Portneuf West Bench Fuels Management Project
Chapter 4 – Environmental Consequences
Hydrology, Water Quality and Floodplain

Please refer to Appendix xxx for a description of fire effects on these resources and for a more detailed description of the model used in this analysis.

Alternative 1 – No Action

Direct and Indirect Effects

For this alternative no treatments would occur. Current erosion/sediment is estimated to be less than 0.5 tons per acre on NFS and BLM lands (Elliot *et al.* 1996). The potential for wildfire would remain at its present level. This analysis used the USDA Forest Service Water Erosion Prediction Project (WEPP) model (Elliot and Hall, 1997). Input values used for the model runs are found in Table xxx in Appendix xxx. Table 1 shows the results from WEPP under the No Action Alternative. A present condition erosion/sedimentation rate of between 0.1 and 0.5 tons/acre was used for all treatment areas (<0.5 tons/acre).

Should a wildfire occur, not only can overall watershed stability be compromised, but sufficient sediment could be generated to measurably increase sediment volumes above established Total Maximum Daily Loads (TMDLs) within the Portneuf River, which is currently a water quality limited waterbody. As such, beneficial uses of the river could be further compromised, indirectly violating State Water Quality rules and regulations and Section 303 of the Clean Water Act.

Should a wildfire occur under this alternative, a mosaic of 10% low intensity fire, 30% moderate intensity fire, and 60% high intensity fire is expected to occur within the project area. A low intensity fire would consume about 15% of the vegetative ground cover and leave much of the overstory in place. A moderate intensity burn would remove about 50% of the vegetative ground cover and a similar amount of overstory. A high intensity fire would consume up to 90% of the vegetative ground cover and remove most of the overstory. Wildfire intensities under the No Action Alternative are higher than under the Proposed Action Alternative after treatment. Under the No Action Alternative erosion and sediment rates from a wildfire are increased between 5 to 30% compared to a wildfire under the Proposed Action (see Table 1).

Under this alternative the floodplains of the nine perennial streams within the project area would be unchanged from their present condition. Small aspen thinnings would not occur within this alternative. Wildfire impacts (if a wildfire occurs) would produce more erosion and sediment from the watershed than under the Proposed Action, impacting floodplains negatively.

Irretrievable and Irreversible Commitment of Resources

Irretrievable commitment of resources includes compacted areas such as roads. These will continue to exist in their present form and condition.

If a wildfire were to occur, there would be an irreversible commitment of vegetation resources, and a possible deterioration of overall watershed stability and downstream water quality in the Portneuf River.

Cumulative Impacts

Cumulative impacts will occur from continued livestock grazing (especially on BLM lands), recreation and continued urban and rural development within and around the project area. Presently, livestock grazing is a minor impact to Forest Service lands in the project area. The main cumulative impact here is recreation. Continued development is occurring below the Forest lands and does not directly threaten them, except through a potential increase in OHV recreation.

The largest cumulative impact for BLM lands is livestock grazing, occurring on lands east of Mink Creek. Livestock grazing impacts on these lands can degrade streambank and floodplain stability and vegetative cover, thereby reducing their effectiveness to trap sediment and improve water quality. Livestock grazing can directly degrade water quality by compacting floodplains and adjacent uplands, causing more sediment to runoff and enter the stream. Livestock grazing has been recently reduced by nearly 50% on the Inkom Allotment east of Mink Creek. This reduction will lessen this cumulative impact and confine it mostly to only traditionally high use areas within the allotment. Through this reduction in grazing, streambanks are expected to increase in stability and vegetative cover, improving the overall functioning condition status of the streams, which should improve water quality.

Should a wildfire occur, erosion and sedimentation would be greater and the cumulative impacts to water quality would be greater under this alternative than under the Proposed Action.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Treatments would occur within 52 separate units on both BLM and FS lands over a nine year period. During this period, private lands would also be treated. Exact locations and numbers and sizes of treatments on these private lands are not specifically known at this time. Private lands will be treated through cooperation with the Gateway Interagency Fire Front (GIFF). All treatments on private lands will be hand-treatments, such as light thinning, and would not measurably degrade overall watershed stability or downstream water quality below current conditions. Individual treatments on private lands would serve to reduce fire severity within and around individual dwellings located adjacent to

BLM and FS managed lands. Within the BLM and FS managed lands, five units would be treated the first year, five the second, eight in year three, eight in year four, nine in year five, six in year six, four in year seven, five in year eight, and two in year nine.

