PLANNING LANDFORM GROUPS (PLFG) DESCRIPTIONS FOR FOREST PLAN REVISION

P.Green/N.Gerhardt - Revised 5/19/2004
Draft: needs more work

PLANNING LANDFORM GROUP ONE: Broad convex ridges – Hard granite, Gneiss and Schist – subalpine fir habitat types.

Planning Landform Group One (PLFG 1) comprises approximately xx percent of the total analysis area. Elevations range from 5,500 feet to 8,000 feet. PLFG 1 occurs in unglaciated areas at upper elevations throughout the subbasins, especially in the Gospel Hump, Selway Bitterroot and Frank Church Wildernesses.

Landform and Soils: This Planning Landform Group is characterized by broadly convex ridges derived from well-fractured and moderately weathered granite, gneiss and schist. This material is moderately to highly erodible, generating mostly sands and gravels. Sediment delivery efficiency is low. Surface erosional processes dominate in this PLFG, but surface soil erosion is buffered by a volcanic ash influenced soil surface layer. Slopes are gentle to moderate: 10-50%.

Climate: Average annual precipitation is 35 to 45 inches per year, with more than 50% being snowfall.

Streams: Streams are generally moderate to high gradient in their headwaters and low to moderate gradient in lower reaches. They are predominately formed of gravel and cobble size particles. First and second order streams are generally A4 and B4. Third to fifth order streams are generally B4, C4 and E4. Most valley bottoms are forested, but meadow/shrub complexes occur occasionally. Channel morphology is defined by relatively frequent bankful flows, rather than catastrophic events. Headwater streams tend to transport fine sediment through their steeper reaches, then store sand and gravel for extended periods in more moderate gradient reaches. Riparian vegetation, both woody and herbaceous, is a key element in channel and bank stability.

Fisheries Habitat: Key salmon habitat elements are riparian vegetation, undercut banks, instream woody debris, sustained base flows, and cold temperatures. Riparian vegetation provides bank stability, cover, and shade; it also regulates nutrient inputs. Undercut banks provide cover and shade. Instream woody debris provides gradient control, structure, carbon and nutrients at the base of the food web, and flow diversity. Flow diversity sorts stream substrate, creating areas of spawning gravels.

Vegetation: Cold, moderately moist to moist habitat types (Cooper et al., 1991) are dominant. Aspect and elevation, coupled with the ecological events and processes like fire, snow loading, competition, herbivory, insect and disease effects are the primary influences on vegetation composition. Upland habitat types include subalpine fir series, and minor grand fir at low elevations. Dominant overstory tree species are lodgepole pine, Douglas fir, Engelmann spruce, western larch, subalpine fir, grand fir and whitebark pine. Shrubs, forbs, and graminoids can dominate the understory. Forest habitat types dominate streamside zones. Upland tree species often grow next to streams on well-drained adjacent hill slopes. Subalpine fir, Engelmann spruce, and lodgepole pine are common. Meadow/shrub complexes occur occasionally, and large meadow complexes are important, or were historically, in
the Big Creek and Wind River watersheds.

Fire: Stand replacing fires occurred on an average 75-150 year cycle in the uplands. Smaller, less lethal fires also occurred occasionally. Valley bottom vegetation often burned with more mixed severity. Fire suppression has reduced the incidence of fire in the landscape, although most stands would not be outside their fire interval. The greater continuity of older age classes means there is some increased potential for larger fires in severe burning conditions. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression and competition. Water yield and sediment yield may fluctuate over a wider amplitude if larger fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP Two: Glaciated Lands - All rock types- subalpine fir and whitebark pine habitat types

Planning Landform Group Two (PLFG 2) comprises approximately xx percent of the total analysis area. Elevations range from 4500 ft. to 9,000 feet. The higher elevations of the Selway subbasin, the Gospel Hump, the Seven Devils area, and Sabe Creek fall in this Planning Landform Group. Much of this PLFG is wilderness.

Landform and Soils: PLFG 2 is characterized by steep, ice-scoured cirques and glacial troughs with inclusions of gently sloping ice scoured ridges, glacial valley bottoms, and moraine deposits derived from poorly weathered rocks of granitic, volcanic or metamorphic origin. They range from slightly to highly erodible, generating sand to cobble size material. Sediment delivery efficiency is moderate to high. Abundant rock or locally abundant volcanic ash surface soil helps to buffer sediment movement. Surface erosion occurs on steep slopes with shallow soils. Debris torrents, colluviation and mass wasting are also important geomorphic processes. Slopes are variable: from 10 to 100%.

Climate: Average annual precipitation is 40 to 50 inches per year, with more than 70% being snowfall.

