Nick Sheedy
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25 May 2003

3050 N.E. 3rd Street
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Mr. Dan Tippy, BLM Prineville Field Office:

Please take into account the following comments on the Environmental Assessment and Proposed Alternatives for the Little Canyon Mountain Fuel Reduction Project.

I include comments below as they relate specifically to certain sections of the text you provided for public review.

—Nick Sheedy,
John Day, Oregon

1.4, under need for proposed actions:

Yes, four bark beetle species are present in the tree stands on LCM; AND, besides them, the insect that feeds on green pine needles and causes "black stain" is also present, and there are several problem areas with mistletoe (a fatal parasite that spreads easily), primarily in Ponderosa Pine, but also in some Douglas Fir.

Where the assessment reads, "several patches of dead trees"—There are more than "several" patches; there are very numerous dead trees all over LCM. While dead needles turn red and are visible in patches (perhaps several patches at a time), the needles soon drop and the trees become less visible in the dense timber stand; other red-needled patches may then become visible as more trees die, and the totality of the dead timber is not readily apparent from a distant.

These dead patches have developed primarily over the past 12 years (not "two years"), and have resulted in significant tree mortality over the past decade. From professional timber cruises conducted on the patented lode mining claims, the Zero and Piedmont, one completed by Phil Jenkins in 1996, and another completed by Arvid Anderson in 2001 (both cruises using comparable methods, and a similar plot grid), we know that about 25% of the timber volume died between spring 1996 and spring 2001. Another estimated 10% of the timber volume died in 2001 and 2002. The described properties comprise 36 acres on the northeast side of the mountain, including the northeastern ridge and down the north face of the mountain. The timber stands on the Zero and Piedmont were (before a recent fuel reduction project) comparable to the forest conditions on the adjacent public lands, and mortality rates are similar: it may be assumed that over 30% of the timber has died on the northern side of the mountain and ridge-tops in the last seven years.

2.1, under approaches for alternative treatments:

The "thin from below" method of treating fire-prone tree stands is a poor approach. It offers poor to fair short-term benefits to reduce the risk of crown fire, and offers very poor to no long-term benefits to reduce the fire danger.

The approach that targets a specific percentage of the basil area to be removed (say 50%), using a "thin from below" approach, offers fair to good short-term benefits, but poor long term benefits to reduce the risk of crown fire.

The approach to restore a "sustainable structure and function" to the forest, would be the preferable alternative. But, this alternative needs to employ a comprehensive fuel-reduction operation, whereby there are no size-restrictions on what trees may or may not be cut. And it should NOT adhere to a strict "thin from below" approach, nor should it focus on removing a specific percentage of the basil area in any given location. Instead, it should focus on removing the dead and least vigorous trees, leaving the healthiest timber well spaced (to allow for at least 30 to 40 years of growth). This is the best way to reach an identified target basal area, to promote vigorous healthy trees, and allow for 25 to 40 years of healthy growth. This approach should try to maintain and improve a healthy multiple-aged timber stand, removing first the dead, dying and weak trees regardless of size or age, and then thinning other trees (especially very congested thickets and stands) in all size categories, leaving a healthy residual forest. A comprehensive fuel reduction produces, by far, the most beneficial crown fire risk reductions, the healthiest and most resilient forest conditions, and the best residual timber stand. It also allows for more future options should another forest treatment become necessary. And it realizes the most benefits from usable timber by harvesting more trees that have commercial value, and is therefore the most cost-effective.

According to recent Strategic Fire Hazard Assessments in the state of Montana and New Mexico (where arid forest conditions are similar to LCM), evaluating the risk of crown fires:

A "thin from below" up to nine inches immediately produced a low-risk rate on 13% of the area treated, while in a 30-year projection only 3% of the area remained at a low-risk rate. This approach had average net revenue of (negative) -$664 per acre (and 0% of the acres had any positive economic return).

A 50% basil area removal, using a thin from below, but only up to 16" in diameter, immediately produced a low-risk rate on 44% of the area treated, while in a 30-year projection, only 10% of the area remained at a low risk for a crown fire. This approach had average net revenue of (negative) -$294 per acre (with 20% of the area producing a positive economic return).

A comprehensive fire-fuel reduction (with no size restrictions, where target basil areas are identified and professional foresters are allowed the discretion to select the worst trees to cut, and identify the best and healthiest trees to leave) immediately produced a low-risk rate on 90% of the area treated, and in a 30-year projection 73% of the area remained in a low-risk state. This approach had an average net revenue (GAIN) of $624 per acre, after covering all expenses associated with the fuel reduction projects (with 51% of the area treated producing a positive economic return).

From this, it should be clear that the comprehensive approach, with no diameter or size restrictions, provides, by far, the best short-term and long-term reduction in risk of crown fire, and is also the most economically sensible. Please consult the afore mentioned assessments of Montana and New Mexico (conducted by the staff of the University of Montana's School of Forestry, Bureau of Business and Economic Affairs, including Carl E. Fiedler, et al, and

supported by the Joint Fire Science Program and the USFS Pacific Northwest Research Station, submitted to the Joint Fire Science Program 29 September 2001, and 11 February 2002.)

2.2.3 "Alternative B—Blue Mountain Biodiversity Project":

I would like to commend the BLM staff for including the proposal of the professional obstructionist, Michael Christian (AKA Asante Riverwind), and his Blue Mountain Biodiversity Project, and thoroughly analyzing the affects and impacts of his prescriptions and proscriptions, and comparing them to the identified objectives and needs of the Little Canyon Mountain area. I believe that this assessment demonstrates that this proposal falls far short of addressing the real problems that exist, and would practically prevent nearly all necessary action that should be taken.

One of this alternative's points under "U" is well taken, and I agree that proposed project planning "must be site specific, accurate and ground truthed …" but his mandate that the outcome should be based on the "historical natural composition and density of area forest stands" is ridiculous should not be followed. This would practically require the BLM to clear-cut perhaps 60 to 70 percent of the area on and around Little Canyon Mountain, and drastically thin and log the remainder of the trees (if it is to be brought into a state comparable to "historical" densities). The BLM should not cut so many trees so as to reduce the forest on LCM to "historic levels, and for Christian/Riverwind to suggest this demonstrates that he apparently does not have a clear understanding of the actual conditions that historically existed in LCM, and the bulk of his suggestions are blanket rhetoric.

