments.

Nest Area – Table 2

Vegetation Management / Harvest Prescriptions

About 2,730 acres would be managed through various harvest prescriptions to meet the objectives.

1. Thin Overstocked Stands through: Overstory Removal with Seed-Cut Shelterwood (100 acres), Seed-Cut Shelterwood (23 acres), Prep-Cut (383 acres), Pre-commercial Thin (3 acres), and POL thinning (8 acres) prescriptions.
2. Restore and maintain Meadows through: Pine Encroachment (341 acres) prescription.
3. Restore Aspen Communities through: Aspen Regeneration (31 acres), Pine & Spruce Removal with Aspen Regeneration (338 acres), and Pine & Spruce Removal (120 acres) prescriptions.
4. Increase Grass/Forb Structural Stage within Forested Stands through: Patch Clearcut (891 acres), Aspen Regeneration, and Pine & Spruce Removal with Aspen Regeneration prescriptions.
5. Remove Commercial Timber through: all prescriptions mentioned in 1 and 3, Overstory Removal (89 acres), Pine and Spruce Removal, and Individual Tree Selection (403 acres), resulting in about 5.1 MMBF of commercial volume counting towards the ASQ.
6. As a result of these vegetation management activities, about 2,360 acres would require follow-up fuels treatments to keep fuel levels at or below Forest Plan Standards.

Transportation System / Access Management

1. Establish an area closure within the project area – all roads and off-roads would be closed to all public motorized wheeled vehicles unless posted open for public use (i.e. snowmobile and administrative use would not be prohibited).
2. Maintain all existing National Forest System roads (FSR), about 21 miles, as open to all wheeled vehicles, with the exception of FSR 117.5D, which would be closed following activities.
3. Construct/Convert about 0.8 miles of existing unclassified road to FSR and maintain their open status to the public.
4. Construct/Convert about 2.2 miles of existing unclassified road to FSR and close them to public wheeled vehicle use.
5. Construct about 0.8 miles of FSR and close them to public wheeled vehicle use.
6. Construct about 1.7 miles of Temporary road and decommission following proposed activities.
7. Decommission about 8.2 miles of unclassified roads.
8. Reconstruct about 13.5 miles of existing road (FSR) for use to implement the proposed vegetation treatments.
9. Move about 0.6 miles of existing road off of private land onto National Forest System Lands.

Table 2. Summary for Nest Portion of the Project Area, Alternative B.

PROJECT AREA SUMMARY (Nest Portion)		
Total Acres Treated – 2,730 acres		Area Closure – Entire Project Area (6,120 acres – excludes 770 acres private)
Open Road Density – 2.1 miles/square mile (FSR only); 2.4 mi/mi ² w/ Private		Total Existing Road Closing or Decommissioning – 10.4 miles
Total Road Construction * – 7.5 miles		Total Road Reconstruction – 13.5 miles
Projected Volume – 5.1 MMBF		
Harvest Methods (acres)		
Tractor – 2,727		
Silvicultural Prescriptions (acres)		
Patch Clearcut – 891	Individual Tree Select – 403	Overstory Removal – 89
Overstory Removal w/ Seed-Cut Shelterwood – 100	Seed-Cut Shelterwood – 23	Prep-Cut Shelterwood – 383
Aspen Regeneration – 31	Pine & Spruce Removal – 120	Pine & Spruce Removal w/ Aspen Regeneration – 338
Pine Encroachment – 341	POL – 8	Pre-commercial Thin – 3
Post-harvest Fuels Treatments (acres)		
Lop and Scatter (L&S) – 603		L&S with Machine Pile & Burn – 461
Whole Tree Yard, L&S, Jackpot Burn to Broadcast Burn – 1,296		
Road Treatments (miles)		
Construct/Convert Unclassified Roads to National Forest System Roads (FSR) – 2.2		
Construct/Convert Unclassified Roads to FSR and Close Year-round – 2.2		
New Construction of FSR and Close Year-round – 0.8		

Construct/Relocate FSR off of Private Land – 0.6
Decommission Unclassified Roads – 8.2
Construct Temporary Roads and Decommission Following Activities – 1.7

* - Total Road Construction includes: 1) conversion of unclassified roads to FSR (4.4 miles), 2) construction of FSR roads (0.8 miles), 3) Construction of Temp Roads (1.7 miles), and Moving FSR off of Private Land (0.6 miles).

Monitoring

BMP Implementation and Effectiveness: The District Sale Administrator and/or Hydrologist will monitor implementation of BMPs and post treatment effectiveness of BMPs for the project area.

Vegetative Diversity and Structure: The District Database manager and silviculturist will update post-treatment cover type and structural stage in the RIS database.

Commodity Production – Regeneration: The District will conduct regeneration surveys on all sites treated with a regeneration harvest. *Plot surveys or walk throughs may be utilized.*

Noxious Weeds: The District Range Tech will monitor pre and post-treatment acres of noxious weed infestations. *Newly disturbed areas will be targeted for monitoring.*

Fire – Fuel Loading Hazard and Fire - Fuel Treatment: The District Fuels tech and Database manager will enter all fuel treatment activities associated with this project in the RIS database.

Prescribed Burn Objectives: The District Wildlife Biologist or Fuels Management Officer will monitor the effectiveness of prescribed burning in Alternative B to see if objectives are met. Browse and forage condition the following growing season will be compared to existing condition.

Snag Creation: The District Wildlife Biologist will monitor the effectiveness of snag creation occurring post-harvest.

Visual: The Landscape Architect will monitor effectiveness of mitigation measures designed to reduce visual impacts of cable harvesting.

Range Water Systems: The District Range Conservationist will monitor the effectiveness of proposed water systems in Crows Nest Upper Beaver and Castle Creek allotments on livestock distribution and utilization.

Goshawks and Marten: The District Wildlife Biologist or a Biological Technician will continue to monitor the goshawk use in the known nest stands in Canyon and will continue to monitor marten use in Nest.

Aspen Regeneration: The District Wildlife Biologist, Silviculturist, Biological Technician, or Range Conservationist will monitor the effectiveness of the aspen regeneration and determine if other protection of the regenerating aspen is necessary.

Other Alternatives Considered

The Black Hills National Forest 1997 Revised Land and Resource Management Plan (Forest Plan), as amended, is the principle policies under which this action was developed. An analysis of the proposal was conducted in accordance with the National Environmental Policy Act (NEPA) and the implementing regulations of 40 CFR 1508. The purpose and need for the proposed action is described in detail in Chapter 1 of the EA (pages 1-2 to 1-4).

The "Alternatives Considered" section of the EA includes a description of the other alternatives considered in detail. The following briefly summarizes those alternatives and discloses why they were not selected.

Alternative A: Under this alternative, the no-action alternative, no timber harvest or restoration activities would occur. No restoration treatments to existing stands would occur. No road decommissioning would occur. No wood fiber would be provided to local mills. No other watershed restoration activities, such as road maintenance, snag creation, and fuels treatment would occur.

This alternative was not selected because it would not meet the purpose of and need for action, nor would it respond to issues raised during scoping. No wood products would be provided to the local communities; no aspen clones, meadows, or grass/forb areas would be restored; no pre-commercial thinning would occur, and no road decommissioning would occur. Unclassified roads would be maintained as they currently are and the short sections of FSR 110 and FSR 117 adjacent to Castle Creek would continue contributing sediment and gravel directly into these streams. Other streams crossings on roads would also continue to impact water quality. The risk for fire would remain, as all stands would remain untreated at this time.

Alternative C: This alternative was developed to meet the project objectives stated in Chapter 1, and reduce expected impacts on several Sensitive and MIS species. This alternative would: expand the width of the forested connectivity corridor for marten; decrease changes to golden-crowned kinglet and brown creeper habitat; and would improve conditions for the Elk Winter HE value by maintaining more cover. The silvicultural activities proposed for Alternative C did not vary from those proposed for Alternative B. Specific activities proposed for this alternative are listed in the EA in Section 2.4.4.3.

This alternative was not chosen because it did not meet the purpose and need for action as thoroughly as Alternative B. It would treat fewer acres than Alternative B, thus increasing the number of acres that would be susceptible to mountain pine beetle and stand replacing fire. It would also result in less timber volume and a lower percentage of grass/forb structural stage within forested areas being produced, and would construct fewer new roads (FSR and temporary), which would not fully meet the transportation needs for the area.

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED STUDY

In addition to internal comments, public comments received in response to the 1998 Proposed Action and EA provided suggestions for alternative methods for achieving all or portions of the purpose and need. Some of these alternatives may have been outside the scope of the project intent, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Use of Prescribed Fire Only

An alternative was proposed that would use only prescribed fire as a management activity. This alternative was considered, but eliminated because many of the forest stands in the project area that need thinning are overly dense, and conducting a prescribed fire without pre-treatment by thinning and fuels reduction would result in unacceptable tree mortality; among the mid-aged size class of trees. The risk of escapement would be high using prescribed fire only. For these reasons, this alternative was eliminated from detailed study.

Non-commercial Thinning Only

An alternative was proposed that would use only non-commercial harvest (trees less than 8 in. diameter) to accomplish management objectives. By removing only non-commercial trees, the remaining vegetative structure in the forest stands would still be susceptible to the hazard of a canopy wildfire, mountain pine beetle attacks, and health and vigor would not be attained. Non-commercial thinning alone would not meet the purpose of and need for action. A non-commercial thinning alternative would not generate economic outputs, which would also not meet the purpose and need for action. For these reasons, this alternative was eliminated from detailed study.

No New or Temporary Road Construction

An alternative was proposed that would not use any new road construction or temporary road construction. The project area has many existing roads (FSR and Unclassified). However, these would not provide adequate access to many stands in need of treatment in both Canyon and Nest portions of the project area. Without the new and temporary roads, these forested areas would be maintained out of desired conditions for many decades and would continue to present a higher risk for a stand replacing fire event. For these reasons, this alternative was eliminated from detailed study.

No Road Closures (Existing, New, or Temp)

An alternative was proposed that would have similar vegetation management prescriptions as the Proposed Action, but would leave all existing and newly created roads open to the public. The existing open road density is 4.1 miles per section in Canyon and 3.3 miles per section in Nest. With the addition of new roads, these levels would increase to 4.8 miles per section in Canyon and 3.5 miles per section in Nest. This would result in impacts to resources that would violate many Forest Plan Standards. In addition, FSH 7700 directs us to complete a roads analysis in planning areas. This was completed in March 2002 for the Canyon/Nest Project Area. As a result of this Roads Analysis, all unclassified roads identified, need to be converted into FSR, trails, or decommissioned. For these reasons, this alternative was eliminated from detailed study.

Uneven-aged Treatments in Ponderosa Pine

The IDT considered and dropped from detailed analysis an alternative that would have managed the ponderosa pine as well as the white spruce components of the project area primarily through uneven-aged treatment. The Forest Plan EIS (FEIS 11-20) considered such an alternative. That analysis determined that uneven-aged management was generally not the appropriate treatment method for the Forest. This finding is included as Guideline 2408(e) "The preferred silvicultural system used for treating ponderosa pine on suitable lands will be shelterwood. Other systems may be used to meet specific resource objectives". Ponderosa pine is best managed under a shelterwood system. Uneven-aged cutting methods could lead to lowering of tree productivity. In addition, such treatments are less economical. The Forest Plan eliminated the alternative from further analysis. For the project area, all opportunities identified could be met with the shelterwood system in *pure* ponderosa pine stands. The consideration of this alternative was generated internally, there was no public input requesting such an alternative. The action alternatives considered in detail include uneven-aged management for white spruce and pine/spruce mixed stands.

Public Participation

Internal and external scoping was conducted as part of the analysis process. Public involvement was extensive throughout the planning and analysis process leading to this document. The NFMA planning for this project was initiated in the fall of 1998 with the original project planning effort. A scoping package describing the vegetation in the project area was mailed to 149 individuals and/or groups in November 1998. In response, eleven written comments were received (Planning Record, Volume 1, Scoping).

In addition to public announcements in the *Rapid City Journal* (July 30, 1999), a pre-decisional (DRAFT) EA was distributed to 56 individuals and/or groups for a 30-day public review and comment period in July 1999. Another 53 letters were sent to individuals and/or groups announcing that the EA was available for review. Six letters were received commenting on the EA.

In addition to public announcements in the *Rapid City Journal* (October 15, 1999), a Decision Notice (DN), Finding of No Significant Impacts (FONSI), and Final EA were distributed to 33

individuals and/or groups in October of 1999. However, in January of 2000 the Forest Supervisor withdrew that decision due to questions about the sufficiency of documentation in the project record, with intentions of re-issuing a decision after further Forest review.

Using comments received from the original planning effort and new direction from the Forest Plan, the 2002 Draft EA was prepared and distributed to about 60 individuals and/or groups for a 30-day public review and comment period; another 80 letters were sent to individuals and/or groups announcing its availability. Eleven letters were received during the public comment period; responses to substantive comments are documented in Appendix C of the Final Environmental Assessment.

Public announcements were published in the *Rapid City Journal* (June 14, 2002), a Decision Notice (DN), Finding of No Significant Impacts (FONSI), and Final EA were distributed to 11 individuals and/or groups in June of 2002. The appeal period concluded on July 29, 2002.

Consistency With The Land and Resource Management Plan

The Phase I Forest Plan Amendment added new standards, elevated some guidelines to standards, and modified others. Resource specialists assigned to the IDT have reviewed their analysis for the Canyon/Nest EA to ensure consistency with the Phase I Amendment. A Biological Evaluation was completed for the Phase I EA. The Phase I EA discusses goshawks on pages 16-20, woodpeckers on pages 22-25 and snails on pages 36-38. The IDT review is documented and included in the project record.

Regulations at 36 CFR 219.10(e) require me to ensure that permits, contracts, cooperative agreements and other activities carried out on the Black Hills National Forest are consistent with the Revised Forest Plan and Phase I Amendment. My decisions are consistent with the Revised Forest Plan in that:

- Planned activities are consistent with management area emphasis.
- Planned activities will contribute to Revised Forest Plan goals. The planned activities will not detract from or jeopardize any Revised Forest Plan goals.
- Planned activities meet resource protection and other requirements of 36 CFR 219.16 and 219.27.

I have determined an amendment to the Revised Forest Plan direction for Management Area 5.1 (Forest Plan pages 3-65 through 3-69) is needed and appropriate. This amendment applies only to the Nest portion of the Canyon/Nest project area lying within Management Area 5.1, and only to this project. This amendment is Amendment #2 to the Revised Forest Plan.