Streams: Streams flow through valleys that alternate between steep cirque/trough walls and low gradient valley bottoms, with cascading reaches over boulder deposits. They are formed of predominantly gravel to boulder size particles. First and second order streams generally are high gradient and the most common channel types are A2a and A3a. They are prone to channel scour and debris torrents during periods of rapid snowmelt or summer thunderstorms. These streams are dominantly forested, but are often intermingled with shrub and herbaceous plant communities. Third through fifth order streams are usually low to moderate gradient, with occasional high gradient reaches. Channel types are typically B3, C3 and E4. A mixture of silt through boulder size material in valley bottom fill makes bank stability highly variable along low to moderate gradient reaches. Coarse material transported from headwater streams may be stored in low gradient reaches for long periods. Riparian vegetation, bedrock and boulders are key elements in channel and bank stability.

Fisheries Habitat: Key salmon habitat variables include instream large wood, large substrate, riparian vegetation, and cool temperatures. Boulders and bedrock are important for channel stability and sediment storage. Third and fourth order streams depend on instream large wood, boulders and undercut banks for cover and pool formation. In meadow complexes, instream large wood deposited from upstream provides bank stability. Undercut banks and aquatic vegetation provide cover and shade. Instream large wood and stream meander are the major pool formers. Fifth order streams are uncommon in these landforms and usually depend on large substrate for pool formation, bank stability, and cover. Stream reaches which are accessible to chinook provide spawning habitat e.g., upper main Slate Creek.

Vegetation: Vegetation patterns are complex, composed of cold, dry to wet grand fir and subalpine fir subalpine habitat types (Cooper et al. 1991), and are highly dependent on elevation, soil depth, and aspect. Dominant tree species are lodgepole pine, Engelmann spruce, subalpine fir, Douglas fir, grand fir, and whitebark pine. Shrub and herbaceous complexes are often intermingled with forest communities in valley bottoms and with herbaceous communities on dry ridges.

Fire: At lower elevations large stand-replacing fires could occur at intervals of 75 to more than 150 years, and more patchy fires of mixed severity at more frequent intervals. Valley bottom vegetation often burned less frequently (>150 years) and in patches. Open high elevation ridges may have experienced frequent ignitions, but burned at mixed severity. Fire suppression and historic grazing have influenced the vegetation in some wilderness and non-wilderness lands. Alpine knotweed has displaced native grasses in some areas, possibly increasing erosion and sedimentation. Fire suppression, blister rust and beetle activity are accelerating succession, with resultant increases in fuel loads and potential for larger, more intense fires. Water yield and sediment yield may fluctuate over a wider range if more severe fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression. Prescribed Fire Management Plans are now in effect for the Gospel-Hump, Selway, and Frank Church wilderness areas, but constraints on naturally ignited fires have resulted in far fewer acres burned than historically.

PLANNING LANDFORM GROUP THREE: Breaklands - Gneiss, Schist, and Granite – Grand fir, Douglas fir, and grassland habitat types

Planning Landform Group Three (PLFG 3) comprises approximately xx percent of the total analysis area. Elevations range from 1,600 feet to 6,800 feet. PLFG 3 occurs on the main river canyons and many larger tributaries of all subbasins.

Landform and Soils: PLFG 3 is characterized by stream breaklands and mountain slopes derived from moderately well weathered granite, gneiss, and schist. These are highly erodible, generating mostly sand to cobble materials. Sediment delivery efficiency is high. Surface erosion occurs on the steepest south aspects and little volcanic ash remains to buffer against erosion. Channel scour, colluviation, and mass wasting are also important geomorphic processes. Slopes are 40-80%.

Climate: Average annual precipitation in the lower elevation canyons and breaklands ranges from 17 inches at Riggins, mostly rainfall, to 40 inches at highest elevations, mostly falling as snow.

Streams: Streams are generally high gradient in confined valley bottoms. The drainage system is parallel. Substrate can be highly variable in headwater streams, ranging from bedrock and boulders to cobbles and gravels. Cobbles and boulders dominate in larger streams. Channel types in first and second order streams are generally A2a, A3 and A3a and in third through fifth order streams are generally A2, B3 and B4. Most valley bottoms are forested. Channel morphology is often a function of extreme events in first and second order streams. They are prone to channel scour and debris torrents. Debris torrents can increase after large fires, in conjunction with summer thunderstorms or snowmelt. Headwater streams tend to transport sediment downstream to moderate gradient lower reaches or directly to the main Salmon River. Riparian vegetation, both herbaceous and woody, is a key element in channel and bank stability of headwater streams. Channel stability in larger streams may depend on large organic debris and boulders.

Fisheries Habitat: Key salmon habitat elements include large substrate, high stream gradient and stream power, confined valley bottom, instream large wood and riparian vegetation. The large substrate forms pools, and slow water areas and creates interstitial spaces. High stream gradient and stream power sorts substrates and deposits clean spawning gravels, transports fine sediment through stream reaches, and scours deep pools. Valley confinement increases transport efficiency. Confined valleys also offer topographic stream shading. In first through fourth order streams large wood is important for channel stability, sediment storage, cover and pool formation. In fifth order streams large wood is most effective as infrequent debris jams which create complex slow water areas. Riparian vegetation provides shade, nutrient filtering, and organic matter input to streams.

