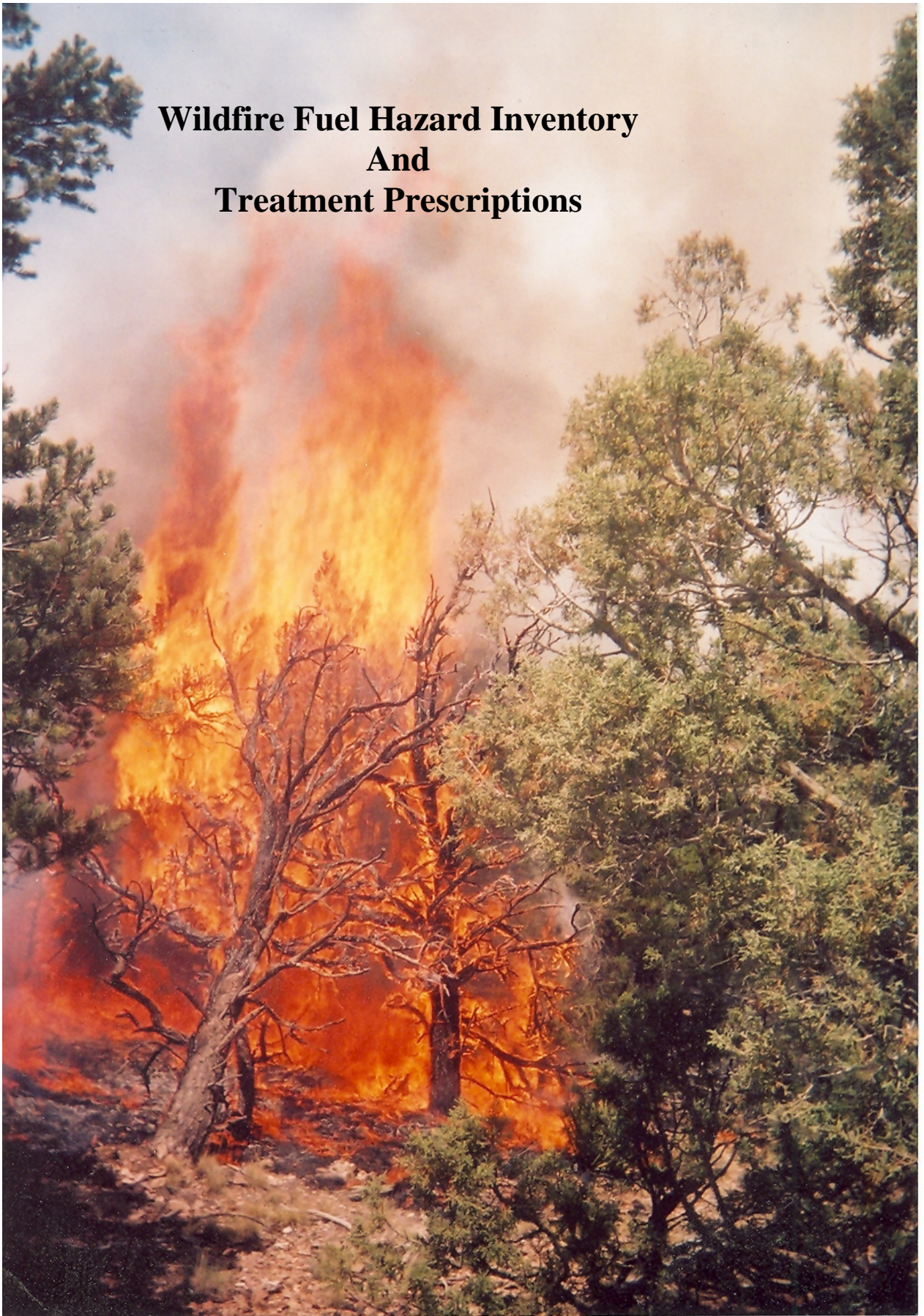# Wildfire Fuel Hazard Inventory
And
Treatment Prescriptions

Wildfire Fuel Hazard Inventory
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Treatment Prescriptions

For

Sanctuary Pointe

El Paso County, CO

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(Cover Photo: Active Fire Front in a Pinon/Juniper Type; Courtesy of the author)

This is a follow-up study to the original Wildfire Hazard & Mitigation Report for Sanctuary Pointe prepared for Classic Companies in 2007. The intent of this report is to detail the vegetative conditions that are present in the proposed subdivision along with the corresponding fuel model that would be subject to wildfire and the subsequent treatment that would be required.

Determining wildfire hazards and risks cannot be readily summarized by mathematical models or statistics as it is not an exact science. While certain assumptions can be made from inventory and modeling data, there are too many factors that influence what a wildfire will do on any given day and those factors can change very rapidly during the course of an incident.

In attempting to predict what risks and hazards a wildfire poses, there is a certain art to the process that comes from personal experience and from reviewing what how previous wildfire events have reacted to the conditions and factors that were present on that particular day. Those conditions and factors have been previously covered in the 2007 report and will not be reviewed in this document.

