Chapter 3

Technical and Economic Analysis of Affected Crop Categories and Recommendations

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Chapter 3: Technical and Economic Analysis of Affected Crop Categories and Recommendations

In 2005 and 2007, District staff evaluated several alternatives to open burning for the crop categories identified in the CH&SC. While most of those crops and materials are already subject to the requirements of Rule 4103 and are prohibited from being burned, there were no technologically or economically feasible alternatives available for some crops and materials at the time. District staff has reviewed the technologically feasible alternatives for each of the affected agricultural crop in the SJVAB. From those alternatives, District staff has evaluated what appears to be the most viable and likely method to open burning for many of the affected crops in the SJVAB. Further discussion on emissions and costs for open burning and the alternatives for these crops are presented in the following chapters of this report. This chapter analyzes the crop categories that are allowed to be burned until June 1, 2010 and presents the findings for those crops.

During the research process, District staff has worked closely with the ag industry representatives and other agencies to address the burn prohibition requirements for various crops. The ag industry representatives have conducted extensive research and effort to provide District staff with key information to help move this project forward. The information used for further analysis include economic data, costs for chipping and burning, descriptions of operations, and other related documents. The ag industry has made significant progress over the years in reducing emissions from open burning through research, development, and implementation of viable alternative methods. However, there are concerns for some crops where growers have not been able to identify technologically or economically feasible alternatives.

The basis of the economic feasibility analysis is a comparison of compliance costs of the likely non-burning alternative to profit rates (Return on Sales, or ROS) of the industry sector. To evaluate the economic feasibility of burn prohibitions on orchard pruning/removal operations for subject crops, the District engaged their regulatory economic consultant, Applied Development Economics, Inc. (ADE). ADE has familiarity with and constant access to comprehensive and applicable profitability and revenue data. Compliance costs for non-burning disposal alternatives were estimated by District engineers and ag industry representatives using a variety of data sources and methodologies. The development of compliance cost estimates is presented in Chapter 6.

Profits for subject industry sectors were estimated by ADE by applying published profitability rates for crops to estimated revenues. Profit rates, production,

acreage, and prices were taken from the USDA Ag Census 2007, University of California Cooperative Extension, and California Agricultural Commissioners' Annual Report, as well as data compiled commercially by Dun and Bradstreet. While the profitability rates used in the analysis below are long-term averages from Dun and Bradstreet, it should be noted that industry stakeholders engaged in extensive effort and provided significant input regarding the recent profitability of certain crops. These data are presented in Appendix E and confirm the District's conclusions on the significance of economic impacts (i.e., greater or less than 10% of profit) on each crop operation.

The analysis was conducted for each crop/operation (nut orchard prunings, citrus orchard removals, vineyard removals, and removal of other orchards such as stone fruit). The calculations are shown on the tables in Appendix E, and the results of the analysis are shown below.

Summary of Results, Economic Feasibility

Crop	Operation	Farm Scale, Acres	Cost/Profit, %
Vineyard – Wine Grapes	Vineyard Removal	<100	55.2% – 82.0%
Vineyard – Wine Grapes		≥100	46.9% – 69.6%
Vineyard – Raisin & Table Grapes		<100	22.6% – 33.6%
Vineyard – Raisin & Table Grapes		≥100	19.2% – 28.6%
Vineyard – Kiwi		<100	11.1% – 16.6%
Vineyard – Kiwi		≥100	9.5% – 14.1%
Citrus	Orchard Removal	<100	10.9% – 11.9%
Citrus		≥100	9.4% - 10.3%
Other orchards	Orchard Removal	<100	7.0%
Other orchards		≥100	5.9%
Almond, Pecan, Walnut	Pruning	<100	10.0%
Almond, Pecan, Walnut		≥100	8.5%

3.1 VINEYARD REMOVAL MATERIALS

Summary and Recommendation

Table 3-1 Summary of Analysis

Vineyard Removal Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Grapes (wine grapes only)					
Farms Less than100 acres	Possibly Biomass	No. Wire Issues.	$762 - $1,132	55.2%-82.0%	No
Farms 100 acres or more	Possibly Biomass	No. Wire Issues.	$762 - $1,132	46.9%-69.6%	No
Grapes (raisin and table grapes)					
Farms Less than100 acres	Possibly Biomass	No. Wire Issues.	$762 - $1,132	22.6%-33.6%	No
Farms 100 acres or more	Possibly Biomass	No. Wire Issues.	$762 - $1,132	19.2%-28.6%	No
Kiwi					
Farms Less than100 acres	Possibly Biomass	No. Wire Issues.	$762 - $1,132	11.1%-16.6%	No
Farms 100 acres or more	Possibly Biomass	No. Wire Issues.	$762 - $1,132	9.5%-14.1%	No

*Biomass power plants can accept vineyard removals given that wires are removed from the vines.

Recommendation:
District staff evaluated biomass power plants as an alternative to open burning of vineyard removal materials and other factors. The economic feasibility analysis is presented in Section E-1 of Appendix E. At this time, District staff recommends that vineyard removal materials continue to be allowed to be open burned based on the following reasons:

- There is currently no economically feasible alternative to remove the wire that is embedded in the cordon and canes to prevent damage to the chipping equipment or prevent the wires from going to the biomass power plants. Wire removal adds a significant cost to the growers. Increasing the amount of materials going into landfills is not considered a viable alternative as landfills are required to divert wood and green materials.

- Most chipping operators are not willing to chip and haul away the vineyard removal materials or would charge a higher fee.

Description and Findings

Vineyards include both grape vines and kiwi vines because both crops require support, such as the trellis systems to help keep the fruits off the ground. Grape vines are used to produce table grapes, wine grapes or raisin grapes. The cultural practices and the type of trellis system used at a vineyard are based on the intended use of the grapes (table, wine, or raisins) and other factors. In addition to the vine and trellis wire, a vineyard may contain cross arms, as well as metal or wooden stakes and posts. Treated stakes (sometimes with metal braces) cannot be chipped and must be taken to a landfill. The posts currently being used are predominantly made out of steel. Metal stakes are removed before chipping and taken to a steel plant. The end posts can also be made out of redwood which can be burned.

According to ag representatives, disposal methods for vineyard removal materials are the same for table, wine and raisins grapes. A grower will generally grow a crop to produce specifically table grapes, wine grapes or raisin grapes. However, some vineyards provide the grower some flexibility so that based on several factors, including market prices, a grower can determine well into the production year whether the grape crop will end up as table grapes, wine grapes or raisin grapes.

Depending on the disposal method with the vineyard removal materials, the materials that help support the vine can pose several issues for the grower during the removal process. In many cases, most of the foreign material can be removed from the vine. However, there are some situations where complete removal of the material, such as wire, can be difficult and expensive for the grower. When too much wire is embedded into the vines, chippers can refuse to chip the agricultural materials. If the wires were to be chipped along with the wood, the number of power plant operators that will accept such agricultural materials can be limited.

According to biomass power plant operators, vineyard removal materials are accepted. The only restriction with vineyard removal materials is that wire is removed and treated posts are taken out. Substantial amount of wire in the chipped material can cause problems for the biomass power plant. Other contamination (as long as not excessive) in the material, such as dirt, need to be controlled but is not a major concern to the operators since some amount of dirt is expected of all agricultural fuel. It is generally not an issue if the chipped materials are clean.

While growers can hire laborers to remove most of the wires that connect the vines, it is not practical to remove the wire that is embedded into the cordon or

the canes. Ag representatives indicated that the raisin vineyards are pruned in such a way that the remaining canes are wrapped around the vineyard wire to support the crop. In order to chip the materials for fuel use at biomass power plants, ag representatives indicated that the wire must be cut more times (compare to open burn) and be removed completely from the vineyard or must be present only in very short lengths before it can be chipped. This presents an issue for vineyards where a cordon is created by wrapping the vine around the wire in the second year. As the vine grows, the wire becomes more and more embedded in the vine, making it impossible to remove. In some trellis systems, there may be as many as four wires embedded in the cordon. Ag representatives also indicated that chipping operators have reported the wire causing problems and getting wrapped around the moving parts of their machinery, and that biomass facilities prefer not to receive material with wire because the wire causes havoc with their equipment.

Ag representatives have also indicated that getting the materials chipped according to the grower's schedule has been an issue because it could take weeks or months to have a field chipped, which may be too late to plant for the next season.

3.2 ORCHARD REMOVAL MATTER FROM CITRUS, APPLE, PEAR, QUINCE, AND FIG CROPS AND ORCHARD REMOVAL MATTER FROM A TOTAL OF 20 ACRES OR LESS

In 2007, ARB concurred with the District's limited postponement to allow for the burning of orchard removal matter from 20 acres or less and other type of orchard removals. Rule 4103 defines "Orchard Removal Matter" as agricultural material generated by the removal of orchards. This includes leaves, branches, trunks, roots, stumps and untreated branch support sticks. The rule prohibits burning of orchard removal material generated as a result of land use conversion from agricultural to nonagricultural purposes.

