FRASER RIVER ACTION PLAN

Sumas and North Matsqui Watersheds - 1997 Farm Practices Survey

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Sumas and North Matsqui Watersheds - 1997 Farm Practices Survey

Prepared for
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Executive Summary

The Matsqui Slough and Sumas River Watersheds are two economically important areas within the Lower Mainland area of the Fraser River basin. In 1991, the gross farm revenues were greater than 115 million dollars with expenses greater than 80 million dollars. In 1994 an agricultural land use study was conducted in these two watersheds. The goals of the study were to: (1) identify farms that followed the Code of Agricultural Practice for Waste Management and Agricultural Environmental Guidelines, and (2) identify possible contaminant sources that could impact water quality. An inventory of the agrowaste facilities and management in the two watersheds was carried out. Integrated Resource Consultants carried out the survey and devised a scoring system called and Environmental Sustainability Parameter (ESP).

A follow up survey was conducted in 1997. The purpose of this study was to compare the findings in 1994 to 1997 and see what improvements, if any, had been made over the three year period.

Farm Surveys

Based on the 1994 survey, 89% of dairy farms and 70% of hog farms participated again in 1997 (different hog farms participated in 1997). There was an increase in poultry farms participating in 1997.

In 1997, the median number of milking cow equivalent per farm was 100 and 115 in the Matsqui Slough and Sumas River watersheds respectively. Median manure storage time was 3.3 months, Matsqui Slough and 3.6 months Sumas River. Forty six percent of the manure storage facilities in the Matsqui Slough watershed were concrete, with 3% of all facilities covered. Seventy percent of manure storage facilities were concrete with 16% of all facilities covered in the Sumas River watershed. Farms with an ESP greater than 80% were considered in this study to have a low potential for degrading water quality. Twenty three percent of dairy farms in the Matsqui Slough watershed had an ESP score over 80% while 20% of dairy farms in the Sumas River watershed had an ESP score over 80%. In the Matsqui Slough watershed, no farms scored below 40%, while only 1% of farms in the Sumas River watershed scored below 40%.

The median number of broiler equivalents per farm over both watersheds was 30,500. Eighty two percent of farms reported shipping some or all of their manure off the farm. Fifty five percent of poultry farm had ESP scores over 80%, while 10% of farms scored below 40%.

The median number of sow equivalents per farm over both watersheds was 228. Median manure storage time was 4.1 months. Eighty six percent of hog farms had concrete manure storage facilities, with 57% of all facilities covered. Fifty seven

percent of hog farms surveyed had ESP scores over 80%, while 14% of farms scored below 40%.

Fertilizer Use

Detailed fertilizer data was collected from dairy farms. This data was added to manure application data and average application rates over the entire landbase for the farm was calculated. In the Matsqui Slough watershed, 9% of farms were applying nitrogen above the application rate of 350 kg/ha. Fertilizer was the main source of nitrogen. Sixty two percent of farms were applying phosphorus above the application rate of 100 kg P_2O_5/ha. Manure was the main source of phosphorus. Three percent of farms were applying potassium above the application rate of 450 kg K_2O/ha. Manure was the main source of potassium.

In the Sumas River watershed, 18% of farms were applying nitrogen above the application rate of 350 kg/ha. Manure was the main source of nitrogen. All of the farms surveyed were applying phosphorus above the application rate of 100 kg P_2O_5/ha. Manure was the main source of phosphorus. Forty eight percent of farms were applying potassium above the application rate of 450 kg K_2O/ha. Manure was the main source of potassium.