Within Federal lands, a variety of treatments have been proposed. These treatment types include low-intensity prescribed fire, machine, hand-thinning, clearing (mostly hand-thinning), and combinations of these treatments. Following is a description of the proposed treatment areas on Federal lands with assumptions used for the WEPP model:

1. Following vegetative treatment, it is anticipated that potential wildfire intensity would be reduced to a mosaic of 33% low intensity, 33% moderate intensity, and 33% high intensity.
2. Within the boundary of any treatment unit, only about 30% to 50% of the total unit area would actually be impacted by the treatment. On slopes equal to or greater than 45%, only thirty percent or less of the unit would be treated in any three year period.
3. Machine treatments would be used only on slopes of less than 40%. This treatment is expected to increase total ground cover by about 25% due to the chipping/mulching effects of the machine that would leave woody material on the ground. Machine treatments would be used only on snow pack, frozen, or dry ground to reduce soil disturbance.
4. Hand thinned treatments are expected to increase total ground cover by about 15% due to "lop and scatter" where cut trees are left as ground cover.
5. Prescribed fire units would be burned primarily in the spring or late fall. Spring or late fall burning would all produce low-intensity fires. Low intensity fires would leave much of the overstory and consume about 15% of the vegetative ground cover. At least 25% ground cover would be retained in all units.
6. Clearing would occur along the roads and trails and mostly by hand-thinning to increase the fire break width on existing roads and trails.
7. No more than 30% of any 6th Hydrologic Unit Code (HUC) watershed would be treated during any one year. These watersheds would not be re-entered for at least two years following any treatment to allow for hydrologic recovery. Should wildfire occur, hydrologic recovery will be determined by a USFS or BLM hydrologist, but treatment will not occur sooner than two years following the fire.
8. At least a 200 foot buffer on each bank will be left between treatment sites and perennial stream channels. A 100-ft. buffer would be left on each bank adjacent to intermittent or ephemeral streams and springs. Only "lop and scatter" hand thinning would be permitted within these buffers. This buffer will serve as a filter to remove sediment from overland runoff prior to reaching the channel. The effectiveness of the filter will depend on the severity of the disturbance and health of the buffer strip. For the proposed treatments, it is assumed the buffer will be 95% -100% effective in trapping non-channelized flow sediment. Should a wildfire occur, the buffer could be overwhelmed and effectiveness could be significantly reduced.

A variety of treatments that have been proposed will result in varying direct effects on potential erosion/sediment and indirect effects to downstream water quality. The effects analysis below considers the assumptions made above.

Prescribed Fires:

It is assumed all prescribed fires will be low intensity, consuming only about 15% of the vegetative ground cover. Prescribed fires would occur in the spring, shortly after snow leaves the unit, or late fall, when the weather is cool. Units 4, 5, 7, 8, 9, 14, 15, 17, 18, 22, 23, 24, 25, 26, 43, 48, 49, 50, and 52 will only be prescribed burned. Also, units 36, 38, 41, 42 and 46 will be prescribed burned after either hand-thinning or machine treated. Potential sediment within these units range from less than 1 ton per acre to over 9 tons per acre on NFS lands and 6.6 to 21 tons per acre on BLM lands. Differences in potential sediment rates are a function of overall ground cover existing prior and after treatment, slope steepness and slope lengths. From the WEPP model erosion and sediment rates from all BLM treatment units under a prescribed fire produced over 5 tons/acre sediment in the first year following treatment, assuming an event happened that first year (see Table 1).

In order to maintain overall soil productivity, erosion rates should not exceed 3 tons per acre on NFS lands and 5 tons per acre on BLM lands. Low intensity burns could cause these criteria to be exceeded in units 5, 7, 14, 15, 17, and 26 on NFS lands, and units 36, 38, 41, 42, 43, 46, 48, 49, 50 and 52 on BLM lands (see Table 1). As stated above, the actual rates of erosion/sedimentation would depend on the actual percent of ground cover removed from each site and the storm event(s) that would occur following the treatment. It is expected that the greatest potential erosion/sedimentation would occur within the first year following treatment (Robichaud 2002b). It is expected that ground cover would return to near pre-burn densities within three years following the treatment.

If treatments occur as proposed, no indirect effects to water quality in area streams or the Portneuf River would be measurable.

Machine Treatments:

Units 1, 28, 31, 32, 34, 35, 40, 44, 45, 47, and 51 (only BLM lands) would be treated with a tracked machine that saws, cuts and chips woody vegetation into smaller sizes. The process scatters the vegetation over the ground surface. This vegetation would be left on the ground, effectively increasing overall ground cover by an estimated 25%. The WEPP model showed less sediment produced from these treatments than what presently occurs because of the increase in total ground cover after the treatment.