Vegetation: Plant community composition is highly dependent on aspect, and habitat types vary from very dry to moderately moist (Cooper et al., 1991, Steele, et al., 1981). Bunchgrass, ponderosa pine, and Douglas fir series dominate lower elevations and grand fir series dominate north aspects and higher elevations. Dominant species are ponderosa pine, Douglas fir, grand fir, western larch, lodgepole pine and Engelmann spruce. Streamside vegetation includes shrub and deciduous tree complexes along lower elevation stream bottoms and conifer dominated communities on north aspects or higher elevations. Tall and mid shrubs are abundant.

Fire: At lower elevations, cool surface fires occurred at 5-25 year intervals, which thinned and maintained open forest stands. Less frequent, stand replacing or thinning fires occurred on north aspects and in forested valley bottoms at 25-75 year intervals. Surface erosion after fire is usually slight, but increased water yields can result in debris torrents in these high gradient reaches. On open south aspects, low fire severity and the limited role of organic debris in tributary streams suggest that streams are only slightly affected by fire. Fire suppression has reduced the incidence of fire, with resultant increases in fuel loads and potential for larger, more intense fires. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression and other human intervention.

Plant communities are being invaded by several non-native plant species, annual grasses and noxious weeds. Erosion and sedimentation will increase because of the limited soil stabilization capabilities of these species (James 1991). Water yield and sediment yield may fluctuate over a wider amplitude if more severe fires occur.

Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP SIX: Rolling Uplands – Hard granite, Gneiss and Schist – grand fir habitat types.

Planning Landform Group Six (PLFG 6) comprises approximately xx percent of the total analysis area. Elevations range from 3,500 feet to 5,500 feet. PLFG 6 occurs throughout the South Fork Clearwater subbasin at low to mid elevations and in the Salmon River subbasin in XXX

Landform and Soils: This Planning Landform Group is characterized by rolling hills derived from moderately to well-weathered granite, gneiss and schist. This material is moderately to highly erodible, generating mostly sands and gravels. Sediment delivery efficiency is moderate. Surface erosional processes dominate in this PLFG, but surface soil erosion is buffered by a volcanic ash influenced soil surface layer. Slopes are moderate: 20-50%.

Climate: Average annual precipitation is 30 to 40 inches per year, with more than 50% being snowfall.

Streams: Streams are generally moderate to high gradient in their headwaters and low to moderate gradient in lower reaches. They are predominately formed of gravel and cobble size particles. First and second order streams are generally A4 and B4. Third to fifth order streams are generally B4, C4 and E4. Most valley bottoms are forested, but meadow/shrub complexes occur occasionally. Channel morphology is defined by relatively frequent bankful flows, rather than catastrophic events. Headwater streams tend to transport fine sediment through their steeper reaches, then store sand and gravel for extended periods in more moderate gradient reaches. Riparian vegetation, both woody and herbaceous, is a key element in channel and bank stability.

Fisheries Habitat: Key salmon habitat elements are riparian vegetation, undercut banks, instream woody debris, and cool temperatures. Riparian vegetation provides bank stability, cover, and shade; it also regulates nutrient inputs. Undercut banks provide cover and shade. Instream woody debris provides gradient control, structure, carbon and nutrients at the base of the food web, and flow diversity. Flow diversity sorts stream substrate, creating areas of spawning gravels.

Vegetation: Cool, moderately moist habitat types (Cooper et al., 1991) are dominant. Aspect and elevation, coupled with the ecological events and processes like fire, competition, herbivory, insect and disease effects are the primary influences on vegetation composition. Upland habitat types include grand fir series, and minor Douglas fir at low elevations. Dominant overstory tree species are ponderosa pine, lodgepole pine, Douglas fir, Engelmann spruce, western larch, grand fir, and subalpine fir. Shrubs, forbs, and graminoids can dominate the understory. Forest habitat types dominate streamside zones. Upland tree species often grow next to streams on well-drained adjacent hill slopes. Grand fir, Douglas fir, Engelmann spruce, and lodgepole pine are common. Meadow/shrub complexes occur occasionally, and large meadow complexes are important, or were historically, in the American River, Crooked River, Red River, Newsome Creek, Mill Creek, and both Meadow Creek watersheds.

Fire: Stand replacing fires occurred on an average 75-150 year cycle in the uplands. Smaller, less lethal fires also occurred at more frequent intervals. Valley bottom vegetation often burned with more mixed severity. Fire suppression has reduced the incidence of fire, with resultant increases in fuel loads and potential for larger, more severe fires. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression and competition. Water yield and sediment yield may fluctuate over a wider amplitude if more severe fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP SEVEN: Steep Mountain Slopes and Stream Breaklands - Basalt and Andesite – Grand fir, Douglas fir and grassland habitat types

Planning Landform Group Seven (PLFG 7) comprises approximately xx percent of the total analysis area. Elevations range from 1,400 feet to 6,400 feet. PLFG 6 occurs along the main Salmon River from about 7 miles

north of Riggins and along lower elevation canyons of the major tributaries in this area, as well as lower Rapid River.