Since 2002, the Natural Resources Conservation Service (NRCS) has encouraged growers to chip debris left from orchard or vineyard removals by providing a cost-share basis through the Environmental Quality Incentives Program (EQIP), which help reduce NOx, VOC, PM10, and PM2.5 emissions generated from open burning. The program also includes chipping of almond and walnut pruning, which will be discussed in Section 3.7.3 of this chapter. According to NRCS staff, the payment rate has increased from $100 per acre to $150 per acre. In order for the growers to replant the field, the chipped orchard removal materials are typically removed from the farm to a biomass power plant or a composting facility. The chips could also be deposited on unpaved roads for dust control purposes. Based on NRCS data, the amount of chipped materials

from the orchard and vineyard removal category averaged about 270 acres in the SJVAB per year, from 2007 to 2009.

3.2.1 Orchard Removal Matter from a Total of 20 Acres or Less

Summary and Recommendation

Table 3-2 Summary of Analysis

Orchard Removal Matter	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
*Orchard Removal Matter from 20 Acres or Less Category**					
Farms Less than100 acres	Biomass	Yes	$161	7.0%	Yes
Farms 100 acres or more	Biomass	Yes	$161	5.9%	Yes

*Reduce Burn allowance to 15 acres per location per year. No case by case determinations for additional acreage.

Recommendation:
District staff has completed the review process for the technologically feasible alternatives to open burning of orchard removal matter from a total of 20 acres or less. The economic feasibility analysis is presented in Section E-2 in Appendix E. Biomass power plants appear to be the most technologically feasible alternative to open burning of orchard removal matter; however, due to the limiting factor of increased cost per acre for smaller acreage and availability of chipping operators, District staff believes that open burning be allowed to continue for small orchard removals. District staff recommends that the current open burning limit be reduced to 15 acres or less of orchard removal at a single location, per calendar year. District staff also recommends that there be no case by case determinations for additional acreage since the cost analysis shows that it becomes more expensive as the acreage becomes smaller regardless of the total size of the farm.

In addition chipping operator typically refuses small jobs, making it difficult for many growers to remove small acreages of orchard removals. The District has increasingly refused most requests for burns that are over 15 acres. The District's Compliance Department has indicated that several requests above 15 acres have been denied because the costs to chip and remove the orchards were determined to be economically feasible.

District staff has found that limiting the acreage amount to 15 acres would be feasible based on the District's cost analysis to chip and haul the orchard removal materials to the biomass power plants, where the cost per acre appears

to level out at about 15 acres or more. Further information on cost analysis can be found in the Costs section of this report. According to the burn applications, burn permits that were approved for less than 15 acres make up for most of the burns, over 84%. According to some growers and chipping operators, the cost per acre could level out to as low as 10 acres for some growers; however, District staff believes that 15 acres is a reasonable limit based on the cost analysis and considering fluctuations in cost caused by location, fuel costs, and materials, and other factors.

Description and Findings

Since June 2007, the District has provided limited burning allocation for orchard removal matter from 20 acres or less and has required a case-by-case economic justification of the open burning alternatives from growers before evaluating and determining whether a burn permit may be issued for farms burning less than 20 acres but are greater than 100 cumulative acres. ARB concluded that the postponements will not substantially contribute to the violation of an applicable federal air quality standard, and discussed the important role of the District's comprehensive smoke management program in preventing impacts to nearby communities. However, ARB noted that orchard removal of 20 acres or less from all other crop types must be implemented narrowly. This category includes all orchard type, except for citrus and pome fruits (apples, pears, and quince crops). As recommended above, figs would be considered as part of this category.

Growers typically need to remove some orchards every few years to keep the farm productive. Growers, ag representatives and chipping operators have expressed several concerns with the chipping of orchard removal matter from small acreage. Generally, small acreage growers are not a priority for chipping operators because of amount of materials generated compared to the time it takes to travel and move the equipment to the field. Biomass power plant operators have indicated that the large chippers are doing jobs less than twenty acres with an understanding that the cost of chipping has gone up.

Chipping operators also charge a minimum fee (or move-in fee) to the grower. As a result of the minimum charge, the per acre cost for such small removals increases as the acreage becomes smaller. Based on the District's cost analysis and information received from ag representatives, the cost per acre appears to level out at a certain acreage. The fee could vary among chipping operators and is dependent on the availability of chipping contractors, storage at biomass power plants, the crop type and density, topography, soil type, and location. Given these considerations and the fact that most growers are already chipping the orchard removals above 20 acres, District staff has used a conservative estimate for chipping costs for the analysis.

Ag representatives have indicated that when chipping operators work on small acreage jobs, growers are often forced to wait until the chipping operator plans to be in the area. This can cause significant delays in fumigation, land preparation, irrigation, and planting. Trees must be ordered a year in advance. When the land is not prepared in time for the trees to be planted, these young trees die, at a large cost to the grower.

For farms greater than 100 cumulative acres in the SJVAB, the District has required a case-by-case economic justification of the open burning alternatives from growers before evaluating and determining whether a burn permit may be issued for less than 20 acres. District staff evaluated the economic feasibility of the alternatives based on the applications and copies of receipts, written bids, or supporting information for the economic justification. District staff has found that the case-by-case economic justification varies significantly, from net losses to the cost exceeding the ten-percent (10%) net profit threshold. Information provided by growers also supports the higher costs per acre for chipping of orchard removal for smaller acreages, which in the past has shown to be less economically feasible.

From June 2007 to February 2010, the District received a total of 1088 applications for orchard removals of 20 acres or less per year. Of those applications, the District issued burn permits for 964 applicants of various farm sizes, including those that are greater than 100 cumulative acres. However, based on the evaluation of the economic justifications, District staff issued burn permits for only 305 applications for farm over 100 cumulative acres. For the approved burn permits, the amount of acres burned relative to the amount of acres farmed is equivalent to four percent (4%), or about 8,200 acres burned from a total of 196,400 acres. Based on this analysis, the District has implemented narrowly the provisions for burning orchard removals of 20 acres or less.

3.2.2 Fig Crops Orchard Removal Matter

Summary and Recommendation

Table 3-3 Summary of Analysis

Orchard Removal Matter	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	District Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
*Fig Crop**					
Farms Less than100 acres	Biomass	Yes	$161	7.0%	Yes
Farms 100 acres or more	Biomass	Yes	$161	5.9%	Yes

*Analysis of fig crop will be considered as part of "Other Fruit Orchards". Reduce Burn allowance to 15 acres per location per year. No case by case determinations for additional acreage.

Recommendation:
District staff has considered the factors currently impacting the alternatives for disposing of fig orchards and recommends that open burning of fig orchard removals be reduced to less than 15 acres at a single location, per calendar year after June 1, 2010. The economic feasibility analysis is presented in Section E-2 of Appendix E. Fig orchard removals would be considered as part of the small other orchard removals category. District staff also recommends that there be no case by case determinations for additional acreage.

Description and Findings

When fig orchards are removed, the trees are typically no longer productive and would be replaced with new fig orchards or are no longer an economical crop and would be replaced with other crops. There are no fire blight issues or other concerns for fig crops. In addition, the orchard materials would be acceptable at biomass power plants as an additional fuel source.

3.2.3 Citrus Crops Orchard Removal Matter

Summary and Recommendation

Table 3-4 Summary of Analysis

Orchard Removal Matter	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
*Citrus Crop**					
Farms Less than100 acres	Biomass	Some operators	$369	10.9%-11.9%	No
Farms 100 acres or more	Biomass	Some operators	$369	9.4%-10.3%	No

*Biomass power plants are willing to take citrus crops; however, the materials are typically blended with other materials and are less desirable.

Recommendation:
District staff evaluated the factors currently impacting citrus crops and the proposed alternative for disposal. The economic feasibility analysis is presented in Section E-3 in Appendix E. For citrus crops, District staff has considered biomass power plants as the most technologically and viable alternative to open burning. Based on District staff's analysis, it is not economically feasible to prohibit open burning for citrus crop. In addition, there appears to be uncertainty in whether all of the citrus materials could be accepted at biomass power plants at this time, due to the lack of future commitments to biomass plan operation.

District staff recommends that citrus orchard removals continue to be allowed to be open burned. As recommended and supported by the industry, District staff also recommends that growers allow a drying time of between eight to ten weeks for citrus materials as a best management practice before burning.