Hand Thinning:

Units 2, 3, 6, 11, 12, 13, 16, 21, 27, 29, 33, and 39 would be hand-thinned. Hand thinning consists of ground crews on foot lopping and scattering brush, shrubs and trees with chain saws. These treatments increase ground cover by about 15% and also showed less sediment produced than the existing condition. Direct effects on erosion/sediment would be negligible and un-measurable. Indirect effects on downstream water quality would also be negligible and un-measurable.

Clearing:

Units 10, 19, 20, and 30 would be cleared. Clearing consists of increasing the fuel break width adjacent to an existing road or trail by hand thinning and would also produce negligible effects on water quality because the actual road width will not be increased.

Mechanical/Burn:

Units 36, 42, and 46 would be treated mechanically and a portion of the treatment area would be prescribed burned. These treatments only occur on BLM lands and WEPP modeling shows erosion and sediment produced from these treatments in excess of 5 tons/acre if an event occurs the first year after treatment. Although the machine treatment itself may increase total ground cover, the prescribed burn on these slopes still contribute sediment.

Hand Thin/Burn:

Units 38, and 41 would be hand-thinned and a portion of the treatment area would be prescribed burned. These treatments also occur on BLM lands only and WEPP modeling shows erosion and sediment rates again over 5 tons/acre from these treatment units.

Wildfire:

If a wildfire were to occur following a treatment under the Proposed Action, it is expected that burn intensities would be reduced from 60% high, 30% moderate, and 10% low, to around 33% high, 33% moderate and 33% low intensity. This would directly reduce the overall erosion/sediment potentials from what could occur if the units were not treated. It is estimated that the reduction in fire intensities would directly reduce sediment potentials from 20% to 30% below that projected from untreated sites on NFS lands and by 5% to 23% on BLM lands. The differences in sediment potentials are a factor of pre- and post-fire ground cover residuals. The Forest generally has greater current ground cover percentages than BLM lands. If a wildfire were to occur, more total ground cover would be removed from NFS lands (e.g. about 72%) than from most BLM lands (e.g. about 54%); therefore the greater the percent differences between pre- and post-treatment sediment rates from wildfires on the NFS lands.

Indirectly, wildfires could degrade overall water quality in adjacent streams and downstream in the Portneuf River. The actual effects would be dependent on the location and severity of the fire and precipitation events following the fire.

The following table depicts the predicted erosion/sediment rates using the Watershed Erosion Prediction Project (WEPP) model. Pre-treatment potential wildfire erosion rates are based on the assumption that 10% of a unit would burn at a low intensity, 30% moderate, and 60% will burn at high intensity. Post-treatment wildfire intensities would be somewhat reduced to 33% low intensity, 33% moderate intensity, and 33% high intensity. Erosion/sediment potentials from both pre- and post-wildfire are based on a 25-year return period, from 50 years of climate as recorded at the Ft. Hall climatic station, adjusted for the location of the project area relative to the climatic station.

Table 1 . Summary of Potential Sediment Rates between Alternatives

		Alternative 1				**Alternative 2**		
		Current Situation	**No Action Wildfire**			**Proposed Action Treatment**	**Proposed Action Wildfire Post-Treatment**	
Map Unit No./ Agency Ownership	Total Unit Area (Acres)	Current potential sediment (Tons per acre)	Potential Sediment from Wildfire (Tons per acre)	Percent of the Unit Treated (%)	Treatment Type	Potential Sediment from Proposed Treatment (Tons per acre)	Potential Sediment from Wildfire (Tons per acre)	Relative % differen in sedimen potentia produce by wildfire between Alt. 2 vs Alt. 1 (%
1/ BLM	103	<0.5	28.1	50	Machine	<0.5	23.0	-18
2/ BLM	28	<0.5	16.9	50	Hand thin	<0.5	13.9	-18
3/ BLM	84	<0.5	13.6	50	Hand thin	<0.5	11.3	-17
4/ FS	65	<0.5	6.3	40	Rx fire	0.14	4.41	-30
5/ FS	26	<0.5	29.4	40	Rx fire	4.7	20.6	-30
6/BLM	86	<0.5	23.0	50	Hand thin	<0.5	20.5	-11
7/FS	97	<0.5	51.3	30	Rx fire	9.05	36.2	-30
8/FS	25	<0.5	2.1	30	Rx fire	0.09	1.7	-22
9/FS	443	<0.5	2.1	30	Rx fire	0.09	1.7	-19
10/FS	19	<0.5	minimal	30	Trail edge clearing	minimal	minimal	0
11/BLM & ID	135	<0.5	36.4	50	Hand thin	<0.5	31.8	-13
12/BLM & FS	92	<0.5	19.7	30	Hand thin	<0.5	16.9	-14
13/BLM	5	<0.5	10.3	50	Hand thin	<0.5	9.2	-11
14/FS	6	<0.5	22.2	50	Rx fire	4.02	15.92	-28
15/FS	13	<0.5	19.9	30	Rx fire	3.37	14.26	-28
16/BLM	383	<0.5	22.9	30	Hand thin	<0.5	19.3	-16