Landform and Soils: PLFG 7 is characterized by steep mountain slopes, stream breaklands, and mass wasted slopes derived from poorly to moderately weathered Columbia River basalt, Seven Devils volcanics and associated limestone and slate. These materials are only slightly erodible in comparison to others in the assessment area. They generate mostly silts, clays, gravels and cobbles. Sediment delivery efficiency is high. Surface erosion, colluviation and mass wasting are important geomorphic processes. Little volcanic ash is present to buffer surface soils against erosion. Slopes are steep: from 40 to 80%.

Climate: Average annual precipitation in the lower elevation breaklands ranges from about 17 inches at Riggins, mostly falling as rain, to 40 inches at highest elevations, mostly falling as snow.

Streams: Streams within PLFG 7 are generally high gradient in confined valley bottoms. Substrate consists of cobbles and gravels in headwater streams to cobbles and boulders in large order streams. Channel types in first and second order streams are typically A3a and A4a and in third through fifth order streams are B2, B3, and G3. Most valley bottoms are forested, but tall shrub and hardwood complexes are common along lower elevation reaches such as lower Slate Creek and lower John Day Creek. Channel morphology is often a function of extreme events in first and second order streams. They are prone to channel scour and debris torrents. Debris torrents can increase after large fires, in conjunction with summer thunderstorms or snowmelt with rain. Headwater streams tend to transport sediment downstream to moderate gradient lower reaches or directly to the main Salmon River. Riparian vegetation, both herbaceous and woody, is a key element in channel and bank stability of headwater streams. Large organic debris and boulders influence channel stability in larger streams.

Fisheries Habitat: Key salmon habitat elements include large substrate, high stream gradient and stream power, confined valley bottom, instream large wood and riparian vegetation. The large substrate forms pools, and slow water areas and creates interstitial spaces. High stream gradient and stream power sorts substrates and deposits clean spawning gravels, transports fine sediment through stream reaches, and scours deep pools. Valley confinement increases transport efficiency. Confined valleys also offer topographic stream shading. In first through fourth order streams large wood is important for channel stability, sediment storage, cover and pool formation. In fifth order streams large wood is most effective as infrequent debris jams which create complex slow water areas. Riparian vegetation provides shade, nutrient filtering, and organic matter input to streams.

Vegetation: Plant community composition is highly dependent on aspect, and habitat types may vary from very dry to moderately moist (Cooper et al., 1991, Steele et al., 1981). Bunchgrass, ponderosa pine, and Douglas fir series dominate lower elevations and grand fir series dominate north aspects and higher elevations. Dominant species are ponderosa pine, Douglas fir, grand fir, western larch, lodgepole pine and Engelmann spruce. Streamside vegetation includes shrub and deciduous tree complexes along lower elevation stream bottoms and conifer dominated communities on north aspects or higher elevations. Tall and mid shrubs are abundant.

Fire: At lower elevations, cool surface fires occurred at 5-25 year intervals, which thinned and maintained grasslands or open forest stands. Less frequent, stand replacing or thinning fires occurred on north aspects and in forested valley bottoms at 25-75 year intervals. Surface erosion after fire was usually slight, but increased water yields could result in debris torrents in these high gradient reaches. On open south aspects, low fire severity and the limited role of organic debris in tributary streams suggest that streams are only slightly affected by fire. Fire suppression has reduced the incidence of fire, with resultant increases in fuel loads and potential for larger, more intense fires. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression.

Several non-native plant species, annual grasses and noxious weeds are invading plant communities. Erosion and sedimentation will increase because of the limited soil stabilization capabilities of these species (James 1991). Water yield and sediment yield may fluctuate over a wider amplitude if more severe fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP 8: Steep mountain slopes and stream breaklands, schist and gneiss - cedar and grand fir habitat types

Planning Landform Group eight (PLFG 8) comprises approximately xx percent of the total analysis area. Elevations range from 1600 feet to 5,000 feet. PLFG 8 occurs along the main Selway and Middle Fork Clearwater rivers from about Moose Creek to Kooskia.

Landform: Steep and very steep stream breaklands and mountain slopes, slopes 40-80%, with parallel drainage pattern of mostly first and second order streams. First and second order streams can deliver sediment rapidly to large order streams.

Parent materials: Moderately well weathered hard crystalline rock, highly erodible, generating mostly silt to gravel material. Soils are mostly deep over bedrock and surface erosion occurs on only the steepest south aspects with shallow soils.

Streams: generally high gradient, highly confined in v-shaped or narrow flat canyon bottoms. Most valley bottoms are forested, with minor inclusions of tall shrub and herbaceous complexes.

1-2nd order streams: Rosgen channel types A4a. These streams are moderately prone to channel scour and debris torrents on north aspects, and highly prone on south aspects or areas of shallow soils. They are highly dependent on large organic debris for channel stability and sediment storage. Banks highly prone to mechanical damage. Instream fines vary greatly in response to fire and channel scour cycles.