In the second paragraph of this alternative under "II", the claim that logging personnel and others are only "recent (and historically reluctant) to embrace" the concepts of "forest health" and "restoration … in word or deed", is an inaccurate and misleading statement. Logging contractors and local forest operators and workers are keenly interested in protecting and improving forest health; the people who live and work in the area and rely on a healthy resilient forest for their livelihood and their way of life, and who are directly affected, and the most affected by any deprivation of forest resources, are most certainly the most important and concerned parties involved in any activity having to do with "forest health", timber productivity, and "restoration". Moreover, Christian's claim that the "management track record in the forest remains dismally close to the old destructive 'business as usual'…" is false; it is mindless rhetoric, hollow words, and disingenuous. Here Christian (AKA Riverwind) demonstrates his ridiculous and radical views, and his words lend themselves to the interpretation that he seems to have more interest in preventing any beneficial (especially any economically beneficial) activity, rather than helping the situation in any way. His numerous rhetorical claims and demand that (unidentified, and assumed numerous) "repeat violators" must be stopped and prohibited from prohibited from conducting any further commercial activities on public lands, is simply stupid and indicative of the ramblings of an hysterical idiot.

I will add something here to refute the oft' repeated blanket claims that larger diameter trees are necessarily more fire resistant than smaller diameter trees. This is not true. While thicker bark and more mass does allow larger trees to survive better in many cases, these are not the only or most important factors to consider.

Larger trees are typically older, and older trees typically have far more dead limbs and "defect" in the form of "cat faces" (areas of exposed dead wood near the base, often caked with very flammable pitch); because of these, even very low-intensity fires can creep into many of the

most mature trees and burn then from the inside-out, especially if the mature tree has any rot in its trunk, which many—especially the oldest—trees do. Larger trees almost always have large amounts of thick duff and pine needles that have accumulated at their bases, which provide fuel that burns very hot around its trunk. Larger trees also have larger crowns, and, if these large crowns touch or are too close to other large crowns, they are the most likely to carry a sustained crown fire.

Large trees also have a larger percentage of their mass in their "heartwood". The heartwood is the dead wood at the center of the tree which does not carry pitch or moisture (the sap wood and the cambium layer are the only parts of the tree that carries moisture. Because the heartwood is dead and does not carry moisture, it is easier to burn. Smaller trees on the other hand may have no heartwood, being all sap-wood. A large mature tree may be 80% heartwood by volume, and only 20% sapwood (the only wood with much moisture), where a small tree is typically 100% sapwood. Because of this, "old-growth" wood is FAR easier to burn that smaller diameter wood.

The claims I make here are not my speculation. Ask any forest worker who has tried to light a landing fire in the winter and they will tell you that they will start a fire with some pitch-wood and then find a large chunk of the biggest diameter green log they can find; it is sure to burn! The smaller diameter green logs are much harder to burn. If an observer were to travel to Dribble Springs, in the 2002 Monument Rock Fire, one can witness where a huge stand of very large and mature trees were killed in a fire where many of them literally burned off at the stump because fire entered their trunks through some defect; they were NOT simply cooked or killed in a crown fire due to heavy ground or ladder fuels. Similarly, an observer can also go around the same fire area and witness many areas where smaller diameter well-spaced timber survived the fire. Driving between Prairie City and Summit Prairie, I have also recently observed conditions after the 2002 High-Roberts Fire, where, in the same exact areas, some small trees were killed and others survived, some medium sized trees were killed and others survived, and some of the largest trees died and others survived. The most important factor for survival was that the trees were well-spaced. And it was very apparent that the most important factor that contributed to the survival of the largest trees that are still living, is that the are not standing very close to other large trees. Spacing, more than any other factor, and spacing of various size-classes, seems to be the most important factor to promote tree survival after a forest fire.

2.2.4: regarding snags and down wood:

The identified objectives to leave one to four medium sized snags and one large snag per acre are not necessary. Leaving this many snags is not necessary to provide adequate wildlife habitat. Similarly, the objectives to leave a volume of large woody material on the ground is not necessary. There is an enormous volume of down woody material and dead snags already present on Little Canyon Mountain, likely exceeding 10- or 20-times the proposed levels. These are the greatest contributing factors that have caused the high-danger of intense fire in the area. Leaving the suggested levels of snags and logs would be counter-productive as it would only continue to contribute to a high danger of fire. Moreover, the slow rate of decay in the area would leave logs on the ground for the next 30 to 50 years, contributing to the long-term fire danger. It should also be emphasized that even if all dead and visibly weak trees were cut and completely removed, and all large down woody material were removed or cleaned up in a controlled burned, more trees would continue to die in the next few years, so many that they would likely satisfy (and exceed) the given objectives for standing snags and down-logs. It has

been my experience on my family's property (the Great Northern patented mine) that trees killed by bark beetle and drought do not remain standing snags for long: in 1997 and 1998, my uncles and I conducted a logging and thinning project on the Great Northern and left four large trees (about 20" in diameter) that we considered to be "border-line" if they would live or not; all four trees died within two years, and all four trees had fallen over and were on the ground by 2001. The blue-stain fungus introduced by the bark beetle, and perhaps the lack of pitch in the wood (I cannot say for sure what the cause) evidently leave snags killed by beetles in a state not suited to stand long, or provide the standing snag wildlife resource that is apparently sought by the numerical objectives outlined in the BLM's Assessment of the LCM Project. I say that the vast majority of all snags (trees killed by bark beetles) that the BLM might leave standing during any treatment, will fall over and be on the ground within three of four years; this would not help meet the wildlife snag objectives supposed by the BLM, and it would cause a continuing and undesirable build-up of heavy fire fuels.

If standing snags are to be left, the BLM should choose snags to leave that have less economic value. This likely will include smaller to medium sized snags, but may well include some of the largest snags as many of the oldest trees have considerable damage, rot and hollows which are "defective" from a commercial perspective, but may better satisfy wildlife resource objectives. A professional forester needs to be mindful of these conditions when marking timber to take advantage of what the resources have to offer, and should be especially mindful to try to recover useful timber that has social and economic value.

