SECTION II

THEORETICAL CAPACITY OF KINGS COUNTY TO HOST DAIRIES

A. Theoretical Capacity in Kings County for Dairies

Dairies generate liquid and solid (dry) manure. This liquid and dry manure contains nutrients that are essential for plant growth. Properly managed and applied to cropland at appropriate agronomic rates, these nutrients and other constituents become safe fertilizer and soil amendment for crops, including those crops used to feed the cows. However, the manure, and its constituents, if not properly managed could cause pollution to occur in ground and surface water, produce harmful and annoying insects, and create air emissions, odors, and dust at significant levels.

A finite amount of these nutrients can be safely managed by land application within a given area. The California Regional Water Quality Control Board Central Valley Region (RWQCB) has developed a set of worksheets for determining how much Nitrogen and salt are expected to be produced by dairy cows for various types of dairies (i.e., freestalls, flushed corrals, or scraped corrals). The method for estimating nutrients is presented in ~~their~~ <u>RWQCB's</u> *Fact Sheet No. 4*. Using the factors developed by RWQCB and the Nitrogen and salt requirements for various crops provided by the U.C. Cooperative Extension and Natural Resource Conservation Service, a theoretical maximum number of dairy cattle (including support stock) can be estimated based on the crop acreage that is available to use these nutrients in Kings County.

The rationale for using the RWQCB methodology for estimating the theoretical maximum dairy herd in Kings County is based on the County's goal to protect water quality.

Various assumptions must be made in order to generate such a *theoretical estimate* and make sure that it is reasonable and does not underestimate the amount of cropland that is needed. The calculations for the estimate, based on the following assumptions, are presented in Table No. 5 in Appendix A. Reductions in the estimated available acreage for dairy manure application are made to account for the additional Nitrogen generated by other sources. These reductions are listed in Table 5A. After applying these other Nitrogen source adjustments, the theoretical limit of dairy cows can be estimated as shown in Table 5. The acreage estimate adjustments must be made on a continuous basis as land is converted to uses which no longer will support the use of manure from dairies as a fertilizer.

B. Assumptions for Theoretical Capacity of Kings County to Accommodate Dairies

ASSUMPTIONS:

- All assumptions are made using the more conservative estimates when a choice is required unless otherwise indicated.
- One Animal Unit (AU) is based on 1,000 pounds per AU (Source: RWQCB).
- A lactating Holstein cow is equivalent to 1.4 Animal Units (AU) (Source: RWQCB).
- Most existing and future dairies operating in Kings County will be supported by Holstein herds.
- The dairy model used in these assumptions is based on a theoretical herd with the following percentages of support stock and show the actual size of a typical milk cow dairy with support stock (Source: U.C. Cooperative Extension). For presentation purposes, a typical 1,000-milk cow dairy is used in this example:

Animal Type	Percentage Of Herd[1]	Head	AU Factor by Age[2]	Holstein Factor[3]	AU Equivalent
Milk Cows	--	1,000	1.00	1.40	1,400
Dry cows & bred heifers	15%	150	0.80	1.40	168
Heifers (2 yrs. & older)	32%	320	0.73	1.40	327
Heifers (1. to 2 yrs.)	16%	160	0.73	1.40	164
Calves (3 mo. to 1 yr.)	40%	400	0.35	1.40	196
Baby Calves (<3mo.)	8%	80	0.21	1.40	24
TOTALS		**2,110**			**2,278**

NOTES:

1. Based on various sources including the U. C. Cooperative Extension, the percentage figures are the typical ratio of support stock to milk cows in the herd necessary to sustain a herd.
2. A factor based on an animal's age and the amount of manure it produces as compared to a 1,000-lb. animal, which is defined as an Animal Unit.
3. A factor to take into account the fact that Holstein cows are bigger animals, i.e., an adult Holstein milk cow typically weighs 1,400 lbs., 1.4 times bigger than a 1,000 lb. animal.

- The *Dairy Development Overlay Zone* (DDOZ) is that portion of Kings County where the majority of dairies exist and new dairies ~~can~~ may be located (see Table No. 4 in Appendix A and Figure 2 on Page DE-16). The zone contains nine separate areas totaling approximately 394 square miles, 341 of which can accommodate dairy facilities. The *Nutrient Spreading Overlay Zone* (NSOZ), adds another ~~646~~ 642 square miles for liquid and solid manure spreading for a total of ~~1,040~~ 983 square miles of area for dairy facilities and for management and recycling of the nutrients in the manure generated by those dairies (see Figure 2 and Table No. 4).
- All dairy facilities are assumed to have a freestall design. ~~The~~ In the dairy model, the freestall design requires the most land for salt and Nitrogen ~~disposal~~ recycling (thus the lowest density of cows). ~~This can be demonstrated by running the model for each of the management types.~~ The result~~s~~ ~~is that~~ for each of the management types are as follows:

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- if all milk cows are in freestalls and support stock are in scraped corrals, ~~less land is required for~~ Nitrogen ~~disposal~~ is the controlling factor,
- if all milk cows are in flushed corrals and support stock is in scraped corrals, ~~more land is required for Nitrogen disposal~~ salt is the controlling factor, and more cows could be accommodated,
- if all cows are in scraped corrals, less land is required for both salt and Nitrogen application, ~~thus~~ and even more cows ~~can~~ could be accommodated.