One of the balancing acts in reviewing proposed subdivisions in regard to wildfire risk is to gauge the risk and modify it sufficiently that the attributes that are attractive to living in the subdivision are retained. At the same time, there is always an inherent risk to living in a forest condition that could burn. The ultimate goal is to reduce the risk to a level that is acceptable to the future residents and to those responsible to protect them from the threat, the local fire departments. Note that the intent is to reduce the risk to an acceptable level and not to eliminate it entirely. In spite of the best mitigation treatments that can be used in vegetation management and residential construction, a wildfire will always be able to burn through the property.

This risk is recognized from a fire department perspective. Suppression forces desire an expectation that any wildfire that does occur has a high probability of being rapidly controlled within the confines of initial attack and not through a prolonged siege. In addition, if a wildfire passes through a subdivision that only a minimal loss of property will be the result.

In order to achieve this balance of needs, an inventory of forest within the subdivision was conducted. This inventory was performed using the location of recorded road survey points. These sample points correspond to the points along the road in the northwest portion of the proposed Sanctuary Pointe subdivision.

While the data from the each sample point may not be statistically valid, it does provide a numerical snapshot of the present condition around each sample location. This sampling is interesting in that most individuals would visually see a forest that would appear uniform. A graph was constructed for each sample point and none of them are even remotely close to being identical. Each sample point, even though they are in close proximity to one another, is uniquely different.

To further illustrate this uniqueness, a series of photos were taken at each sample point. These photos were taken roughly in each cardinal direction, starting at the north and moving clockwise around the point.

Using the inventory data along with the photos and comparing them to a treated point, a target condition was determined. However, there are opportunities to reach a low wildfire risk while

retaining a large number of trees per acre to supply visual buffering and maintaining the forest's health over the long term. This was based on a growing stock level that is appropriate for each individual sample location so as to keep the risk of an outbreak of mountain pine beetle to a low level. This results in the number of trees per acre to be left after a thinning treatment in relation to the average diameter of trees at each sample point. From research on mountain pine outbreaks, the preferred growing stock level ranges from a low of 70 up to 90. The maximum value of 90 was used in this review so as to keep the maximum visual buffering benefits the forest may provide.

From the graphical information, the growing stock level present and the fuel model in which the sample point was located, a treatment prescription was developed. These prescriptions are still general in nature but are more detailed than originally presented in 2007. Note that there is a tremendous amount of diversity in the forest stand over a very short distance. So as one moves through the sample point locations, the treatment will need to be adjusted as one point is left and the next one approached.

Map 1 provides the location of the survey lathe locations that served as the sampling points. The second map provides the same locations using their GPS recordings.

Location Stake #8543
Waypoint #40

View from survey Lathe is to the northwest (296°)

This survey lathe location is located in an area that received an historical forest management treatment. This area can be best described as Fuel Model 8 (Anderson, 1982) or Low Load Compact Conifer Litter (Scott & Burgan, 2005).

The primary carrier of a wildfire will be the compacted forest litter of needles, cones and small twigs and branches. Live green fuel will have very little effect on the fire behavior. The fuel load per acre will be light to moderate with a depth of 1-3 inches. This fuel layer is very compacted with little air surrounding the available fuel. A wildfire's rate of spread and flame length will be very low.

This fuel model is representative of the final condition of the residual forest after mitigation treatments. While a wildfire can still burn through the area, it will remain at ground level and not climb into the tree canopy. This type of wildfire condition should be controlled quickly with a rapid response by local fire resources.

Location Stake #8546
Waypoint #42

View from the survey Lathe is to the north and moves clockwise with photos taken at all cardinal directions.

NORTH

This area is representative of Fuel Model 8 or Moderate Load Conifer Litter. While the predicted rate of spread and flame length is low, the smaller, snow bent trees provide a ladder in which to climb into the upper canopy and potentially change from a ground fire into a crown fire.

      This view is representative of Fuel Model 8 or Moderate Load Conifer Litter. While the predicted rate of spread and flame length is low, the smaller, snow bent trees provide a ladder in which to climb into the upper canopy and potentially change from a ground fire into a crown fire.

This view is looking back towards Survey Lathe #8543 (red arrow). This area is more representative of Fuel Model 8 or Low Load Compact Conifer Litter. This is a transition zone between the treated forest area and the untreated. While there are smaller trees present, there is much less when compared to the number in the east view.