Under "ii", As for the "visual contrast" resulting from prescribed treatments: The BLM easily could remove over 50 to 60 percent of all the trees in every size category, selectively logging evenly and throughout the area, and the visual appearance of the mountain from a distance would remain virtually unchanged. The on-the-ground appearance, would of course, be noticeable, but such action would only bring about a positive change in the aesthetics of LCM if done carefully. The thinning rate does not need to be reduced along ridgelines. In fact, ridge lines is where thinning really needs to occur because it is at the ridgeline that relative firebreaks can be created in an effective way by reducing stand density. The recent fire fuel reduction that I and my uncles conducted on the Zero and Piedmont patented mines removed perhaps 55-65 percent of the trees (stems), being about 75% of trees under 12 inches in diameter, about 50 of the trees between 12" and 20", and about 45% of the trees over 20". The on-the-ground visual affects of the treatment produced a park-like setting (also removing 90 to 100 percent of the existing ground fuels and 99% of all slash); however, the aesthetic value and appearance of the property from afar remains relatively unchanged—so unchanged in fact, that people who look at the mountain every day have asked when we are going to start the project (after it had been practically completed).

It is unnecessary to retain a denser stand of timber immediately below an area of insect-killed trees (say for aesthetic purposes). It is actually very very important to thin those same trees immediately adjacent to beetle-killed patches, because the insects will most certainly have started multiplying and moving into adjacent stands. The dense stands immediately adjacent to identifiable insect-killed patches are in the most need of thinning to reduce competition, promote vigor and healthy resistance to the inevitable insects' spread. The "color and texture" of the insect treatment areas are such a miniscule and minor issue that it really deserves no attention.

The proposal under "iii" to identify wildlife cover in relatively healthy forest areas is a good idea.

Under "iv", even with prescribed burning (ranging between 7 and 25 years), another vegetative treatment will be needed within 30 years. This is a realistic statement. It must be understood, however, that significant work needs to be done to thin and log the timber stand on LCM, and significant work needs to be done to clean up existing dead fuel loads on the ground, before any safe burning treatment will be possible. The existing ground fuels and slash will not be able to be burned all at once: there is simply too much, and they may need to be piled and burned in stages to avoid killing a large number of healthy residual trees.

Under "v" describing the thinning method, a "thin from below" is most certainly not the most effective or desirable approach. By cutting so many small trees (90 to 100 percent under 12") and 80 to 90 percent of size classes above 12" until prescribed basal areas are met is too aggressive toward the smaller trees; this amounts to cutting the future of the forest; it would unnecessarily cut small healthy trees while leaving less vigorous larger trees, and it would limit future options should conditions on LCM require more vegetative treatments. Instead, the thin, if it is conducted "from below", should not remove more that 60 to 70 percent of small trees (under 12"), and not more than 50 percent of trees in each size class until basal areas are met. An approach like this will be more likely to produce a vigorous multiple-aged stand of healthy timber and allow for the best possible future conditions on the mountain.

The claim that the proposed strategy would "tend to leave the larger, healthier trees on the site" is not necessarily true, because the larger trees are not necessarily the healthiest or most vigorous. Marking "leave trees" is a good idea, if the large trees to be left are identified as the healthiest trees in the immediate area. It would be far more desirable to mark (to leave) four or five very healthy vigorous medium-sized trees (12" to 20"), rather than cut them and leave one or two moderately healthy large trees (20"+); in this scenario, it would be far wiser to cut one or both of the larger trees and leave the very healthy and vigorous medium sized trees. A professional forester needs to have the discretion to remove the worst and leave the best (and these are relative terms requiring subjective discretion on the specific site.)

2.2.5 "Alternative C—the Historical Perspective"

I cannot stress enough that, through active management, we can do better than default to what some people believe the forest conditions were like prior to the settlement by white men. We can do better than that to improve the health of the forest, reach all needful objectives identified in this Assessment, and also reap the benefits of the forest's resources.

Mention is made that there is a need to reduce canopy closure. This is the best way to reduce the risk of crown fire: but the only way to reduce canopy closure is to thin trees that are in the size- and height-class of the canopy (it cannot be accomplished by focusing on removal of trees under the canopy). By removing some trees at the canopy level, tree crowns will be spaced better and less apt to carry and sustain a crown fire. If thinned properly, residual tree crowns will naturally fill out to mitigate any ill-effects to the ground vegetation, and, by reducing competition, the larger trees left (the identified healthiest trees) will become more vigorous and able to withstand the pressures of insects, drought, and other adverse conditions.

The assumption that the larger trees are older is a reasonable assumption. However, I must give an example that tree spacing and specific site conditions are very important to actual tree size. On a 40-acre tract of private land I own within two miles of LCM, where nearly all the trees were in the 97-110 year old category, sizes ranged from about 9" in diameter (a tree 97 years old in a very tight and depressed thicket of similar trees) to over 40" in diameter (a tree 99 years old with wide spacing and good growing conditions); these trees are growing only 600 feet

apart. Tree size does not necessarily correlate to the age of a tree. Specific site conditions can cause widely varying sizes in trees of the same age, and it demonstrates the importance of proper tree spacing and site conditions to promote vigorous and healthy growth.

The explanation that a majority of the 2500 acres will be treated "with varying degrees" is very good.

In describing proposed treatment of mountain mahogany (page 46):

While this shrub may not have been "common" in the mid 1800s, according to the BLM's assessment, perhaps it needs to be understood that deer and elk were not common in this area in the mid 1800s either. The increased growth of mountain mahogany and other environmental factors (many as a result of human activity) have led to the increased populations of deer and elk. This is a good thing and the increase in certain vegetation has and can continue to support these populations of big game animals. Mountain mahogany is very important to winter browse for deer and elk. The historical relatively low numbers of large game animals in the area in the early and mid 1800s led early French trappers and mountain men to name the region "Malheur" which means "hardship"; traveling through this country and trying to feed one's self in the mid 19th century was indeed a hardship, largely because of the scarcity of game animals. We should not rely so heavily on, or try to return to "historic" models of what vegetation was like over 150 years ago. We can do better than that by working with "nature" to improve all aspects of our natural environment.

2.2.6 "Alternative D—Uniform Basal Treatment…"

The uniform basal treatment would be the simplest to implement. It would also be the most drastic, in my opinion. I do NOT think it is the most ideal treatment because it would simply cut too many trees, and jump to too great a tree spacing too quickly. After being in such a relatively congested state, these trees need to be spaced in stages so as to allow their roots and trunks to firm up and become stronger. Otherwise, a great number of trees will end up blowing over and snapping out, leaving a great number of dead and damaged trees, possibly leading to unhealthy and ugly forest conditions, and contributing to increased heavy fire-fuels on the ground. This tree spacing that would result from this option would be more drastic than I would suggest for this immediate treatment, but another treatment in 25 to 40 years would likely be able to withstand a similar tree spacing as what would result from this proposal (although, if an immediate treatment is properly implemented, a subsequent treatment in 25-40 years would not require such a low basal area target because the trees would be larger, and the measured basal area would be greater, with the same spacing).