• Nitrogen is the principal limiting factor for protection of water quality, and salt is the secondary limiting factor for this model.

• Salt and Nitrogen usage assumes both single and double cropping farming methods will be used.

• Salt is generated at a rate of 1.29 lbs. per day per animal unit (AU). Using the "Holstein factor" of 1.4, each Holstein Milk cow will generate 1.81 lbs. of elemental salt per day.

• Nitrogen is generated at a rate of 0.56 lbs. per day per AU. Using the "Holstein factor" of 1.4, each Milk cow will generate 0.78 lbs. of Nitrogen per day.

• Transportation cost of solid manure may limit the range of hauling dry manure.

• Solid manure transported into Kings County from other counties is assumed to be offset by the amount of manure transported out of Kings County.

• In January of 2000 the total number of dairies in Kings County was 149 with an average herd of 837 milk cows plus support stock. These dairies and cows are subtracted from the calculated theoretical limit to determine the additional capacity that can be accommodated. (The January 2001 herd figures were received after the analysis for the Dairy Element and Program EIR was completed~~. It includes 130,443 milk cows on 147 dairies for an average of 887 milk cows per dairy~~.)

• "Harvested selected crops" are those crops on which dairy manure can be applied as fertilizer, verses crops that are grown for direct human consumption.

• Ratio of acres of "harvested selected crops" to all harvested crops countywide from the *1999 Agricultural Crop Report* by the Kings County Agricultural Commissioner is the ratio of "harvested selected crops" to all harvested crops countywide used for the "Dairy Development Overlay Zone" and "Nutrient Spreading Overlay Zone."

• The dairy process water ~~(liquid manure)~~ and solid manure factors are assumptions used in calculating Nitrogen values based on RWQCB's *Fact Sheet 4*. The animals are housed for 365 days~~/~~ per year. The Nitrogen excretion rate is 0.56 lbs.~~/~~ per day per animal unit for the milk cows and 0.45 lbs.~~/~~ per day per animal unit~~s~~ for the support stock. Freestall systems generate 80% ~~and 60%~~ of the manure ~~is generated in freestalls and flushed corrals, respectively, and is handled~~ as liquid, and flushed corral systems generate 60% of the manure as liquid. For milk cows in dry corrals or where alleys and corrals are scraped, 10% of the manure is in process water generated at the milk barn.

• When dairy process water is held less than 30 days and then applied to cropland there is a 50% loss of Nitrogen. ~~and when~~ When dairy process water is held more than 60 days ~~is~~ and applied to cropland there is a 75% loss of Nitrogen. These same rates are assumed for the Nitrogen loss from storage and application of dry manure. These values are based on RWQCB's *Fact Sheet 4*; however, the values may be modified in the future as new information becomes available.

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- Adjustments in the acreage available for dairy manure use are made to reflect the Nitrogen loading from other livestock and poultry operations and sewage sludge (biosolids) application operations in the county.

C. Explanation of Tables No. 5 and 5A - Theoretical Dairy Capacity of Kings Co.

A model that calculates the theoretical capacity of Kings County to host dairies based on the nutrients, i.e., salt and Nitrogen, generated by the livestock on dairies is presented in Table 5 of Appendix A. The end result is the amount of nutrients (salt and Nitrogen) that can be utilized by the available cropland. As stated above, Nitrogen and salt are assumed to be the limiting factors for dairies using freestall facilities. Table No. 5 provides the gross acreage available with the selected types of crops where ~~cow~~ dairy manure and process water can be applied. ~~a~~Adjust~~ed~~ments are made to account for the other Nitrogen sources listed in Table No. 5A. Table No. 5A calculates the acreage reduction necessary to account for the other Nitrogen sources applied to cropland.