Sommaire

Les bassins hydrographiques du marécage Matsqui et de la rivière Sumas sont deux zones économiques importantes des basses terres du bassin du Fraser. En 1991, les recettes agricoles brutes étaient supérieures à 115 millions de dollars, avec des dépenses s'élevant à plus de 80 millions de dollars. En 1994, une étude sur l'utilisation des terres agricoles, menée dans ces deux bassins hydrographiques, visait les buts suivants : 1) déterminer les exploitations agricoles qui respectaient le code des pratiques agricoles pour la gestion des déchets et les lignes directrices en matière d'agriculture et d'environnement et 2) établir les sources probables de contaminants susceptibles d'avoir des effets sur la qualité de l'eau. On a dressé un inventaire des installations de traitement et de gestion des déchets agricoles dans ces deux bassins hydrographiques. Des conseillers en ressources intégrées ont mené une enquête et ont un système de pointage appelé paramètre de durabilité de l'environnement (ESP).

Une étude de suivi a été menée en 1997 en vue de comparer les résultats obtenus entre 1994 et 1997 et de déterminer si la situation s'est améliorée au cours de cette période.

Enquête sur les fermes

D'après l'enquête de 1994, 89 % des fermes laitières et 70 % des exploitations porcines ont participé de nouveau à l'enquête de 1997 (d'autres exploitations porcines y ont participé en 1997). Un plus grand nombre d'exploitations avicoles ont participé en 1997.

En 1997, le nombre médian d'équivalents vaches en lactation par exploitation dans les bassins hydrographiques du marécage Matsqui et de la rivière Sumas était respectivement de 100 et de 115. La durée moyenne d'entreposage du fumier était de 3,3 mois dans le marécage Matsqui et de 3,6 mois dans le bassin hydrographique de la rivière Sumas. Dans le bassin hydrographique du marécage Matsqui, 46 % des installations d'entreposage du fumier étaient en béton, avec 3 % de toutes les installations couvertes. Dans le bassin de la Sumas, 70 % des installations étaient en béton, dont 16 % étaient couvertes. Dans le cadre de cette étude, les exploitations dont le ESP était supérieur à 80 % étaient considérés comme ayant un faible potentiel d'altération de la qualité de l'eau. Un pointage ESP supérieur à 80 % a été enregistré dans 23 % des fermes laitières du marécage Matsqui et dans 20 % de celles du bassin de la Sumas. Dans le bassin hydrographique du marécage Matsqui, aucune ferme ne présentait un ESP inférieur à 40 %, tandis qu'il était inférieur à 40 % dans seulement 1 % des fermes du bassin hydrographique de la Sumas.

Le nombre médian d'équivalents poulets à griller par exploitation dans les deux bassins hydrographiques était de 30 500. Les exploitants de 82 % des fermes ont

déclaré qu'ils expédiaient tout leur fumier ou une partie de celui-ci hors de leur exploitation. Le pointage ESP était supérieur à 80 % dans 55 % des exploitations avicoles, tandis qu'il était inférieur à 40 % dans 10 % des exploitations.

Le nombre médian d'équivalents truies par exploitation dans les deux bassins hydrographiques était de 228. La durée moyenne d'entreposage du fumier s'établissait à 4,1 mois. Les installations de conservation du fumier étaient en béton dans 86 % des exploitations porcines, dont 57 % étaient couvertes. Le pointage ESP était supérieur à 80 % dans 57 % des exploitations porcines étudiées, tandis qu'il était inférieur à 40 % dans 14 % des exploitations.

Utilisation des engrais

Les fermes laitières ont fourni des données détaillées sur l'utilisation des engrais. Ces données ont été ajoutées aux données sur l'épandage du fumier, et on a calculé les taux moyens d'application pour l'ensemble des terres. Dans le bassin hydrographique du marécage Matsqui, la quantité d'azote appliquée était supérieure à 350 kg/ha dans 9 % des exploitations. Les engrais étaient la principale source d'azote. La quantité de phosphore appliquée était supérieure à 100 kg de P_2O_5 par hectare dans 62 % des exploitations. Le fumier était la principale source de phosphore. La quantité de potassium appliquée était supérieure à 450 kg de K_2O par hectare dans 3 % des exploitations. Le fumier était la principale source de potassium.