Description and Findings

The following citrus crops are all grown in the San Joaquin Valley: grapefruits, lemons, oranges (primarily Navels and Valencias), tangerines, and mandarins. According to the County Agricultural Commissioner's Data for Calendar Year 2008, oranges make up about 82% of the harvested acreage of citrus crops in the SJVAB. Growers typically remove old citrus orchards in the year prior to planting. Based on the District's data, orchard removals from citrus crops are spread out through the year; however planting usually occurs between February and April.

Citrus is often grown in clay-like soil that adheres to its roots. The extensive lifespan of citrus crops leads to the development of an extensive root structure

that is difficult to free of soil debris when the root is removed. Clay soil, common to citrus orchards, is difficult to remove from the roots. Separating the roots from the trunk and then processing the trunk and the stump or root separately for the purpose of multiple uses increase the costs of operations, such as chipping and grinding. Furthermore, screening of chipped materials to remove excessive clay from stumps increases the overall citrus orchard removal costs to growers. It takes about six to eight weeks of drying time for a typical non-citrus orchard; citrus takes longer to dry. Growers would need to dry the material long enough so that a biomass facility will take the material and ration it.

In addition to the concerns noted above, growers, ag representatives and chipping operators have expressed several other concerns with the chipping of citrus crop orchard removal matter. Key concerns include 1) the reluctance or refusal of some power plants to accept citrus chips, 2) the additional processing and costs that are required to make the citrus chips acceptable by the power plants, and 3) whether biomass operators will take citrus once the economy improves and they start getting more construction material.

Biomass power plant operators recognize that citrus has been a problem in the past, but feel that this no longer seems to be the case as there have been considerable changes in processing the citrus materials. Biomass power plant operators have indicated that mixing citrus chips with chips from other crops helps promote better flow of the chips through their equipment. In the past, one of the issues was that clay soil could become trapped in the rootballs and damage the power plant boiler refractories. The stringy nature of citrus tree chips could also clog conveyors and material handling equipment unless the chips were finely ground. Biomass power plant operators have indicated that from 2003 to 2005, the roots seemed to be a problem initially with citrus materials getting into the conveyor systems, but later it was determined that citrus needed a drying process of around six to eight weeks, maybe shorter in hotter temperatures.

According to CBEA, all of the facilities have worked diligently with the orchard removal contractors to resolve the issues with citrus wood and as a result, higher percentage of citrus material could now be accepted. Biomass power plants continue to fall short of their goals for more citrus orchard materials and a number of plants continue to be extremely short of wood fuel. Many are currently curtailed or operating at reduced loads and are in need of more fuel at this time. The District looks forward to working with the biomass industry to achieve long-term commitments toward the extensive use of agricultural biomass.

For more information on biomass facilities, please refer to Chapter Eight of this report.

3.2.4 Apple, Pear, and Quince Orchard Removal Matter

Summary and Recommendation

Table 3-5 Summary of Analysis

Orchard Removal Matter	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	District Percent of Return on Sales	Industry Stakeholder Percent Return on Sales
Apple, Pear, & Quince Crops	None. Disease Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered the factors currently impacting the alternatives for disposing of orchard removals for apple crops, pear crops, and quince crops and has determined that there are currently no feasible alternatives that would substitute open burning of these crops. There are two factors for this consideration: 1) biomass operators will not accept treated materials and 2) requiring that these crops transport materials in closed containers is beyond what is required for other orchard removals and therefore, costs are expected to be greater. For the second factor, District staff is not aware of any chipping operators that have closed containers for this purpose. District staff recommends that open burning continue for these crops.

Description and Findings

As mentioned above for prunings from pome fruits, crops such as apples, pears, and quince are susceptible to fire blight, a bacteriological disease that can spread through insects, wind, and mechanical devices and kills blossoms, shoots, limbs, and sometimes the entire tree. In most cases, the on-set of fire blight is unidentifiable and can be spread by contact or exposure to other healthy orchard material. For orchard removals, the equipments used to cut or remove the tree are also routinely sterilized with antibacterial agents to mitigate exposure to the disease or potential disease.

Similar to pruning, orchard removals from apple, pear, and quince crops need to be burned to combat further spread of fire blight within orchards and to prevent potential infection of nearby orchards. As indicated by some operators and county ag commissioners, they are not aware of an effective treatment for fire blight. Growers have considered chipping the orchard removals and transporting the materials to biomass facilities. However, the primary concern with this

alternative is potentially spreading the disease to other orchards during transportation. In addition, biomass operators prefer clean product and will not accept treated materials. As a result, burning is the preferred and most viable method used in the SJVAB to dispose of these crops in order to avoid potential exposure of the fire blight to healthy trees.

3.3 WEED ABATEMENT ACTIVITIES AFFECTING SURFACE WATERWAYS, INCLUDING PONDING AND LEVEE BANKS

Summary and Recommendation

Table 3-6 Summary of Analysis

Weed Abatement Activities	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Surface Waterways – Ponding and Levee Banks	None. Mowing and Herbicide Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered the factors currently impacting the weed abatement activities affecting surface waterways, including ponding and levee banks and recommends that open burning be allowed to continue as part of weed abatement activities affecting surface waterways, including ponding and levee banks. While chemicals and mowing are available for weed control in many locations, these alternatives are not viable because of the slopes and remote locations.

Description and Findings

It is noted in the May 19, 2005 Rule 4103 Final Staff Report, that although some weeds and locations lend themselves to Best Management Practices (see Attachment 1 in Rule 4103), there remains a need for limited burning of some weeds. As mentioned earlier, this analysis does not include the category for "other weeds and maintenance". The CH&SC required the District to establish best management practices in 2005 for the control of other weeds and maintenance, which includes ditch bank work, canal bank work, dodder weed, star thistle, tumbleweeds, noxious weeds, pesticide sacks, and fertilizer sacks. Since the implementation, landowners and irrigation districts have continued to do their part to reduce burning by seeking alternative ways to manage weeds.

The best management practices in the rule were developed in collaboration with affected sources and are alternatives that must be considered prior to any open burning. Landowners and operators have also opted for more mechanical and chemical control of weeds and only burned at times when conditions, such as remote locations or other requirements, prevent other alternative practices.

Since 2005, open burning is no longer allowed for weed abatement activities from berms, fence rows, pasture, grass and Bermuda grass. However, open burning is currently allowed for weed abatement activities affecting surface waterways, including ponding and levee banks. The following materials are not considered to be part of the burn allowance for weed abatement activities affecting surface waterways, ponding, and levee banks: 1) weeds that originate from outside and away from the surface waterways, ponding or levee banks and 2) any other debris or materials that are gathered from surface waterways, ponding, or levee banks, such as tree limbs or foreign materials.

According to comments and information received from ag representatives and several agencies, there are currently no feasible alternatives to burning all of the weeds along surface waterways, ponding and levee banks. Landowners and operators have considered using hand crews for removing weeds but found the alternative to be impractical. Landowners and operators typically mow and spray most of the weeds or use flame desiccation, for direct heating of residual weed foliage and over growth of weeds to assure the destruction of weed seeds. One operator discs specific sites as needed. In many remote locations along surface waterways, ponding, and levee banks, fire is the only option for effective control of weed seeds and for safety of workers.

In addition, ag representatives and agencies have indicated that burning weeds is the most effective option to slope the banks to stabilize them and allow the water to flow easily, with less erosion. Rodents, such as gophers, have also been a concern around levees, including some ground squirrels that have bored through entire levees. Standing weeds make it nearly impossible to check the banks for rodents, which can cause ditch breaks or erosions and lead to flooding of surrounding areas. Complete prohibition to open burning in these areas could also increase additional use of other chemicals for pest control.

The Federal EPA and the State and Regional Water Boards continue to push to eliminate the use of chemicals near any waterway. Recognizing these issues, many landowners and operators are controlling the use of chemicals along surface waterways, ponding, and levee banks due to concerns over runoff of chemicals from land to waterways. Ag representatives have provided a copy of the California's Porter-Cologne Water Quality Act of 1969 and related information from the federal EPA (attached as part of Appendix B), which further explains the

water regulations. The California Porter-Cologne Water Quality Act regulates the discharge of waste into ambient waters, and authorizes Regional Boards to impose requirements on waste dischargers after consideration of several factors. Along with other responsibilities, the Regional Boards also regulate all pollutant or nuisance discharges that may affect either surface water or groundwater. One of the purposes of the federal Water Pollution Control Act (or Clean Water Act) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and nonpoint pollution sources.

One operator indicated that the ability to burn occasionally would reduce the amount of chemical needed. According to the operator, the area of the banks by the water line make up about 0.2% of the agency's total acreage and only a portion of that is burned annually.

3.4 OTHER MATERIALS

Other materials include brooder paper, deceased goats and diseased bee hives.