17/FS	8	<0.5	16.7	30	Rx fire	5.85	13.46	-19
18/FS	16	<0.5	13.7	30	Rx fire	2.65	10.47	-23
19/FS	11	<0.5	minimal	30	Trail edge clearing	minimal	minimal	0
20/FS	86	<0.5	minimal	30	Trail edge clearing	minimal	minimal	0
21/BLM	28	<0.5	22.1	50	Hand thin	<0.5	19.3	-13
22/FS	90	<0.5	24.6	30	Rx fire	2.49	17.2	-30
23/FS	103	<0.5	1.0	30	Rx fire	0.01	0.6	-36
24/FS	145	<0.5	24.8	30	Rx fire	2.57	17.3	-30
25/FS	31	<0.5	17.9	30	Rx fire	1.98	12.7	-29
26/FS	27	<0.5	20.5	30	Rx fire	3.83	15.0	-27
27/BLM	12	<0.5	17.6	50	Hand thin	<0.5	15.3	-13
28/BLM	217	<0.5	37	50	Machine	<0.5	32.5	-12
29/BLM	122	<0.5	30.8	50	Hand thin	<0.5	27.2	-12
30/FS	43	<0.5	minimal	30	Trail side clearing	minimal	minimal	0
31/BLM	72	<0.5	20.1	50	Machine	<0.5	19.1	-5
32/BLM	68	<0.5	30.2	50	Machine	<0.5	26.4	-13
33/BLM	75	<0.5	24.9	40	Hand thin	<0.5	22.0	-12
34/BLM	99	<0.5	26.9	40	Machine	<0.5	22.2	-17
35/BLM	345	<0.5	42.6	40	Machine	<0.5	33.2	-22
36/BLM	447	<0.5	47.0	50	Mech/ burn	13.2	38.7	-18
37/BLM	144	<0.5	29.1	25	Hand thin	<0.5	22.5	-23
38/BLM & ID	175	<0.5	51.3	50	Hand thin/ burn	10.9	40.3	-21
39/BLM	123	<0.5	40.3	40	Hand thin	<0.5	36.1	-10
40/BLM	273	<0.5	33.5	50	Machine	<0.5	26.0	-22
41/BLM	96	<0.5	42.0	50	Hand thin/ burn	8.7	32.4	-23
42/BLM & FS	399/297	<0.5/<0.5	57.2/28.5	40	Mech/ burn	7.4/2.5	44/19.5	-23/-32
43/BLM	383	<0.5	34.1	30	Rx fire	13.6	26.9	-21
44/BLM	64	<0.5	31.8	30	Machine	<0.5	25.2	-21
45/BLM	41	<0.5	22.4	30	Machine	<0.5	17.7	-21
46/BLM	131	<0.5	39.9	30	Mech/ burn	6.6	30.8	-23
47/BLM	88	<0.5	35.8	50	Machine	<0.5	29.5	-18
48/BLM & FS	160/171	<0.5/<0.5	35.8/24.7	30	Rx fire	14.7/1.4	28.5/17.6	-20/-28
49/BLM	309	<0.5	33.6	30	Rx fire	14.9	26.9	-20
50/BLM & FS	222/102	<0.5/<0.5	43.6/22.5	30	Rx fire	19/2.3	34.5/18.5	-18
51/BLM	133	<0.5	29.4	30	Machine	<0.5	22.8	-22

& ID								
52/ID	270	<0.5	54.4	40	Rx fire	20.8	42.3	-22

The floodplains of Cusick, Johnny, Gibson Jack, Mink, Kinney, Fort Hall Canyon, Papoose and Indian Creeks will be adequately protected from upland sediment and erosion from the proposed actions on federal lands in Table 1 by the 200' buffer strip. This buffer strip will be enough to filter overland flow from all but the most extreme precipitation events. Floodplain protection of the intermittent/ephemeral Buck and Doe Creeks, Trough and Morris Canyons and Smith Gulch would also occur by a 100' buffer strip either side of the channel. Wildfire impacts, even after the Proposed Action treatments, will likely impact the floodplains by channelizing overland flow and sediment from the watershed to the stream.