This view is representative of Fuel Model 8 or Low Load Dry Climate Timber-Grass-Shrub. In this instance, the smaller snow bent trees are similar to shrubs due to their thick density While the predicted rate of spread and flame length is low due to the closed canopy, the smaller, snow bent trees provide a ladder in which to climb into the upper canopy and potentially change from a ground fire into a crown fire.
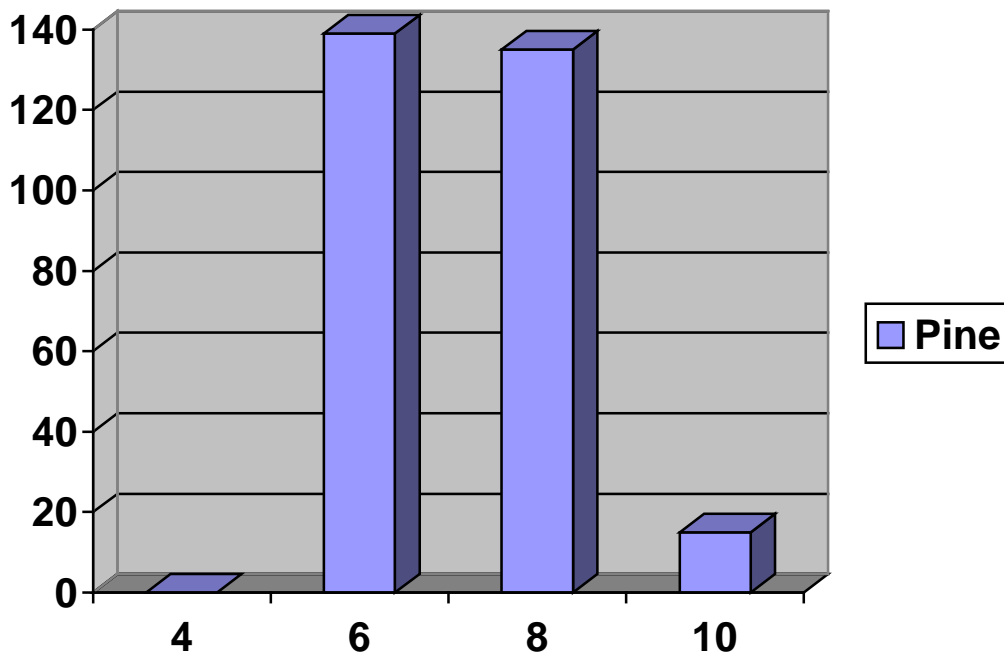
The chart above displays the number of trees per "2" diameter class. At this particular sample location no trees were tallied that were four inches in diameter or less. But while no trees were sampled, the photo record shows they are present.

This dominant presence of the lower diameter class trees is still evident in the chart. This is based on the severe drop in the 10-inch diameter class which has approximately an average of 15 trees per acre. Based on the sample, there are no trees present that are larger.

Sample Point Statistics

Average Diameter of All Trees = 7.5 inches
Average Number of Trees per Acre = 290

Based on the average diameter and the number of trees per acre, the growing stock level is approximately 110. The growing stock level is a level of stocking designed to attain a targeted basal area when the stand reaches an average of ten inches or more in DBH. In this case, the target basal area is a range from 70 to 90 in order to keep the threat of infestation from mountain pin beetle at a controllable level.

So in order to reach our GSL target, the minimum number of trees to be removed is 37.

Treatment Prescription

Based on the number of trees present in the lower diameter classes, this sample point would be thinned from below the dominant 10-inch tree canopy. This means the treatment would concentrate on removing the smaller trees and retaining as many of the larger trees as is possible. Larger diameter trees, 8-inch and 10-inch classes, would be removed only for poor form or overall health conditions.

Location Stake #8549
Waypoint #44

View from survey Lathe is to the west/northwest.

This location exhibits the characteristics of Fuel Model 8 or Low Load Compact Conifer Litter. This area is adjacent to an area immediately to the west that was treated in the past.

Notice the virtual absence of smaller trees that are contained at this location. The trees are relatively uniform in height and diameter. All that will be required to treat this area is to remove the suppressed and snow bent trees.

This location is also adjacent to a former camp structure. The picture below depicts the view to the east of the survey lathe.

It is assumed that vehicle and foot traffic has prevented the regeneration of the ponderosa pine that was evident at Survey Lathe #8546. Again this view is representative of the same fuel model characteristics as the previous view. The presence of the grass clumps indicates that the litter layer is very thin when compared to the previous locations.

The sample point was very open and resulted in no trees being sampled at this location. The removal of the snow bent smaller trees and any 'ladder fuel' by pruning the green branches of the remaining larger trees is all that will be necessary to bring this location to the targeted forest condition.

Location Stake #8551
Waypoint #46

View from the survey Lathe is to the north and moves clockwise with photos taken at all cardinal directions.

<u>NORTH</u>

This sample is located at the edge of a transition zone from Fuel Model 8 or Low Load Compact Conifer Litter to Fuel Model 6 or Very High Load, Dry Climate Shrub. While ponderosa pine is correctly classified as a tree, the belt of reproduction is considered a shrub in this instance.

The trees are relatively short and dense with the live green canopy reaching all of the way to the ground in a uniform manner. This tree stand will reflect fire behavior characteristics more in the line with a shrub model than a timber model.

The primary carrier of a wildfire will be the woody trees and litter. This fuel load is considered very heavy with a depth of 6-20 feet. The rate of spread will be very high as will the flame length making this area resistant to direct control tactics.

There were no trees in the shrub fuel model tallied at this sample point.

       This view exhibits the characteristics of Fuel Model 8 or Low Load Compact Conifer Litter. While it may appear that this area has received some level of treatment in the past, there is no evidence present. It is assumed this stand displays a 'park-like' appearance from historical disturbances such logging or cattle grazing.

Again, this view depicts the transition from a timber fuel model to a shrub-like fuel model. As this timber stand is next to what must have been a disturbed area, there are more grasses and tall weeds present.

This view from the sample point shows the ponderosa pine reproduction swings around the location from the south and to the east. There is an old road that separates the two fuel models from each other. If no treatment were performed, there is high probability that the road would constrain a wildfire from moving out of the timber location into the pine reproduction.