The reason for this amendment is as follows. As a result of implementing this project the Habitat Effectiveness (HE) value for elk winter range in the Nest portion of the project area would be reduced from the existing HE value of 0.228 to an expected value of 0.221. Because the existing value is below the minimum HE value of 0.34, it would conflict with Standard 5.1-3201, which limits activity effects to deer and elk habitat effectiveness values. This amendment would allow this deviation in elk winter Habitat Effectiveness value in this portion of the Canyon/Nest project area, for this project only, as described in this EA.

I have determined that Revised Forest Plan Amendment #2 is not significant in terms of the National Forest Management Act and its associated implementing regulations at 36 CFR 219.10(f). In accordance with Forest Service policy at FSH 1909.12, Section 5, I have determined that the actions allowed by this amendment will take place within the next few years, and that the affected area is limited to the Nest portion of the Canyon/Nest project area within Management Area 5.1, which is a small percentage of the Black Hills National Forest (about ½ of one percent). Further, I have determined that there is no effect on the long-term relationship of goods and services projected by the Forest Plan; that this change is only for a specific situation; and that this amendment does not alter the desired future condition of the land. (Documentation of National Forest Management Act significance review is contained in the project file.)

The public was notified at the notice and comment period of the need to amend the Revised Forest Plan as part of any decision to implement Alternative B, as well as the substance of this amendment.

Finding of No Significant Impact (FONSI)

The context of the project is local. Local issues have been identified through the scoping process and considered in alternative development and analysis. Effects are limited to the vicinity of the planned activities. Forest-wide issues and effects were addressed in the Revised Black Hills National Forest Land and Resource Management Plan, as amended, and accompanying FEIS. No effects from this decision are predicted to be different from those discussed in the FEIS.

Based on the documentation in the Canyon/Nest Project EA and Analysis File, I have determined the following with regard to the intensity of this project:

1. The Environmental Assessment provides sufficient information to determine that this project will not have a significant impact (either adverse or beneficial) on the land and its natural resources, air quality, or water quality (EA section 3.1 to 3.13, DN Appendix A).
2. Considering the remoteness of the project in relation to local and regional population centers, the mitigation measures and project design features associated with the proposal (EA section 2.4.2), the effects disclosure in the EA (EA section 3.1 to 3.13), the information contained in the Analysis File, and the response to public comments, the likelihood of the project affecting the public's health and safety is low.
3. The supporting documentation located in the EA and in the Analysis File section of the Canyon/Nest Project EA provides sufficient information to determine that this project will not negatively affect any known unique characteristics of the geographic area such as park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas (EA section 3.13).
4. The degree of controversy with regard to effects on the quality of the human environment are limited and considered not significant. I find that this degree of controversy does not satisfy the threshold for the preparation of an Environmental Impact Statement (EIS).
5. The proposed timber harvest and restoration activities have occurred previously on the Black Hills National Forest. No impacts to the human environment that are highly uncertain

or involve unique or unknown risks have been identified in this analysis (EA section 3.1 to 3.13).

6. The proposed timber harvest and restoration activities are well-established practices and do not establish a precedent for future actions.
7. I have reviewed the impacts of those past, present, and reasonably foreseeable actions described in the Environmental Effects Section of the Canyon/Nest Project EA (EA section 3.1 to 3.13) and find that this action will not have a significant cumulative impact on the environment.
8. The Cultural Resources Report contained in the Analysis File section of the Canyon/Nest Project EA and the associated disclosure in the EA (EA section 3.10) discloses that two archaeological sites in Canyon and three sites in Nest were found. These sites will be buffered and protected from management activity. No direct, indirect, or cumulative effects to cultural resources are anticipated. Management requirements included with Alternative B (EA section 2.4.2.1) are intended to prevent the loss or destruction of unknown cultural resources. The State Historic Preservation Officer's (SHPO) from South Dakota and Wyoming both agreed with a no effect determination for this project on 09/30/1999 and 01/28/02 respectively.
9. Based on the information disclosed in the Canyon/Nest Project EA (EA section 3.1 to 3.13), and the wildlife and fisheries biological evaluations, I have determined that this action will not jeopardize any species listed or proposed for listing under the Endangered Species Act. For wildlife species, I base this on the "No Effect" determination for listed wildlife species by the wildlife biologist. For fish species, I base this on the "No Effect" determination by the fisheries biologist.
10. Laws imposed for the protection of the environment provided the framework for the 1997 Revised National Forest Land and Resource Management Plan, as amended. From the documentation provided in the Canyon/Nest Project EA and Analysis File, I find that the timber harvest and restoration activities do not threaten a violation of Federal, State, or local law imposed for the protection of the environment.
11. The Context of the project is local. Local issues have been identified through the scoping process and considered in alternative development and analysis. Effects are limited to the vicinity of the planned activities. Forest-wide issues and effects were addressed in the Revised Black Hills National Forest Land and Resource Management Plan, as amended, and accompanying FEIS. No effects from this decision are predicted to be different from those discussed in the FEIS.

From the preceding, I find that the Canyon/Nest Project does not constitute a major Federal action that would significantly affect the quality of the human environment. Therefore, an Environmental Impact Statement is not necessary.

Findings Required by Laws and Regulations

1) NFMA

The NFMA, at 16 U.S.C. 1604(m)(2), allows exceptions to the general prohibition on harvesting trees prior to the culmination of mean annual increment for a given timber stand. This decision will create exceptions consistent with the law at part (m)(2) with the following treatments: meadow restoration, pine encroachment, POL thinning, and commercial thinning. These treatments are more fully described in the Canyon/Nest Environmental Assessment in Section 2.4.1. The public was advised of these exceptions to the law in the draft EA Section 3.3.3.2.

In accordance with the National Forest Management Act (NFMA) and other applicable laws, I also find that all actions meet NFMA requirements detailed in 36 CFR 219.27, including those for:

Resource Protection: Specific silvicultural requirements of Alternative B will not result in the degradation of habitat for Threatened, Endangered, and Sensitive species, particularly the bald eagle (EA section 3.4.4.4). Mitigation measure and management requirements will aid in the protection of water and cultural resources (EA section 2.4.2). Harvest and fuels prescriptions are designed to minimize hazards from wildfire.

Vegetative Manipulation: All vegetation manipulation in the project area will comply with the requirements of 36 CFR 219.27(b). Specifically, this project utilizes silvicultural prescriptions that are best suited to timber stands that occur on the landscape.

Silvicultural Practices: Alternative B allows for the use of various silvicultural techniques to improve forest conditions in the project area. No timber will be sold from lands not suitable for timber production (see 36 CFR 219.14 for definition).

Even-aged Management: This project involves using regeneration harvest methods (shelterwood seed cuts) on approximately 203 acres located within the project area. No other even-aged management prescriptions are proposed.

Riparian Areas: Riparian buffers would occur along streams within the project area. This would result in minimal impact to riparian areas.

Soil and Water: Mitigation measures and project design features detailed in Appendix A of this Decision Notice document that the soil and water resources would be adequately protected during harvest and restoration activities.

Diversity: Animal and plant diversity will not be adversely affected by this project as documented in the EA (section 3.1 to 3.13). Leaving snags, coarse woody debris, and unburned piles will also enhance stand diversity throughout the project area.

2) Endangered Species Act

This project complies with Section 7 of the Endangered Species Act. The project wildlife biologist found that this project would have no effect on federally listed wildlife or plant species. The fisheries biologist found that there would be no effect to any listed fish species.

Therefore, this project will not jeopardize any proposed or listed threatened or endangered species or their habitat.

3) Clean Water+Air+National Historic Preservation Act

This project complies with the Clean Air Act, Clean Water Act, and the National Historic Preservation Act. The project is consistent with the goals and objectives of the Black Hills National Forest Revised Land and Resource Management Plan, as amended, and will help achieve the desired future condition of the Black Hills National Forest.

4) Executive Orders 11988 and 11990

Floodplains have been identified in the Nest Project Area, but none in Canyon (EA section 3.1.1.2).

Castle Creek, which has been identified as having a 100 year floodplain, has been designated as a "Protected Streamcourse". No project activities will occur in this floodplain. Therefore, there will be no increased flood hazard due to the selected alternative.

Riparian areas occur in Bear Canyon, Wet Parmlee Canyon, Castle Creek and around springs. The springs are fenced to protect them from grazing will be protected by a buffer. No heavy equipment will be used in any wetland. The selected alternative will have no adverse impacts to wetlands.

Implementation of Decision

In accordance with Forest Service Regulations, 36 CFR 215.5, notice of the opportunity to comment on the Canyon/Nest Project EA was published in the Rapid City Journal on April 30, 2002. The Environmental Assessment was mailed to those who requested notice and to those who were involved in the scoping process. Ten expressions of interest were received during the 30-day comment period, which closed on May 30, 2002. This project was appealed and remanded to the Responsible Official with instruction for remedy. That remedy has been completed and is appended to this decision. This document constitutes a new decision for this project and will trigger a new administrative appeal period.

This project may be implemented no sooner than five business days from the close of the appeal filing period if no appeal is filed. If an appeal is filed, implementation may not occur for fifteen (15) days following the date of the appeal disposition (36 CFR 215.10). For additional information concerning the Forest Service appeal process, contact Ed Fischer at the Black Hills National Forest Supervisor's Office, RR2 Box 200, Custer, SD 57730, or phone (605) 673-2251.

Administrative Review

In accordance with 36 CFR 215.7(a), this decision is subject to appeal. Any Notice of Appeal of this decision must be submitted in accordance with 36 CFR 215.13 and must meet the content requirements of 36 CFR 215.14. Appeals must be submitted to:
USDA Forest Service, Region 2
Regional Forester, Appeal Deciding Officer

P.O. Box 25127
Lakewood, CO 80225-25127

Appeals must be received within 45 days of the date this decision is published in the Rapid City Journal.

Contact Person: For further information, contact Kelly Honors at the Hell Canyon District Office, 330 Mount Rushmore Road, Custer, SD 57730, (605) 673-4853.

WILLIAM SCHLEINING
Acting Forest Supervisor

Date Signed

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Appendix A:

Canyon/Nest

Soils and Hydrology Report

Black Hills National Forest
Canyon/Nest Environmental Assessment
Soils and Hydrology Report

Prepared by:

M. Parenti & Associates, Inc.

Berkeley, CA

Michael Parenti

Introduction

This report describes the results of the analysis of the effects of implementation of the Canyon/Nest Project on soil and water resources. This report focuses on the environmental assessment of the Alternatives and proposed Best Management Practices (BMP's) to protect hillslope and aquatic resources. Appendices are attached which include a listing of the BMP's (Appendix A) that would apply to the project and the Watershed Cumulative Effects Assessment (Appendix B).

Direction

The Regional Office of the United States Forest Service Rocky Mountain Region developed the Watershed Conservation Practices Handbook (FSH 2509.25) which provides the legal background for soil and water conservation measures, as well as providing standards, design criteria, and monitoring requirements for project implementation. The Black Hills National Forest Land and Resource Management Plan (LMRP) provides Goals and Objectives regarding riparian, stream and overall watershed health. The Regional Watershed Conservation Practices Handbook (WCPH) standards are included in the LMRP as standards, and the entire handbook is incorporated by reference.

Soils and Watershed Concerns

Erosion from road surfaces and vegetation management areas could increase peak flows and sediment delivery to stream channels and as a result water quality, stream channel stability downstream aquatic resource habitat and beneficial uses of water could be adversely impacted.

Description of the Alternatives as they Relate to the Soil and Water Resource

Alternative A (No Action)

Implementation of the No Action Alternative will maintain the existing condition of the water resource, riparian environment, and stream channels. An opportunity will be foregone to reduce stand densities that would reduce the fire hazard and potential for large fires and to close and or rehabilitate roads.

Alternatives B and C

Implementation of the Alternative B or C could increase on-site erosion and sediment delivery to stream channels, resulting in increased fluvial erosion and adversely effect water quality, stream channel stability, downstream aquatic resource habitat and beneficial uses of water. The processes and watershed conditions that could cause increased fluvial erosion are reduction of canopy cover, ground disturbance, and loss of ground cover. Increased fluvial erosion could result in increases in the percentage of fine material in stream channels. Nutrient laden ash produced by prescribed burning would enter adjacent streams and temporarily change water quality conditions.

Watershed Mitigation for Alternatives B and C

1. Water quality would be protected by implementing BMP's. BMP's are the primary method utilized by the Forest Service to prevent water quality degradation and to meet State Water Quality objectives relating to nonpoint sources of pollution. BMP's that relate directly to the Canyon/Nest Project are described in Appendix A.

2. Site specific mitigation measures that relate directly to these BMP's would be implemented to minimize on-site erosion and instream water quality and aquatic habitat impacts. Measures would also be designed and implemented to minimize adverse changes in other water quality parameters such as dissolved oxygen, water temperature, and turbidity.