3.4.1 Brooder Paper

Summary and Recommendation

Table 3-7 Summary of Analysis

Other Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Brooder Paper	Landfill	Yes	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has found that the current and primary disposal method for brooder paper is landfilling. District staff considers landfills to be a viable alternative to open burning and will recommend that these materials be prohibited from being burned. The District's SMS data also shows an insignificant amount of emissions from open burning of brooder paper in the SJVAB in the last few years.

Description and Findings

A broad variety of fowl are raised in confined animal facilities in the SJVAB. Poultry operators use brooder paper to protect their young birds during transportation and the first few weeks of life. In general, the paper needs to easily absorb poultry droppings and disintegrate for easier disposal. District staff

contacted four operators that raise poultry. Three of the operators indicated that they do not burn their brooder paper but put it in a dumpster for delivery to a landfill. A large operator that raises turkeys and chickens indicated that he doesn't "…believe that burning brooder paper is a common practice in California." District staff also contacted an operator that burns the brooder paper used for raising ducks. The operator indicated that he has alternatives to burning the brooder paper including composting the brooder paper or taking it to a landfill.

3.4.2 Deceased Goats

Summary and Recommendation

Table 3-8 Summary of Analysis

Other Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Deceased Goats	Burial	Yes	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff considers burial to be a viable alternative to open burning. District staff does not consider rendering to be a viable alternative to open burning due to the many issues noted for that technology. District staff recommends that these materials be prohibited from open burning. The District's SMS data also shows an insignificant amount of emissions from deceased goats being burned in the SJVAB in the last few years.

Description and Findings

Several published articles have noted that meat goat production has been gaining in popularity in the United States in recent years. Some goat operators confirmed that there is increased demand for their products.

The discussion below on deceased goats differentiates goats that expire from diseases (diseased) and goats that expire from other causes (not diseased).

Deceased goats that were not diseased - Whether goats are raised for their milk, their meat or their fur, goats are subject to fatal injury due to accidents, predatory animals, exposure to the elements, and other causes. Operators have experienced several particular issues in the past few years with the disposal of goats that have died from causes other than diseases. Issues have included the

die off of goats due to high summer temperatures and the reluctance or refusal of rendering plants to accept goats due to concerns over the cost to collect the animals and possible diseases. Two goat operators noted that they did not know of any operators that used open burning to dispose of their goats. Instead, operators usually bury the goats on their property in as safe a manner as possible.

Deceased goats that were diseased - In the interest of protecting public health, several regulatory agencies have regulations affecting the handling of diseased animals. Two diseases of particular concern are mad cow disease and scrapie. Bovine spongiform encephalopathy (BSE), also known as mad cow disease is a fatal disease that causes progressive neurological degeneration in cattle. Scrapie is a fatal, degenerative disease affecting the central nervous system of sheep and goats.

The California Department of Food and Agriculture (CDFA) regulates on-site carcass disposal in the case of animals suspected of succumbing to contagious disease. The California Code of Regulations, California Food and Agriculture, Division 5, Part 1, Chapter 1, Section 9141 requires that "Any person that has the care or control of any animal that dies from any contagious disease shall immediately cremate or bury the animal." Section 9142 requires that "An animal which has died from any contagious disease shall not be transported, except to the nearest crematory." And Section 9143 requires that "An animal which has died from any contagious disease shall not be used for the food of any human being, domestic animal, or fowl."

In addition, the Department of Resources Recycling and Recovery (CalRecycle) has prohibitions that impact the disposal of deceased goats. Section 17855.2 of California Code of Regulations Title 14, Natural Resources, Division 7, CIWMB, Chapter 3.1, Compostable Materials Handling Operations and Facilities Regulatory Requirements, prohibits the composting of unprocessed mammalian tissue except for certain specific instances.

In 1997, FDA published a final regulation designed to prevent the spread of BSE through animal feed. The 1997 FDA rule prohibits the use of most mammalian protein in the manufacture of animal feeds given to ruminant animals, such as cows, sheep, and goats. The regulation also requires process and control systems to ensure that feed for ruminants do not contain the prohibited mammalian tissue. In 2008, FDA published a regulation that strengthened the 1997 rule by prohibiting the tissues that have the highest risk for carrying the agent thought to cause BSE in animal feed.

When goats die from unknown causes, some operators will try to discover the cause of death by taking the carcass to a veterinarian for an examination in an effort to determine the cause of death.

3.4.3 Diseased Bee Hives

Summary and Recommendation

Table 3-9 Summary of Analysis

Other Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Diseased Bee Hives	None. Disease Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
Several key considerations for diseased bee hives are that the diseases could be dormant in the frames and used equipment, as well as develop resistance to chemicals used in the sterilization process. The CH&SC specifically identify this crop type as “diseased” bee hives. District staff believes that there are currently no technologically feasible alternatives to open burning of diseased bee hives at this time. District staff recommends that diseased bee hives be allowed to continue to be burned.

Description and Findings

Bees are a key component in the growing of crops. The importance of bees was noted in an article in the U.S. Department of Agriculture's science magazine, "Agricultural Research." The author Kevin J. Hackett (ARS National Program Leader, Biological Control, Beltsville, Maryland) noted in the March 2004 issue of Agricultural Research magazine that "The value of honey bee pollination to U.S. agriculture is more than $14 billion annually, according to a Cornell University study. Crops from nuts to vegetables and as diverse as alfalfa, apple, cantaloupe, cranberry, pumpkin, and sunflower all require pollinating by honey bees. For fruit and nut crops, pollination can be a grower's only real chance to increase yield. The extent of pollination dictates the maximum number of fruits." In light of this, it is vitally important to growers that the supply and availability of bees are protected to the highest degree possible.

Artificial bee hives serve two purposes: production of honey and pollination of crops. The hives are commonly transported so the bees can pollinate crops in

selected areas. Modern bee hives are usually constructed of wood and consist of several parts which include the following:

- Bottom board - this has an entrance for the bees to get into the hive.
- Brood box - is the most bottom box of the hive and is where the queen bee lays her eggs.
- Honey Super - same as brood box, but is the upper-most box where honey is stored.
- Frames and Foundation - wooden frame and plastic sheet with honey comb impression where bees build wax honey combs.
- Inner and Outer Cover - As the name implies.

Beekeepers have experienced several problems in the past few years. A recent development is the problem of colony collapse disorder (CCD), a phenomenon where bees mysteriously abandon their hives. The UC Davis Department of Entomology website contains an article dated Oct. 16, 2007, about a lecture presented by UC Davis honey bee specialist Eric Mussen. The article notes the following comment: "One-third of America's honey bees vanished this past year due to the mysterious CCD, characterized by almost total hive abandonment. Nearly all adult worker bees unexpectedly fly away from the hive, abandoning the stored honey, pollen, larvae and pupae. Usually they leave in less than a week, and only the queen and a few young workers remain".

Section 29208 of California Code of Regulations Title 3, Food and Agricultural Code, Division 13, Bee Management and Honey Production, requires that "If American foulbrood is found in an apiary, the abatement shall be by killing the bees in the infested colonies and disposing of the hives and their contents, together with any other infested comb, hives, and associated appliances which are found in the apiary, in one of the following ways: If abatement is by burning, the person abating shall act in accordance with applicable air pollution control district or air quality maintenance district regulations and state and local fire control laws. If the regulations or laws prohibit burning immediately, the diseased colonies shall be sealed and placed in an enclosed structure and thereafter burned on the first date allowed by the regulation or law. All the activities shall be reported to the inspector prior to burning, who may require that burning occur only under his or her supervision."

3.5 RICE STUBBLE (STRAW)

Until June 1, 2010, permits may be issued for the burning of rice stubble up to 70% per year of the total acreage of rice farmed by the operator. Permits may also be issued for the burning of residual rice stubble, spot burning of rice stubble, and burning of weeds and vegetative materials on rice field levees and banks.

Summary and Recommendation

Table 3-10 Summary of Analysis

Rice Stubble (Straw)	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	*District Percent of Return on Sales*	*Industry Stakeholder Percent Return on Sales*
Rice Stubble (Straw)	No. Market and Water Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered the factors currently impacting the alternatives for disposing rice stubble. Due to the fluctuation in market demand for rice stubble, which impacts growers ability to effectively remove the material, and issues with water allocation, District staff recommends that open burning of rice stubble be allowed to continue for burns at 70% per year of the total acreage of rice farmed by the operator after June 1, 2010 and until June 1, 2015. District staff will review the feasibility of a complete burn prohibition for rice stubble in 2015.

Description and Findings

Most of the rice grown in the SJVAB is grown in the northern part of the air basin. Rice is planted in the spring and harvested in the fall. Once the rice is harvested, the rice straw remains in the field for disposition. Reducing the amount of post-harvest straw residue in the rice fields is important to the successful production of the next crop. Burning has been the historical cultural practice for removing straw and residues for the California rice industry. Burning rice straw helps prepare the field for the next rice crop as burning destroys any diseases in the rice straw of the current crop.