The only treatments themselves that would occur within these buffer strips would be small hand-thinning treatments of aspen stands to rejuvenate these aspen stands. These thinnings would be small in size and not contiguous, and would not significantly nor measurably change the floodplain condition from the present condition.

Irretrievable and Irreversible Commitment of Resources

Irretrievable commitment of resources includes compacted areas such as roads and man-made buildings and structures. These will continue to exist in their present form and condition within the project area.

Irreversible commitments of resources will occur from the proposed activities. These commitments will last only for a few years, corresponding with re-growth of removed vegetation. If a wildfire were to occur, the potential effect would be somewhat reduced from Alternative 1 due to the decrease in overall fire intensities within the treated areas (see Table 1).

Cumulative Impacts

In order to assess cumulative impacts to watersheds of past, present and reasonably foreseeable future actions, effects are subdivided into short and long-term consequences. Over the short-term, proposed treatments remove vegetation from a site and may disturb the ground, especially when a tractor-sized machine is use. The affected portion of the watershed could be reduced from a stable condition to an unstable condition over the short-term (less than 5 years). However, over the long-term (several years to decades), as the vegetation grows back and disturbances are stabilized, this effect can be reversed. In some situations, overall conditions can actually be improved over existing condition as the result of the proposed treatments.

The cumulative effects area for this proposal are the 6th field HUC watersheds identified in Chapter 3 and the Portneuf River from Indian Creek to American Falls Reservoir. The Portneuf River above Indian Creek would not be affected by the proposed action and all potential effects from the project that could reach the river would be trapped and deposited into American Falls Reservoir and would not continue downstream.

Past and present conditions are constant between all alternatives. Reasonably foreseeable actions are the proposed treatments on Federal lands, continued livestock grazing especially on BLM lands, recreation and continued urban and rural development within and around the project area. Past and present conditions within the cumulative effects area include agriculture, livestock grazing, roads, man-made structures, recreation (including horseback riding, hiking, camping and ATVs), heavy industry, and the like.

For BLM lands, continued recreation will be a minor cumulative impact not significantly impacting stream channels, water quality or floodplain unless a significant increase in use of OHV stream crossings occurs due to the fuels treatments. Due to steep slopes, lack of public access, downed trees and shrubs and the small amount of treated areas, outdoor recreation should remain a minor cumulative impact.

The largest single cumulative impact on BLM lands is continued livestock grazing, especially just after the treatments. Livestock will continue to to have access to BLM lands just after the treatments and could increase erosion and sedimentation rates from those shown in Table 1, increase the length of time required to reach adequate regrowth and a pre-treatment watershed condition and more importantly could reduce the vegetative cover and increase the compaction of the stream buffer strips, decreasing its capability to trap sediment and protect the channel and the stream's water quality. Grazing will be excluded from hand thinning in aspen stands, and since some of these occur within the stream's buffer strip, this will improve the effectiveness of the buffer strip. Livestock grazing on BLM lands will cumulatively impact the channel, water quality and floodplain on treatment units east of Mink Creek. The units west of Mink Creek will not have livestock grazing as a cumulative impact. Livestock grazing has been recently reduced by nearly 50% on the Inkom Allotment east of Mink Creek. This reduction of grazing will lessen this cumulative impact and confine it mostly to only traditionally high use areas within the allotment. Through this reduction in grazing, streambanks are expected to increase in stability, vegetative cover, improving the overall functioning condition status of the streams, which should also improve water quality.

For Forest Service lands, a guideline for maintaining overall watershed health is found in the Revised Forest Plan for the Caribou National Forest. This guideline states that no more than 30% of any 6^{th} field HUC watershed should be in a detrimentally disturbed condition at any one time. This includes all land ownerships within a watershed, on both public and private lands. Past and present activities have disturbed major portions of each watershed, potentially in excess of this 30% guideline. However, the actual portion of each treatment area within each watershed is relatively small (see Table 1, Chapter 3). For example, the Gibson Jack watershed would have treatments that affect only about 3.5% of the sub-watershed. Even though the cumulative impacts from this relatively small treatment area may exceed 30% within the entire watershed, the effects of the treatments themselves are relatively minor over the short-term and should help to improve overall conditions over the long term, if fire intensities are reduced as a result of the treatments. It is anticipated that most treatments on Forest Service lands will not exceed 3-5 tons per acre in order to maintain overall soil productivity and watershed stability, and would reduce post-treatment catastrophic fire erosion/sedimentation rates by up to 30%. Therefore, even if the 30% total watershed disturbance guideline is exceeded, downstream effects from the proposed treatments would be potentially un-measurable over current background conditions.