3-6th order streams: A2, A3, B2, B3, B3a channel types. Banks are resistant to damage. Third and fourth order streams may depend on large organic debris for cover and pool formation. Fifth and 6th order streams usually depend on boulders. Third and fourth order streams usually show levels of cobble embeddedness of 20 to 40 percent. Fifth and 6th order streams have high transport capacity and usually show low levels of cobble embeddedness.

Vegetation: Plant community composition is dominated by warm to cool moist cedar and grand fir habitat types (Cooper et al., 1991, Steele, et al., 1981). Douglas fir and grand fir series dominate lower elevations southerly aspects and cedar series dominate north and east aspects, riparian and higher elevations. Dominant species are western red cedar, ponderosa pine, Douglas fir, grand fir, western larch, lodgepole pine and Engelmann spruce. Streamside vegetation is usually conifer-dominated. Tall and mid shrubs are abundant.

Fire: Stand replacing fires occurred at 75-150 years, and more frequent mixed severity fires often occurred between stand replacement events. Fire group 11 is dominant in uplands and narrow valley bottoms. . These productive habitat types produce heavy fuels, but fire hazard is usually low to moderate because of high fuel moisture. Intervals between fires are highly variable. About half of stands show evidence of one or two underburns before a stand replacing fire occurred. Stand replacing fires may occur at intervals of 200 years or more south of the Selway, and may have occurred more often north of the River, spreading from drier fuel types on south aspects. Lower slopes and ridges are most likely to underburn. On steep south aspects, fire groups 1,2, and 3 are characterized by frequent low severity fires, with a mean fire return interval of 10 to 20 years, and usually little tree mortality. In low gradient valley bottoms along large order streams, fire group 12 is characterized by very long fire free intervals, perhaps as much as 400 years. Lightning ignitions occur in these areas, but usually only burn a few trees. Most stand replacing fires occur during extreme fire weather, and originate in surrounding drier sites.

Long (50 years or more) seral brush and deciduous tree stages are common on warm aspects and in moist draws. Fire killed snags provide woody debris for as long as 80 years after fire.

Surface erosion after fire is usually slight, except on shallow soils in drainage headland areas. Channel scour associated with increased water yields and more rapid delivery through the soil mantle can result in debris torrents in these high gradient channels. Scoured material is often delivered directly into a 3rd order stream or larger, which may result in short or long term changes in channel configuration, and addition of large rock and

organic debris to the channel. These events appear to be more common on south aspects than north, because of local storm tracks, or because soils are thinner and have lower cohesion on south aspects.

Debris flows and rotational failures are usually associated with steep slopes and periodic or persistent high water tables in depressions and on lower slopes. Stand replacing fires result in loss of root strength in these areas and, with subsequent increases in water yield after fire, can reactivate these areas of slope instability. Most low order channels and some lower slopes show evidence of historic debris flows and slumping.

Climate: Hydrology is dominated by snowmelt runoff at upper elevations, but spring rain on snow and summer thunderstorms can result in significant hydrologic response at all elevations, most particularly on open south aspects with shallow soils. On all aspects, spring runoff after fire can result in channel scouring and debris inputs to downstream channels.

PLANNING LANDFORM GROUP NINE: Rolling Uplands – Granodiorite and quartz monzonite – grand fir and subalpine fir habitat types

Planning Landform Group NINE (PLFG 9) comprises approximately xx percent of the total analysis area. Elevations range from 5,000 feet to 6,500 feet. PLFG 9 occurs within the analysis area on the middle and upper reaches of Little Slate Creek and its tributaries, upper Bargamin Creek and the Dixie area.

Landform and Soils: PLFG 9 is characterized by rolling uplands derived from moderately well weathered granodiorite. This material is very highly erodible, generating mostly sand and small gravel. Sediment delivery efficiency is moderate. Surface erosional processes dominate in this PLFG, but a thin volcanic ash-influenced soil surface layer buffers against erosion in most places. Slopes are moderate: 20-50%.

Climate: Average annual precipitation is 30 to 40 inches per year, with more than 50% being snowfall.

Streams: Streams are generally low to moderate gradient and formed predominately of sand and gravel size particles. The drainage system is dense and dendritic. The lower gradient valleys tend to fill with sediment, forming meadows and meadow/shrub complexes interspersed with forest. Channel morphology is defined by relatively frequent bankful flows, rather than catastrophic events. Headwater streams tend to transport fine sediment through their steeper reaches, then store sand and gravel for extended periods in lower gradient reaches. Channel types of first and second order streams are generally A4 and B4. Third to fifth order streams are generally B4, C4 and E4. Riparian vegetation, both woody and herbaceous, is a key element in channel and bank stability.

Fisheries Habitat: Key salmon habitat elements include: riparian vegetation, undercut banks, instream woody debris, and cool temperatures. Riparian vegetation provides bank stability, cover, and shade; it also regulates nutrient inputs. Undercut banks provide cover and shade. Instream woody debris provides gradient control, structure, carbon and nutrients at the base of the food web, and flow diversity. Flow diversity sorts stream substrate, creating areas of spawning gravels.