The farming operations for rice growers in the SJVAB are different from Sacramento Valley growers, where significant acres of rice are also farmed. Rice growers in the Sacramento Valley typically dispose of their rice straw by

incorporating the rice straw into the soil. Unlike Sacramento Valley where water allocations allow post-season irrigating, water cannot be delivered to agricultural operations in the Northern SJVAB in the post-harvest season due to the annual distribution schedules designated by irrigation districts. Due to the lack of available water in the post-harvest season, rice growers in the SJVAB do not use soil incorporation to dispose of their rice straw because the residue may not breakdown by planting season. Most rice growers in the SJVAB do not have access to water wells for their rice fields.

In 2007, District staff believed that rice growers could sell the rice straw to rice straw baling operators who would then sell it to their customers such as dairies. Therefore, the District prohibited open burning for 30% of rice stubble per year.

In 2009, District staff attended a meeting held by several rice growers that farm in the Escalon area. According to the growers, the baling alternative worked well for the 2007 harvest as there was a market for the baled rice straw. However, rice growers stated that they were having difficulty in their efforts to comply with the 70% burn allowance for 2009. Specifically, they were having difficulty in getting their rice straw baled and removed from their farms. The rice growers and a rice straw baling operator indicated that they have conducted several searches on alternatives to burning the rice material and there is currently no market for baled rice straw. In November 2009, a variance was approved for a group of rice growers that farm in the Escalon area to allow them to burn the remaining 30% of their acreage. Growers noted in their variance application that there were no viable alternatives currently available for disposal of the rice stubble.

According to the District's burn data for rice stubble, the annual burn acreage have fluctuated since 2006. This change is primarily due to the market demand for rice stubble. However, open burning from rice stubble have been reduced by 42% since 2005, base on a three-year average from 2007 to 2009. The market should continue to be assessed annually to ensure that rice stubble can continue to be used for other alternatives, such as dairies.

3.6 Prunings from Apple, Pear, Quince, and Fig Crops

3.6.1 Prunings from Apple, Pear and Quince Crops

Summary and Recommendation

Table 3-11 Summary of Analysis

Prunings	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Apple, Pear, & Quince Crops	None. Disease Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered the factors currently impacting the alternatives for disposing prunings from apples, pears, and quince crops and do not believe that there are technologically feasible alternatives to open burning of these materials. Depending on the amount and size of materials, it may not be feasible to require that growers place the materials into plastic bags for burial. The chemicals are preventative measures to help control fire blight; however, chemicals are not the solution to ensure complete control since the bacterial disease may develop resistant strains. District staff recommends that prunings from apples, pears, and quince be allowed to be burned to help control the spread of fire blight.

Description and Findings

Pome fruit including apple, pear, and quince crops are susceptible to a disease called fire blight. Fire blight is a destructive bacterial disease that kills blossoms, shoots, limbs, and sometimes the entire tree. Insects, wind, and mechanical devices can spread fire blight. According to the ag representatives and an agricultural commissioner, fire blight can destroy an entire orchard in a single season if left uncontrolled. The bacterium can be easily transmitted to susceptible tissue by contact. The equipments used to prune the tree are routinely sterilized with antibacterial agents when moving from one tree to the next to mitigate exposure to the disease or potential disease. The unrestricted movement of infected tissue will cause the disease to spread rapidly and under certain environmental conditions (hot and wet). Containment of the infected tissue is an essential element for control.

Apple, pear, and quince prunings are burned to combat further spread of fire blight within orchards and to prevent potential infection of nearby orchards.

Some operators and county ag commissioners have indicated that they are not aware of an effective treatment for fire blight. Chemicals that are used to control the bacterial disease could prove ineffective if the disease becomes resistant over time. According to an agricultural commissioner, the options for controlling fire blight that is becoming resistant to chemical means of control with Streptomycin are burning on site or disposal by placing infected plant material in double plastic bags for burial.

3.6.2 Prunings from Fig Crops

Summary and Recommendation

Table 3-12 Summary of Analysis

Prunings	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Fig Crop	Shredding	Yes	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered shredding as an alternative to open burning of prunings from fig crops and other factors currently impacting fig crops. Shredding the pruning materials on site appears to be a common practice and the most feasible alternative to open burning of prunings from fig crops. Shredding the fig prunings and allowing it to decompose should not be a significant fruit degradation concern for fig orchard removal as the chipped material should have decomposed or be reduced in size by the time of harvest. The current mowing and sorting practices would help reduce any excessive materials from the figs during harvest. As a result, District staff recommends that open burning be prohibited for prunings from fig crops.

Description and Findings

Most figs are harvested as a dried crop. Figs are dried on the tree and allowed to fall to the ground. Dried figs are mechanically swept into windrows and collected and harvests are repeated at two to three week intervals. This method of surface harvesting requires the orchard grounds to remain free of excess debris that will hinder the harvest. The harvested figs are then transported to a dry location to be sorted before being sold.

According to ag representatives, there are no fire blight issues for figs and shredding the pruning material has become a common practice. Fig crops are typically pruned by hand during the winter. The pruning materials are placed in

the aisle of the tree rows and shredded in place. Operators typically mow the center of the tree rows a few times a year to manage and maintain the orchard floor.

3.7 SURFACE HARVESTED PRUNINGS

3.7.1 Prunings from Grape Vines and Grape Canes

Summary and Recommendation

Table 3-13 Summary of Analysis

Surface Harvested Prunings – Vineyard Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Grape Vines	Soil Incorporation	Yes	N/A	N/A	N/A
Grape Canes	Soil Incorporation	Yes	N/A	N/A	N/A

*N/A: not applicable

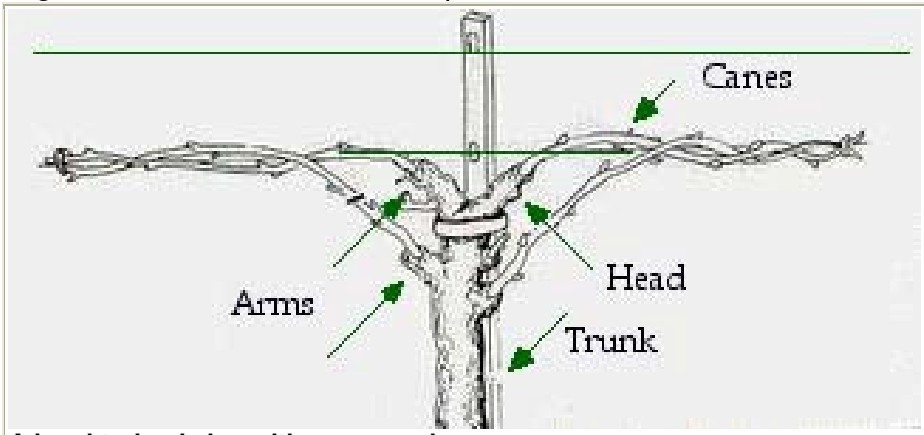
Recommendation:
As shredding and soil incorporation of prunings from grape vines and grape canes are already widely practiced, District staff considers soil incorporation to be a viable alternative to open burning and recommends that prunings from grape vines and grape canes be prohibited from open burning.

Description and Findings

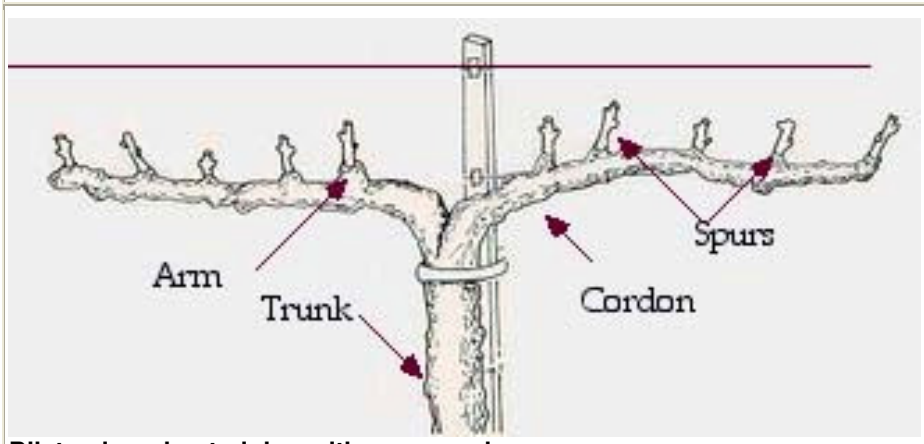
This category does not include grape attrition. According to the District's policy, attrition is vegetative materials not associated with pruning (as defined in Rule 4103) or orchard removals. Attrition materials include the incidental cuttings of dead or broken branches, tree mortality, water sprouts or suckers, or other damage to tree crops. Attrition materials may be burned provided that the materials are listed on a valid burn permit and daily burn authorization is granted.