Affected Environment

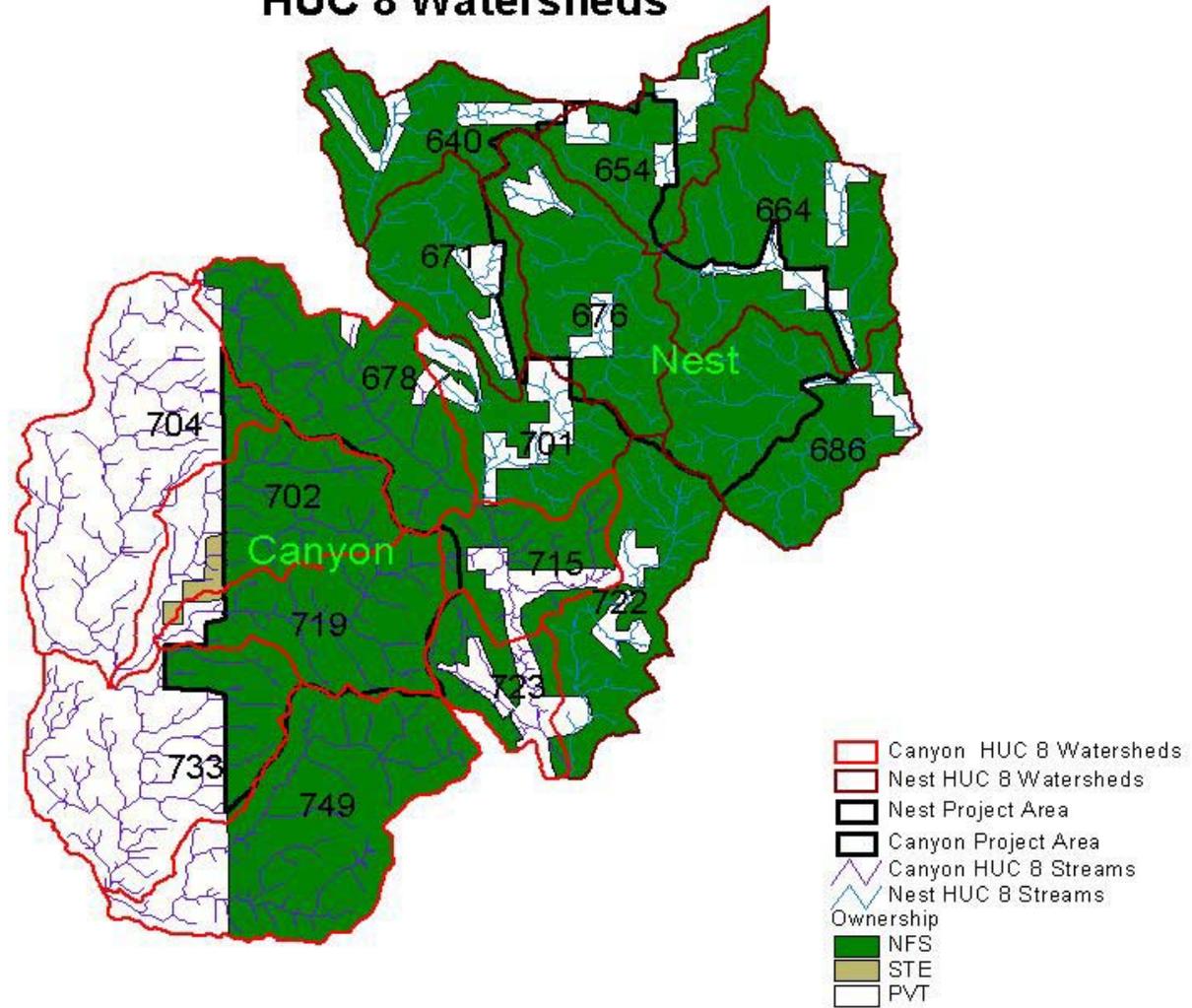
Analysis Watersheds

Hydrologic Unit Codes (HUC) consist of a nested series of two digit numbers that detail the watershed level. A watershed assigned a 12 digit HUC would be a 6th level watershed. The HUC numbers demonstrate the relative position of watersheds, so that a first level watershed contains the mainstem stream that drains into the ocean, as well as all its tributaries. A second level watershed contains the mainstem tributary to the first level, as well as all tributary streams to the second level stream. Project watersheds include both lands managed by the Forest and those privately owned or managed by other agencies (Table 1, Figure 1). This report analyses watersheds at the 8th level (Analysis Watersheds). Watersheds with a minor amount of land within project boundaries are not analyzed.

Table 1 – Analysis Watersheds

Watershed Name HUC 6	HUC 6 Number	Figure 1 HUC 8-ID	HUC 8 Number	HUC 8 Acres	Acres Within Project Area	FS Acres	Non FS Acres
Canyon							
Stockade Beaver	101201070401	678	1012010704010203	3,114	28	2937	177
Stockade Beaver	101201070401	702	1012010704010302	2,679	1,794	1798	880
Stockade Beaver	101201070401	704	1012010704010303	4,661	228	232	4,429
Stockade Beaver	101201070401	715	1012010704010202	1,637	88	1219	418
Stockade Beaver	101201070401	719	1012010704010301	2,429	2,205	2236	193
Redbird Canyon	101201070404	723	1012010704040102	1,207	10	725	482
Stockade Beaver	101201070401	733	1012010704010402	4,050	956	981	3,068
Stockade Beaver	101201070401	749	1012010704010401	4,223	19	3529	694
Nest							
Stockade Beaver	101201070401	640	1012010704010101	1,945	26	1522	423
Upper Castle Creek	101201100105	654	1012011001050101	2,113	1,060	1679	434
Upper Castle Creek	101201100105	664	1012011001050201	3,743	1,088	3212	531
Stockade Beaver	101201070401	671	1012010704010102	1,992	278	1666	326
Upper Castle Creek	101201100105	676	1012011001050102	2,700	2,666	2345	355
Upper Castle Creek	101201100105	686	1012011001050202	3,348	1,698	3136	212
Stockade Beaver	101201070401	701	1012010704010201	1,835	40	1165	670
Redbird Canyon	101201070404	722	1012010704040101	2,388	22	1992	396

**Figure 1
HUC 8 Watersheds**



Beneficial Uses

The Clean Water Act (PL92-500) mandates that states designate beneficial uses for each water body and determine water quality standards for each use type. The State has assigned all streams in South Dakota the beneficial uses designation of wildlife propagation and stock watering, and irrigation. Castle Creek has the additional beneficial uses of Coldwater permanent Fish Life propagation waters, and Limited-Contact recreation waters. Bjorland Draw has the additional beneficial uses of Coldwater marginal Fish Life propagation waters and Limited-contact Recreation Waters.

Current Watershed Condition

Field Review of Watershed Conditions

A field survey of the Canyon and Nest Project areas was conducted on November 26th and 27th, 2002. The field survey focused on:

- The condition of the current road system, and
- Stream channel conditions,

In general the current road system is in good condition although minor area of road rutting and road surface erosion were observed the sediment produced from these areas was not delivered to stream channels with the exception of about a 0.7 mile segment of FDR 117.1 in the Nest Project Area adjacent to an intermittent reach of Castle Creek. This segment starts at the intersection with FDR 110 and proceeds north to the Luhtasaari Ranch. The road crosses Castle Creek in three locations and the channel is eroding the road surface at each crossing. Sediment generated from erosion of the road surface can be delivered to the stream because the road is located in the stream channel or less than 10 feet from the channel. This segment of road should be improved to reduce sediment delivery to Castle Creek. One option is reconstruct the road with a new alignment that moves the road out of the stream channel. Another option is to harden the crossings with rock or a constructed concrete ford and prevent erosion of the road surface by applying gravel.

The major perennial streams within or adjacent to the Canyon and Nest Project Areas are Stockade Beaver Creek and Castle Creek. These streams are Rosgen C type channels - low gradient, meandering streams, in a wide valley. These streams are well vegetated and stable and excessive downcutting or lateral migration of the channel is not evident. Most of the ephemeral and intermittent streams in the Canyon and Nest Project Areas are well vegetated and stable.

Stream Density, Watershed Sensitivity, and Current Impact Index

A method for classifying the relative stream segment location in the channel network is stream order. First order streams are non-branching segments. The channel segment below the confluence of two first order segments is designated as a second order stream. A second order stream can only have first order tributaries, for when two second order streams join, the segment below their confluence is a third order stream.

Streams are also classified as to flow regime, so that a stream that flows only in response to precipitation events, or snowmelt runoff, is classified as an ephemeral stream. In the analysis watersheds order 1

through 3 streams are ephemeral. Intermittent streams do not flow throughout the year, but are fed by groundwater sources, such as springs or seeps and are annually scoured. In the analysis watersheds, orders 4 and 5 are often intermittent. Perennial streams run year round and often consist of stream orders 6 and 7 (Table 2, Figure 2).

Stream density is an indicator of how flashy a watershed will be in its response to a storm event. Stream densities in the analysis watersheds range from 3.5 mi/mi² to 4.7 mi/mi² (Table 3). Road density is an indicator of potential problems with sediment, compaction or other soils concerns. Road density in the analysis watersheds ranges from 2.3 mi/mi² to 5.8 mi/mi² (Table 3).

In analyzing watershed condition, the natural sensitivity of the watershed is determined. The Natural Watershed Sensitivity Index (NWSI) is the percentage of the watershed composed of physical components that make it sensitive to management activities (Table 3). This index is composed of the sum of stream buffered areas, soils with a high to very high erosion hazard rating (EHR), soils with a hydrologic soil group (HSG) rating of D, and slopes over 80%, divided by total watershed acreage.

The Natural Watershed Sensitivity Index (NWSI) and the Impact Index for the analysis watersheds was calculated using the methodology described in the Black Hills NF FEIS, Appendix J- Watershed Analysis. A key component of the methodologies described in Appendix J is the identification of lands on which management activities have occurred in close proximity to the drainage network which are considered “at-risk” unless field surveys indicate otherwise. Connected Disturbed Areas (CDAs) are most likely to be at risk. Connected disturbed areas are areas of bare or compacted ground adjoining the stream system, or with an inadequate buffer between them and the stream system, or connected to such an area. Examples include: roads running parallel to streams without an adequate buffer; road ditches which empty into a stream channels; skid trails which empty into road ditches which then empty into stream channels; and landings within buffer areas. Such areas add sediment into channels and increase the flashiness of the watershed response to storm events and may result in increased peak flows. Increases in peak flows could cause lateral migration or degradation of stream channels.

The methodology for the current Impact Index was modified in the following manner:

1. Grazing acres at-risk were calculated by assuming that 5% of the stream buffered acres were impacted by grazing.
2. Road acres at-risk were calculated by assuming that 10% of the roads in the analysis watersheds were roads running parallel to streams without an adequate buffer or with road ditches that drain into stream channels.

Table 2 Stream Order and Stream Buffer Acres

HUC 8-ID	1st Order (mi)	Buffered Acres	2nd Order (mi)	Buffered Acres	3rd Order (mi)	Buffered Acres	4th Order (mi)	Buffered Acres	5th Order (mi)	Buffered Acres	6th Order (mi)	Buffered Acres	Total Stream Length (mi)	Total Buffered Stream Acres
Canyon														
678	7.6	18.8	4.3	26.5	0.5	8.6	0.0	0.0	4.9	152.3	0.0	0.0	17.2	206.2
702	7.9	19.6	2.5	15.6	3.4	64.2	1.6	38.7	0.6	18.7	0.2	0.0	16.2	156.7
704	13.8	34.3	9.1	56.6	2.7	49.3	0.0	0.0	6.4	197.5	0.1	0.0	32.0	337.7
715	5.7	14.1	2.4	15.1	1.7	32.1	1.2	29.2	0.0	0.8	0.0	0.0	11.1	91.3
719	7.2	17.9	2.9	17.8	1.2	22.6	2.5	63.0	0.0	0.0	0.0	0.0	13.8	121.3
723	3.8	9.5	2.2	13.4	1.8	34.1	0.0	0.0	0.0	0.0	0.0	0.0	7.8	57.0
733	14.5	35.9	9.8	60.5	2.6	48.8	0.0	0.0	0.0	0.0	3.1	116.0	30.0	261.3
749	11.2	27.7	5.7	35.4	6.2	115.3	1.2	28.6	0.0	0.0	0.1	0.0	24.3	207.0
Nest														
640	5.1	12.6	4.3	27.0	0.8	15.8	1.5	36.3	0.0	0.0	0.0	0.0	11.8	91.7
654	5.5	13.8	3.6	22.6	2.1	39.4	1.4	34.0	0.0	0.1	0.0	0.0	12.7	109.8
664	9.1	22.6	6.8	42.0	3.1	57.6	0.0	0.0	3.3	103.5	0.0	0.0	22.3	225.7
671	5.4	13.5	2.7	17.0	3.7	68.8	0.2	3.9	0.0	0.0	0.0	0.0	12.0	103.2
676	6.9	17.1	4.8	29.9	3.9	72.4	0.3	6.9	0.0	0.0	0.0	0.0	15.9	126.2
686	9.1	22.6	4.3	26.7	4.7	88.1	1.0	25.8	1.0	31.8	0.0	0.0	20.2	195.0
701	6.0	14.8	2.9	17.9	2.3	42.5	0.4	10.0	0.0	0.2	0.0	0.0	11.5	85.4
722	7.3	18.1	3.3	20.4	3.0	56.7	2.4	60.5	0.0	0.0	0.0	0.0	16.1	155.7

Notes:

- 1st order streams buffered 10 ft.
- 2nd order streams buffered 25 ft
- 3rd order streams buffered 50 ft
- 4th order streams buffered 75 ft
- 5th order streams buffered 100
- 6th order stream buffered 125 feet
- Stream orders derived using 30 meter DEM and ArcView Extension – Create Strahler Stream Order.