Vegetation: Cold, moderately moist habitat types (Cooper et al., 1991) are dominant. Aspect and elevation, coupled with ecological events and processes like fire, competition, herbivory, and pathogen activity are the primary influences on vegetation composition. Upland habitat types include subalpine fir and grand fir series. Dominant overstory tree species are lodgepole pine, Douglas fir, western larch, grand fir, and subalpine fir, and Engelmann spruce. Mid and low shrubs, forbs and graminoids can dominate the understory. High water tables in sediment-filled valley bottoms favor development of meadow and meadow/shrub complexes interspersed with forest.

Fire: Stand replacing fires occurred on an average 75-150 year cycle in the uplands. Valley bottom vegetation often burns less frequently (150 years or more) and in patches. Fire suppression has reduced the incidence of fire, with resultant increase in fuel loads and potential for larger, more intense fires. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression. Water yield and sediment yield may fluctuate over a wider amplitude if more severe fires occur. Woody debris

recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP FIFTEEN: Rolling hills and plateaus – Basalt – Grand fir and Douglas fir habitat types

Planning Landform Group fifteen (PLFG 15) comprises approximately xx percent of the total analysis area. Elevations range from 2,400 feet to 6,000 feet. PLFG 15 occurs primarily in the headwaters of Whitebird Creek and Skookumchuck Creek, and other tributaries of the Lower Salmon river, and in Clear Creek.

Landform and Soils: PLFG 15 is characterized by low rolling hills and plateaus of low to moderate relief, derived from moderately weathered Columbia River basalt. This substrate is only slightly erodible in comparison to other geologic materials in the assessment area. It generates from clay to cobble size material. Sediment delivery efficiency is low. Soils have volcanic ash surface layers, and highly aggregated subsoils with high rock contents that buffer effectively against erosion. Surface erosional processes dominate in this landform but are slight in comparison to other PLFGs. Slopes are moderate: 10-40%.

Climate: Average annual precipitation is 30 to 45 inches per year, with more than 50% being snowfall.

Streams: Streams are generally moderate to high gradient and formed predominantly of gravel and cobble size particles. The drainage system is widely spaced, mostly first and second order, with typical channel types being A4 and B4. Most valley bottoms are forested, but sedge meadows, and forest-meadow complexes occur occasionally. Channel morphology is defined by relatively frequent bankful flows, rather than catastrophic events. Headwater streams tend to transport fine sediment through their steeper reaches, then store sand and gravel for extended periods in lower gradient reaches. Riparian vegetation, both woody and herbaceous, is a key element in channel and bank stability.

Fisheries Habitat: Key salmon habitat elements are riparian vegetation, undercut banks, instream woody debris, and cool temperatures. Riparian vegetation provides bank stability, cover, and shade; it also regulates nutrient inputs. Undercut banks provide cover and shade. Instream woody debris provides gradient control, structure, carbon and nutrients at the base of the food web, and flow diversity. Flow diversity sorts stream substrate, creating areas of spawning gravels.

Vegetation: Cool, moderately dry to moderately moist habitat types (Cooper et al., 1991) are dominant. Aspect and elevation, coupled with ecological events and processes like fire, competition, herbivory, pathogen activity are the primary influences on vegetation composition. Upland habitat types include Douglas fir, grand fir and subalpine fir series. Dominant tree species are grand fir, Engelmann spruce, Douglas fir, lodgepole pine, ponderosa pine, western larch, and subalpine fir. Mid and low shrubs, forbs and graminoids can dominate the understory. Meadow/shrub complexes occur occasionally.

Fire: Mixed severity fires occurred at 25 to 75 year intervals. Stand replacing fires occurred on an average 75 - 150 year cycles in the upland subalpine and grand fir zones. Smaller, less lethal fires also occurred at more frequent intervals. Valley bottom vegetation often burns in patches. Fire suppression has reduced the incidence of fire, with resultant increases in fuel loads and potential for larger, more severe fires. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression and competition. Water yield and sediment yield may fluctuate over a wider range if more severe fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression.

PLANNING LANDFORM GROUP SIXTEEN: Plateaus – Basalt - grassland, shrubland, and ponderosa pine habitat types

Planning Landform Group Sixteen (PLFG 16) comprises approximately xx percent of the total analysis area. Elevations range from 2,800 feet to 6,000 feet. PLFG 16 occurs primarily as slightly tilted plateaus isolated by the entrenchment of Baker Gulch and Whitebird Creek in steep walled canyons, as well as the Camas Prairie around Grangeville.

Landform and Soils: This Planning Landform Group is characterized by plateaus of low relief, derived from poorly to moderately weathered Columbia River basalt. This substrate is only slightly erodible compared to others in the assessment area. Sediment delivery hazard is low. Soils have thin or mixed volcanic ash surface layers, and highly aggregated subsoils with high rock contents that buffer effectively against water erosion. Slopes are gentle: 5 to 40%.