Grape vines are used to produce table grapes, wine grapes or raisin grapes. The grape canes and spurs from a grape vine are usually pruned once a year in the winter when the grape vine is dormant. Wine vineyards now have high tensile wire to withstand the machines that go through the rows during pruning. The pruned grape canes and any other pruned material, such as spurs, are positioned in the center of the grape vine rows and shredded. Many growers typically shred their grape vine pruning material using a tractor and a shredder. Grape canes and other materials from the grape vines do not include the prunings from kiwi crops, which are already subject to Rule 4103.

Figure 3-1 Illustration of Grape Vine and Cane



A head-trained vine with cane pruning



Bilateral cordon training with spur pruning

http://www.ipm.ucdavis.edu/PMG/GARDEN/FRUIT/CULTURAL/grtrainprune.html

According to ag representatives and growers, the shredding and soil incorporation of grape cane prunings and other pruning materials from a grape vine have been long time traditional practices of growers. According to ag representatives, growers and biomass power plant operators, they are not aware of anyone doing anything with grape canes and other pruning materials from vines, except for shredding them and incorporating the shredded material back into the soil.

3.7.2 Raisin Trays

Summary and Recommendation

Table 3-14 Summary of Analysis

Surface Harvested Prunings – Vineyard Materials	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Raisin Trays	None. Polymer & Recycling Issues.	N/A	N/A	N/A	N/A

*N/A: not applicable

Recommendation:
District staff has considered the factors currently impacting the alternatives for open burning of raisin trays and recommends that open burning of raisin trays be allowed to continue. There is currently not enough research information for using raisin trays as fuel at biomass power plants. In addition, District staff believes that the increase to 40% of mechanical harvest for raisin production in 2009 alone has also significantly reduced the amount of emissions from these materials. As growers continue to switch to mechanical harvesting as an alternative to using raisin trays and open burning the material, District expects that open burning emissions from raisin trays will subside as well. According to the District's burn data, growers have continued to reduce open burning of raisin trays. Since 2007, growers have reduced burning of raising trays by over 27%, or 0.11 tons. District staff recommends that growers implement the practices below to control open burning of raisin trays and that the District work with the ag industry to develop any additional measures.

Description and Findings

Raisin trays are used in producing raisins. There are several types of drying trays used for sun-dried raisins. Wooden trays were used in the past, but have been replaced by paper trays. Due to changes in farming practices and other factors, several new paper trays have been developed. The types of paper trays available include regular paper, wet-strength paper and poly-coated paper. Both wet-strength paper and poly-coated paper trays are especially suited for protecting the raisin crop under wet conditions.

The traditional paper tray is approximately 24 inches wide and 36 inches long although other sizes are available for certain situations. The continuous tray, which consists of tray material wound into rolls of specified widths, resulted from

the development of mechanical harvest machines. The continuous paper is a heavier weight than individual trays.

Once the raisins have cured adequately and the moisture in the rolls is acceptable, normally in late September, they are ready to be collected. Raisins must be at 16 percent or less moisture content to meet the industry's incoming inspection requirements. There are several methods used for collecting the raisins and preparing them for the next step in their processing. After the raisins are collected, they are separated from the raisin trays for further processing and delivery to a raisin handler. Once the raisins are removed from the raisin trays, the raisin trays are ready for some other use or disposal.

Growers have continued to pursue alternative ways to burning raisin trays for over 50 years. Ag representatives indicated that only about 50,000 acres of vineyards using raisin trays are expected by 2015 because growers are transitioning to mechanical harvesting, which does not include the use of raisin trays. It is expected that there will be a continual reduction in burning. The long term goal of the California raisin industry is to transition toward 100% mechanization of raisin harvest and drying[5]. Based on information received from the ag representatives, the historical use of paper raisin trays has been significantly reduced by over 52% since 1990. The table below is a summary of information provided by ag representatives and shows the progress made in reducing the use and open burn of raisin trays.

Table 3-15 Raisin Tray Paper Volume History

Year	Total Amount of Raisins in Production (tons)	Percentage of Raisins Mechanized (%)	Amount of Raisins Produced on Raisin Trays (tons)	Number of Raisin Trays (four pounds of raisins per tray)
1990	395,000	5	375,000	188,000,000
2000	432,000	10	389,000	195,000,000
2009	300,000	40	180,000	90,000,000

According to ag representatives, some growers used recycling firms to dispose of their trays in the past. The trays were then shipped to China. The growers were typically charged a fee when the recycling firms picked up the trays at the growers site. However, China has cut off import of raisin trays because of the dollar's value and the practice of sending raisin trays to China is no longer a feasible alternative.

District staff has considered soil incorporation and biomass power plants as possible alternatives; however, the materials in the raisin trays create several

potential issues. Ag representatives have indicated that some growers grind and soil incorporate their raisin trays. The raisin trays contain polymer (5%) so that the moisture on the ground can not be absorb efficiently through the raisin trays. The trays that are ground up and soil incorporated into the soil can create problems because the materials are slow to decompose and some pieces will scatter around. Growers prefer clean fields for operations, which also help keep rodents and pests away.

The raisin trays currently can not be recycled for use as fuel at biomass power plants due to the polymer in the material. According to biomass power plant operators, both Madera and Mendota power plants are permitted to burn paper. Power plant operators indicated that they are willing to work with the District to address these issues. Power plant operators are determining a way to incorporate raisin trays into their fuel and analysis is pending. Additional research is needed for the potential use of raisin trays as fuel for biomass power plants.

In efforts to help reduce and control the burning of raisin trays, Ag representatives have developed and recommended the following practices for the burning of raisin trays:

1) All burning locations must be attended at all times when the raisin trays are burning, by able bodied adults with adequate tools or equipment to control a fire from escaping.

2) All burn locations must have adequate clearance to avoid escape. The burn area should be a “fire safety zone” away from dry fields, homes, shops, garages, utility poles or utility supply lines, and other buildings or equipment. A rule to remember is to remove all combustible materials from 30 or more feet around the burn area.

3) Paper raisin trays must be burned in a container to avoid escape of burning embers or ash, such as a wire cage. A wire cage may be constructed out of hardware cloth or chicken wire provided that the mesh is no larger than a ½ inch opening. The cage should never be filled beyond half and should be placed in a “fire safe zone”. Using a burn barrel for burning anything is illegal.

4) Don’t burn on windy days.

5) Avoid burning near a highway or roadway. Ashes or heavy smoke can create a very dangerous situation for drivers and winds caused by vehicles could cause the fire to escape from the fire safety zone.

6) Don't cause a smoke nuisance to your neighbors.

District staff will work with the Ag stakeholders to implement the recommended practices when burning raisin trays.

3.7.3 Almond, Walnut, and Pecan Prunings

Summary and Recommendation

Table 3-16 – Summary of Analysis

Surface Harvested Prunings	Potentially feasible alternative	Currently in practice by operators?	Incremental Cost, $/acre at 20 acres or more:	Percent of Return on Sales	Economically Feasible? (less than 10% ROS)
Almonds, Walnuts, and Pecans					
Farms Less than 100 acres	Shredding	Some Operators	$38	10.0%	Yes
Farms 100 acres or more	Shredding	Some Operators	$38	8.5%	Yes

Recommendation:
The economic feasibility analysis is presented in Section E-4 in Appendix E. Based on the considerations and analysis for prunings from almonds, walnuts, and pecans, District staff recommends the following:

The District would provide limited burn allocation for surface harvested prunings from almonds, walnuts, and pecans according to the following:

1. Prohibit burning of prunings for each agricultural operation whose total nut acreage (i.e., almonds, walnuts, and pecans) at all agricultural operation sites is 3,500 acres or more.
2. For each agricultural operation whose total nut acreage at all agricultural operation sites is less than 3,500 acres,
   a. Allow burning of up to 20 acres of prunings per year, and
   b. Allow burning of additional prunings, provided:
      i. The operator submits to the APCO before the pruning operation is completed, a representative cost estimate(s) for shredding all prunings generated by the total nut acreage at the agricultural operation site. The cost estimate(s) shall reflect shredding in a time frame that allows the operator to proceed with established post-pruning cultural practices.
      ii. The APCO determines that either the submitted cost estimate(s) represent(s) an unreasonable financial impact to the operator, or that adequate shredding services are not

available in time for the operator to proceed with established post-pruning cultural practices.

Description and Findings

Although the pruning methods will vary among growers, nut crops in general would have similar or common practices. So, unless otherwise noted, the following description for nut crops applies to almonds, walnuts, and pecans.