Appendix xxx

Hydrology, Water Quality and Floodplain (Chapter 4)

A goal of the proposed project is to reduce fuel loads to decrease fire behavior and intensities in the Wildland Urban Interface area and move vegetation to lower risk fire condition classes. Proposed treatments would occur over a nine-year period.

Catastrophic wildfire, besides being a potential hazard to those who live within a potential wildland fire zone, and to those who fight the fires, can cause significant damage to watershed values and downstream water quality. For this reason, it is thought that if areas can be treated to reduce the potential and intensities of catastrophic fire, social and environmental consequences may be reduced. Values-at-risk include human life, property and critical natural and cultural resources (Davis 2002).

As discussed in Chapter 3, the project area is in a critical watershed that supplies water to the City of Pocatello and the surrounding communities. Maintenance of healthy watersheds and the production of clean water are essential to the well-being of area residents and businesses.

Numerous studies have been conducted concerning fire effects on water quality and watershed values, including changes in runoff characteristics and mass stability. An examination of the available literature suggests a nearly unanimous consensus that intense or severe fire can have dramatic effects on both runoff and erosion rates within the affected watershed(s) (Moody 2002, Spigel 2002, Ryan 2002, Benavides-Solorio 2002, Kunze 2002, Troendle and Bevenger 1996, Robichaud and Waldrop 1994) as well as nutrient balances (White 2002).

Specific studies have found that intense fire can induce significantly more runoff and erosion, and substantially change the nutrient balance within a watershed. Davis (2002) suggested that fire can create emergency watershed conditions, which include both hydrologic and soil factors, potential for flash floods and debris flows, and deterioration of soil condition, particularly loss of soil structure, which can lead to a decline in overall soil productivity. For example, Gould (2002) found that runoff from post-fire storms from the Jasper Fire, Black Hills, resulted in an increase of 200% to 1000% over pre-fire flows. Farnes (1996) in an investigation of the Yellowstone fires, suggested that Yellowstone area streams would have a one percent increase in April through July runoff for every three to four percent of the drainage area that has a canopy burn. Troendle and

Bevenger (1996) suggested that preliminary data anlaysis of the Clover-Mist fire in Wyoming provided evidence the fire increased both streamflow quantity and sediment export. Moody (2002) found that after the 1996 Buffalo Creek Fire in steep mountainous topography of Colorado, hillslope erosion was about 100 times greater on burned vs. unburned areas. Robichaud and Waldrop (1994) found that sediment yields were 40-times greater for high-severity burns than the low-severity burns. White (2002) suggested that fire may destroy the protective organic layer and underlying root mat, thereby increasing the soil's susceptibility to nutrient depletion. Cannon (2002) suggested that burning induced changes in the hydrologic response to rainfall events, initiating debris-flow processes in burned basins. Ragan (2002) suggested that wildfire can alter hillslope processes which in turn can alter the erosional processes, by altering rill patterns, which disrupt the hydrology of the hillslope. Collins (2002) found that drainage density increased by 200% and many 1st order channels eroded headward in the Muddy Hollow watershed, California.

Most wildfires create a patchwork of low, moderate and high severity burn areas, often causing spatially varied hydrologic surface conditions. Severely burned areas often have increased erosion due to loss of the protective forest floor layer and loss of water storage and creation of water repellent soil conditions (Robichaud 2002a). Robichaud (2002a) also found that short-duration, high-intensity thunderstorms following fire events caused the highest erosion rates by several orders of magnitude over long duration, low-intensity rain events. Similar results were found by Spigel (2002), Malmon (2002) and Wagenbrenner (2002). Hughs (2002) found sediment yields varied significantly with fire severity. He found for several fires in Colorado, that sediment yields from high severity sites averaged from four to seven times the value for sites burned at moderate severity and 17 to 24 times the value for sites burned at low severity and unburned plots. He concluded that percent bare soil is the primary control on sediment yields, although soil water repellency, slope and soil moisture were also significant factors. Spigel (2002) attained similar conclusions. In another Colorado study, Benavides-Solorio (2002) found that sediment production rates at sites that burned at high severity was 400 to 1000 times higher than similar sites burned at moderate to low severity. He also found that summer convective storms generated about 90% of the annual erosion, with most of the sediment resulting from only a few of the most intense storms. Similar results were found by Macdonald (2002). Pierce (2002) studying long-term responses of ponderosa pine forests in central Idaho, found that sediment has historically occurred following higher intensity fires, whereas light surface fires produced little or no geomorphic responses over time. She also found that fire-related sediment occurred more often from storms with recurrence intervals of several decades.