However, it may well be that Alternative D is actually the most practical and preferable option, given the current state of public policies on public land and the current trends concerning timber harvests and forestry projects. If a different, less aggressive (albeit more ideal), alternative is implemented (whereby another vegetative treatment will become necessary in say 30 years), and future public policy prevents necessary action from being taken at that time, the forest conditions on LCM and the affected parties around it may be in a similar or a worse position at that time. In that case, perhaps this alternative would best serve the short- and long-term objectives to reduce the fire danger and promote forest health.

The proposed action to treat 10 acres of riparian area is well-intentioned and would likely benefit the area, so long as the "overstory removal" is NOT a TOTAL overstory removal, and selectively targets and removes trees, regardless of size, that would most benefit the riparian

area. The riparian undergrowth, hardwoods and willows benefit the streamside soils and helps to stabilize them, while the thick timber along these areas suppresses this beneficial vegetation.

Any proposed "rerouting" of portions of the existing road must involve parties that have a vested interest in the road itself. Closing a portion of a road and constructing a new road cannot have the force or effect of diminishing the existing and historic rights vested or owned by private property and mine owners. Recent federal, statutes, rules and regulations cannot be construed to infringe, deny or nullify rights that were granted and vested under previous valid Laws at the time roads were constructed when rights of way were established. Since many of the roads on LCM were constructed when neither the General Land Office, nor any other federal agency had any road authority, the Oregon Legislature and Oregon Revised Statutes were the only authorizing road powers; therefore, rights of way granted by statute by the Oregon Legislature (rights to construct, use, maintain, and alter the location of a road to improve grade or access, and the statutory rights subsequently vested in the real property of an owner by Federal and State statutes, and by explicit language in Deed and contract conveyed by the General Land Office) must be honored and protected.

If large rocks are to be placed in the front area of the "pit" area, the cleanup of the garbage and abandoned car bodies should be completed first to make access simpler.

2.2.7 "Alternative E—Graded Basal Treatment":

This is an interesting proposal, and may serve to reduce the threat of crown fire nearest to the developed areas close to Canyon City, but this option is not the most sensitive to site specific needs on the mountain. In general, a professional forester could and should use his or her discretion to address areas of higher risk with more intensive treatments (as this alternative proposes to do), but such a strict prescription may not serve the best needs of the forest.

2.2.8 "Alternative F—Stand Condition Stratified Treatment"

This alternative seems to be the most site-specific and that is very good. The basal area targets proposed are realistic and, if achieved, will produce the best immediate and near-term benefits. They will also encourage more vigorous growth, and if the best and healthiest trees are left standing, the best timber will experience the growth. It is very good to avoid strict basil area requirements and to be flexible with "targets" and apply these targets to the site, as the requirements of the stand require.

The proposal to target (for removal) first dead and dying trees, then juniper, followed by a thin, to meet basil area targets is a very good plan. However, a strict "thin from below" is not advisable. A comprehensive thin, cutting and leaving healthy trees of different size categories is the best approach.

The proposal to employ ground-based yarding on approximately 1/3 of the treated area, and use air-based yarding on approximately 2/3 of the area is an accurate estimate, given grade criteria. However, units could be organized to maximize the ground-based yarding—by including, in ground-based units, perhaps 200 feet into an area where slopes exceed an ideal grade (say 35%). By including peripheral slopes in a ground-based unit, harvested trees could be felled toward the skid trails and yarded using winches and chokers, without heavy equipment passing over the steeper ground. It is preferable to maximize ground-based yarding for two reasons: 1) it is less expensive—smaller diameter commercial trees, and even non-commercial trees, could be yarded by ground based methods, realizing greater economic returns, and also removing more non-merchantable wood fiber from the ground, alleviating some of the labor-

intensive work for hand-crews to pile slash and reducing the volume and density of slash and fire-fuel left on the ground; 2) by yarding trees (especially tree-length, with limbs left on) across the ground, a great deal of old woody material will be dragged to a landing or into a skid trail, and a great deal of duff wood, limbs and other debris would be mulched.

Whole-tree yarding is the preferable method to minimize slash left on the ground. In areas where there is good access, some trees smaller than 7" could be removed mechanically to a landing pile or a chip-wood pile, rather than use (labor-intensive) concentration or hand-piling slash disposal. It is preferable, where possible, to yard the majority of slash into large landing piles. This not only reduces the fire-fuel load immediately (rather than waiting for piling and burning projects to be completed), it also allows better utilization of the wood fiber for pulp or chips. Another benefit of removing larger amounts of logging and thinning slash and concentrating it in large landing piles is: the fresh cut green slash will attract hatching bark beetles; as the beetles continue to hatch, feed and multiply, the fresh green slash will offer the most convenient and readily available food for them; as they continue to feed and burrow deeper into large green slash piles, they will eventually either die, be burned when the pikes are burned, or be mechanically removed when the piles are chipped. This has been the exact experience in a recent fuel reduction project completed on private land I own within 2 miles of LCM: we removed 99% of the slash through tree-length harvesting, and skidding all non-merchantable thinning residue into one single landing pile; innumerable harmful insects could be seen during hatching periods streaming toward the large green slash landing pile. These insects were destroyed when the pile was chipped, and the remaining slash was burned; we essentially removed three generations of harmful insects. When hand-piling and concentration piling is to be prescribed, the piling must also include bucking, piling, and burning the numerous fuels that are already on the ground, and not just the resulting logging or thinning slash. By piling the accumulated dead material that is already on the ground, and also piling newly created green slash, piles can be burned easier.

Regarding Mountain Mahogany treatment under Alternative F, see my comments under the previous mention on page 46 of the Assessment. If Mountain Mahogany is to be thinned, only the most mature and weak stands of Mahogany should be treated. By removing some mature Mahogany, slightly scarifying the ground in Mahogany thickets, and completing a low-intensity ground burn in the areas, Mahogany stands can be rejuvenated.

Map 2.6—Alternative F:

The depiction of the forest compositions on LCM found on this map seems realistic and mostly accurate. This knowledge will allow professional foresters to better apply prescriptions in a site-specific manner.