**Figure 2
Stream Buffers**

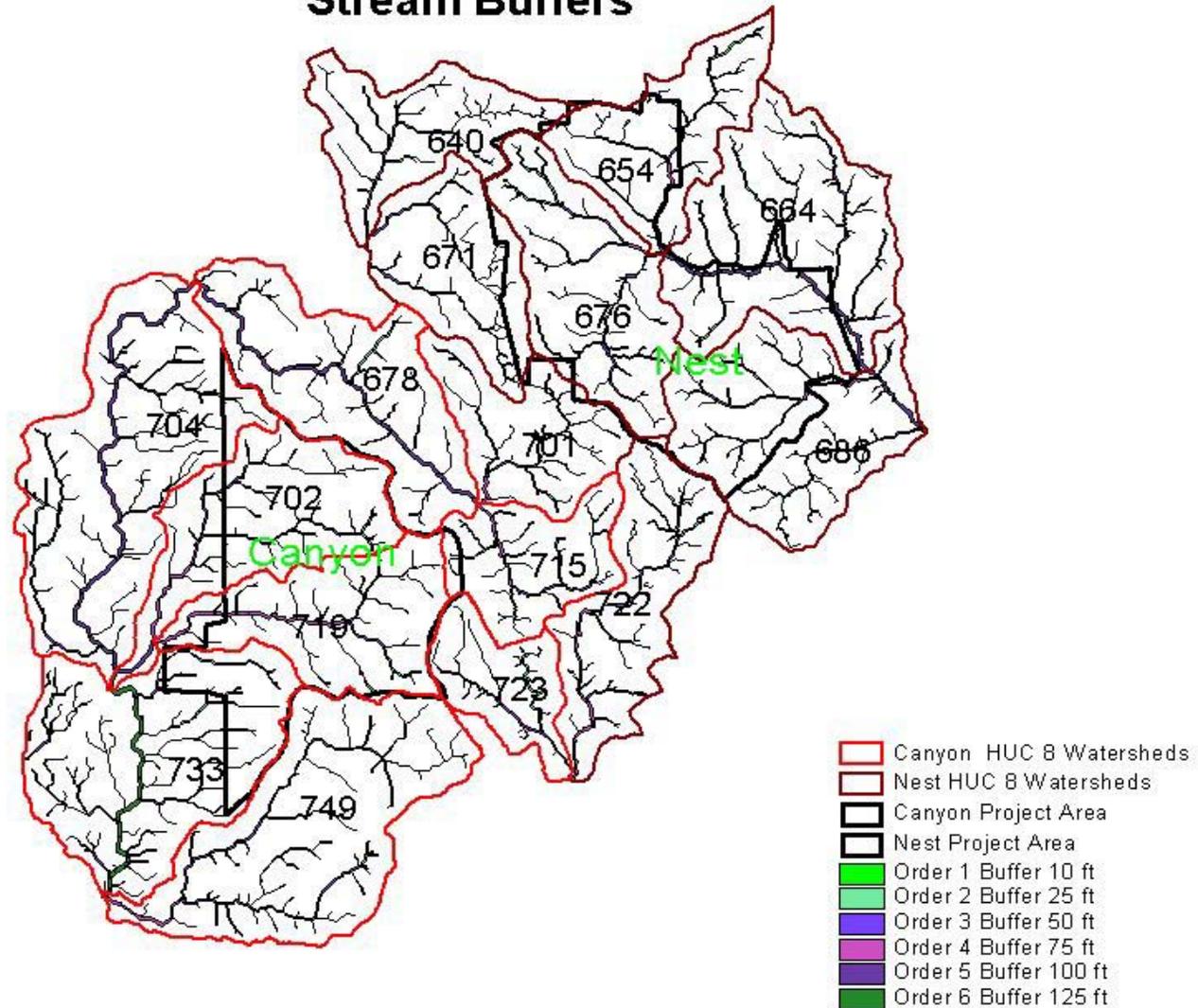


Table 3 Natural Watershed Sensitivity Index and Impact Index

Figure 1 HUC 8-ID	Watershed Acres	Stream Buffered Acres	Very High Erosion Hazard (acres)	Hydrologic Soil Group D (acres)	Slopes > 80% (acres)	NWSI	Impact Index	Watershed Sensitivity Class	Stream Density (mi/mi ²)	Road Density (mi/mi ²)
Canyon		0.0							0	
678	3,114	206	1168	409	0	57%	7%	Moderate	3.5	4.9
702	2,679	157	1169	409	0	65%	7%	Moderate	3.9	5.0
704	4,661	338	1	0.2	0	7%	6%	Low	4.4	3.6
715	1,637	91	1	0.3	0	6%	6%	Low	4.3	2.7
719	2,429	121	782	274	3	49%	8%	Moderate	3.6	5.2
723	1,207	57	0	0	0	5%	7%	Low	4.1	3.4
733	4,050	261	353	124	1	18%	6%	Low	4.7	2.4
749	4,223	207	1541	539	6	54%	7%	Moderate	3.7	3.0
		0.0							0	
Nest		0.0							0	
640	1,945	92	27	9.4	0	7%	5%	Low	3.9	2.3
654	2,113	110	0	0	0	5%	7%	Low	3.8	4.4
664	3,743	226	644	225.6	0	29%	6%	Moderate	3.8	3.7
671	1,992	103	247	86.3	0	22%	5%	Low	3.9	3.8
676	2,700	126	25	8.6	0	6%	8%	Low	3.8	5.8
686	3,348	195	824	288.4	0	39%	6%	Moderate	3.9	3.3
701	1,835	85	0	0	0	5%	5%	Low	4.0	3.9
722	2,388	156	0	0	0	7%	5%	Low	4.3	3.5

Class I watersheds (Table 4) with an interpretation of no concern are in robust health with a stream network in equilibrium and the risks of human-caused deterioration are low. Class II watersheds have an interpretation of concern and may have streams and soils in disequilibrium. A change in the rate or nature of management activity, stricter implementation of BMPs, or minor structural projects should be able to return Class II watersheds to a Class I condition of robust health and stream network equilibrium. Class III watersheds have an interpretation of high concern and management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects, or other activities which will improve the health of the watershed, must be a part of project planning.

Table 4 - Natural Watershed Sensitivity Index, Impact Index, the Interpretation of Their Combination, and the Resulting Watershed Class (From Black Hills FEIS, Appendix J - Table J - 4)

NWSI (%)	Impact Index %	Interpretation	Watershed Class
<30%	<11%	no concern	I
<30%	>10%	concern	II
30-65%	<11%	concern	II
30-65%	>10%	high concern	III
>66%	<11%	high concern	III
>65%	<10%	high concern	III

Four of the analysis watersheds in the Canyon Project area are Class I watersheds with an interpretation of No Concern and four are Class II watersheds with an interpretation of Concern (Table 5). Seven of the analysis watersheds in the Nest Project Area are Class I watersheds with an interpretation of No Concern and one is a Class II watershed with an interpretation of concern (Table 5).

Table 5 Current NWSI, Impact Index, Interpretation and Watershed Class

HUC 8-ID	NWSI	Current Impact Index	Current Interpretation	Current Watershed Class
Canyon				
678	57%	7%	Concern	II
702	65%	7%	Concern	II
704	7%	6%	No concern	I
715	6%	6%	No concern	I
719	49%	8%	Concern	II
723	5%	7%	No concern	I
733	18%	6%	No concern	I
749	54%	7%	Concern	II
Nest				
640	7%	5%	No concern	I
654	5%	7%	No concern	I
664	29%	6%	No concern	I
671	22%	5%	No concern	I
676	6%	8%	No concern	I
686	39%	6%	Concern	II
701	5%	5%	No concern	I
722	7%	5%	No concern	I

Soils

Several soils within the analysis area have severe limitations on whole tree harvesting. These soils include Syce, TuG, VcE and VoG (Tables 6a and 6b). If whole tree harvesting is the selected harvest method for the units listed in Tables 6a and 6b limbs, tops, and unmerchantable material should be returned to the units to provide for long-term soil productivity. TuG also has management concerns regarding roads due to steep slopes, and VoG and VcE have concerns for roads due to excess fines (Figure 3). Several areas within the analysis areas also have soils with severe erosion ratings (Figure 4).

Soil fertility depends on organic matter, cation exchange capacity (CEC) and nutrients. Soil productivity can be degraded if humus and topsoil, or even excess leaves and limbs, are taken offsite. All soils within the Canyon/Nest analysis area meet the 2% or greater organic matter requirements. All soils within the project area also meet the rooting depth requirement (at least 15 inches), although the Paunsaugunt portion of JhD and VnC has a rooting depth of 10-20.

Windthrow may be a severe problem in these areas. The shallower soils are more likely to occur on the ridges.

Soil creep, debris avalanches and flows, slumps, and earthflows can occur on unstable slopes if roads overload or undercut them, vegetation is removed from them, or runoff is emptied onto them. Hazard depends on type of disturbance, nature of earth material, and water content. Soil failures include land subsidence, shrinking-swelling soils, and collapsing soils. Removal of subsurface fluids or materials, or changed hydrology of certain soil types, can induce soil failures. Three of the analysis area soils (TuG, VcE, and VoG) are listed as potentially having old slides present. Wet or

seepy areas have the potential to slide if disturbed. Although the potential for slides is generally low, the SycE soil type may have some potential on steeper slopes.

The soil limitations described above will be mitigated by the implementation of BMPs described in Appendix A. For example BMP 9202, will reduce the long-term impact of roads on soils because the entire road prism of temporary and local native surface roads will be revegetated upon completion of the project work and cut-and-fill slopes of all newly constructed or reconstructed roads will also be revegetated. Permanent drainage and protective vegetative cover will be established on all new temporary roads or equipment ways, and all existing roads that are being removed from the transportation system. Surface erosion and loss fines from road surfaces constructed on the VoG and VeG soils will be reduced by the installation of adequate road cross drainage.

BMP III.C.1 requires that tractor skidding be accomplished in a manner that minimizes compaction, displacement, and erosion and that tractor or wheeled skidding should be avoided on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Also, skidding will be avoided on highly erodible soils or with the blade lowered. Implementation of this BMP will reduce erosion on soils with severe erosion ratings and soils with steep slopes.

Table 6a Canyon Units with Limitations on Whole Tree Harvesting

Unit	SycE (Acres)	TuG (Acres)	VcE (Acres)	VoG (Acres)	Unit	SycE (Acres)	TuG (Acres)	VcE (Acres)	VoG (Acres)
0403040091				2.2	0409030149	1.7			7.2
0403040092				2.7	0409030150	0.6			11.7
0403040095			1.3	1.5	0409030151				10.9
0403040096			0.0		0409030153	8.3			
0403040098			1.5	1.2	0409030156			3.5	23.3
0409030103			33.2	0.6	0409030157			5.1	15.9
0409030105			67.5	17.6	0409030161			14.9	4.0
0409030106	13.8		31.9	2.0	0409030162			3.8	21.0
0409030108				41.4	0409030163	3.2			14.4
0409030109	4.7		0.0	37.1	0409030164				42.0
0409030110	5.0			30.7	0409030165	13.9	1.1		30.1
0409030111	0.8			17.3	0409030172	0.9	4.6		
0409030112	23.4			10.1	0409030180		11.9		6.2
0409030113				11.8	0409030185		16.3		
0409030114	2.3			11.1	0409030186		22.5		
0409030117	68.7				0409030187	7.3	37.5		
0409030118	6.6				0409030191	14.1			30.3
0409030119	34.0				0409030192			4.2	27.7
0409030120				15.5	0409030194				15.2
0409030121	2.1			17.4	0409030195	62.9			26.6
0409030122	7.9			49.7	0409030197	104.4	5.1		2.6
0409030125	96.4				0409030217	7.5		3.1	25.2
0409030126	2.5			37.3	0409030220	2.0		14.3	6.8
0409030127	1.8			21.2	0409030223			6.1	1.4
0409030130	39.0			28.7	0409030224			5.6	14.1
0409030133	119.0				0409030225			17.3	2.2
0409030137	9.1			14.0	0409030226			10.3	1.7
0409030141				30.2	0409030227			18.2	
0409030142	24.3			10.1	0409030229			14.1	18.2
0409030143	9.1			81.9	0409030232			59.6	16.7
0409030144	4.6			36.4	0409030233			40.3	3.5
0409030145	4.2				0409030234			2.9	0.5
0409030147	6.2			15.9	0409030238	1.7	16.3		
0409030148	1.4			26.6	0409030239	3.2	7.4		
					0409030240	2.8	26.7		

Table 6b Nest Units with Limitations on Whole Tree Harvesting

Unit	SycE (Acres)	TuG (Acres)	Unit	SycE (Acres)	TuG (Acres)
0404010101	51.9		0404030108	20.3	
0404010102	24.4		0404030109	13.2	
0404010103	1.9		0404030110	29.1	
0404010104	17.4		0404030111	23.9	
0404010106	22.2		0404030112	31.8	
0404010107	21.6		0404030113	3.7	
0404010109	34.2		0404030114	22.5	
0404010111	4.9		0404030115	18.8	
0404010112	2.0		0404030116	31.4	
0404010113	1.9		0404030120	26.2	
0404010116	12.0		0404030121	6.1	
0404010118	0.2	2.2	0404030122	24.6	
0404010125	44.5		0404030123	9.2	
0404010133	48.2	1.3	0404030124	29.8	
0404010135	40.6		0404030125	26.8	
0404010136	7.6		0404030126	45.6	
0404010147	1.3		0404030127	67.5	
0404010150	0.1		0404030128	41.6	
0404010999	25.7	94.0	0404030129	20.8	
0404020101	10.7		0404030130	11.0	
0404020103	5.0		0404030131	33.1	
0404020104	6.1		0404030132	31.3	
0404020106	3.9		0404030134	46.9	
0404020107	1.3	1.8	0404030135	70.8	
0404020108	9.7		0404030136	0.9	
0404020111	52.7		0404030137	53.6	
0404020112	40.0		0404030138	81.8	
0404020113	14.9		0404030141	1.9	
0404020114	2.8		0404030143	20.2	
0404020118	15.2		0404030998	91.3	
0404020120	10.5		0404030999	43.1	
0404020122	65.3		0404050103	14.6	13.3
0404020124	17.3		0404050109	8.2	25.8
0404020125	11.2		0404050122	2.3	16.3
0404020126	31.3		0404050125	30.9	11.1
0404020128	4.2		0404050127	96.6	29.5
0404020130	7.7		0404050128	20.1	3.8
0404020138	5.3		0404050130	0.9	1.9
0404020998	30.8		0404050131	24.6	0.7
0404020999	87.8		0404050133	81.4	
0404030101	0.1		0404050135	9.6	
0404030102	1.2		0404050136	19.3	1.5
0404030103	21.0		0404050139	0.7	5.3
0404030105	28.4		0404050142		7.4
0404030107	4.0		0404050146	20.8	8.6