Nut trees are usually pruned after harvesting, either late or early in the year. In the past, growers generally open burned nut prunings to dispose of the material. However, many growers have found alternative ways to convert prunings into something useful such as soil amendment, dust control on unpaved surfaces, compost material, or fuel for biomass power plants. According to published documents and stakeholder comments, most nuts growers are currently shredding the prunings and leaving the materials on the orchard floor. Stakeholder comments include growers, vendors, and custom shredders. The ability to shred the materials varies among growers of different size farms and regions. One top nut grower in the SJVAB has continued to help minimize impact on air quality through environmentally responsible efforts, which include a contract with a biomass power plant to take its orchard removals and prunings. In 2008, another farm of several thousand acres initiated cultural practices and equipment necessary to shred all of the prunings rather than burn. District staff has also received comments from growers and custom shredders indicating that shredding of nut prunings has been a successful procedure in the farming operation, particularly for walnuts for one grower. However, there were also concerns from other growers regarding the burn prohibition for the prunings of nut crops.

A primary concern that some almond and walnut growers have is preventing the pruning material from interfering with the harvesting of the crop. Some of the existing shredding equipment currently shred the materials from one inch to a few inches in size.

One problem that some growers have experienced with chipping is the build up of chipped material on the ground, which slows the decomposition process. This situation can then cause the chipped material to be picked up during harvest. Some growers till the shredded material to help the decomposition. A grower noted that all pecans are no till operations whereas only a third of walnuts are no till operations. Although tilling could be done to bury the chipped material to promote faster decomposition, growers try to minimize the number of tractor passes in their orchards.

According to ag representatives, the almond hullers indicated that the impact of almond prunings or chips has been problematic. The chips are picked up with the almonds during the harvest process. The chips pass by the "detwiggers" which remove the larger sticks and branches that may get knocked down during the typical harvest process (shaking, sweeping and pick-up). The product then goes to the almond hullers/shellers, which separate the hull and shell from the almonds. Growers want to keep the harvest as clean as possible in order to maximize the price they receive from the almond hull processors that convert the hulls into animal feed. In order to keep the ground surface free of pruning material at harvest time, many growers have mostly relied on removing the pruning material from the field and open burning the pruning material.

Ag representatives also provided the following information to the District. The hull has significant feed value to dairies, and hulls with 15% fiber content or less are considered "prime hull" and receive the highest value. The next product is "hull and shell" which is limited to a fiber content of between 15% and 29%. And lastly, the shell or any product that has greater than 29% fiber content has little value and hardly any market. The almond hullers that the ag representatives spoke to estimate a five percent to 11% loss in prime hull revenue due to the presence of chips. Prices vary from year to year, but prime hull sells for significantly more than hull and shell. During a survey that the ag representatives conducted in 2009 for the purposes of developing comments for Rule 4103, prime hull was selling for $75 per ton, while hull and shell was selling for $45 to $50 per ton. Chips are high fiber content and when picked up with the hulls during the hulling process, they can significantly shift the fiber content. One huller estimated that the 4,000 tons out of 35,000 expected tons were shifted from "prime hull" to "hull and shell" due to the existence of chips. This was an 11.4% loss amounting to $120,000 in lost revenue. Another huller lost an estimated five percent of their "prime hull sales" due to the existence of the chips.

For walnuts, the hulls are not used for feed; however, growers still need to keep the harvest clean in order to minimize any negative impacts during the processing of the nuts. According to the ag representatives, the walnut growers and walnut processors have indicated that the primary issue is that the chips plug the lines at the processor, especially under wet conditions. Walnuts are typically harvested from mid-September through mid-November. About half of the time, rains during the fall begin before the harvest can be completed. Since the prunings occur in the winter, it is impossible to get a chipper into the orchard until after the rains subside. The chips do not decompose in the six to seven months between the pruning and the beginning of harvest. This is where the plugging occurs. The wet chips impede the ability to move the walnuts through the ductwork at a huller/dehydrator and processor, as the chips are picked up with the walnuts.

Ag representatives stated that walnut processors have also expressed concern with the chips being left in the orchard due to concerns over food safety. Since the chips are an organic material, they are subject to mold growth. If this mold is picked up during harvest, it can create a significant food safety issue in terms of the potential for aflatoxin. Food safety has become the number one issue of concern for the tree nut industry, and any issue that would confound food safety would be problematic.

As the trees are pruned late in the year, the ground is usually too wet to run heavy equipment in the field in order to chip the prunings. Growers will then wait for the ground to dry but they can only wait for a limited time as they need to spray and irrigate their fields early in the year and the pruning material can interfere with these operations. This gives the growers a short window of opportunity to have their prunings chipped. Some growers usually find it more conducive to their operations to gather the prunings and burn them.

For growers that shred the pruning material as an alternative method to open burning, the practice varies among nut growers. In addition, the pruning practice for the growers in the northern region appears to be different than the southern region. Growers could shred the prunings by renting, purchasing, or borrowing special equipment, or by hiring a custom shredder. These options depend on the availability of the custom shredder or the equipment. Costs for the options above also vary; however, District staff has analyzed the cost of hiring a custom shredder as the likely alternative (see section on Costs for analysis) for growers that own smaller farms. Custom shredders currently charge a two hour minimum fee to shred nut prunings. The average charge is around $260 per hour for a total of $520 for two hours. Purchasing a special shredding equipment that can shred the material into fine pieces to address the issue with the chips being picked up during harvest season could cost over $300,000 and is an expensive option and less likely for a small grower.

Ag representatives, custom shredders, and growers have mentioned that there is a shredder in the market which can shred the prunings into smaller pieces, thereby reducing problems during the harvest season. The shredder can also operate in all weather conditions, including the raining season. The vendor of the shredding equipment has indicated that 48 of those shredders are currently available for the industry and that previous shredding equipments have been sold mostly to growers where some also provide custom shredding service. One of the custom shredder indicated that most growers that farm over 3500 acres typically shred their own material and that it would be more costly for a grower that farms less than that to purchase the same shredder.

District staff conducted an analysis to determine whether it would be viable for growers to purchase a shredder instead of hiring a custom shredder. The following information was used to conduct this analysis:

1. Harvesting ends in October and cultivation begins around January/February. District staff estimated that the available months during the pruning season are November, December, and January (three months).
2. According to a custom shredder, the specific shredding equipment can cover eight to ten acres per hour. District staff estimated nine (9) acres per hour for the shredding equipment.
3. One working day equates to about eight (8) hours. Average number of working days per month is 22 days. District staff estimated that two hours are used to prepare the equipment before and after operation and six hours are used to shred (process) the pruning material.

The calculations for one shredder are as follow:

1. Total Number of Acres Processed Per Month

   Hours Processed Per Day x Acres Processed Per Hour x Averaged Number of Days Per Month:

   6 hrs/day x 9 acres/hr x 22 days/month = 1188 acres/month

2. Total Number of Acres Processed During the Pruning Season (Three Months)

   Total Acres Per Month x Three Seasonal Months:

   1188 acres/month x 3 months = 3564 acres

Based on the calculations, one shredder can cover approximately 3500 acres. District staff believes that it would be reasonable for a grower that farms 3500 acres or more to purchase an equipment to address heavy to light prunings from the nut orchards. As mentioned by the vendor and custom shredder, many growers that own their own shredding equipment also provide custom shredding service to other growers.

District staff conducted further analysis on the cost benefit of purchasing the shredding equipment for a farm over 3500 acres. The analysis below is intended to compare the two methods for the shredding alternative and is not representative of the incremental cost. The analysis is based on the following factors:

1. Hiring a Custom Shredder:

    - Per custom shredder, the average charge is $520 for two hours minimum.
    - Equipment can process eight to ten acres per hour, or 16 to 20 acres minimum (Averaged: 18 acres).
      (Reference: http://www.panerofarms.com/why-flory-powertrack.html)
    - Based on the above information, minimum averaged cost per acre is $29.