As the litter layer near the road was disturbed and removed, the grasses and tall weeds established a foot-hold. But their presence dos not increase the wildfire risk.
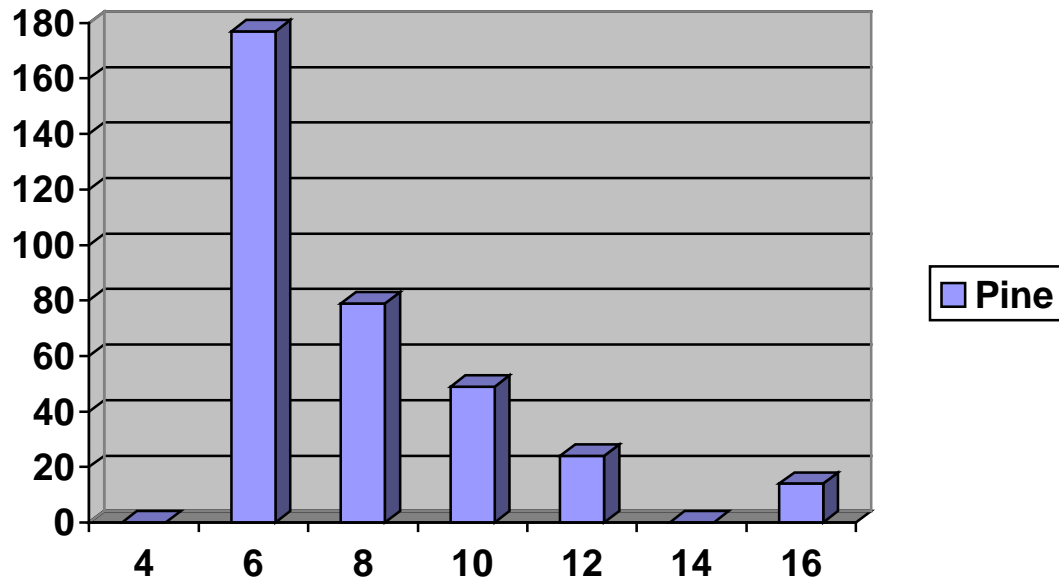
The chart above displays the number of trees per "2" diameter class. At this particular sample location no trees were tallied that were four inches in diameter or less. But while no trees were sampled, the photo record shows they are present.

This dominant presence of the lower diameter class trees is still evident in the chart. However, this is distinct population curve exhibited as the diameter class increases in size, the number of trees decreases.

Sample Point Statistics

Average Diameter of All Trees = 8.7 inches
Average Number of Trees per Acre = 343

Based on the average diameter and the number of trees per acre, the growing stock level is approximately 130. The growing stock level is a level of stocking designed to attain a targeted basal area when the stand reaches an average of ten inches or more in DBH. In this case, the target basal area is a range from 70 to 90 in order to keep the threat of infestation from mountain pin beetle at a controllable level.

So in order to reach our GSL target, the minimum number of trees to be removed is 146.

Treatment Prescription

Based on the number of trees present in the lower diameter classes, this sample point would be thinned from below the dominant 10-inch tree canopy. This means the treatment would concentrate on removing the smaller trees and retaining as many of the larger trees as is possible. Larger diameter trees, 8-inch through 16-inch classes, would be removed only for poor form or overall health conditions.

Depending on the condition and health of the 16-inch diameter class, one-half of this diameter class should be removed. This may be necessary to prevent the average diameter post-treatment from becoming too high and presenting an environment for mountain pine beetle infestation.

The pine shrub fuel model was not tallied for inventory. Consideration should be given to this forest stand for privacy benefits to the lots in close proximity to this sample point. This could also be treated first as visual filter, breaking up the long view through the forest that will result from thinning treatments.

Location Stake #8598
Waypoint #49

View from the survey Lathe is to the north and moves clockwise with photos taken at all cardinal directions.

<u>NORTH</u>

This view from the sample point is still considered Fuel Model 8 but contains a High Load Conifer Litter. While the ground rate of spread will remain low, the probability of a crown fire is high as there is sufficient fuel present to generate enough heat to ignite the canopy. This will occur even if the snow-bent trees do not serve as 'ladder fuels'.

       The east view provides a typical view of the Low Load Compact Conifer Litter model. However, the back ground portion of the photo reveals continuation of the conditions present in the north direction position.

       This occurrence is not uncommon, with an island of low wildfire hazard surrounded by a high wildfire risk. This location contains trees that tend to be much older and having a thicker bark that will insulate the live cambium from the heat of a wildfire.