**Figure 3
Soils**

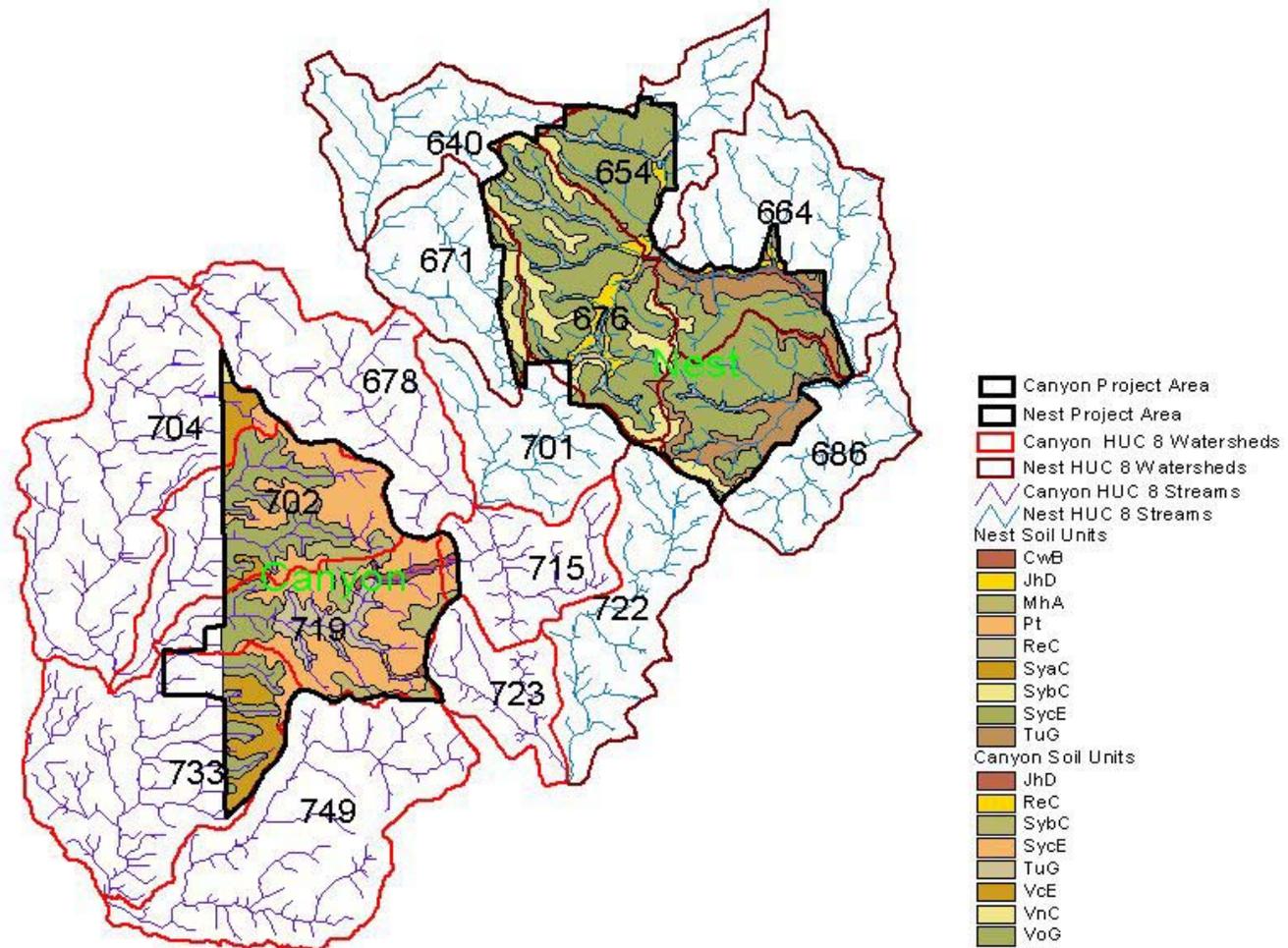
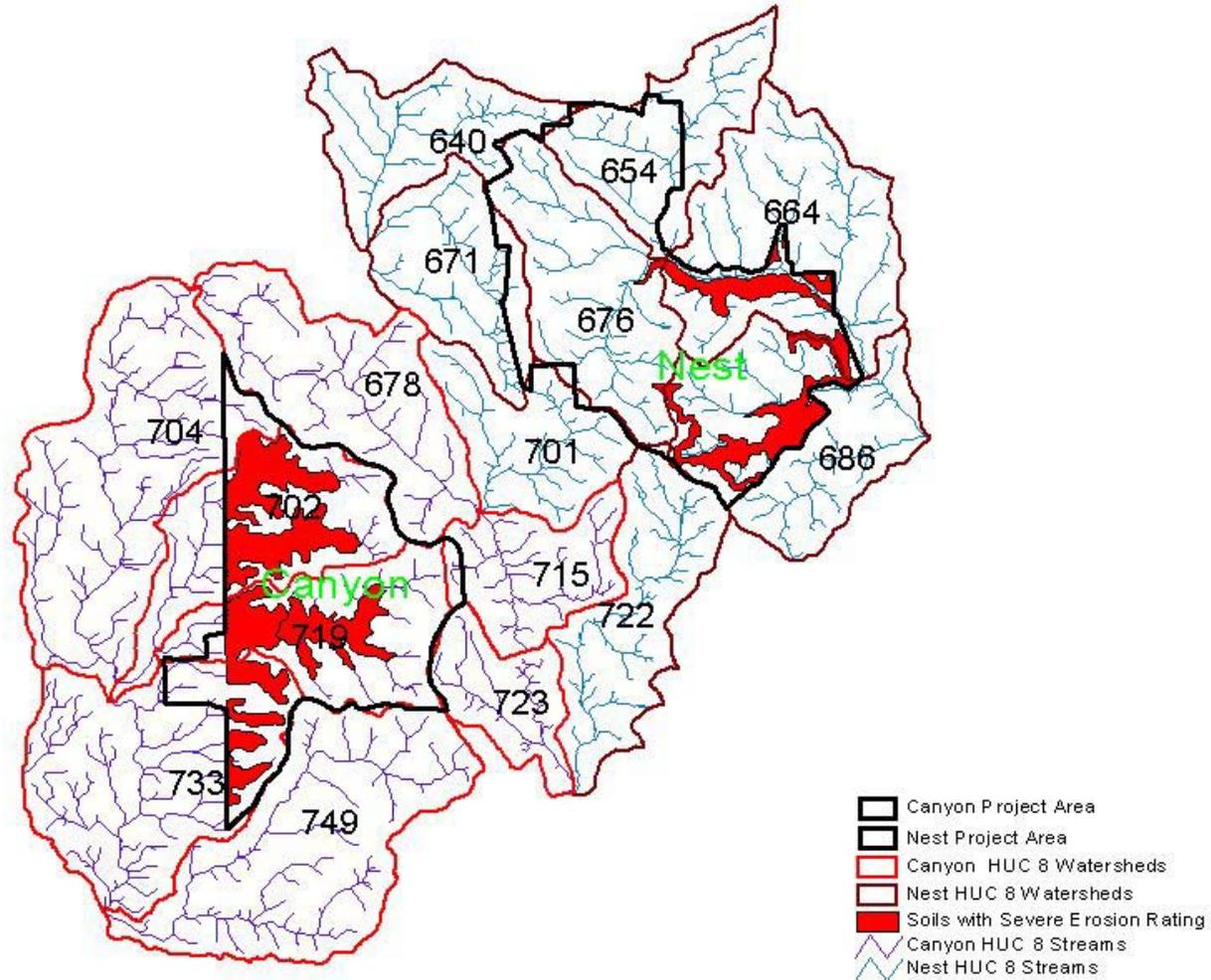


Figure 4
Soils with Severe Erosion Rating



Environmental Consequences

The assessment of environmental consequences for this report will focus on on-site erosion, the potential for sediment delivery to stream channels, water quality, flow regime and stream channel changes.

Alternative A-No Action

Direct Effects

Roads

Sediment delivery from the existing road system will remain at its current level. The open road density in each analysis watershed will not change (Table 7) and as a result the existing effective stream network will not change and current times of concentration of the watersheds will not change. The opportunity to surface and improve the stream crossings to reduce sediment delivery from FDR 117.1 adjacent to Caste Creek would be foregone.

Vegetation Management

Watersheds impacted by historical vegetation management would continue to regain their inherent hydrologic character as stand growth continues, ground cover conditions improve, and porosity of compacted soils increases. Streams in the analysis watersheds would experience a very gradual, long-term improvement in channel stability as peak flows and sedimentation rates decrease.

Fuel Treatments

Given the increase in fuel loading resulting from high stand densities, there is a good probability that a large, intense wildfire would occur during this time frame. Such a fire would be intense, removing vegetation, ground cover and large organic debris within stream channels. Given a large intense fire within these drainages, peak flows may increase five to ten times above existing levels and sediment loads could increase up to 50 to 100 fold and as a result local and downstream water quality would be affected until watersheds recover from the fire. Aquatic habitat could be impacted to a level that it would not be used by aquatic species as streams become devoid of cover, large organic debris and aquatic food.

Indirect Effects

The percent of Equivalent Roaded Area (ERA) in a watershed is a good indicator of the potential for increases in peak flow and increased stream channel erosion. The methodology for calculating ERA is described in Appendix B. ERA values will not change from current levels because new roads will not be constructed nor will ground disturbing activities be implemented (Table 8). Currently all watersheds in the Canyon and Nest Project Areas are below the Threshold of Concern (TOC). The TOC for ERA is based on the NWSI of a watershed (USDA Forest Service 1998). The following table describes the relationship between the NWSI and the TOC.

NWSI	Sensitivity	TOC
0-29%	Low	16-18%
30-65%	Moderate	14-16%
66-100	High	12-14%

Cumulative Effects

To provide a measure of the cumulative watershed impacts associated with management activities on the water resource this report utilizes the NWSI and Impact Index methodologies and the level of concern interpretation developed by the Black Hills National Forest. The methodology for calculating the Impact Index for Alternatives B and C is presented in Appendix B. Currently five Canyon Project Area watersheds 678; 702; 719; 749; and Nest Project Area watershed 686 have an interpretation of concern (Table 9). Watersheds with an interpretation of concern are Class II watersheds and may have streams and soils in disequilibrium. A change in the rate or nature of management activity, stricter implementation of BMPs, or minor structural projects should be able to return Class II watersheds to a Class I condition of robust health and stream network equilibrium.

Table 7 Road Densities

HUC 8 ID	Alternative A Road Density (mi/mi ²)	Alternative B Road Density (mi/mi ²)	Alternative C Road Density (mi/mi ²)
Canyon			
678	4.9	4.9	4.9
702	5.0	4.9	4.5
704	3.6	3.5	3.5
715	2.7	2.5	2.5
719	5.2	3.2	3.1
723	3.4	3.4	3.4
733	2.4	2.3	2.3
749	3.0	3.0	3.0
Nest			
640	2.3	2.3	2.3
654	4.4	4.9	4.7
664	3.7	6.9	6.9
671	3.8	3.7	4.1
676	5.8	7.1	7.0
686	3.3	4.7	4.8
701	3.9	3.6	3.5
722	3.5	4.3	4.3

Table 8 Equivalent Roaded Area

HUC 8-ID	Threshold of Concern	Alternative A ERA	Alternative B ERA	Alternative C ERA
Canyon				
678	14-16%	1.3%	1.5%	1.5%
702	14-16%	1.4%	11.5%	9.5%
704	18-20%	1.0%	1.6%	1.6%
715	18-20%	0.7%	0.7%	0.7%
719	14-16%	1.4%	5.2%	3.9%
723	18-20%	0.9%	0.9%	0.9%
733	18-20%	0.6%	3.3%	2.5%
749	14-16%	0.8%	0.8%	0.8%
Nest				
640	18-20%	0.6%	0.8%	0.8%
654	18-20%	1.2%	10.8%	2.9%
664	18-20%	1.0%	1.6%	1.3%
671	18-20%	1.0%	1.3%	1.4%
676	18-20%	1.6%	9.3%	8.0%
686	14-16%	0.9%	4.6%	4.6%
701	18-20%	1.1%	1.2%	1.2%
722	18-20%	1.0%	1.0%	1.1%

Table 9 Alternatives A and B Impact Index and Interpretation

HUC 8 ID	Current Impact Index	Current Interpretation	Alternative B Impact Index Yr 1	Alternative B Impact Index Yr 5	Alternative B Interpretation YR 1	Alternative B Interpretation YR 5
Canyon						
678	7%	Concern	7%	7%	Concern	Concern
702	7%	Concern	25%	18%	High Concern	High Concern
704	6%	No concern	7%	7%	No concern	No concern
715	6%	No concern	6%	6%	No concern	No concern
719	8%	Concern	15%	12%	High Concern	High Concern
723	7%	No concern	7%	7%	No concern	No concern
733	6%	No concern	10%	8%	No concern	No concern
749	7%	Concern	7%	7%	Concern	Concern
Nest						
640	6%	No concern	7%	7%	No concern	No concern
654	7%	No concern	26%	19%	Concern	Concern
664	7%	No concern	8%	7%	No concern	No concern
671	7%	No concern	8%	7%	No concern	No concern
676	8%	No concern	25%	17%	Concern	Concern
686	7%	Concern	13%	10%	High Concern	Concern
701	7%	No concern	8%	7%	No concern	No concern
722	6%	No concern	7%	6%	No concern	No concern

Alternative B

Canyon Project Area

Direct Effects

Roads

Soil compaction resulting from skid trails and landings located near roads, streams and other drainage features cause water to runoff more rapidly during storm events. In addition the existing road system and construction of new temporary or permanent forest system roads can increase delivery of sediment to stream channels and alter watershed response making the watershed flashier by increasing the effective stream network within a watershed. Road densities will remain the same or decrease in all Canyon watersheds (Table 7). Increases in sediment delivery and the effective stream network will be reduced by implementation of the BMPs described in Appendix A because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001). For a complete listing of BMPs applicable to this project and a discussion of BMP effectiveness refer to Appendix A - Best Management Practices. For example, BMP 1114, requires the installation of structures to divert runoff which reduces the erosion of the road surface and delivery of sediment to stream channels. BMP 1306 prohibits log landings and decking areas in riparian areas. BMP 1106 requires that roads be stabilized and maintained during and after construction to control erosion. BMP 1113 requires that road construction minimizes the sediment discharge into streams, lakes and wetlands.

Vegetation Management

Initiation and growth of rill and gully networks on disturbed ground has a higher probability of occurring in treatment units located in areas with severe erosion ratings and on slopes greater than 30 percent (Figure 5 and Figure 6). The implementation of the BMPs described in Appendix A will prevent most surface erosion and the development of rill and gully networks. Delivery of surface erosion or rill and gully network products to stream channels will also be reduced by the implementation of BMPs. For Example, FSH 2509.18 - Soil Management Handbook, 2.2 - Soil Quality Standards requires the following minimum percent effective ground cover:

Erosion Hazard Class	1st Year After Disturbance % Minimum Effective Ground Cover	2nd Year After Disturbance % Minimum Effective Ground Cover
Low	50	70
Moderate	40	60
High	30	50
Very High	30	50

The minimum effective ground cover percentages will be met by implementation of vegetation management activities proposed under Alternative B. Because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black

Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001) adverse changes in water quality and impacts to beneficial uses will not occur.

In Alternative B 1129 acres of proposed treatment are located within severe erosion areas (high and very high Erosion Hazard Class) and 501 acres of treatment units are on slopes greater than 30 percent. BMP III.C.1 requires that skidding be accomplished in a manner that minimizes compaction, displacement, and erosion and that tractor or wheeled skidding should be avoided on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Also, skidding will be avoided on highly erodible soils or with the blade lowered. Implementation of this BMP will reduce erosion on soils with severe erosion ratings and soils on slopes greater than 30 percent.