Dans le bassin hydrographique du marécage Matsqui, la quantité d'azote appliquée était supérieure à 350 kg/ha dans 18 % des exploitations. Le fumier était la principale source d'azote. La quantité de phosphore appliquée dans toutes les exploitations étudiées était supérieure à 100 kg de K_2O_5 par hectare. Le fumier était la principale source de phosphore. Dans le cas du potassium, la quantité appliquée était supérieure 450 kg de K_2O_5 par hectare dans 48 % des exploitations. Le fumier était la principale source de potassium.

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1.0 Introduction

The Fraser River Action Plan (FRAP) was established to reduce the pollution inputs to the Fraser River and restore the natural productivity of the Fraser River basin. The primary goal of the agricultural component of FRAP has been to implement a strategy to reduce the loading of nutrients, bacteria and agrochemicals from agricultural operations to ground and surface waters. Targets and strategies for their reduction were developed in consultation with stakeholders such as producer groups, the BC Ministry of Agriculture and Food, BC Ministry of Environment, Lands and Parks, Agriculture and Agri-Food Canada, Environment Canada, Department of Fisheries and Oceans and the BC Federation of Agriculture (now the BC Agriculture Council). The first step toward devising a strategy to achieve this goal was to identify the contaminant sources and to determine the loading of specific contaminants. The former was achieved, in part, through a survey completed for FRAP by IRC Integrated Resource Consultants in 1994 (IRC, 1994a,b). As the FRAP program sunsets in Spring 1998, a follow up survey in 1997 was considered useful to measure the accomplishments of FRAP, in conjunction with other concurrent initiatives such as the Canada-BC Green Plan for Agriculture and the provincial Agricultural Waste Control Regulation. All of which, contributed to activities to reduce the loading of nutrients from agricultural operations to ground and surface waters.

The primary objective of this study was to follow up on the survey completed by IRC Integrated Resource Consultants in 1994. This survey focused on livestock operations, dairy, poultry and pork, and their waste management and fertilizer practices. Comparison of data from 1994 and 1997 was utilized to determine whether positive changes have been made in managing agricultural waste and nutrient utilization on the farm. This study was completed in the region of the Matsqui Slough and Sumas River watersheds within the City of Abbotsford.

2.0 Legislation

In BC, legislative acts, regulations and guidelines that apply to agricultural operations include the federal Fisheries Act, the BC Waste Management Act, the Agricultural Waste Control Regulation and Code of Agriculture Practice for Waste Management, and the Environmental Guidelines for various producer groups developed by the BC Ministry of Agriculture and Food and the producer groups.

The pollution prevention Section (36.3) of the federal Fisheries Act prohibits the release of “deleterious substances” to waters frequented by fish. Deleterious substances are defined by this act as follows:

- Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or
- Any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation of alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat of to the use by man of fish that frequent that water.

In BC, agricultural operations were recognized as a possible source of contamination and/or pollution to surface and subsurface waters. Consequently, the Agricultural Waste Control Regulation was jointly deposited in April 1992 under the Waste Management Act and Health Act (Agricultural Waste Control Regulation, 1992). The Code of Agricultural Practice for Waste Management attached to the regulation was developed by a committee including representatives from BC Ministry of Environment, Lands and Parks, BC Ministry of Agriculture, Fisheries and Food, BC Federation of Agriculture, Department of Fisheries and Oceans and commodity group representatives. All agricultural commodity groups had extensive input into the development of the Code and the BC Federation of Agriculture actively supported enactment of the Code.

The purpose of the Code was to reduce the export of substances from agricultural operations to surface and subsurface waters, by describing practices for using, storing, and managing agricultural wastes. Environmental sustainability is dependent on farm operations having properly constructed and located waste storage facilities combined with the use of other environmentally sound management practices. The Code and supporting commodity Environmental Guidelines provide guidance to producers so that the impacts of the individual farm operations on surface and subsurface water quality are minimized. The Waste Management Act defines pollution as “the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment”. The Agricultural Waste Control Regulation exempts waste management aspects of agricultural operations from the permit process if these operations conform to the Code.