If wildfire should occur within the project area, a mosaic of fire intensities would be expected to occur, with similar hydrologic responses as those suggested in the literature. More severely burned sites would potentially generate more runoff/erosion/sediment than sites that are burned less severely, or not burned at all. In an effort to determine effects of varying fire intensities within the project area, the USDA Forest Service Water Erosion Prediction Project (WEPP) model is used. WEPP applies user inputs of local climate, soils, slope gradient and length, percent ground cover and soil rock content. Values modeled by WEPP are not absolutes, as actual amounts of runoff and erosion are site specific and climate dependent. However, output values are capable of indicating the relative differences in treatments. For example: On a site that has a low severity burn on a 30% slope with about 70% residual ground cover, a 25-year return period analysis based on 50 years of climate could potentially produce from about 0.6 to 1.5 tons of erosion/sediment per acre of land affected, depending on slope length. On the same site that is moderately burned, about 3 to17 tons of erosion/sediment per acre could result, depending on slope length. The same site, if burned severely, could have as much as 6 to 35 tons of erosion/sediment per acre, again depending on slope length. Generally speaking, a moderate burn intensity would generate erosion an order of one magnitude greater than a low intensity burn, and a high intensity burn would generate erosion two orders of magnitude above a low intensity burn. The probability that runoff/erosion/ sediment would occur the 1st year following the disturbance would be about 60% from a low severity site, about 80% on moderate severity site and 100% for all three elements on the high severity site. Therefore, the high intensity burn site has about twice the potential for runoff/erosion/sediment than the low intensity burned site. These modeled findings are consistent with values suggested in the literature. Spigel (2002) specifically measured his findings from the Bitterroot National Forest to WEPP and found his results fell well within the accuracy range of the model. Please see Table xxx for the input values used for the WEPP model for this project.

Table xxx. WEPP Model Input Values for BLM and USFS Lands for the Portneuf Project

Map Unit No.	Ownership	Ave. Elevation (Ft.above MSL)	Aspect	Middle Slope (%)	Slope Length (Ft.)	Total Ground Cover (%)	Rock Cover (%)
1	BLM	5000	N; S	22	1606	55	5
2	BLM	4800	NW	30	402	55	5
3	BLM	4920	S; SE	17	703	55	5
4	FS	5400	NE	32; 9	3012	85	0
5	FS	5440	NE	33	602	75	10
6	BLM	5440	E	28	2409	55	5
7	FS	5880	S	45	803	75	10
8	FS	6740	E	4	1004	84	13
9	FS	6740	E	4	1004	84	13
10	FS	5250	N; NE	N/A	N/A	N/A	N/A
11	BLM/ID	5400	NE	30	2008	60	5
12	BLM/FS	5200	N	28	1004	60	5
13	BLM	5000	NE	10	1004	60	5
14	FS	5000	SW	60	402	75	3
15	FS	5040	W	27	602	75	5
16	BLM	5200	SW	25	1305	65	35
17	FS	5080	W	32	502	70	10
18	FS	5120	NW	40	602	81	0
19	FS	5400	N	N/A	N/A	N/A	N/A
20	FS	7055	S	N/A	N/A	N/A	N/A
21	BLM	4720	NW	50	402	60	5
22	FS	6400	N	27	3011	80	5
23	FS	7040	N	2; 25	3814	80	5; 20
24	FS	7040	N	2; 25	3814	80	5; 20
25	FS	7020	S	14	1405	80	15
26	FS	7040	SW	20	1004	80	15
27	BLM	5480	W	30	402	60	5
28	BLM	5000	NW; N; NE	30	1606	60	5
29	BLM	5000	N; W	27	1205	60	5
30	FS	5250	S; SE	N/A	N/A	N/A	N/A
31	BLM	5320	E	20	2090	60	5
32	BLM	5400	E	30	903	60	5
33	BLM	5200	NE	18	1807	60	5
34	BLM	5320	N	30	803	55	5
35	BLM	5500	NE; N; NW	33	1104	65	35
36	BLM	5600	NW	55; 40	2008	40; 65	5