Fuel Treatments

Prescribed fire is generally not a threat to water quality and may be beneficial in the long-term (Forest Plan FEIS, III-91). Implementation of BMPs will minimize any adverse effects on water quality because buffer strips will be required between burned areas and stream channels. These buffer strips will filter most ash and limit the sediment delivery to stream channels. Similar to the road and vegetative treatment BMPs, BMPs applied to fuel treatment areas have proven to be effective in protecting the beneficial uses of water (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001).

**Figure 5
Alternative B
Treatment Units in Severe Erosion Areas**

- Nest Units**
- 0404010118
 - 0404010133
 - 0404020107
 - 0404050103
 - 0404050109
 - 0404050122
 - 0404050125
 - 0404050127
 - 0404050128
 - 0404050130
 - 0404050131
 - 0404050136
 - 0404050139
 - 0404050142
 - 0404050146

- Canyon Units**
- 0403040091
 - 0403040092
 - 0403040095
 - 0409030103
 - 0409030105
 - 0409030106
 - 0409030108
 - 0409030109
 - 0409030110
 - 0409030111
 - 0409030112
 - 0409030113
 - 0409030114
 - 0409030120
 - 0409030121
 - 0409030122
 - 0409030126
 - 0409030127
 - 0409030130
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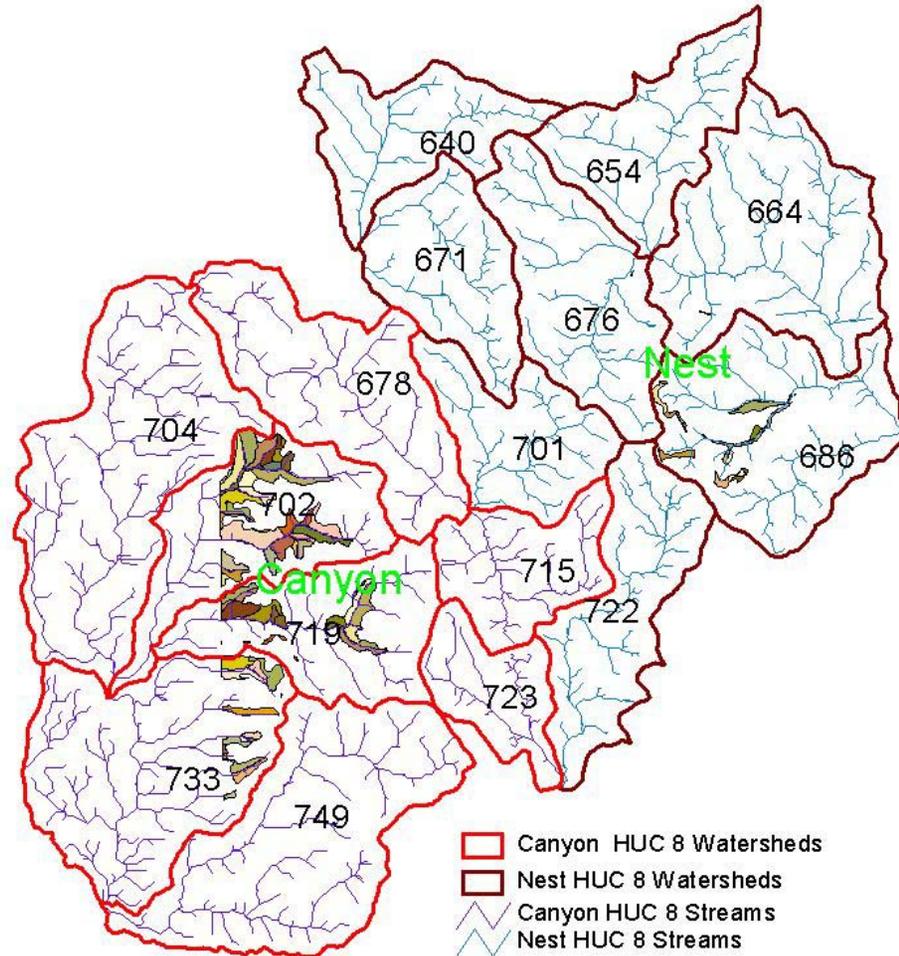
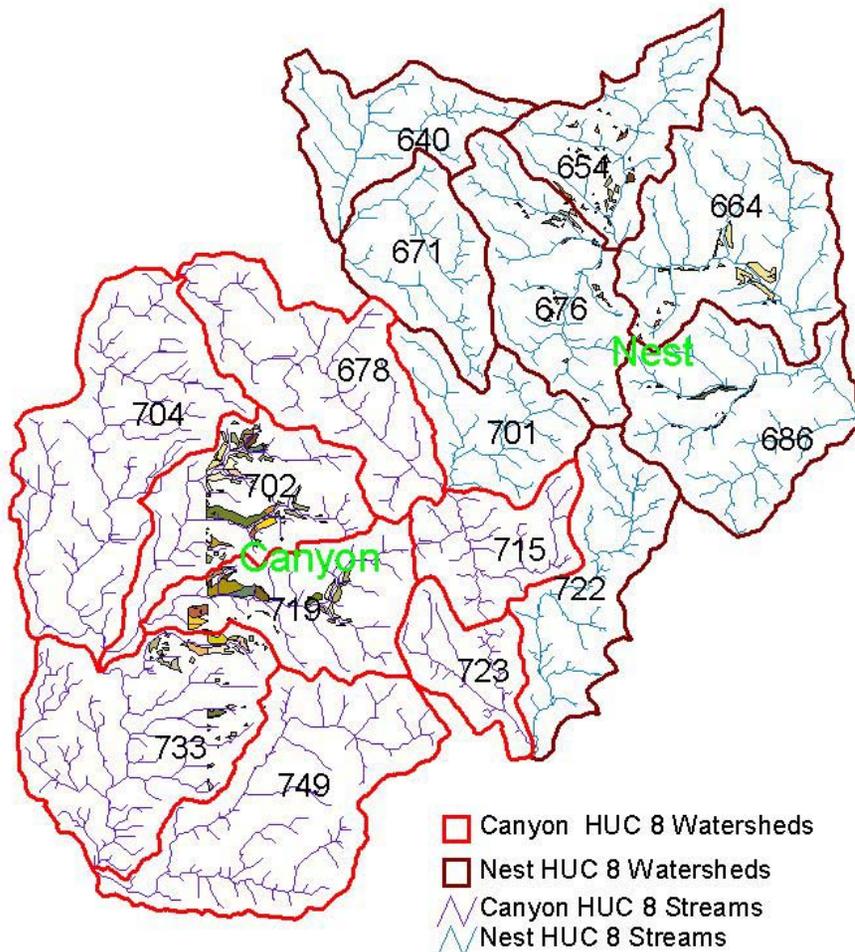


Figure 6

Alternatives B Treatment Units on Slopes > 30%

- Nest Units
- 0404010101
 - 0404010102
 - 0404010125
 - 0404010133
 - 0404010135
 - 0404010150
 - 0404010999
 - 0404020107
 - 0404020108
 - 0404020111
 - 0404020114
 - 0404020122
 - 0404020128
 - 0404020137
 - 0404020998
 - 0404020999
 - 0404030103
 - 0404030105
 - 0404030107
 - 0404030108
 - 0404030109
 - 0404030111
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 - 0404030136
 - 0404030137
 - 0404030138
 - 0404030141
 - 0404030143
 - 0404030998
 - 0404030999
 - 0404050109
 - 0404050127
 - 0404050128
 - 0404050130
 - 0404050142

- Canyon Units
- 0403040091
 - 0403040092
 - 0403040094
 - 0403040095
 - 0403040096
 - 0409030105
 - 0409030108
 - 0409030109
 - 0409030110
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 - 0409030229
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 - 0409030234
 - 0409030238
 - 0409030239
 - 0409030240



Indirect Effects

The percent of Equivalent Roaded Area (ERA) in a watershed is a good indicator of the potential for increases in peak flow and increased stream channel erosion. In the Canyon analysis watersheds increases in peak flows are not expected to be substantial because the ERA in the analysis watersheds is relatively low (Table 8). All watersheds in the Canyon Project Area will remain below the TOC (Table 8). Any potential increases in flow related to increases in ERA will be minimized by the implementation of BMPs addressing runoff. For example BMP 1116 requires that land treatments be managed to conserve site moisture and protect long-term stream health from damage by increased runoff. BMP 1209 requires management of vegetation treatments so that stream flows are not changed to the extent that long-term stream health is degraded. Also vegetative treatments will be managed to maintain enough organic ground cover in each treatment unit to prevent harmful increased runoff. These BMPs have proven to be effective in protecting the beneficial uses of water (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001).

Cumulative Effects

Impact Index interpretations for watersheds 702 and 719 change from Concern to High Concern. The primary reason for the change in interpretation relative to Alternative A is the increase in the Impact Index due to the level or acres of vegetation management in watersheds 702 and 719. Both of the watersheds will retain the High Concern interpretation for 5 years. For watersheds with an interpretation of high concern management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects will be implemented to improve the health of the watersheds. These projects include improving stream crossings on all forest development roads within watersheds 702 and 719 to reduce sediment delivery.

Nest Project Area

Direct Effects

Roads

Soil compaction resulting from skid trails and landings located near roads, streams and other drainage features cause water to runoff more rapidly during storm events. In addition the existing road system and construction of new temporary or permanent forest system roads can increase delivery of sediment to stream channels and alter watershed response making the watershed flashier by increasing the effective stream network within a watershed. Road densities will increase in watersheds 654, 664, 676, and 686 and decrease in watershed 671 (Table 7). All other watershed road densities will remain the same. Increases in sediment delivery and the effective stream network will be reduced by implementation of the BMPs described in Appendix A because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001). For example, BMP 1114 requires the installation of structures to divert runoff which reduces the erosion of the road surface and delivery of sediment to stream channels. BMP 1306 prohibits log landings and decking areas in riparian areas. BMP 1106 requires that roads be stabilized and maintained during and after construction to control erosion. BMP 1113 requires that road construction minimizes the sediment discharge into streams, lakes and wetlands.

Vegetation Management

Initiation and growth of rill and gully networks on disturbed ground has a higher probability of occurring in treatment units located in areas with severe erosion ratings and on slopes greater than 30 percent (Figure 5 and Figure 6). The implementation of the BMPs described in Appendix A will prevent most surface erosion and the development of rill and gully networks. Delivery of surface erosion or rill and gully network products to stream channels will also be reduced by the implementation of BMPs. For Example, FSH 2509.18 - Soil Management Handbook, 2.2 - Soil Quality Standards requires the following minimum percent effective ground cover:

Erosion Hazard Class	1st Year After Disturbance % Minimum Effective Ground Cover	2nd Year After Disturbance % Minimum Effective Ground Cover
Low	50	70
Moderate	40	60
High	30	50
Very High	30	50

The minimum effective ground cover percentages will be met by implementation of vegetation management activities proposed under Alternative B. Because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001) adverse changes in water quality and impacts to beneficial uses will not occur.

For the Nest Project Area 131 acres of proposed treatment are located within severe erosion areas and 173 acres of treatment units are on slopes greater than 30 percent (Figure 5 and Figure 6). BMP III.C.1 requires that skidding be accomplished in a manner that minimizes compaction, displacement, and erosion and that tractor or wheeled skidding should be avoided on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Also, skidding will be avoided on highly erodible soils or with the blade lowered. Implementation of this BMP will reduce erosion on soils with severe erosion ratings and soils with steep slopes.

Indirect Effects

In the Nest analysis watersheds increases in peak flows are not expected to be substantial because the ERA in the analysis watersheds is relatively low (Table 8). All watersheds in the Nest Project Area will remain below the TOC (Table 8). Any potential increases in flow related to increases in ERA will be minimized by the implementation of BMPs addressing runoff. For example BMP 1116 requires that land treatments be managed to conserve site moisture and protect long-term stream health from damage by increased runoff. BMP 1209 requires management of vegetation treatments so that stream flows are not changed to the extent that long-term stream health is degraded. Also vegetative treatments will be managed to maintain enough organic ground cover in each treatment unit to prevent harmful increased runoff. These BMPs have proven to be effective in protecting the beneficial uses of water (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001).

Cumulative Effects

Watersheds 654 and 676 interpretations change from No Concern to Concern (Table 9). An interpretation of concern may have streams and soils in disequilibrium. The primary reason for the change in interpretation relative to Alternative A is the increase in the Impact Index due to the level or acres of vegetation management in watersheds 654, 676, and 686. Watershed 654 and 676 will retain the Concern interpretation for 5 years and watershed 686 will move from High Concern to Concern after 5 years. A change in the rate or nature of management activity, stricter implementation of BMPs, or minor structural projects should be able to return these watersheds to a condition of robust health and stream network equilibrium. Watershed 686 changes from Concern to High Concern (Table 9). For watersheds with an interpretation of high concern management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects will be implemented to improve the health of the watersheds. These projects include improving stream crossings on all forest development roads within watersheds 654, 676, and 686 to reduce sediment delivery and fencing the headwaters of Castle Creek to exclude livestock. .

Conclusions

Localized areas of soil compaction and on-site erosion would occur in the Canyon and Nest analysis watersheds. Increases in peak flows, channel scour and sediment loads would be minor and would recover to pre vegetation management levels in 20 - 30 years. Aquatic habitat and the beneficial uses of water would not be adversely impacted in Canyon and Nest analysis watersheds because BMPs will be implemented to reduce sediment delivery, water quality effects, and increases in peak flow. Watershed improvement projects will be implemented in Canyon watersheds 678, 702, 719, and 749 and Nest watersheds 654, 676, and 686 and include obliteration of roads, fencing of riparian areas and springs to exclude cattle grazing, and surfacing and improving stream crossings of existing roads to reduce the potential for sediment delivery to stream channels.