The BC Ministry of Agriculture and Food, in consultation with the BC Federation of Agriculture and producer groups developed Environmental Guidelines for the various commodity groups including dairy (BCMAFF, 1993a), and poultry producers (BCMAFF, 1993b). The guidelines provide the industry with various options for managing farms in an environmentally sound manner, but are not law.

3.0 Study Area

3.1 Matsqui Slough Watershed

The Matsqui Slough watershed has an area of approximately 4,200 hectares and is within the City of Abbotsford (Figure 1). The Slough discharges to the Fraser River just downstream of Mission. Most of the agricultural area in the basin has a flat topography with elevations between 5 and 8 meters above sea level. The drainage system for the Slough consists of over 28 km of ditches, sloughs and creeks with one 5.6 kilowatt (7.5 HP), two 11.2 kilowatt (15 HP), one 18.7 kilowatt (25 HP), two 22.4 kilowatt (30 HP) and one 30 kilowatt (40 HP) pumps and 9 check gates. The pumping capacity for the system is 0.71 m^3/s. Except for the drainage area on Sumas Mountain and near the base of the mountain, the drainage area has small gradients and the velocities in the creeks are small and largely controlled by pumps and check gates.

3.2 Sumas River Watershed

The Sumas study area is located between Sumas Mountain to the northwest and Vedder Mountain to the southeast, with the International Canada/USA border as the south boundary and the Vedder Canal the eastern boundary (Figure 2). The Sumas Prairie has an area of approximately 10,000 hectares. Drainage from the prairie flows to the Fraser River just east of Sumas Mountain. The basin is characterized by small gradients in the drainage system with resultant low velocities in the creeks and drainage canals.

The Sumas River watershed consists of the Sumas River and Sumas Drainage Canal, Arnold and Stewart Sloughs, and Marshall and Saar Creeks. Sumas River, Arnold Slough and Saar Creek flow north form their headwaters in the USA into BC. Approximately one-half of the 277 km^2 Sumas River watershed is in British Columbia (Hutton, 1987). The Sumas River receives sewage treatment plant effluent form communities in Washington State before entering Canada. A large portion of the Sumas River, from No. 2 Road to Hougen Park, is dyked (91%) and passes through agricultural land. Peak discharges at the international border occur in December/January and minimums in August/September. Sumas River stream gradients vary from 0.06% at the international border to 0.02% downstream (Hutton, 1987). The north side of Arnold Slough is dyked from Vye Road to the Saar Creek junction. From the Saar Creek junction the north side of Saar Creek is dyked until it meets the Sumas River. The BC portion of Saar Creek is 6 km in length and has an approximate watershed area of 44.5 km^2 (Hutton, 1987).

In 1924, a shallow lake occupying part of Sumas Prairie was artificially drained after construction of the Sumas Drainage Canal and exposed terraced beach sands around its perimeter (Halstead, 1986).

Gravity drain floodgates at Barrowtown pump station control the level in the Sumas River for irrigation purposes. Irrigation water is stored in the Sumas River from May 24 through to September 15 by closing the floodgates (IRC, 1994b). For the area West of the Sumas Drainage Canal, the water level in the Sumas River and its tributaries are controlled by three inlet valves (81 cm diameter valves and 91 cm diameter pipes) on the Sumas River which are opened from 35% to 50% of their maximums. Two of these valves are operated by the City of Abbotsford and the third valve by an independent group of farmers known as the East Sumas Irrigation District. For the area East of the Sumas Drainage Canal, four lift pumps into the canal regulate the water level. Considerable seepage from the Vedder Canal into the Sumas River watershed and land base around the Sumas Drainage Canal occurs. During the winter months the Sumas River floodgates can be closed to prevent flooding if the Fraser River rises above 4.5 to 5.0 m (Hutton, 1987). A large part of the Sumas Prairie has an elevation of less than 6 m (Halstead, 1986) and much of the Prairie is 1 to 2 meters below the Sumas Drainage Canal elevation. There are 212 km of municipal drainage/irrigation ditches and the Sumas Drainage Canal is 9 km in length.