2. Purchasing a Shredding Equipment:

    - Per vendor and custom shredder, the estimated cost of purchasing the shredding equipment range from $315,000.
    - Labor rate of $14.74 per hour for machine operators, which includes payroll overhead of 34%.
      (Reference: http://coststudies.ucdavis.edu/files/almondvs08sprink.pdf)
    - Price for on-farm delivery of diesel is $2.50 per gallon, which includes a 2.25% sales tax on diesel fuel.
      (Reference: http://coststudies.ucdavis.edu/files/almondvs08sprink.pdf)
    - Fuel use for a shredding machine with similar horsepower is 12 to 15 gallons per hour. District staff estimates that the averaged amount of fuel (diesel) required to operate the shredder for one hour is 14 gallons (References:
      http://www.jgpress.com/archives/_free/001555.html and
      http://www.neequip.com/KFNA/BROCHURES/PDF_BRO/Crambo_2005E.pdf)
    - Annual maintenance is calculated as two percent of the purchase price. (Reference: http://coststudies.ucdavis.edu/files/almondvs08sprink.pdf)
    - Other additional costs include property insurance and property taxes (cash overhead). According to the *2008 Almonds costs and Returns Study*, the cash overhead contributes to about 9.5% of the capital recovery. (Reference:
      http://coststudies.ucdavis.edu/files/almondvs08sprink.pdf)

Based on the best available information and analysis above, the following calculations use 3564 acres per year for an equivalent comparison of the cost of purchasing a shredder and the cost of hiring a custom shredder.

The calculation for hiring a custom shredder is as follows:

1. Total Annual Cost of Hiring a Custom Shredder

Minimum Averaged Cost Per Acre x Number of Acres:

$29/acre x 3564 acres = **$103,356**

The calculations for purchasing a shredder are as follows:

1. Total Annualized Capital Costs of the Shredder

   The District uses the following formula to calculate an equivalent annual cost from a capital cost using a capital recovery factor as shown below:

   $$A = [P \times i(1 + i)^n] / [(1 + i)^n - 1]$$

   Where:
   - A = Equivalent annual cost of control
   - P = Capital cost of the control equipment, including installation cost
   - I = Interest rate (used 10% as a conservative estimate)
   - n = Equipment life (used 10 years as a conservative estimate)

   [$325,000 x 10%(1 + 10%)^10yrs] / [(1 + 10%)^10yrs – 1] = **$51,265**

2. Total Annual Cost of Diesel Fuel

   [Estimated Amount of Fuel (in Gallons) Used Per Hour x Hours Processed Per Day x Averaged Number of Days Per Month] x Cost of Fuel Per Gallon:

   [14 gallons/hr x 6 hrs/day x 22 days/month x $2.50/gallon] x 3 months = **$13,365**

3. Total Annual Cost of Hiring a Machine Operator

   Labor Rate Per Hour x Total Number of Work Hours Per Day x Averaged Number of Days Per Month x Three Seasonal Months:

   $14.74/hr x 8 hrs/day x 22 days/month x 3 months = **$7,783**

4. Total Annual Cost of Maintenance

   Cost of the Shredder x Two Percent of the Cost of the Shredder:

$315,000 x 2% = **$6,300**

5. Total Annualized Cost of Property Insurance and Property Taxes

   Total Annualized Costs of the Shredder x 9.5 Percent for the Cash Overhead (Insurance and Taxes):

   $52,892 x 9.5% = **$4,883**

Table 3-17 and Table 3-18 summarizes the annualized cost estimates for the purchase of a shredder and the annual costs of hiring a custom shredder.

Table 3-17 – Annualized Cost Estimates for the Purchase of a Shredder

Description	**Costs**
Total Capital Cost	$315,000
Total Annualized Capital Cost of the Shredder (10% - 10 years)	**$51,265**
Annual Operation & Maintenance Costs	
Total Annual Cost of Diesel Fuel	$13,365
Total Annual Cost of Hiring a Machine Operator	$7,783
Total Annual Cost of Maintenance	$6,300
Total Annualized Cost of Property Insurance & Taxes	$4,883
Total Annual Operation & Maintenance Costs	**$32,331**
Net Annual Costs (Annualized Capital Cost + Annual O&M Costs) **($/year)**	**$83,596**

Table 3-18 – Annual Cost Estimates for a Custom Shredder

Description	**Costs**
Averaged Cost Per Acre	$29
Total Annual Cost for 3564 acres	**$103,356**
Net Annual Costs ($/year)	**$103,356**

Based on the analysis above, the estimated savings from purchasing a shredder is close to $20,000 per year.

According to GrowingProduce.com, the 2009 Top Nut Growers make up about 228,000 of nut acreages in California. Out of the 25 Top Nut Growers, 18 of those growers are in the District's burn permit database or the Conservation Management Practices (CMP) database. The 18 growers make up about 183,154 acres of nut crops. Pistachios contribute to about 16% of the total acreage in the SJVAB, therefore the estimated acreage for almonds and walnuts for SJVAB growers is 154,327 acres, which is about 20% of the total nut acreage in the SJVAB. Twelve of those growers are over 3,500 total farm acres of nut crops and contributes to over 94% of the top acreages on the list, or about 212,000 total nut acreages. At least two growers in this group are either shredding the pruning material or taking the material to the biomass power plant. Based on the 2007, 2008 & 2009 Top Nut Growers tables, District staff expects that at least 80 percent of the farms in the top 25 list could buy their own shredding equipment. At the bottom of the 80 percent range, the total nut acreages average about 3460 acres.

According to the custom shredders, the average charge to shred the prunings is a minimum of two hours. The recommended shredder, which can shred the materials to finer pieces to address issues with the chips not being decomposed by harvest season or being picked up during harvest, can process eight to ten acres per hour. Due to the two hours minimum that custom shredder charges the grower, District staff believes that the cost on a per acre basis would increase as the acreage becomes smaller. Therefore, the 20 acres limit within the two hour timeframe is reasonable.

District staff is aware of at least three custom shredders in the SJVAB that operate a total of five of those shredders and another two contractors that do custom shredding. There are also several types of other shredding equipment available, where some may require more passes in order to shred the prunings into acceptable sizes.

The Jack Rabbit equipment is typically used to remove the material from the orchard. Transporting the material to composting facilities appear to be less common among growers compared to shredding the material onsite or taking the material to the biomass power plants. According to biomass power plant operators, some biomass power plants purchase some, but not all, of these prunings. The preferred alternative at this time for most pruning material is to shred and leave the material on the ground, since it can be more efficient than chipping and transporting the material offsite. Some growers have found that shredding and incorporating the materials back into the ground helps replenish the soil with nutrients. Several growers are also moving towards lighter pruning, which are about one-fifth of what they used to be. Since 2007, the amount of almond prunings burned has been reduced by over 22,000 acres, or 76 tons of

PM2.5. The amount of burn acres from walnut prunings has also been reduced by over 5,500 acres, or over 13 tons of PM2.5. The category for pecan prunings has shown a slight change in open burning; however, prunings are also shredded and left on the ground. The overall amount of emissions reduced since then could be even higher as a result of lighter prunings.

Over the past ten years, NRCS has encouraged growers to chip or shred the prunings from almond and walnut orchards by providing a cost-share basis through the Environmental Quality Incentives Program (EQIP). According to NRCS staff, it is uncertain how long this program will last. Many of the growers shred the material on site through this program, which helps reduce Nox, VOC, PM10, and PM2.5 emissions generated from open burning. According to NRCS, the program resulted in an average of 120,333 acres of almond and walnut prunings chipped per year in the SJVAB from 2007 to 2009. Along the same years, the average amount of almond and walnut prunings burned from the District's database was 68,802 acres per year. According to the County Agricultural Commissioner's data for Calendar Year 2008, the total harvested acreage for both of those crops in the SJVAB was 753,515 acres. The total harvested acreage for pecans is 611 acres, or 0.08% of the total nut harvested acreage. See table below for a summary of the alternative methods for almond and walnut prunings. Pecans are not included in the analysis below because NRCS data only addresses almonds and walnuts.

Table 3-19 – Analysis of Alternative Methods for Almond and Walnut Prunings

Surface Harvested Prunings from Almond and Walnut Crops	Acres
Total Harvested Acreage for Almonds	625,814
Total Harvested Acreage for Walnuts	127,701
Total Harvested Acreage for Almonds and Walnuts	753,515
Estimated Acreage Pruned per Year[1]	376,758
Chipped/Shredded Acreage of Almond & Walnut Prunings per year (NRCS)	120,592
Open Burned Acreage of Almond & Walnut Prunings per year (District)	68,802
Estimated Acreage from Alternative Disposal of Almond & Walnut Prunings[2]	187,364

[1]Assume Pruning is done in alternate years: [(753,515) / 2] = 376,758. The *2008 Almonds Costs and Returns Study* and *2007 Walnuts Costs and Returns Study* use alternate years for pruning of mature orchard. Both studies analyzed the alternative method of chipping and shredding onsite and indicated that the practices will vary among growers and regions.

[2]The remaining acreage is likely to be voluntary disposal through alternative methods to open burning, such as shredding, chipping, biomass fuel, or other methods, and without the EQIP program.

Based on the table above, if growers prune the harvested orchards during the dormant period every other year, the actual amount of acres pruned per year would be about 376,758 acres. Based on the analysis above, about 18% of the acreage pruned per year is contributed to open burning, while most of the growers are using other alternative practices rather than open burn.

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