37	BLM	5120	NE; N; NW	60; 50	562	65	15; 10
38	BLM/ID	5200	SW; W	43	1104	65	35
39	BLM	5200	N; NE	29	3710	60	5
40	BLM	5520	E; W	14; 28	2108	65	20
41	BLM	5300	E	20; 31	1807	65	20
42	BLM/FS	5800	NW	30; 48	3814	75; 60	15; 5
43	BLM	5500	NE; E	26	1365	65	15
44	BLM	5040	NE	27	1606	60	10
45	BLM	5120	NE	32; 20	743	60	10
46	BLM	5520	E	20	2108	65	10
47	BLM	5800	E	31; 20	1807	50	15
48	BLM/FS	5840	N; SE	24	2510	65/85	20/10
49	BLM	5300	W; E	25; 20	3714	60	15
50	BLM/FS	5600	NW	31; 25	2208	60	10;15
51	ID/BLM	5300	N	19	1706	65	30
52	ID	5800	N	50; 28	2770	65	30

Eroded soils can be filtered through buffers of vegetation. Various authors have investigated the use of vegetation buffers to filter eroded soils prior to reaching a channel. Belt *et al*.(1992) summarizes investigated research. He suggested four characteristics about buffer strip design to trap sediment and nutrients: 1) buffer strips should be wider where slopes are steep; 2) buffers are not effective in controlling channelized flows originating outside the buffer; 3) sediment can move overland as far as 300 feet through a buffer in a worst case scenario; and 4) removal of natural obstructions to flow – vegetation, woody debris, rocks, etc – within the buffer increases the distance sediment can move. They concluded that filter strips on the order of 200-300 ft are generally effective in controlling sediment that is not channelized. Ketcheson and Megahan (1996) found that sediment in granitic watersheds seldom moved more than 200 feet through vegetation buffers. NRCS (2002) suggests using a 100 ft. buffer to control sediment, nutrients and organic material. The State of Idaho Rules and Regulations pertaining to the Idaho Forest Practices Act, advocates maintaining at least 30 feet on each side of the ordinary high water mark of a Class II channel.

Alternative 1--No Action Alternative

Literature suggests that wildfire can substantially increase erosion/sediment potentials of burned areas (Moody 2002, Spigel 2002, Ryan 2002, Benavides-Solorio 2002, Kunze 2002, Troendle and Bevenger 1996, Robichaud and Waldrop 1994).
WEPP modeling of individual units within the project area indicates that potential erosion/sediment from lands impacted by such a wildfire can be several orders of magnitude over current conditions. For example: a site on a 30% slope, with a 2000 ft. slope length that is burned at a high-severity, could increase sediment from less than 0.5 tons per acre to about 35 tons per acre, an increase of two orders of magnitude. This modeled sediment increase is based on a 25-year return period analysis based on 50 years

of climate input. Actual erosion/sediment would depend on the actual severity of the fire and precipitation events that occurred following the fire. If very light or no precipitation occurred following the fire, little erosion/sediment would occur. Conversely, if a substantial storm event followed the fire, more erosion than modeled could result (Germanoski 2002, Pierce 2002). The national weather service has not specifically calculated the percentage chance of a substantial storm occurring during any given year, but 58 intense storm events were recorded between 1993 and 2002 in the Pocatello area. Therefore, there is a good chance that a high-intensity storm event could occur following a wildfire, which could cause a three or four order of magnitude increase in erosion/ sediment and directly degrade overall watershed conditions and indirectly degrade downstream water quality.

Agency Direction

The effects of this alternative on Desired Future Conditions and Goals described by the Forest Service and Bureau of Land Management are mixed. The watersheds are currently heavily impacted by a variety of activities (see cumulative effects section). Proposed treatments would not occur and disturbances within each proposed unit would not occur. However, if a catastrophic wildfire were to occur, the affected watersheds would be degraded and there could be a substantial loss of adjacent property. If this were to occur, Agency direction to maintain healthy watersheds and adequate water quality to support designated beneficial uses would not be satisfied.

Alternative 2—Proposed Action Alternative

Agency Direction

The effects of this alternative on Desired Future Conditions and Goals described by the Forest Service and Bureau of Land Management are mixed. The watersheds are currently heavily impacted by a variety of activities (see cumulative effects section). Proposed treatments would occur and disturbances within each proposed unit would occur as described. If a catastrophic wildfire were to occur following treatment, the affected watersheds would potentially not be degraded as much as if the treatments did not occur. In this scenario, Agency direction to maintain healthy watersheds and adequate water quality to support designated beneficial uses would be satisfied since efforts will take place to reduce fire intensities and reduce risks to watersheds and adjacent properties.

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