The most Western portion of the Sumas study area (West of Sumas Way) has been developed for light industry. The remainder of the study area lies in the Sumas Prairie and is intensively used for agricultural production. Dairy, poultry and hog farms are scattered throughout this area, with the central northern portion (area bounded by McDermott Road, Campbell Road, Tolmie Road, No. 3 Road and Highway 1) being used for rotation of vegetable and bulb crops. The northeast corner of the Sumas Prairie includes Yarrow in the District of Chilliwack and Stewart Slough, which drains into the Sumas Drainage Canal. Stewart Slough provides irrigation for farms in this area.

4.0 Methods

4.1 Overview

The survey was completed by means of a questionnaire. The questionnaire was developed in consultation with the Ministry of Agriculture and Food, Ministry of Environment, Lands and Parks, Environment Canada and members of the three Producer Conservation Groups. Producers were mailed an introductory letter explaining the purpose of the project. Producers were then contacted by telephone and an appointment was made to interview the producer on their farm. Data was collected on the farm during a farm visit.

4.2 Questionnaire

The main components of the questionnaire were based upon a previous survey completed in 1994 by IRC Integrated Resource Consultants. Following consultation with the three Producer Conservation Groups (Hog Sustainable Producers Group, Sustainable Poultry Farming Group and the Dairy Producers' Conservation Group) a revised questionnaire was completed incorporating additional questions regarding the past performance of the conservation groups and fertilizer use (Appendix A). The Producer Conservation Groups requested that farm data be published in a manner representing the industry overall, and not on an individual farm basis. Only summary statistics are reported within this document. The survey was completed around the late summer harvest schedule of the participating producers.

5.0 Results and Discussion

5.1 Individual Farm Data

The completed questionnaires were arranged in binders by commodity group. Some hog producers requested that their names and addresses not be included on the actual questionnaire form. Information was obtained from 117 dairy, 29 poultry and 14 hog farms in both watersheds. These farms utilized 8,510 hectares of their own or rented land, or 59% of the total land base, within the two watersheds. The Ministry of Environment, Lands and Parks will retain the questionnaires.

5.2 The Application of the Environmental Sustainability Parameter (ESP)

Integrated Resource Consultants (IRC, 1994a,b) developed the method of comparing the potential for contamination of surface and ground water from agricultural operations in both watersheds. A farm ranking system was developed using the information from the completed questionnaires. This produces a single score for the farm, called and Environmental Sustainability Parameter (ESP). Of the farm operations, the manure storage capacity and disposal methods were determined to have the greatest potential for contaminating surface and ground waters (IRC, 1994a,b). An evaluation of these manure management methods accounted for a large portion of the overall ESP value. The basis of the evaluation process are the methods recommended in the Code of Agricultural Practice and relevant Environmental Guidelines.

Table 1 summarizes ESP scores for the dairy, hog and poultry groups. Data was combined for the poultry and hog farms in both watersheds as sample sizes were relatively small and descriptive statistical analysis was more accurate for these groupings.

Table 1. ESP Summary Scores, 1994 vs. 1997

Group	Region	Median Score 1994 ESP (SE)*	Median Score 1997 ESP (SE)*
Dairy	Matsqui	61 (3)	65 (2)
	Sumas	65 (1)	64 (1)
Poultry	Both	72 (5)	85 (4)
Hog	Both	64 (5)	81 (7)

* Standard Error

In most cases, ESP scores improved. For the dairy group in the Sumas River watershed there was no apparent change in ESP scores, however, manure storage time did improve in this region (see Table 2). Both the poultry and hog groups made improvements over the three years between surveys.