Alternative C

Canyon Project Area

Direct Effects

Roads

Soil compaction resulting from skid trails and landings located near roads, streams and other drainage features cause water to runoff more rapidly during storm events. In addition the existing road system and construction of new temporary or permanent forest system roads can increase delivery of sediment to stream channels and alter watershed response making the watershed flashier by increasing the effective stream network within a watershed. Road densities will decrease in watersheds 702 and 719 (Table 7). All other watershed road densities will remain the same relative to Alternative B. Increases in sediment delivery and the effective stream network will be reduced by implementation of the BMPs described in Appendix A because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001). For example, BMP 1114 requires the installation of structures to divert runoff which reduces the erosion of the road surface and delivery of sediment to stream channels. BMP 1306 prohibits log landings and decking areas in riparian areas. BMP 1106 requires that roads be stabilized and maintained during and after

construction to control erosion. BMP 1113 requires that road construction minimizes the sediment discharge into streams, lakes and wetlands.

Vegetation Management

Initiation and growth of rill and gully networks on disturbed ground has a higher probability of occurring in treatment units located in areas with severe erosion ratings and on slopes greater than 30 percent (Figure 7 and Figure 8). The implementation of the BMPs described in Appendix A will prevent most surface erosion and the development of rill and gully networks. Delivery of surface erosion or rill and gully network products to stream channels will also be reduced by the implementation of BMPs. For Example, FSH 2509.18 - Soil Management Handbook, 2.2 - Soil Quality Standards requires the following minimum percent effective ground cover:

Erosion Hazard Class	1st Year After Disturbance % Minimum Effective Ground Cover	2nd Year After Disturbance % Minimum Effective Ground Cover
Low	50	70
Moderate	40	60
High	30	50
Very High	30	50

The minimum effective ground cover percentages will be met by implementation of vegetation management activities proposed under Alternative C. Because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001) adverse changes in water quality and impacts to beneficial uses will not occur.

In Alternative C 759 acres (32% reduction) of proposed treatment are located within severe erosion areas and 304 acres (39% reduction) of treatment units are on slopes greater than 30 percent (Figure 7 and Figure 8). BMP III.C.1 requires that skidding be accomplished in a manner that minimizes compaction, displacement, and erosion and that tractor or wheeled skidding should be avoided on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Also, skidding will be avoided on highly erodible soils or with the blade lowered. Implementation of this BMP will reduce erosion on soils with severe erosion ratings and soils on slopes greater than 30 percent.

Indirect Effects

ERA in the Canyon analysis watersheds would be less than the ERA for Alternative B (Table 8) and increases in peak flows are not expected to be substantial because the ERA in the analysis watersheds is relatively low (Table 8). All watersheds in the Canyon Project Area will remain below the TOC (Table 8). Any potential increases in flow related to increases in ERA will be minimized by the implementation of BMPs addressing runoff. For example BMP 1116 requires that land treatments be managed to conserve site moisture and protect long-term stream health from damage by increased runoff. BMP 1209 requires management of vegetation treatments so that stream flows are not changed to the extent that long-term stream health is degraded. Also vegetative treatments will be managed to maintain enough organic ground cover in each treatment

unit to prevent harmful increased runoff. These BMPs have proven to be effective in protecting the beneficial uses of water (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001).

Cumulative Effects

All Canyon watersheds would have no change in interpretation from Alternative B (Table 10). The primary reason for the change in interpretation relative to Alternative A is the increase in the Impact Index due to the level or acres of vegetation management in watersheds 702 and 719. Both of the watersheds will retain the High Concern interpretation for 5 years. For watersheds with an interpretation of high concern management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects will be implemented to improve the health of the watersheds. These projects include improving stream crossings on all Forest Development Roads within watersheds 702 and 719 to reduce sediment delivery.

Table 10 Alternatives A and C Impact Index and Interpretation

HUC 8 ID	Current Impact Index	Current Interpretation	Alternative C Impact Index Yr 1	Alternative C Impact Index Yr 5	Alternative C Interpretation YR 1	Alternative C Interpretation YR 5
Canyon						
678	7%	Concern	7%	7%	Concern	Concern
702	7%	Concern	21%	16%	High Concern	High Concern
704	6%	No concern	7%	7%	No concern	No concern
715	6%	No concern	6%	6%	No concern	No concern
719	8%	Concern	13%	10%	High Concern	High Concern
723	7%	No concern	7%	7%	No concern	No concern
733	6%	No concern	9%	7%	No concern	No concern
749	7%	Concern	7%	7%	Concern	Concern
Nest						
640	6%	No concern	7%	7%	No concern	No concern
654	7%	No concern	11%	9%	Concern	No concern
664	7%	No concern	7%	7%	No concern	No concern
671	7%	No concern	8%	7%	No concern	No concern
676	8%	No concern	22%	16%	Concern	Concern
686	7%	Concern	13%	11%	High Concern	High Concern
701	7%	No concern	8%	7%	No concern	No concern
722	6%	No concern	7%	7%	No concern	No concern

Nest Project Area

Direct Effects

Roads

Soil compaction resulting from skid trails and landings located near roads, streams and other drainage features cause water to runoff more rapidly during storm events. In addition the existing road system and construction of new temporary or permanent forest system roads can increase

delivery of sediment to stream channels and alter watershed response making the watershed flashier by increasing the effective stream network within a watershed. Road densities will increase in watersheds 671 and 686, decrease in watersheds 654, 676 and 701 relative to Alternative B and remain the same in all other watersheds (Table 7). Increases in sediment delivery and the effective stream network will be reduced by implementation of the BMPs described in Appendix A because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001). For example, BMP 1114 requires the installation of structures to divert runoff which reduces the erosion of the road surface and delivery of sediment to stream channels. BMP 1306 prohibits log landings and decking areas in riparian areas. BMP 1106 requires that roads be stabilized and maintained during and after construction to control erosion. BMP 1113 requires that road construction minimizes the sediment discharge into streams, lakes and wetlands.

Vegetation Management

Initiation and growth of rill and gully networks on disturbed ground has a higher probability of occurring in treatment units located in areas with severe erosion ratings and on slopes greater than 30 percent (Figure 7 and Figure 8). The implementation of the BMPs described in Appendix A will prevent most surface erosion and the development of rill and gully networks. Delivery of surface erosion or rill and gully network products to stream channels will also be reduced by the implementation of BMPs. For Example, FSH 2509.18 - Soil Management Handbook, 2.2 - Soil Quality Standards requires the following minimum percent effective ground cover:

Erosion Hazard Class	1st Year After Disturbance % Minimum Effective Ground Cover	2nd Year After Disturbance % Minimum Effective Ground Cover
Low	50	70
Moderate	40	60
High	30	50
Very High	30	50

The minimum effective ground cover percentages will be met by implementation of vegetation management activities proposed under Alternative B. Because these BMPs have proven to be effective in protecting the designated beneficial uses of water in South Dakota and Wyoming (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001) adverse changes in water quality and impacts to beneficial uses will not occur.

In Alternative C 131 acres (no reduction) of proposed treatment are located within severe erosion areas and 111 acres (35% reduction) of treatment units are on slopes greater than 30 percent. BMP III.C.1. requires that skidding be accomplished in a manner that minimizes compaction, displacement, and erosion and that tractor or wheeled skidding should be avoided on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Also, skidding will be avoided on highly erodible soils or with the blade lowered. Implementation of this BMP will reduce erosion on soils with severe erosion ratings and soils with steep slopes.

Indirect Effects

Effects would be similar to Alternative B however the ERA in the Nest analysis watersheds would be less than the ERA for Alternative B and increases in peak flows are not expected to be substantial because the ERA in the analysis watersheds is relatively low (Table 8). All watersheds in the Nest Project Area will remain below the TOC (Table 8). Any potential increases in flow related to increases in ERA will be minimized by the implementation of BMPs addressing runoff. For example BMP 1116 requires that land treatments be managed to conserve site moisture and protect long-term stream health from damage by increased runoff. BMP 1209 requires management of vegetation treatments so that stream flows are not changed to the extent that long-term stream health is degraded. Also vegetative treatments will be managed to maintain enough organic ground cover in each treatment unit to prevent harmful increased runoff. These BMPs have proven to be effective in protecting the beneficial uses of water (Black Hills Forest Resource Association, 2001; Wyoming Timber Industry, 2001).

Cumulative Effects

All Nest watersheds would have no change in interpretation from Alternative with the exception of watershed 654 which would change from concern to no concern in year 5 and watershed 686 which would change from concern to high concern in year 5. The primary reason for the change in interpretation relative to Alternative B is the decrease in the Impact Index due to the level or acres of vegetation management in watersheds 654 and an increase in the Impact Index due to vegetation management activities in watershed 686. For watersheds with an interpretation of high concern management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects will be implemented to improve the health of the watersheds. These projects include improving stream crossings on all forest development roads within watersheds 654, 676, and 686 to reduce sediment delivery and fencing the headwaters of Castle Creek to exclude livestock

Conclusions

Localized areas of soil compaction and on-site erosion would occur in the Canyon and Nest analysis watersheds however soil compaction and on-site erosion will decrease relative to Alternative B because vegetation management on soils with severe erosion ratings and on slopes greater than 30 percent will decrease in the Nest project area and vegetation management activities on slopes greater than 30 percent will decrease in the Canyon project area. Increases in peak flows, channel scour and sediment loads would be minor and overall would decrease relative to Alternative B due to the reduction in vegetation management activities and would recover to pre vegetation management levels in 20 - 30 years. Aquatic habitat and the beneficial uses of water would not be adversely impacted because BMPs will be implemented to reduce sediment delivery, water quality effects, and increases in peak flow. Overall watershed interpretations would remain the same relative to Alternative B because Nest watershed 654 would change from concern to no concern in year 5, Nest watershed 686 would change from concern to high concern in year 5, and all Canyon watershed interpretations would remain the same. Watershed improvement will be implemented in watersheds with an interpretation of Concern or High Concern (Table 10). Watershed improvement projects will include obliteration of roads, fencing of riparian areas and springs to exclude cattle grazing, and surfacing and improving stream crossings of existing roads to reduce the potential for sediment delivery to stream channels.

Figure 7
Alternative C
Treatment Units in Severe Erosion Areas

- Nest Units
- 0404010118
 - 0404020107
 - 0404050103
 - 0404050109
 - 0404050122
 - 0404050125
 - 0404050127
 - 0404050128
 - 0404050130
 - 0404050131
 - 0404050136
 - 0404050139
 - 0404050142
 - 0404050146

- Canyon Units

- 0403040091
- 0403040092
- 0403040095
- 0409030103
- 0409030105
- 0409030106
- 0409030108
- 0409030109
- 0409030110
- 0409030111
- 0409030112
- 0409030113
- 0409030114
- 0409030120
- 0409030121
- 0409030122
- 0409030126
- 0409030127
- 0409030130
- 0409030137
- 0409030141
- 0409030142
- 0409030144
- 0409030151
- 0409030156
- 0409030172
- 0409030180
- 0409030185
- 0409030186
- 0409030187
- 0409030194
- 0409030195
- 0409030197
- 0409030217
- 0409030220
- 0409030223
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- 0409030238
- 0409030239
- 0409030240

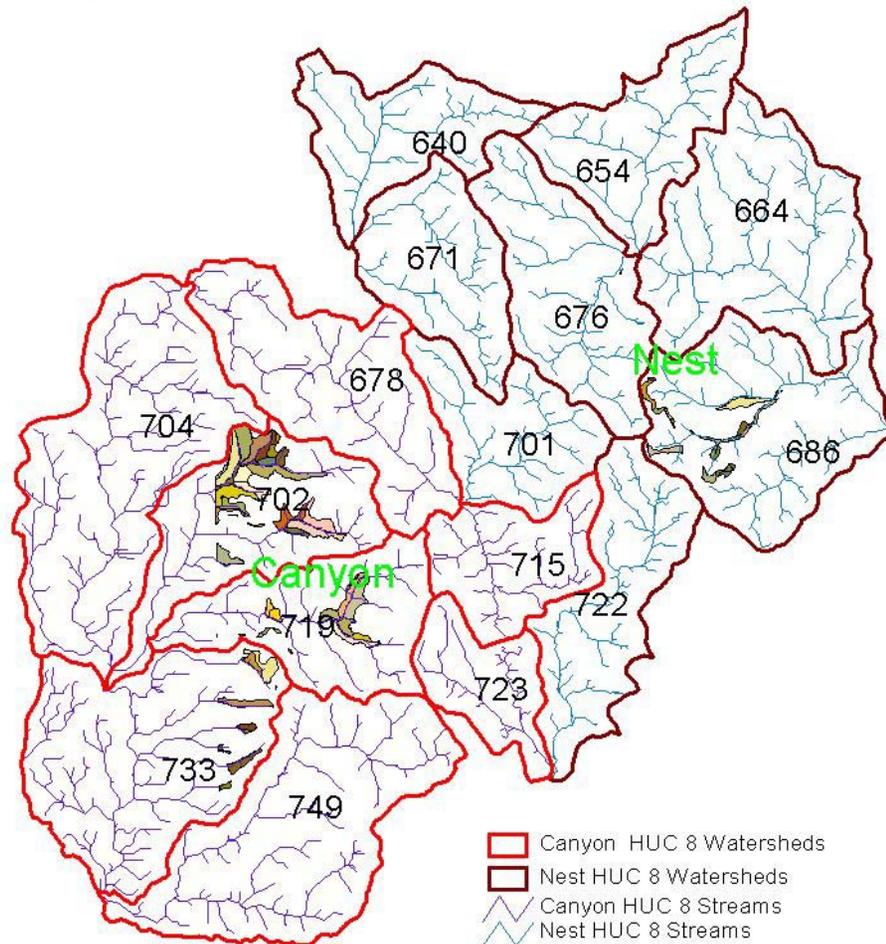
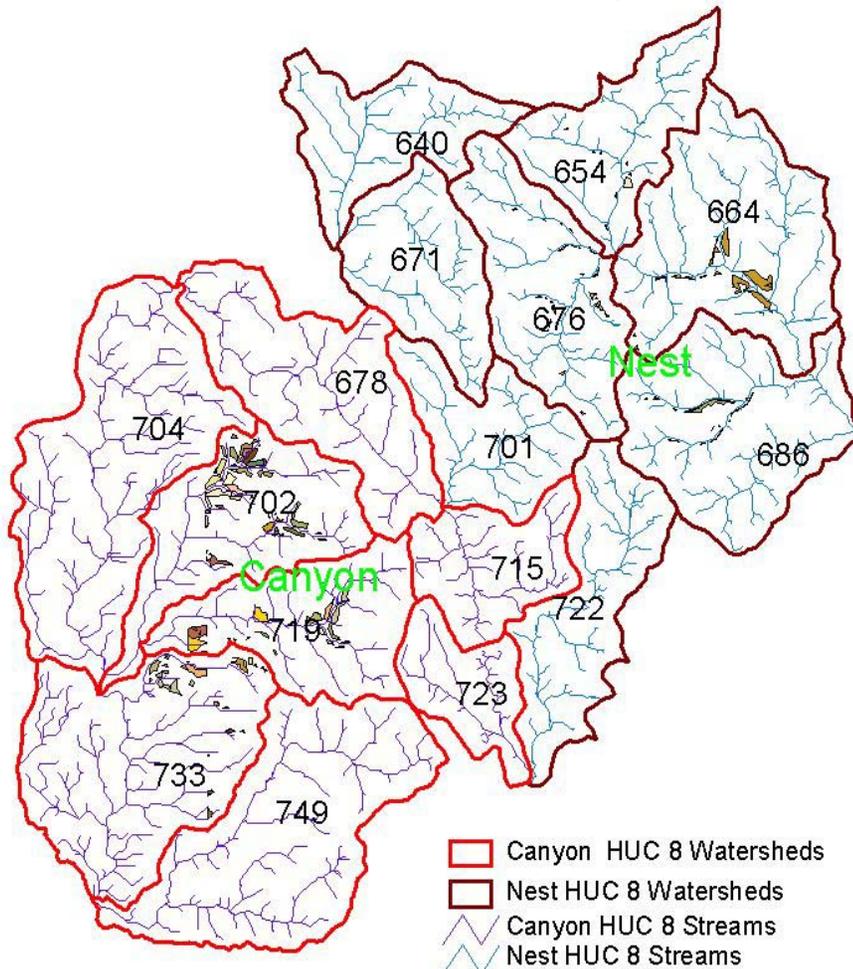