2.2.9 Summary of Alternatives, Table 2.3:

The summary of the alternatives outlined by this table seems to be reasonable. The resulting acres of specific Basil Areas described seem accurate. The assumed mechanical re-entry also seems accurate. While reentry may become necessary, variably according to each of the more viable alternative, between 10-30 or 20-30 years, Any alternative must include monitoring and a contingency to reenter any problem areas within 5 years if further treatment is needed to finish cleaning up dead trees, remove more beetle infested stands, or salvage usable dead timber. The 10-30 or 20-30 year reentry expectation should be considered as a typical

interval and not excluding the possibility of reentry should another prescription become necessary because of some future forest condition. Ideally, a prescribed reentry period of 30-50 years would be ideal in a multiple aged forest, using selective harvest techniques, but because of the current conditions, perhaps a shorter reentry of 20 years should be anticipated, and after that, an interval of 40-50 years; it could take that long for the stand to recover and grow enough to be considered healthy and viable. Again, given current public policy trends and pressures from obstructionists, it cannot be assumed that such a reentry plan will be implemented, and it may be preferable, although regrettable, to undertake a more drastic cut, reducing the stand to the lowest acceptable basil area and thereby extending the necessary reentry interval as far into the future as possible. This is not ideal, but may be the practical and preferred solution.

2.3.2 Alternatives considered but eliminated from Analysis:

The Assessment claims that an Overstory Removal and commercial thin would not meet the Purpose and Need of the project because it "would not reduce fuel loads significantly to reduce crown fire potential." This is NOT CORRECT. By removing the overstory, the crown fire potential would NECESSARILY be reduced, because trees and the trees' crowns of the canopy would be removed: i.e. if the overstory were removed, there would be no crown to support a crown fire. While removing all the trees in the upper canopy level crown of the canopy would be the surest way to prevent a crown fire (i.e. no crown = no crown fire), a total overstory removal is neither needed, nor is it desirable. The BLM really should consider removing some select larger trees with crowns in the canopy; by doing so, the crown fire index would be substantially reduced. This is by far the best way to reduce the risk of crown fire, rather than relying primarily on understory and ground-fuel load removals. Selectively removing some of the overstory needs to be complimented by commercial and non-commercial thins.

When harvesting any larger trees, cutting and falling should be STAGED, so that not all the trees in a given area are felled at one time. Falling all trees at once would increase the damage to the residual stand and smash potentially viable and healthy smaller trees. by STAGING the harvest and thinning project, one or two trees in an immediate area would be felled and removed and then other trees could be felled into the same openings and removed. This is the best way to harvest larger timber; it is the tried and true way and has been employed successfully by conscientious and careful timber operators for many years.

I should also point out that removing 90 to 100 percent of the understory is just as undesirable as removing 90-100 percent of the overstory. Neither practice is advisable or desirable. The smaller trees are the future of the forest; the older trees will not live forever, and multi-generations of trees are necessary to promote a healthy and vigorous forest. Trees in multiple size categories should be selectively removed and selectively retained, cutting the worst and leaving the best to reach acceptable basil areas, and crown fire indexes, reduce understory densities, space overstocked stands, remove insect-killed –and infected trees, and promote general forest health.

The claim that a pre-commercial thin (cutting trees up to 7") would not meet purpose and need because it "would not sufficiently affect crown fire potential" and "would quickly return to pre-treatment densities", is very true! See my comments under 2.1 which describe the immediate and long term benefits of a such a thin: the "thin from below" up to 9" produced an immediate "low risk" of crown fire in only 13% of the areas treated, while only 3% of the areas remained at

"low risk" in a 30-year projection. To say that a pre-commercial thin up to 7" would not "sufficiently" effect crown fire potential is an UNDERSTATEMENT.

The conclusions that alternatives A and B would not sufficiently address the identified problems is accurate. While some elements of these alternatives might be incorporated into the final decision, these alternatives should not be considered viable options.

The claim that Alternative D would be inconsistent with the John Day RMP is a very minor point. The "visual resource" is a very low-priority. I own property on little Canyon Mountain and drive through public land to get access my land. From where I live in John Day, I have a clear view of Little Canyon Mountain from the north-by northwest; from my properties and my cabin above Canyon Creek on Miller Mountain, I have clear views of the southern and western faces of LCM. LCM is very visible to me and I, no less than anyone else, do not want to look at a mess or an unattractive landscape, but I think that the "visual resource" should not be a driving force in the decision. Rest assured that, if main forestry objectives are met, the aesthetic aspect of the mountain will come out just fine. (Please read my comments below under 3.2.4)

Table 2.6 treatment impacts on the soil resource:

Any negative impacts of the various treatments on the soil can be mitigated by staging certain aspects of the operations, placing trails and skid paths in strategic locations, and utilizing tried and true methods of water bars and reclamation to minimize these impacts. Controlled burns should NOT be so intense as to burn organic soils, or burn the roots of the plants, which will help stabilize soils. If seeding is to be used to help reclaim skid trails, landings or affected areas, native grasses and plants should be used.

Also, I should point out that low to moderate and even some high- impacts to soil disturbance will have a POSSITIVE impact on the generation of certain beneficial plants. It has been my personal experience (on the Great Northern Mine and on land within 2 miles of LCM) that Lupine production was dramatically increased, and I have conducted plots of Lupine, Paintbrush, Wild Columbine and other wildflowers on the Great Northern, and on adjacent public land with a similar aspect, and the wildflower production on the private land exceeded 600% that of the neighboring public land. This increased production of Lupine (a legume) and other beneficial plants is attributed to the low to moderate soil disturbance incurred in some areas when we thinned and logged the Great Northern in 1997-98, and the controlled burning (burning slash piles in stages, followed by a low intensity broadcast burn conducted in short-interval strips along the hillsides) I conducted in 1998.

The same actions that may have a low, medium, or high impact on the soil, will also have a correlating impact on the heavy woody materials, duff and fire fuel load concentrated on the ground (which is considerable!) In some areas, the heavy down fuels will protect the soils from some disturbance, and the disturbance and mulching effects of the activity on the organic matter (fuel load) will only be beneficial to the over all project.

2.4.2.1 (Alt. B-F) Fuels:

The claim that "thinning trees reduces overall canopy cover and opens up stands" is not necessarily true. The ONLY way to reduce canopy cover is to remove trees that have their crowns in the canopy. Thinning the understory alone CANNOT reduce the overstory canopy cover in any way. Thinning the understory may reduce the risk of crown fire by reducing ladder

fuels, but the surest and most desirable way to reduce the risk of crown fire and reduce competition and promote general forest health, is to remove some of the trees in the size category with their crowns in the upper canopy. A Comprehensive fuel reduction treatment needs to thin trees of various sizes selectively.