5.2.1 Dairy

5.2.1.1 Dairy ESP

As in 1994, the median grass crop yield (12 tonnes/hectare) with a nitrogen application capacity of 360 kg/ha was used to determine the allowable spreading rate of manure per hectare without supersaturating the soils with nitrogen (BCMAFF, 1993a). This computation is based on an average manure production of 77 L per day per milking cow. Milking cow equivalents were determined as the total number of dairy animals divided by 1.52. In order to simplify animal units per hectare in this report all units were converted to kg of nitrogen produced per hectare per year (kg N/ha/yr) for the entire farm. Manure storage capacity was determined using storage facility dimensions, a 77 L/d/MCE manure production factor, a 27.3 L/d/MCE factor for milk parlour waste (IRC, 1994a,b) and rainfall input of 1091mm/6 months for storage that is uncovered. Storage facility dimensions were taken from the questionnaire sheet as reported by the producer and were not verified by measurement. In the case of solid manure storage, height of waste piles was assumed to be 8 feet.

The contribution of yard and roof runoff was not included in the manure storage calculation. Yard and roof drainage is subject to individual management practices and can vary dramatically between farms. For example a farm that has no gutters on barn roofs, and no yard drains diverting clean rainwater away from manure storage can have significant rainfall input to manure storage. The quantity of this input can only be determined through detailed measurements of yard and roof areas for each farm. This was not done in this survey.

For the dairy farms in the Lower Fraser Valley, a storage time of six months is recommended. This allows the manure to be stored during periods when manure application to the land is not desirable in the winter, rainy period when surface and ground water contamination is most likely to occur (BCMAFF, 1993a). Manure pit storage time of equal to or greater than six months was given a ranking of zero. Those farms with less than six months storage received higher rankings from 1 to 5 (see Table 9). Covered concrete facilities were given a ranking of zero. Concrete uncovered and steel uncovered waste storage facilities were considered equivalent in their potential to prevent agricultural waste pollution and both received the same weighted rank of 5. Earthen pits were considered to be more of a risk because of the possibility of exfiltration in sandy soils and were given a weighted rank of 15. For future studies an additional ranking of 25 has been added for earthen lagoons that are known to be seeping. This survey, as in 1994, did not identify whether seepage was occurring in earthen lagoons.

The Environmental Guidelines for Dairy Producers recommends that solid manure be stored in a concrete, covered facility. Dairy farms that followed this recommendation, or had no solid manure received a ranking of zero.

Waste from the milk parlour and runoff from the yard and silage bunker should go to the manure storage facility. Runoff from any of these three factors to a ditch is undesirable and could contribute to water contamination. These practices were scored the maximum possible ranking for their respective category. Yard runoff refers to the runoff from any uncovered concrete areas on the farm. In the case where clean rainwater was diverted to a ditch a ranking of zero was scored. Not all dairy farms have concrete areas outside of the barns. Some dairy farms store silage in watertight plastic bags from which there is no runoff. Silage drainage is seasonal, occurring following the loading of a silage storage area at harvest.

Figures 3 and 4 show the distribution of ESP scores in 1994 and 1997. A shift to the right has occurred in both the Matsqui Slough and Sumas River watersheds, indicating an improving trend in waste management handling.

5.2.1.2 Dairy Manure Storage

Manure storage has the highest weighting in the ESP scoring system. Figures 5 and 6 indicate the distribution of manure storage time for dairy farms in the Matsqui Slough and Sumas River watersheds. In both figures there is a trend to the right, or there is a trend for manure storage to increase. Table 2 indicates the mean and median storage times for both areas.

Table 2. Manure Storage Mean and Median Times for Matsqui Slough and Sumas River Watersheds.

Region		**1994 months**	**1997 months**	**Region**		**1994 months**	**1997 months**
Matsqui	Mean	3.4	3.6	**Sumas**	Mean	3.1	3.9
	Median	2.6	3.3		Median	2.8	3.6
	SE*	0.5	0.4		SE*	0.2	0.2

*Standard Error

While there is a notable improvement of manure storage time, these storage times are not adequate to get producers through the rainy winter months. In 1997 only 20% of dairy farms in the Matsqui Slough watershed had greater than 5 months storage; 28% in the Sumas River watershed.