      This view is very similar to the north position; however there are a lower number of snow-bent trees. As this location is treated, the litter layer should be disturbed as little as possible. By maintaining the low risk litter layer, a high number of trees could be left. This would allow this location to serve as a visual buffer.
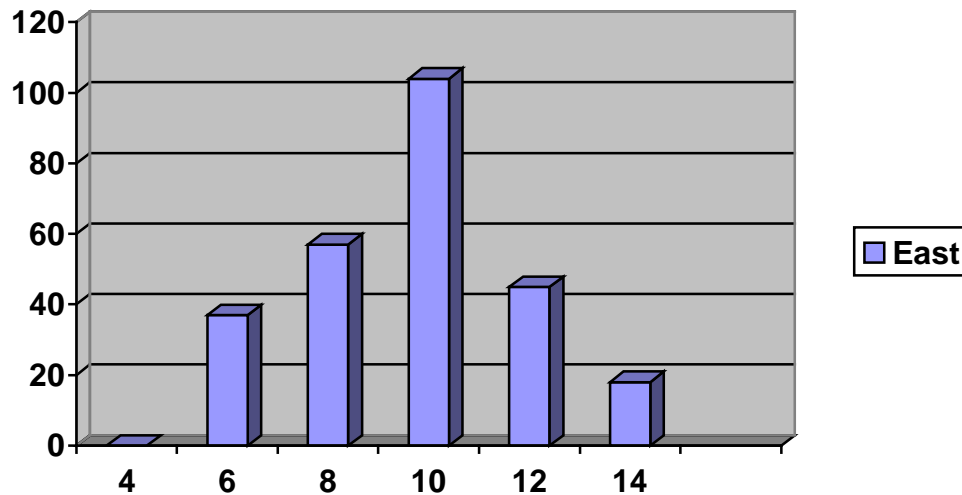
This view is similar to the previous south facing position. This location has even a smaller number of snow-bent trees. Removing these damaged trees will provide a longer view through the forest stand. If care is taken to preserve the compressed litter layer, this area could serve as a privacy screen to adjacent lots.

The chart above displays the number of trees per "2" diameter class. At this particular sample location no trees were tallied that were four inches in diameter or less. But while no trees were sampled, the photo record shows they are present.

The chart shows the highest number of trees lies in the 10-inch class. This class has twice as many trees as the 8-inch or 12-inch diameter classes. Treatment should follow individual tree form and health and not a diameter class removal.

Sample Point Statistics

Average Diameter of All Trees = 10.3 inches
Average Number of Trees per Acre = 261

Based on the average diameter and the number of trees per acre, the growing stock level is approximately 130. The growing stock level is a level of stocking designed to attain a targeted basal area when the stand reaches an average of ten inches or more in DBH. In this case, the target basal area is a range from 70 to 90 in order to keep the threat of infestation from mountain pin beetle at a controllable level.

So in order to reach our GSL target, the minimum number of trees to be removed is 96.

Treatment Prescription

Based on the number of trees present in the 10-inch diameter class, this sample point would be thinned from sanitation and forest health perspective with attention given to the number of stems per acre. The resultant residual stand should be inventoried to ensure that the average diameter does not subject the stand to attack by mountain pine beetle over the short term.

Consideration should be given to this forest stand for privacy benefits to the lots in close proximity to this sample point. This could be treated first as visual filter, breaking up the long view through the forest that will result from thinning treatments.

Location Stake #8601
Waypoint #50

View from the survey Lathe is to the north and moves clockwise with photos taken at all cardinal directions.

NORTH

This view from the sample point is still considered Fuel Model 8 but contains a moderate Load Conifer Litter. There is more dead fuel on the ground, but very little 'ladder fuel' due to the thick density of the trees. As this location is treated, the litter layer should be disturbed as little as possible. By maintaining the low risk litter layer, a high number of trees could be left. This would allow this location to serve as a visual buffer.

EAST

This view from the sample depicts Fuel Model 8, but when compared to the previous view, this is now Low Load Compact Conifer Litter. This location reflects much larger diameter trees which should be retained. A sanitation treatment removing the suppressed and snow-bent trees should be adequate to reach the desired condition.

This view is very similar to the North view photo except for the lower level of dead ground fuel. Again, a simple sanitation treatment will be sufficient to reach the preferred target condition. Keeping the litter layer undisturbed will allow for a higher number of trees to be kept as a visual buffer.

This view is still reflective of Fuel Model 8 and has a much lower density of tree cover. Even though grasses are present due to the higher level of sunlight reaching the forest floor, it is not enough to change the existing condition to a grass fuel model.

The target condition can be easily reached by removing the small diameter trees and keeping the larger trees in place. Here, it is critical to keep the litter layer intact so as to not allow additional development of the grasses. This could result in changing the existing hazard to Fuel Model 1.
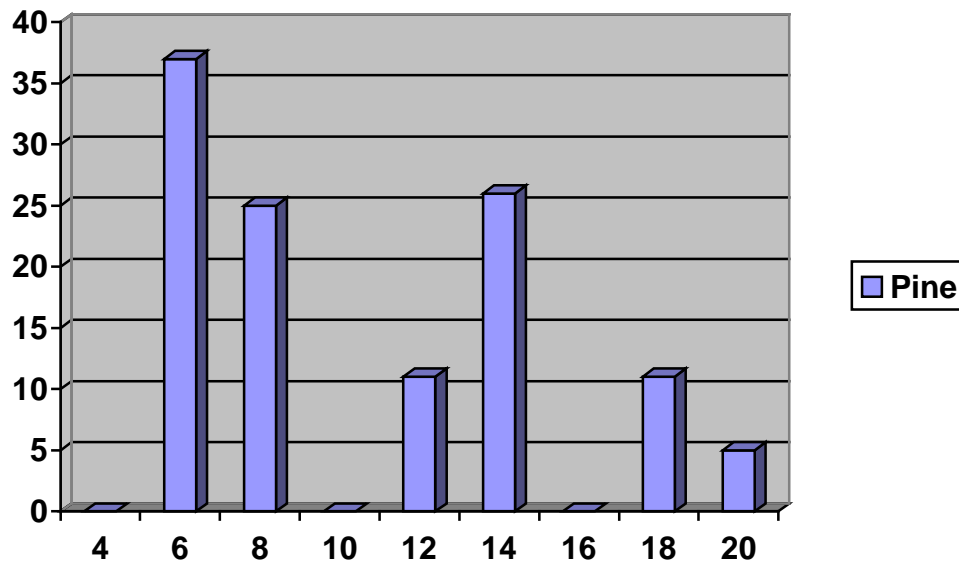
The chart above displays the number of trees per "2" diameter class. At this particular sample location no trees were tallied that were four inches in diameter or less. But while no trees were sampled, the photo record shows they are present.