2.4.2.2. Entomology:

Besides insect damage from bark beetle and the four insects identified in the Assessment, another insect is present which eats the green needles and causes a condition commonly called "black scale".

The threshold basal area for the UMZ, identified to be 100-basal area, is a reasonable and, in my opinion, accurate threshold. I should point out, however, that if the threshold is 100-BA and this is the target BA to be prescribed, the immediate affects may be very good, and the short term-effects may be good, but the thinned trees will quickly outgrow this identified threshold and again be susceptible to insects, drought and other pressures. If the identified UMZ threshold in 100BA, and a reentry period of 20-30 years is anticipated, then a target Basal area for the actual treatment should be below the ideal identified threshold to allow for years of healthy growth without compromising the forests' ability to withstand adverse conditions such as the current bark beetle infestation.

2.4.2.7 Mining and Minerals:

Describing the potential negative impacts on the available trees for posts and timbers for mine use, the BLM needs to understand that the surface management of public land cannot interfere with mining activity or the needs of miners. While it may be desirable to remove the same trees that might be needed by the miners, the BLM should be advised that the U.S. Revised Statutes would require the BLM to provide a mining claim owner with timber for incidental use in developing his/her mine; if the surface management reduces or removes the available timber on an unpatented mining claim, the BLM would be required by Law to provide another place where a mine owner could access timber for use in his/her mine.

It could very well be possible that, among the vast amount of trees (mainly the smaller trees, say up to 10") to be cut and thinned, the BLM could, where convenient, allow mine owners access to the cut trees at some point for mining use, even if it meant stock-piling some smaller logs for future use. This would be better than simply piling and burning the material, and would realize better utility of the resource.

2.4.2.10 Wildlife:

The proposed snag levels in the Assessment must admit that more snags will be created in the near future because some of the live trees left will continue to die, and snag levels will become far higher than the supposed ideal or prescribed levels.

2.4.2.11 Fisheries:

The component of Alternative D that calls for some very selective thinning of riparian areas where such prescription would benefit riparian vegetation is very good.

2.5 Monitoring:

Monitoring will be very important to this project. While a reentry interval of 30 years or more (for a vegetative treatment) may be ideal in this area, the BLM should be prepared to go

back in to identified areas with a follow-up treatment if problems are found, such as continuing insect or mistletoe problems, unacceptable numbers of dead trees (and to make beneficial use of valuable timber), or to further reduce the fuel loads through more concentration or hand-piling, and/or controlled burning.

3.1.1 Historical Conditions:

While historical conditions are helpful to understand the "unnaturally" dense growth that has occurred in the past 140 years, the goal of land management should NOT be to return or to reduce the land and forest to its "pre-settlement" conditions. This is not desirable! We can do better than that!

3.2.1 Fuels:

The description of the fuels build-up on LCM is very good and fairly accurate, if perhaps understated.

The promulgation of Mountain Mahogany as an important browse for deer is very well taken and should be an integral part of the wildlife-values included in making a final decision.

3.2.2 Entomology:

This is a good synopsis of the insect presence on LCM, but the beetle that eats green needles and causes "black stain" is also present. And I have not read mention in the Assessment of mistletoe being present, but it is and the areas affected by mistletoe need to be addressed.

3.2.3 Siviculture:

This is an excellent description of the current forest conditions on LCM, and I can corroborate a great deal of the statistics cited herein, including the average height, age, size and density of the trees. The claim that current growth rates are 20-50 growth rings per inch seems accurate. The professional opinion that grown-ring counts of less that 13 rings per-inch are desirable is very reasonable. That the residual stands are dense and "well above the carrying capacity for the site", is accurate and the fact that approximately 30% of the timber volume has died on some parts of the mountain in the last decade attests to this fact.

3.2.4 Visual Resource:

Again, concerns about the visual aspect are far inferior to other concerns about the forest health on LCM. If the BLM will focus on the scientific and professional evaluations of the needs of the trees, the forest, and the wildlife, and make sure the operators don't just make the place look like a bomb went off, the visual resource will turn out just fine.

I should also say that, to a casual observer, or a layperson, the aesthetic or "visual resource": of the mountain is totally subjective. A person from Western Oregon might look at LCM and think the timber looks fine and is not too dense (because the don't know any better). A person from the east coast may have a completely different idea of what is visually pleasing (or perhaps that the red contrast of all the dead trees is "pretty".) It may be like the person who knows nothing of gardening, but looks into the garden area and sees it full and green, thinking that it is just beautiful, but not realizing that the garden is actually full of noxious weeds. Here on LCM, it could be the same situation: and even when the project is completed, someone may think that it looks too thin here or there, or that too many small trees or too many big trees. This is all subjective and should not be a guiding factor. If forest health is the main goal, aesthetic

prescriptions should NOT be a driving force. Again I stress, if the main forestry objectives are met, the aesthetic aspect of the mountain will come out just fine.

3.2.5 Road Engineering:

The assumption that the main road, that goes up the Little Pine Creek drainage and into Quartz Gulch and Quartz Basin, is in a "declining" state is not accurate. While the road is not in ideal condition, it is now in perhaps as good or better condition that any time I can remember. Some areas of the road may not be suitable for haul, but could quickly be made haul-ready with a quick sweep of a grader or bulldozer.

That the road receives little maintenance is accurate. Except for minor roadwork completed very recently during the timber salvage from the Byrum Gulch fire a few years ago, the ONLY road maintenance I know of in the past 30 years was done by Doug Sand on a Grant County grader in the early 1980s, and at the request of my father, David Sheedy, who had leased and was working the Golden West Mine, owned at the time by my great-grandfather, J. George Sand. Otherwise, some minor road work and a few water bars have been conducted by various miners on the mountain, including dumping pickup loads of rock in particularly muddy areas, and where my uncles and I removed some green junipers under BLM firewood permits along the road to allow sunlight to alleviate brushy areas and more quickly dry problem-muddy areas.