5.2.1.3 Dairy Livestock densities and manure production

Livestock density (MCE/ha) had the second highest weighted ranking in the ESP calculation. While this study used MCE/ha as a factor in the ESP scoring system, for ease of comparison between the different livestock commodities, MCE/ha has been converted to kg nitrogen produced on the farm per hectare per year (kg N/ha/yr). Of the manure produced by 1 milk cow equivalent, 77% of nitrogen excreted remains in the manure in storage and 83% of that is incorporated into the soil following manure application to the land. This calculates out to 74.1 kg N/MCE/yr (BCMAFF, 1993a). Manure production was compared to the land available for application on each farm and kg N/ha/yr was calculated. Table 3 indicates the mean and median livestock manure application rates for dairy farms in the Matsqui Slough and Sumas River watersheds. Farms that utilized more than one source of manure had the total nitrogen per hectare per year for all manures added and accounted for in the statistics where applicable.

Table 3. Dairy Manure Application Rates for Matsqui Slough and Sumas River Watersheds.

Region		**1994 kg N/ha/yr**	**1997 kg N/ha/yr**	**Region**		**1994 kg N/ha/yr**	**1997 kg N/ha/yr**
Matsqui	Mean	207	89	**Sumas**	Mean	185	193
	Median	193	82		Median	185	185
	SE*	15	7		SE*	7	7

*Standard Error

Average and median values for Matsqui Slough watershed show a drastic decline in the amount of nitrogen in manure that is being applied to the land. This indicates that farmers have acquired more land to apply manure to (see Table 12 for survey summary data). There is no noticeable change in the Sumas River watershed. Figures 7 and 8 show the distribution of manure nitrogen application rates in the Matsqui Slough and Sumas River watersheds. In both watersheds, the median amount of nitrogen applied to the land in manure is well below annual forage crop requirements of 360 kg N/ha (BCMAFF, 1993a).

5.2.2 Poultry

5.2.2.1 Poultry ESP

Manure production for poultry operations is based on the number of broiler equivalents (BE) per cycle. For other poultry units, it was assumed that layers were equivalent to 1.55 BE, pullets = 0.94 BE and turkeys 2.26 BE based on nitrogen output in their manure (BCMAFF, 1993b). As in the dairy ESP, the permissible manure loading per hectare was based on a median grass crop yield (12 tonnes/hectare) with nitrogen removal of 360 kg/ha (see Table 10 for poultry ESP scoring system). The manure handling on poultry farms differs substantially from dairy farms due to the differences in the nature of the operations. Manure is normally cleared out of the barns at the end of a cycle (10 to 12 weeks for broiler/roasters and 12 months for layers). The manure is then removed within days to make room for the next cycle.

Poultry manure spreading practices are also different from dairy operations. Poultry manure is dry and solid and therefore easier to handle than liquid manure. Storage of poultry manure is also easier as it can be piled on concrete or on the field, and is not limited to the dimensions of liquid storage facilities.

ESP scores were combined for both watersheds due to smaller number of farms. Table 4 shows the mean and median ESP scores in 1994 and 1997. The median scores improved substantially over the three years between surveys. This is due to an increase in the export of manure off of poultry farms to other locations within the Lower Fraser Valley and outside of the region. The success of this export program is due to the work of the Sustainable Poultry Farming Group, who are now in the process of arranging the transport of poultry manure to the cattle ranches in the Interior of BC and to vegetable farms in South Surrey and Delta, BC.

Table 4. ESP Mean and Median Scores 1994 and 1997.

	1994 ESP	1997 ESP
Mean	68	75
Median	72	85
SE*	5	4

*Standard Error

Figure 9 indicates the difference in distribution of ESP scores for poultry farms between 1994 and 1997. There is a trend to the right, or an improving trend amongst poultry farms with regards to waste management practices.