As shown in Section A of Table No. 5, 381,980 milk cows (534,772 AU) plus 423,998 head of support stock (335,409 AU) can be accommodated based on the above assumptions. Generally a dairy includes both milk cows and support stock. Support stock includes dry cows that are periodically rotated into the milking portion of the herd. In addition, there are bred and young heifers, as well as calves and baby calves. The ratio of support stock to milking cows varies from operation to operation, but on average the ratio is as indicated in Section A of Table No. 5. In addition, Holstein cows are a large breed of cow, and a factor of 1.4 animal units (AU) per head is applied. An AU is equivalent to a 1,000 pound animal, characterized by a Jersey cow. Factors are also given for the age (and theoretical size) of the cows and calves. On average a dairy that milks 1,000 Holstein cows has a total herd of approximately 2,110 head of all ages that are equivalent to 2,278 AU.

Section A of Table No. 5 gives the estimate of the total head and equivalent AUs that can be accommodated based on the assumption ~~about~~ as to the amount of cropland that is available to spread the liquid and solid manure at agronomic rates.

The manure and dairy process water generated from the dairy cows contains various nutrients that are essential to plant growth. These nutrients are a natural fertilizer. To estimate how much fertilizer can be used within Kings County, Section D of Table No. 5 estimates the Selected Crops to Harvested Crops (SC/HC) acreage ratio of crops that can use this kind of fertilizer, which is calculated to be 73.15%. This SC/HC ratio is based on the *1999 Agricultural Commissioner's Report* for Kings County. The estimate is then applied to the total amount of Nitrogen and salt each of these various crops can utilize. Each dairy operation must account for the nutrient load of dairy process water ~~(liquid manure)~~ on the site~~, or area~~ controlled by the dairy operator. The solid, or dry, manure may be accounted for off site.

The model assumes the capacity for managing the Nitrogen is a function of the SC/HC ratio of land in ~~an~~ area~~s~~ designated as the *Dairy Development Overlay Zone* (DDOZ) and the *Nutrient Spreading Overlay Zone* (NSOZ), where manure and process water may be spread at agronomic rates. These two areas of Kings County are shown on Figure 2 (page De-16). The DDOZ includes about 341 square

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miles (217,657 acres) and includes all but about 15 of the existing dairies. The NSOZ includes about ~~646~~ 642 square miles (~~413,693~~ 411,055 acres) where new dairy facilities are not allowed, but manure may be transported and used to fertilize crops there. This model does not consider areas outside of Kings County based on the assumption that the same amount of manure is exported from the county as is imported into the county.

The total available acreage within Kings County, where both liquid and solid manure can be used to fertilize crops, is approximately ~~1,040~~ 983 square miles (~~633,807~~ 628,712 acres). This area is discounted by the SC/HC ratio of 73.15%, leaving a usable cropland area of approximately ~~463,630~~ 459,903 acres to spread the dairy process water and dry manure. However, using the *1999 Agricultural Commissioner's Report* approximately 429,700 acres of selected crops were harvested in the entire County. Therefore, only 73.15% of the selected harvested crops are used in the model, leaving 314,313 acres available for the spreading of the liquid and solid manure. Using the liquid waste and solid waste factors for both the milk cows and the support stock in freestall dairy facilities (with support stock in scraped corrals), the number of cows can be ~~estimated~~ determined.

This acreage must be further discounted to account for the land needed by other sources of Nitrogen (other livestock and poultry operations and sewage sludge applications). Table No. 5A provides this accounting to further reduce the available acreage for dairy manure use by 95,395 acres (including a 20% contingency factor).

D. Theoretical Dairy Herd Capacity for Kings County

The results of this model, as shown in Appendix A, Table 5, estimates that ~~369,383~~ 381,980 milk cows (~~517,136~~ 534,772 AU) and ~~410,015~~ 423,998 head of support stock (~~324,348~~ 335,409 AU) totaling ~~779,398~~ 805,978 head (~~841,484~~ 870,181 AU) can be accommodated within Kings County using current freestall designed dairies. In January 2000 there were estimated to be 124,668 milk cows in Kings County. Assuming the 52.6% support stock to milk cow ratio, there are currently approximately 138,344 head of support stock in the County. Thus theoretically, the potential available remaining capacity in the County is approximately ~~244,715~~ 257,312 milk cows and ~~271,671~~ 285,654 head of support stock.

E.   Relationship of Capacity to Air Quality

There is no parallel process, such as using the RWQCB standards, to determine what the capacity is with regard to air quality ~~is~~ in Kings County. The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) does not regulate dairies directly. ~~Draft~~ Rule 8081, however, regarding PM_{10} control measures, applies to certain ~~parts of~~ activities on dairy operations. Compliance with those standards is part of the operational requirements of the Dairy Element. Moreover, the Dairy Element requires use of advanced manure ~~management systems~~ treatment technology, which will greatly reduce many of the air quality impacts of future dairies and dairy expansions. By requiring these and other feasible measures to control air emissions, the Dairy Element will ~~protect air quality~~ reduce the impact of further dairy development and operation within the County and within the Basin.

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