3.2.7 Mining and Mineral History:

Under the gold production of Little Canyon Mountain, I will add that Isaac Guker's Great Northern Mine produced an initial strike worth $70,000 in 1898 and over $200,000 in the following two years. Intensified development ensued and the Great Northern was capitalized at $1,000,000 by 1900. An ore mill was erected on Little Pine Creek, on the Oro Grande claim, near the present driveway accessing Harry and Sally Pointer's property. Less than 100 ounces of Gold have been extracted from the Great Northern since 1942. Historically, refined valuable metals sent to the U.S Mints show that this gold runs between 96 and 98 percent pure (exceptionally high for native gold), with the main "impurities" being silver and platinum-group metals. Besides the Great Northern (patented 1902/03), the Zero and Piedmont are also patented lode mining claims (patented in 1918/19).

The Golden West Mine employed three men full-time for nearly 30 years, with continuous operation ceasing with the death of Daniel Gucker in 1972. Mining on the Golden West has since been casual.

The potential minerals described are all present, but this Assessment should also include the significant deposits of Chromite, which is the most strategic mineral in the area.

3.2.8. Range Management:

Describing a grazing allotment as a grazing "lease" is not accurate. A grazing allotment is not a lease; it is "fee land" and is a private property right appurtenant to the patented real estate owned in "fee simple". Grazing "permits" are a separate legal instrument and the ownership of an allotment does not depend on a permit.

3.2.9 Social and Economic:

The claim that the "roads and trails are not maintained and are in terrible condition" carries minimally importance. Current road conditions serve the purposes of the local property owners and the mines for which the roads were constructed. Improving the roads in any way would only increase traffic, and most importantly the undesirable traffic in the area. Over the years, my family has had to deal with innumerable trespassers, mineral trespassers, vandals and thieves; they have destroyed buildings, set fires, stolen timber, stolen minerals, stolen dynamite caps, vandalized and stolen timbers and ladders, stolen tools, left garbage and torn up roads and trails; the real damages to and costs accrued by my family's properties, if tallied, likely would exceed $100,000. Improving road access to LCM would only serve to increase the potential for these unlawful and damaging activities. The improved access would not necessarily improve the ability to patrol or prevent any unlawful activity, due to other constraints.

In describing the history of the area, the assumption that "mineral activities became less lucrative" (in describing the historical economic changes in the area) may be misleading. While most easy placer deposits were developed by the 1870s, the discovery of substantial hard-rock gold by Isaac Guker on the Great Northern in 1898 sparked a small gold rush to Little Canyon Mountain, and in increased interest in lode deposits in the area. Considerable investments were made to develop lode mines on LCM and an ore mill was constructed by the Great Northern Mining and Milling Company; this mill was not abandoned or dismantled: it burned down and a lack of capital due to a recession in the first decade of the 20th century, and a cooling effect on investors due to capital scandals in the mining industry, and a rift and disagreement (and subsequent lawsuits) between Great Northern's owners, prevented a reinvestment and rebuilding of the said ore mill.

Mining in the area did not gradually decline because the gold was exhausted or gold mining became "less lucrative". Virtually all mining activity in Grant County ceased quite abruptly in 1942 when it was made illegal by a presidential proclamation, "L-208", which continued through 1945. Not only was gold mining illegal, the operation of gold mining equipment was illegal, any equipment in transit was confiscated, idle equipment, tools, ore mills and other mining infrastructure was literally dismantled and removed to provide iron and other metals for war-effort scrap drives. Mining activity saw a sharp increase in the 1930s with the decreased gold content of the dollar (in 1932) making an ounce of gold immediately worth $35, rather than $20.67 per ounce, and the soft market of the depression which contributed to lower material and labor costs. Gold production increased steadily through 1941.

The rapid decline and abrupt end of the mining industry in the area was the result of compulsive federal policies. After WWII, most gold mining was unfeasible because federal monetary policies kept the price of gold artificially low through 1979, not to mention that practically all mining infrastructure had been dismantled, and the mine-labor force had mostly left the area during the time gold mining was prohibited.

The claim that "most" of the recreational activity is "illegal" may be an overstatement. Granted, there is a great deal of illegal and destructive activity, and at questionable hours, on LCM.

The insinuation that firewood "theft" is in any way a bad thing is almost laughable. There is such an incredible abundance of firewood material on LCM that the resource could not be depleted at current levels of extraction, and certainly not in the more inaccessible areas. The concept of firewood "theft" from public lands is a very recent concept and historic and

customary use of the area has, since the early days, provided area residents with firewood to provide energy to cook and heat a shelter, a basic human need that must be met to provide for human life. Furthermore, nearly all firewood removal, whether with a BLM permit or not, likely has a positive effect on the forest conditions on LCM by removing heavy fuel loads, decreasing the fire-danger, and removing dead insect-infested trees; it also removes dead trees that pose public safety hazards—and all without public expense being incurred.

3.2.13 Hydrology:

Yes, the suppression of forest fires and other factors have contributed to a change in the ponderosa pine stand on LCM, and resulted in a forest far more dense and congested that history would suggest.

Yes, by thinning trees (especially trees in all size categories) to open up the canopy of the forest, more precipitation will reach the ground. This will have far reaching benefits to all flora and fauna on the mountain and in the whole watersheds.

4.1.12 Hydrology:

It is a good Assessment that the proposed alternatives would not result in any mass-movement or notable erosion on LCM. The sub-soil and rock conditions on the mountain and the significant alterations to the landscape in years past from mining exploration and activity (which have not moved far if at all in most cases) testify to the fact that no mass-movement should be expected.

4.1.13.1 Compaction:

The negative effects of compaction are minimal and can be mitigated by strategic placement of skid trails and heavy equipment use. Trails could easily be reclaimed when the project is at completion. Moreover, by employing tree-length yarding (with limbs left on the logs), skidding has less negative impacts: logs do not drag in a trench on the ground; instead, the limbs keep logs suspended off the ground and apply pressure in a more disbursed manner in a sort of "sweeping" manner (which also serves to mulch fuels on the ground). While some mid- and even long-term effects on compaction may be unavoidable, these potentially negative effects are far outweighed by the positive effects of the project on other aspects of the land and forest.

4.1.15 Air Quality:

Any negative air-quality effects from prescribed or controlled burning must be understood in context of the alternatives. The smoke and particulate by-products of such burning is inevitable, but in a controlled burn, the negative effects can be minimized by burning in stages, choosing good timing, and removing a large portion of the fire–fuels by mechanical means before a prescribed burn is undertaken. If the fire-fuels that currently exist were to burn in an uncontrolled forest fire, the negative effects would be far greater. (And the positive effects of the prescribed burning far outweigh the negative.)