Climate: Average annual precipitation is 18 to 40 inches per year, most falling as rain, except above about 4000 feet elevation.

Streams: Streams are generally moderate to high gradient and formed of predominantly gravel and cobble size particles. The drainage system is widely spaced and dendritic, mostly first and second order, and streams are often intermittent. The most common channel types are probably A3 and B4. Channel morphology is defined by episodic events, although they are seldom extreme because of small stream size and power. Headwater streams transport the rapid storm runoff and sediment through their steeper reaches to the even steeper breakland reaches downstream. Rock and riparian vegetation are key elements in channel and bank stability.

Fisheries Habitat: Key salmon habitat elements are those that contribute to water quality downstream: sediment storage and water temperature. Both fluctuated historically in response to fire and storm flow. Current management: grazing, harvest, annual crop production, and loss of bunchgrass and pine to annual grasses and forbs, has increased rates of sediment production and decreased duration of storage between flushing events. Fire suppression has probably reduced temperature fluxes in response to fire, but grazing has removed shade so that mean temperatures may have increased.

Vegetation: Vegetation patterns are influenced by thin soils or deeper clay soils and dominantly low elevations. Warm, dry habitat types (Cooper et al., 1991) are dominant. Grasslands and open, park-like stands of ponderosa pine and Douglas fir once dominated this PLFG. Upland shrub species occurred and still occur with scattered trees in stream bottoms. Bunchgrass habitat types are at low elevations and on thinnest soils. Existing vegetation is now primarily cropland, hay and pasture, with some remaining forest land that has been heavily impacted by grazing and harvest. Riparian areas are conifer or shrub dominated, often with rock outcrop.

Fire: Dry climate, thin soils, and frequent low severity fires limited the occurrence of trees within this PLFG. Frequent cool surface fires (every 5 to 25 years) thinned and maintained grasslands or open stands of ponderosa pine or Douglas fir. Grazing, crop production, timber harvest, and invasion by annual grasses and noxious weeds have affected the role of fire and sediment yields as much as fire suppression in this PLFG. Valley bottom vegetation develops greater fuel accumulations and slightly higher fuel moisture so that presettlement fires may have been slightly less frequent, but more severe in streamside zones. The potential for larger, more lethal fires has probably not increased.

Several non-native plant species, annual grasses and noxious weeds are invading plant communities. Erosion and sedimentation will increase because of the limited soil stabilization capabilities of these species (James 1991).

PLANNING LANDFORM GROUP 17: Rolling hills, well weathered gneiss and schist parent materials – cedar and grand fir habitat types

Landform: rolling hills of low to moderate relief, slopes 20-50%, dendritic drainage system, about 3 miles of stream per square mile, mostly first and second order streams.

Parent materials: Well-weathered hard crystalline rock, highly erodible, generating silts, sands and gravel material. Rock is highly fractured and surface erosion is rare. Soils have about 15 inches of volcanic ash surface layers that buffer effectively against surface erosion.

Streams: generally moderate to high gradient, well to moderately confined in v-shaped to trough shaped valley bottoms. Most valley bottoms are forested, but shrub-forest complexes are important components. Tree stocking

is often low because of plant competition and high water tables, but trees may grow to very large size. Numbers of large woody debris may be limited as a consequence.

1-2nd order streams: Rosgen channel types A4, A4a, B3a, B4 in forest types, and forest/shrub complexes. Forested streams depend on large woody debris for sediment storage, and banks are sensitive to trampling damage.

3-4th order streams: A3, A3a, B3, B3a, B4 channel types in forested and shrub-forest complexes. Streams depend on large woody debris for cover, pool formation, and sediment storage, and on tree canopy cover for temperature moderation.

Vegetation: Cool, moist habitat types. Prone to frost in openings.

Upland habitat types: Cedar/clintonia NID fire group 11
Cedar/ginger NID fire group 11
Grand fir/ginger NID fire group 10
Subalpine fir/menziesia NID fire group 8

Streamside habitat types
Cedar/lady-fern NID fire group 12
Cedar/maidenhair fern NID fire group 12
Grand fir/senecio NID fire group 10
Forest/alder complexes NID fire group 0

Presettlement disturbance regimes:
Fire: Fire group 11 is dominant on ridges and south aspects. These productive habitat types produce heavy fuels, but fire hazard is usually low to moderate because of high fuel moisture. Intervals between fires are highly variable. About half of stands show evidence of one or two underburns before a stand replacing fire occurred. Stand replacing fires may occur at intervals of 200 years or more south of the Selway, and may have occurred more often north of the River, spreading from drier fuel types on south aspects. Lower slopes and ridges are most likely to underburn.

Fire group 10 is dominant on north aspects and moist depressions. Fuels can be heavy, but they dry slowly and large severe fires are very infrequent. These stands will occasionally stop the spread of large fires. Evidence of underburning is very infrequent, and occurrence of seral species is limited to spur ridges, where spot fires have occurred.