The chart shows the highest number of trees lies in the 6-inch diameter class, but the classes are relatively even overall. As the six-inch class will be subject the most tree removal, it should be counterbalanced in the 14-inch diameter class so as to not overly expose the area to mountain pine beetle attack. This location should be treated carefully as it is probably most representative of old pine growth prior to settlement of the Black Forest.

Treatment should follow individual tree form and health and not focus strictly on diameter class based removal.

<u>Sample Point Statistics</u>

Average Diameter of All Trees = 12.0 inches
Average Number of Trees per Acre = 115

Based on the average diameter and the number of trees per acre, the growing stock level is approximately 90. The growing stock level is a level of stocking designed to attain a targeted basal area when the stand reaches an average of ten inches or more in DBH. In this case, the target basal area is a range from 70 to 90 in order to keep the threat of infestation from mountain pin beetle at a controllable level.

In this case, the target GSL is already reached and no further tree removal is necessary beyond those trees subject to health or poor form.

Treatment Prescription

Removal should focus on snow-bent and suppressed trees in the lower diameter classes. The larger diameter class trees should be retained whenever possible, unless they pose a potential liability hazard to users of the subdivision.

Location Stake #8588
Waypoint #52

View from the survey Lathe is to the west only.

       This view represents Fuel Model 8, Low Load Compact Conifer Litter and is located at a transition from untreated to treated areas. North of this sample point is a former recreation area of the camp. The litter layer is sparse and the soil is compacted allowing very little grass, forbs or weed growth.

       No sample data was taken at this point due to the proximity of the road. Other than releasing the smaller pine that has regenerated under the main canopy, no further treatment is required.

Location Stake #8503
Waypoint #52

View from the survey Lathe is to the north and moves clockwise with photos taken at all cardinal directions.

NORTH

This sample point is located within the historically treated area. The Fuel Model still remains at 8, as a Low Load Compacted Conifer Litter. Treatment consists of inspecting the residual forest for health. There is a mountain pine beetle killed tree in the center background.

Where bare soil was exposed, it created a favorable seed bed for ponderosa pine. This resulted in seed germinating in a limited area, creating 'dog hair' stands (yellow arrow) of pine. These locations need to be thinned so as to reduce the fuel level but to provide replacement trees for the future forest.

   This view shows an increased number of small pine trees that have seeded in from the historical thinning that occurred. While there is very little dead ground fuel or 'ladder fuel', the pine reproduction should be considered a shrub making this representative of Fuel Model 6 which can be an extremely hazardous fuel model. However, due to a low density and shorter height of the pine reproduction, this would be considered as a Low Load Dry Climate Timber-Grass-Shrub. Wildfire spread rates and flame length are typically low at calm to low wind speeds. However, the rate of spread and flame length increases dramatically as wind speeds approach 15-20 miles per hour.

This view shows a deep depth of field through the forest. The litter layer is still suppressing grass and other herbaceous growth in spite of the increased sunlight. As depicted in the 'north' photo there is a small 'dog hair' stand of pine in the right center of this location. While residual tree health needs to be examined, thinning the dense thicket will bring this location to the desired condition.