Moreover, it must be recognized that the natural carbon cycle dictates that ALL organic fuel WILL BURN sooner or later; it well either burn in an uncontrolled catastrophic fire, or in a controlled prescription, or in large landing pile, or in someone's home in the form of fire wood, or in a wood-chip-fired electric generation plant. The difference is, when this fire-fuel burns, will it be destructive, inconsequential, or beneficial?

4.2.2 Entomology:

The claim that, "Much of the tree mortality has occurred in the past two years", is not quite accurate. A great number of trees have died recently, and the tree mortality is accelerating, but tree mortality has been occurring at significant and undesirable levels over the past 12 years. An estimated 30% of the timber volume has died in specific areas in the last 6 years alone.

4.2.7 Mining and Minerals:

This is all true.

4.2.9 Social and Economic:

The claim that the "main access road would continue to degrade", assumes that the road's condition is declining. This is not necessarily the case. (Please read my comments under 3.2.5.)

4.2.12.1 Annual Hydrology and 4.2.12.3 Water Quality:

These assessments are quite accurate.

4.8.1.6 Mining and Minerals (Under past Management):

The assumption that the federal government took over mineral management on public lands in 1866, by virtue of the 1866 Mining Act, is not accurate. The Oregon State Legislature (and subsequent state statutes) was the only governing authority in regard to mining activities for 80 years after the passage of the 1866 Mining Act. Neither the General Land Office, nor any other federal agency assumed the authority to manage mining activity until after 1946.

The 1866 Mining Act was a prescriptive act that simply established uniform procedures for staking, holding and keeping mining claims (to alleviate the confusion caused by independent mining districts across the country imposing widely varying standards), and made uniform standards as to the exclusive rights of mine owners, claim sizes, time-frames, etc., by creating a statutory right of exclusive possession, which guaranteed a mining claim owner the right to exclude all others from possessing or using the minerals he owned.

Filing a mining claim does not actually establish ownership of a mine or mineral right, but only a possessive right to keep the minerals and exclude others. The actual right of ownership is and always has been established by the simple discovery of valuable minerals. The date of DISCOVERY is the all-important date. The simple discovery and continued work invested in a mineral prospect is the primary act of establishing ownership of a mineral right. By filing a claim, a mineral right owner then protects the property interest he/she owns by virtue of his/her discovery, and establishes an exclusive statutory right to the mineral discovered.

While the 1866 Mining Act may have "declared" public lands to be open to mineral entry, it needs to be understood that, prior to 1866 (with the exception of lands specifically reserved) all vacant and unpatented land was and had forever been open to mineral entry under the Laws of the United States.

The explanation that "by 1870 the mining boom was beginning to fade" may be misleading. Certainly, by that time, easy placer ground was developed, but significant investments and developments in the mining industry were made for another 80 years in Grant County, with increasing exploration and development of lode deposits. While easy placer deposits may have been exploited in a relatively short period of time, lode gold saw relatively steady and increased production. By far, the most productive lode gold production in Oregon's

history occurred in 1941, the last year of full operation before mining operations were ceased because of federal policies during WWII. (Please see my comments under 3.2.9.)

4.8.2.1 Fuels (under Adjacent Private Lands):

Regarding the 135-acre Little Canyon Fire mentioned here, I should add that this fire occurred in a predominantly "old growth" and large-diameter forest regime where no or very little timber harvest ever occurred. This fire resulted in a practical "total kill", which sterilized organic soils in some areas; and, because no timber was ever salvaged, the remaining heavy down fuels that did not burn in 1987 certainly contributes to the current and future fuel load in the area. The steep and inaccessible terrain made fighting this fire difficult and very dangerous.

The fact that the 1999 Byrum Gulch Fire did not initiate a sustained crown fire is due mainly to well-spaced trees. Trees of various sizes (from very large to very small) survived this fire in areas where the trees were well-spaced. Where this fire leapt to the crown was in areas that had relatively heavier ground fuel loads and ladder fuels, but the most important factor that contributed to the occurrence crown fire (and the death of larger diameter trees) was close proximity of large trees where the crowns were touching or close. This testifies to the need to space larger trees so that crowns are not continuous; this is the best way to reduce the risk of crown fire.

4.8.2.7 Mining and Minerals:

While chromite production may not have been able to compete with foreign sources for most of the period, the wartime production is noteworthy because of the very important role that Chrome plays in the strategic national defense of the USA, and that the chrome found in the area of LCM is a very important strategic domestic deposit of the metal. Serious mining for chrome actually initiated in 1914 (not 1916) and investments and production was dramatically increased in 1916 when the War Department and federal officials threatened to claim eminent domain over identified strategic mineral deposits if the mineral right owners did not take measures to develop their mines and produce the strategic metals of the war effort.

That known copper deposits in the "area" are small or low quality should be limited to the immediate area of LCM and the western Strawberry Mountain Range. Valuable and viable copper ore bodies exist in the greater area, most notably the Copperopolis Mine NE of Prairie City, which has produced very high grade copper in the form of malachite.

Yes, native mercury or Cinnabar is found in the area of LCM and elsewhere in Grant County, and this fact should be taken into consideration in any survey of mercury levels in the area. Elevated levels of mercury should not necessarily be attributed to sloppy miners who used the mineral to recover gold in placer operations. Miners were actually very very careful with their mercury because it was an expensive commodity, and if they lost any mercury in their operation, they were also losing gold, so it never happened intentionally and rarely inadvertently. In fact, dredging records for operations on the Middle Fork of the John Day River near Galena show that the dredge operators actually recovered more mercury that they put into they system, the excess mercury being attributed to native deposits.

4.8.3. Reasonably Foreseeable Future Actions:

"Forseeable" should be spelled "Foreseeable".

These are very reasonable assumptions. I, as an adjacent landowner, recently completed a fuel-reduction project on 36 acres and plan to continue with monitoring and follow up treatments as needed.

4.8.3.5 Road Engineering and Transportation:

Again, this assumes that the present condition of the road is a deterioration of past conditions of the road. This is not necessarily the case.

4.8.3.7 Mining and Minerals:

Chrome should be included in the list of present minerals.

Cobalt, another important strategic mineral, is also present in the area.

The assumption that the mentioned minerals would be mined using an open-pit method is likely if large-scale production of the mineral potential was the objective. However, historic use and present mining activities on LCM mainly employ tunnels and shafts in hard rock and underground mining with small-scale operation, hand tools and labor-intensive strategies.

4.9 Summary of Impacts:

This summary is well taken and the points made seem accurate.