Figure 8
Alternative C
Treatment Units on Slopes >30%

- Nest Units
- 0404010101
 - 0404010102
 - 0404010125
 - 0404010135
 - 0404010150
 - 0404010999
 - 0404020107
 - 0404020108
 - 0404020111
 - 0404020114
 - 0404020128
 - 0404020998
 - 0404020999
 - 0404030107
 - 0404030136
 - 0404030141
 - 0404030998
 - 0404030999
 - 0404050109
 - 0404050127
 - 0404050128
 - 0404050130
 - 0404050142

- Canyon Units
- 0403040091
 - 0403040092
 - 0403040094
 - 0403040095
 - 0403040096
 - 0409030105
 - 0409030108
 - 0409030109
 - 0409030110
 - 0409030111
 - 0409030112
 - 0409030113
 - 0409030114
 - 0409030120
 - 0409030121
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USDA Forest Service. 1998. Eldorado National Forest Cumulative Off-Site Watershed Effects (CWE) Analysis Process. Eldorado National Forest. Placerville, CA.

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Appendix A
Best Management Practices

Soils and Hydrology Report

Background

Land management activities have been recognized as potential sources of nonpoint water pollution. By definition, nonpoint pollution is not controllable through conventional treatment technologies. Nonpoint pollution is controlled by containing the pollutant at its source precluding delivery to surface water. Sections 208 and 319 of the Federal Clean Water Act, as amended, acknowledge land treatment measures as being an effective means of controlling nonpoint sources of water pollution and emphasizes their development.

The Forest Service has developed and documented nonpoint pollution control measures applicable to forest management activities. These measures were termed "Best Management Practices" (BMP's). Best Management Practice control measures are designed for each unique site condition and take into account the complexity and physical and biological variability of the natural environment. The implementation of BMP's is the performance standard against which the success of the Forest Service's nonpoint pollution water quality management efforts are judged.

Effectiveness of Best Management Practices

The Clean Water Act provided the initial test of effectiveness of the Forest Service nonpoint pollution control measures where it required the evaluation of the practices by the regulatory agencies and the certification and approval of the practices as the "BEST" measures for control. Another test of BMP effectiveness is the capability to custom fit them to a site-specific condition where nonpoint pollution potential exists. The Forest Service BMP's are flexible in that they are designed to account for diverse combinations of physical and biological environmental circumstances. A final test of the effectiveness of the Forest Service BMP's is their demonstrated ability to protect the beneficial uses of waters of the State. The BMP's incorporate 75 years of erosion control and watershed protection experience and are based on sound scientific principles. The land treatment measures incorporated into Forest Service BMP's evolved through research and development measures and have been monitored and modified over several decades with the expressed purpose of improving the measures and making them more effective.

On - site evaluations of the control measures by the Black Hills Forest Resource Association (Black Hills Forest Resource Association, 2001) and Wyoming Timber Industry (Wyoming Timber Industry, 2001) found the practices are effective in protecting beneficial uses of water. The Black Hills Forest Resource Association found that "On average, the BMP's met or exceeded 82 and 84 percent of the total rated points for application and effectiveness, respectively. Instances of gross neglect were not identified in any of the audited sales." The Crawford and Greenant Timber Sales on the Black Hills National Forest were two of the six timber sales audited. The Crawford Timber Sale scored an application rating of 78% and an effectiveness rating of 78%. The Greenant Timber Sale scored an application rating of 78% and an effectiveness rating of 80%. The Wyoming Timber Industry audited six timber sales in 2000 and six in 2001 and found that "On average, audited sales were found to meet or exceed the standard set forth in the

Soils and Hydrology Report

BMP handbook on 91.4 percent of the total application points, and 93.3 percent of the total effectiveness points.” Three Forest Service timber sales were included in the audit, Caribou, Rednose, and Cedar Creek. The Caribou Timber sale scored an application rating of 81% and an effectiveness rating of 80%. The Rednose Timber Sale scored an application rating of 81% and an effectiveness rating of 82%. The Cedar Creek Timber Sale scored an application rating of 78% and an effectiveness rating of 79%.

Soils and Hydrology Report

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Appendix B
Cumulative Watershed Effects Methodology

Introduction

Cumulative Watershed Effects (CWE) are defined as "all effects on beneficial uses of water that occur away from the locations of actual land use which are transmitted through the fluvial system". CWE may be either beneficial or adverse and can result from synergistic or additive changes in watershed structure and processes caused by multiple land management activities within a watershed. Changes in flow regimes especially peak flows, and sediment introduced to streams can combine to upset the dynamic sediment-water equilibrium conditions. Increased flows provide more stream energy for cutting of stream banks, and widening and/or deepening of channels. Increased sediment loads can fill channel bottoms with fine sediment, cause braiding of channels, reduce habitat for fish and other aquatic organisms as well as impair water quality for other beneficial uses of water.

Unacceptable CWE can occur over different time frames. For example, short-term effects on beneficial uses may occur if sediment is introduced to and routed through the stream system soon after ground-disturbing activities have taken place. In other situations, CWE may not manifest for a number of years following intensive land use. A climatic event may trigger the initiation of adverse CWE resulting in long-term effects on beneficial uses.

Assessment of cumulative watershed effects is required by the National Environmental Policy Act (NEPA) of 1969. The Clean Water Act of 1972, 1977 and 1980 also indirectly requires CWE assessment through the implementation of Best Management Practices (BMPs) that address control of non-point source pollution. The USDA Soil and Water Handbook also directs these analyses.

Methodology for Determining Equivalent Roaded Acres and Impact Index

Equivalent Roaded Acres

Normalized numerical coefficients are used to track overall land disturbance within the watershed. The "Equivalent Roaded Acre" or ERA is used as the standard. A road surface is considered to be the most extreme type of disturbance in terms of increasing or concentrating water flows and sediment production. A road is given an ERA coefficient of 1.0. Other types of disturbance are equated to a road surface by ERA coefficients reflecting their relative level of disturbance. For example, disturbance from a tractor clearcut is considered to be one-fourth that of a road surface and is given a coefficient of 0.25. ERA coefficients are decayed over time to reflect watershed recovery.

The Threshold Of Concern for ERA is based on the Natural Watershed Sensitivity Index of a watershed (USDA Forest Service 1998). The following table describes the relationship between the NWSI and the TOC.

NWSI	Sensitivity	TOC
0-29%	Low	16-18%
30-65%	Moderate	14-16%
66-100	High	12-14%

TABLE 1-ERA Coefficients

Activity Or Impact	Years Since Impact					
	1	2	5	10	20	50
TRANSPORTATION SYSTEM						
<u>System and Non- System Roads & Landings</u>						
good drainage	1.0	1.0	1.0	1.0	1.0	1.0
poor drainage	1.5	fixing of road drainage problems associated				
diversion potential						
Abandoned Roads & Landings	2.0	w/ditches, culverts, etc. returns to 1.0				
Trails (recreational)	1.0	0.9	0.9	0.8	0.8	0.8
Ripped & Oblit. Rds. / Landings	1.0	1.0	1.0	1.0	1.0	1.0
	0.4	0.3	0.3	0.2	0.1	0.1
SILVICULTURAL SYSTEMS						
<u>Tractor</u>						
Clearcut & Seed Tree	0.25	0.24	0.20	0.15	0.10	0.08
Shelterwood	0.22	0.20	0.15	0.10	0.10	0.08
Overstory Removal	0.20	0.16	0.12	0.10	0.10	0.08
Sanitation/Salvage	0.15	0.10	0.08	0.05	0.05	0.04
Selection/Thinning	0.15	0.12	0.10	0.08	0.08	0.08
<u>Cable</u>						
Clearcut	0.15	0.14	0.10	0.05	0	
Oversotry Removal	0.10	0.06	0.02	0		
<u>Helicopter</u>						
Clearcut & Seed Tree	0.10	0.09	0.05	0.02	0	
Overstory Removal	0.05	0.05	0.05	0		
Sanitation/Salvage	0.02	0				
Selection/Thinning	0.05	0.02	0.01	0		
Activity Or Impact	Years Since Impact					
	1	2	5	10	20	50
SITE PREPARATION METHOD						
<u>Mechanized</u>						
Pile & Burn	0.15	0.12	0.10	0.05	0.05	0.05
YSM Tractor	0.10	0.08	0.05	0.03	0.03	0.03
YSM Cable	0.05	0.02	0			

Crush/Chip <u>Non-Mechanized</u>	0.04	0.02	0.02	0.02	0.02	0.02
Broadcast Burn	0.08	0.05	0.02	0		
Hand Pile & Burn	0.05	0.02				
Lop & Scatter				0		
<u>Herbicides</u>	0	0.05	0			
<u>Rip & Obliterate skid trails</u>	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
<u>Hand Grubbing</u>	0.10	0.05	0			
<u>Disc (not plowed)</u>	0.07	0.05	0.02	0		
WILDFIRE (strong hydrophobic conditions could double coeff.)						
<u>Crown (0-10% gc)</u>	0.30	0.30	0.20	0.10	0.05	0
<u>High Intensity (10-40% gc)</u>	0.18	0.15	0.10	0.05	0	
<u>Mod. Intensity (40-60% gc)</u>	0.05	0				
<u>Low Intensity (60+% gc)</u>				0		

The level of disturbance or "percent ERA" of each HUC 8 analysis watershed was calculated by multiplying the acres of each activity by the appropriate ERA coefficient to calculate the ERA for that activity. The ERA's for the various activities were totaled for each watershed and then divided by the watershed area to get the "percent ERA" for the watershed.

Impact Index

The Natural Watershed Sensitivity Index (NWSI) and the Impact Index for the analysis watersheds was calculated using the methodology described in the Black Hills NF FEIS, Appendix J- Watershed Analysis. A key component of the methodologies described in Appendix J is the identification of lands on which management activities have occurred in close proximity to the drainage network which are considered "at-risk" unless field surveys indicate otherwise. Connected Disturbed Areas (CDAs) are most likely to be at risk. Connected disturbed areas are areas of bare or compacted ground adjoining the stream system, or with an inadequate buffer between them and the stream system, or connected to such an area. Examples include: roads running parallel to streams without an adequate buffer; road ditches which empty into a stream channels; skid trails which empty into road ditches which then empty into stream channels; and landings within buffer areas. Such areas add sediment into channels and increase the flashiness of the watershed response to storm events and may result in increased peak flows. Increases in peak flows could cause lateral migration or degradation of stream channels.

The methodology for the current Impact Index was modified in the following manner:

3. Grazing acres at-risk were calculated by assuming that 5% of the stream buffered acres were impacted by grazing.

4. Road acres were at-risk were calculated by assuming that 10% of the roads in the analysis watersheds were roads running parallel to streams without an adequate buffer or with road ditches that drain into stream channels.

One of the inputs to the Impact Index is road acres “at-risk”. Generally these are roads that are hydrologically connected to stream channels or are located near stream channels. Since ERA for a vegetation management activity or area is essentially the same as road surface vegetation management activities can be “modeled” as roads in the Impact Index analysis. The ERA for includes the assumption that one 0.25 acre would be constructed for every 20 acres of vegetation management activities. The Impact Index for the action alternatives was calculated by summing the ERA for each HUC 8 analysis watershed for all of the proposed vegetation management and road management activities and multiplying this value by 0.1. This calculation method assumes that 10% of the vegetation management areas act as “at-risk” or hydrologically connected roads. The resulting roaded acre “at-risk” was added to the existing impact index acres (Grazing and Existing Roads - See Affected Environment - Watershed Conditions). The ERA for the first year and fifth year after project implementation was calculated. The fifth year ERA was calculated using the 5 years since impact ERA coefficients in Table 1.

Class I watersheds (Table 4) with an interpretation of no concern are in robust health with a stream network in equilibrium and the risks of human-caused deterioration are low. Class II watersheds have an interpretation of concern and may have streams and soils in disequilibrium. A change in the rate or nature of management activity, stricter implementation of BMPs, or minor structural projects should be able to return Class II watersheds to a Class I condition of robust health and stream network equilibrium. Class III watersheds have an interpretation of high concern and management activities must be done with great care. Management activities can still occur in these watersheds, but watershed improvement projects, or other activities which will improve the health of the watershed, must be a part of project planning.

**Table 4 - Natural Watershed Sensitivity Index, Impact Index, the Interpretation of Their Combination, and the Resulting Watershed Class
(From Black Hills FEIS, Appendix J - Table J - 4)**

NWSI (%)	Impact Index %	Interpretation	Watershed Class
<30%	<11%	no concern	I
<30%	>10%	concern	II
30-65%	<11%	concern	II
30-65%	>10%	high concern	III
>66%	<11%	high concern	III
>65%	<10%	high concern	III