   This view still shows a treated area of Fuel Model 8. The cluster of trees in the right hand center of the photo (yellow arrow) does not necessarily need to be thinned or pruned. This grouping can be left intact to provide a privacy barrier and to break up the long view through the forest. While a 'ladder fuel' condition exists here, there is insufficient fuel on the ground to allow a crown fire to develop or sustain itself. The large pine tree (red arrow) may ignite and torch, but it is predicted that a wildfire will remain on the ground and should be readily suppressed.
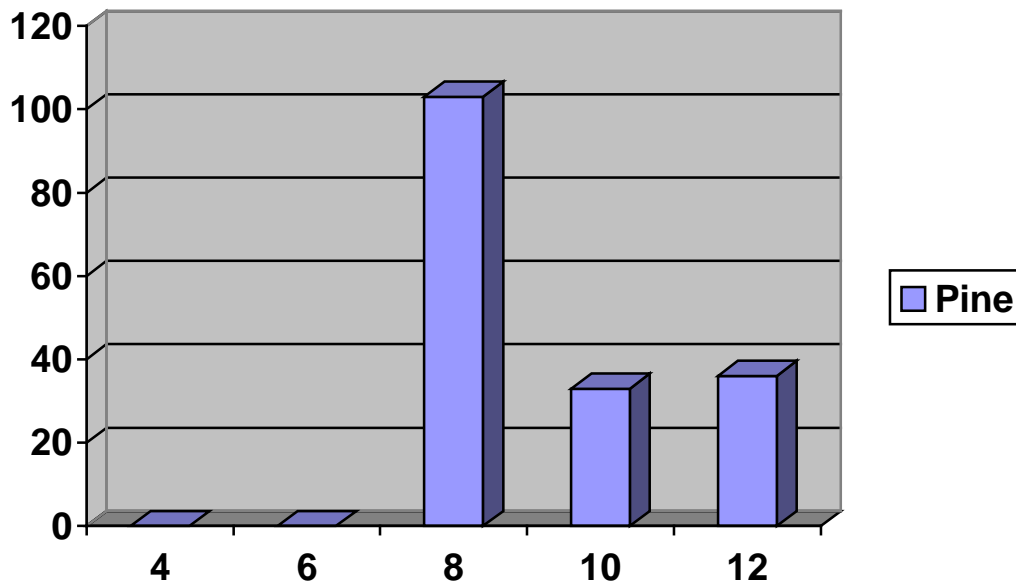
The chart above displays the number of trees per "2" diameter class. At this particular sample location no trees were tallied that were four or six inches in diameter or less. But while no trees were sampled, the photo record shows they are present.

The chart shows the highest number of trees lies in the 8-inch diameter class, and this is to be expected due to the historical forest stand improvement thinning. These trees were thinned at a yonder age and have now been allowed to develop into a fairly uniform stand of ponderosa pine as the 10 and 12-inch diameter classes represent barely 40% of the stand.

Treatment should follow individual tree form and health and not focus strictly on diameter class based removal. The eight-inch class should not be focus for tree removal as it is the current forest. Reproduction should be thinned where it is crowded to provide future replacements.

Sample Point Statistics

Average Diameter of All Trees = 9.8 inches
Average Number of Trees per Acre = 172

Based on the average diameter and the number of trees per acre, the growing stock level is just slightly higher than the target level of 90. The growing stock level is a level of stocking designed to attain a targeted basal area when the stand reaches an average of ten inches or more in DBH. In this case, the target basal area is a range from 70 to 90 in order to keep the threat of infestation from mountain pin beetle at a controllable level.

In this case, the target GSL is already reached and no further tree removal is necessary beyond those trees subject to health or poor form.
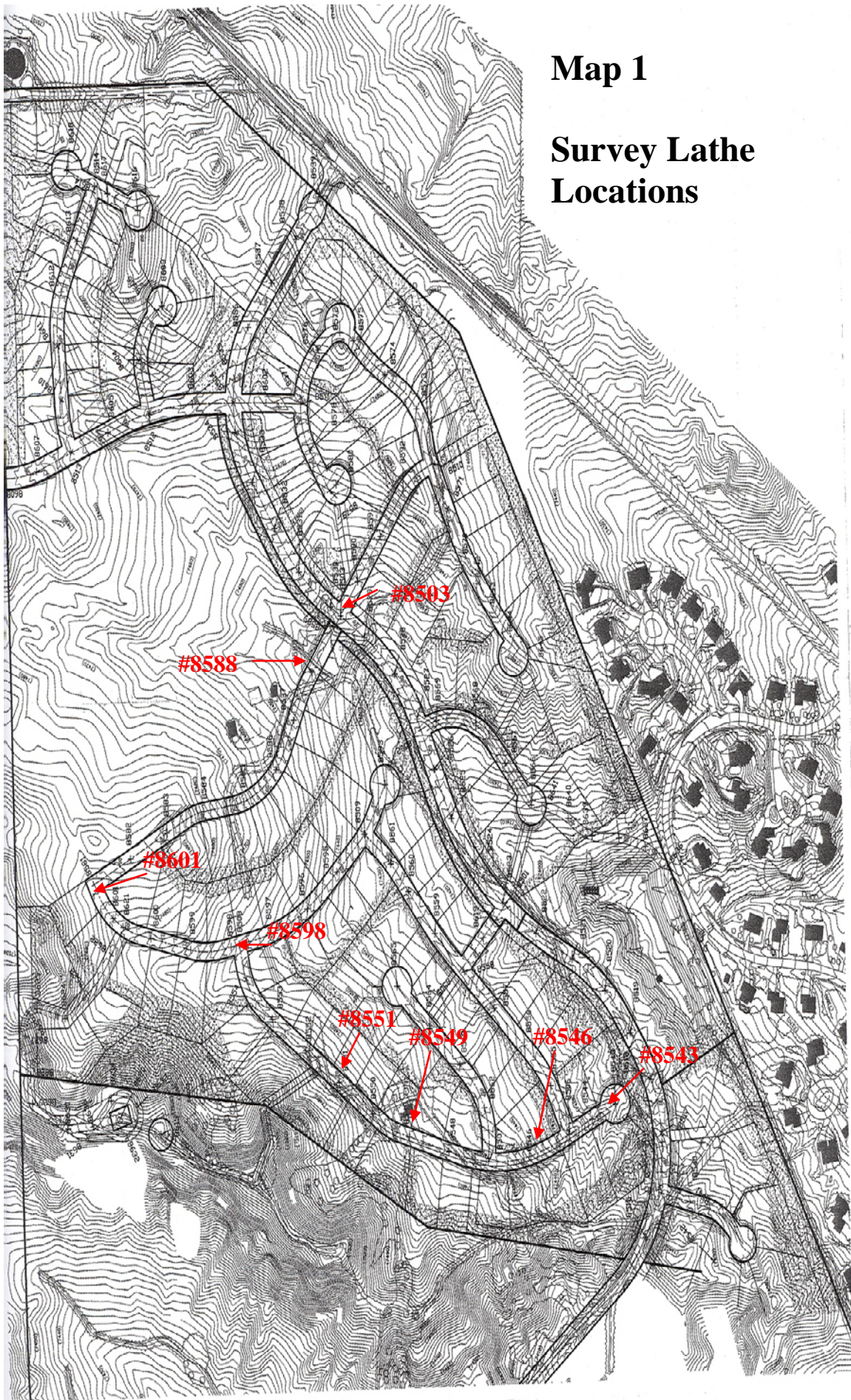
Treatment Prescription