Fire group 12 and 0 are in streamside zones and depressions. Fire group 12 is characterized by very long fire free intervals, perhaps as much as 400 years along most streams, but more frequent in narrow entrenched valleys. Lightning ignitions occur in these areas, but usually only burn a few trees. Most stand replacing fires occur during extreme fire weather, and originate in surrounding drier sites. Fire group 0 includes patches of alder and other tall shrubs in moist sites. They also burn infrequently and patchily except under extreme conditions.

Climate: Hydrology is dominated by snowmelt runoff, which is usually slow and sustained. Rain on snow events and summer thunderstorms occur, but deep soil mantles with volcanic ash layers readily absorb snowmelt or rainfall. Post fire erosion is usually minimal and limited to the immediate streamside zone. Fire effects are little reinforced by climate. Increased water yields after fire could result in local channel scour or higher seasonal water tables in depressions.

Debris torrents, debris flows and rotational slumps are minor occurrences in this landform.

PLANNING LANDFORM GROUP 21: Steep mountain slopes and breaklands– hard granite, gneiss and schist – subalpine fir and grand fir habitat types

Planning Landform Group twenty one (PLFG 21) comprises approximately xx percent of the total analysis area. Elevations range from 5000 feet to 8000 feet. PLFG 21 occurs on the many larger tributaries of all subbasins at upper elevations, in areas little affected by glaciation.

Landform and Soils: PLFG 21 is characterized by stream breaklands and mountain slopes derived from granite, gneiss, and schist, that may be highly fractured, but is usually poorly weathered. These are highly erodible, generating mostly sand to cobble materials. Sediment delivery efficiency is high. Surface erosion occurs on the steepest south aspects, but volcanic ash often remains on north aspects to buffer against erosion. Channel scour, colluviation, and mass wasting are also important geomorphic processes. Slopes are 40-80%.

Climate: Average annual precipitation in the upper elevation mountain slopes and breaklands ranges from 35? to 40 inches at highest elevations, mostly falling as snow.

Streams: Streams are generally high gradient in confined valley bottoms. The drainage system is parallel. Substrate can be highly variable in headwater streams, ranging from bedrock and boulders to cobbles and gravels. Cobbles and boulders dominate in larger streams. Channel types in first and second order streams are generally A2a, A3 and A3a and in third through fifth order streams are generally A2, B3 and B4. Most valley bottoms are forested. Channel morphology is often a function of extreme events in first and second order streams. They are prone to channel scour and debris torrents. Debris torrents can increase after large fires, in conjunction with summer thunderstorms or snowmelt. Headwater streams tend to transport sediment downstream to moderate gradient lower reaches. Riparian vegetation, both herbaceous and woody, is a key element in channel and bank stability of headwater streams. Channel stability in larger streams may depend on large organic debris and boulders.

Fisheries Habitat: Key salmon habitat elements include large substrate, high stream gradient and stream power, confined valley bottom, instream large wood and riparian vegetation. The large substrate forms pools, and slow water areas and creates interstitial spaces. High stream gradient and stream power sorts substrates and deposits clean spawning gravels, transports fine sediment through stream reaches, and scours deep pools. Valley confinement increases transport efficiency. Confined valleys also offer topographic stream shading. In first through fourth order streams large wood is important for channel stability, sediment storage, cover and pool formation. In fifth order streams large wood is most effective as infrequent debris jams which create complex slow water areas. Riparian vegetation provides shade, nutrient filtering, and organic matter input to streams.

Vegetation: Plant community composition is highly dependent on high elevations, and habitat types vary from very cool, moderately moist to cold and harsh (Cooper et al., 1991, Steele, et al., 1981). Grand fir series dominate lower elevations on southerly aspects, and subalpine fir series dominate north aspects and higher elevations. Dominant species are grand fir, Douglas fir, Englemann spruce, western larch and lodgepole pine at lower elevations and subalpine fir, Englemann spruce, lodgepole pine and whitebark pine at upper elevations. Streamside vegetation includes shrub and conifer complexes along lower elevation stream bottoms and conifer dominated communities on north aspects or higher elevations. Mid shrubs like menziesia and alder are important.

Fire: Mixed and lethal fires occurred at intervals of 75-150 years. Riparian areas and moist lower north slopes may have burned less frequently. Surface erosion after fire is usually slight, but increased water yields can result in debris torrents in high gradient reaches. Fire suppression has reduced the incidence of fire at the landscape level, but individual stands are still mostly within their fire return interval. The continuity of older age classes across the landscape suggests there is potential for larger fires under severe burning conditions. An increase in tree mortality caused by insects and diseases can also be expected as vegetation changes as a result of fire suppression and other human intervention.

Water yield and sediment yield may fluctuate over a wider amplitude if larger fires occur. Woody debris recruitment and nutrient cycling may be affected by the shift toward later seral plant species and uneven age structure that would develop with continued fire suppression across a larger portion of the landscape.

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