This area should be inspected for overall tree health and form. Reproduction should be thinned sufficiently to provide for future replacements but can be left in higher densities for use as visual barriers across the forest as a whole.
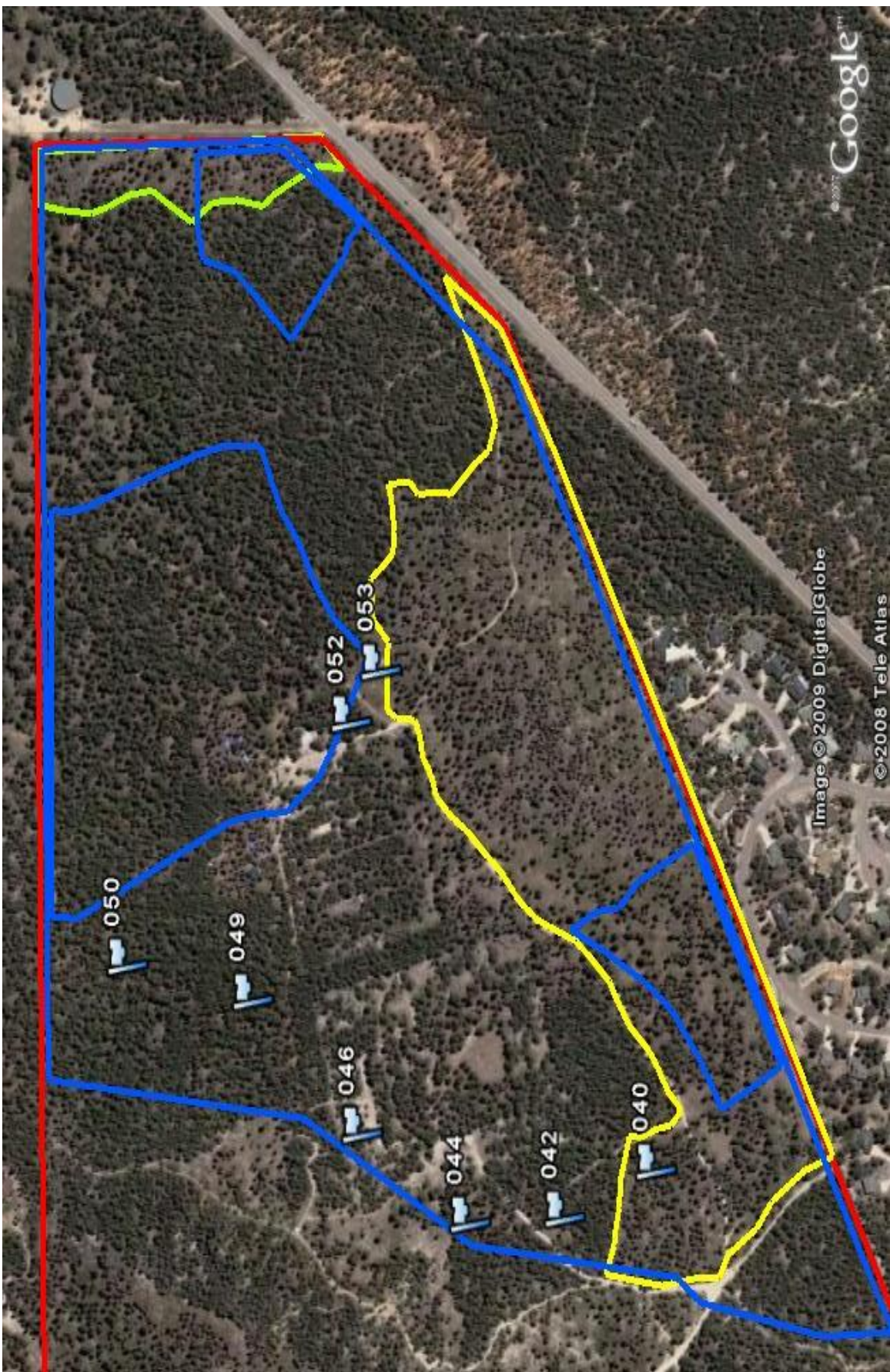
Map 1

Survey Lathe Locations