5.2.2.2 Poultry Livestock Densities and Manure Production

Livestock density (BE/ha) holds the highest weighted ranking in the ESP score for poultry farms. While BE/ha was used in the ESP calculations, for ease of comparison between commodities, BE/ha was converted to kg N/ha/yr. Seventy-seven percent of nitrogen excreted is retained in poultry manure and 90% of that nitrogen is incorporated into the soil following manure application to the land (BCMAFF, 1993b). This calculates out to 0.24 kg N/BE/yr. Manure production was compared to the land available for application on each farm and kg N/ha/yr was calculated. Table 5 indicates the mean and median livestock manure application rates for poultry farms in both of the watersheds. Farms that utilize more than one source of manure had the total nitrogen per hectare per year for all manures added and accounted for in the statistics where applicable.

Table 5. Poultry manure application rates for Matsqui Slough and Sumas River watersheds.

	1994 (kg N/ha/yr)	1997 (kg N/ha/yr)
Mean	767	436
Median	525	345
SE*	142	96

*Standard Error

Average and median values for poultry manure application rates show a significant decline in the amount of manure applied nitrogen that was applied to the land. This indicates that farmers have adopted the practice of shipping manure off of their farms. In 1994, 35% of producers reported shipping some or all of their manure off the farm. In 1997, 86% of producers reported shipping some or all of their manure off the farm, an increase of 51%. Figure

10 shows the distribution of manure nitrogen application rates in 1994 and 1997. The median amount of nitrogen applied to the land was within the annual forage crop requirement of 360 kg N/ha in 1997, a reduction of 34%.

5.2.3 Hog

5.2.3.1 Hog ESP

There are four types of hog operations in the Lower Fraser Valley: farrow to finish, farrow to wean, finishers and farrow to round hog. In farrow to finish operations, sow farrowed piglets are raised on the farm to maturity (100 kg mature weight). On farrow to wean farms, sows farrow the piglets which are raised on the farm until they are weaned (20 kg weight). They are then sold to finisher operations or to market. Finisher operations raise the weaner pigs to maturity for sale to market. Hogs are raised to 50 kg when marketed as round hogs.

As with the dairy ESP, the median grass crop yield (12 tonnes/hectare) with a nitrogen removal capacity of 360 kg/ha was used to determine the allowable spreading rate of manure per hectare without supersaturating the soils with nitrogen. This calculation is based on an average manure production of 72 L per day per sow equivalent (SE) (BCMAFF, 1997). Manure storage capacity was determined using the storage facilities dimensions, a 72 L/d/SE animal manure factor and rainfall input of 1091 mm/6 months when storage was uncovered. For finishers, which represent 14% of a sow equivalent, an animal waste production factor of 10.1 L/d was used (R. Van Kleeck, pers comm., BCMAFF). Storage facility dimensions were taken from the questionnaire sheet as reported by the producer and were not verified by measurement.

For the hog farms in the Lower Fraser Valley, a storage time of six months is desirable. This allows the manure to be stored during periods when manure application to the land is not desirable in the winter, rainy period, when surface and ground water contamination is most likely to occur (BCMAFF, 1997). Manure pit storage time of equal to or greater than six months was given a ranking of zero. Those farms with less than six months storage received higher rankings from 1 to 5 (see Table 11). Covered concrete facilities were given a ranking of zero. Concrete uncovered and steel uncovered waste storage facilities were considered equivalent in their potential to prevent agricultural waste pollution and both received the same weighted rank of 5. Earthen pits were considered to be more of a risk because of the possibility of exfiltration in sandy soils and were given a weighted rank of 15. For future studies an additional ranking of 25 has been added for earthen lagoons that are known to be seeping. This survey, as in 1994, did not identify whether seepage was occurring in earthen lagoons.

Table 6 indicates the mean and median ESP scores in 1994 and 1997. ESP scores have improved over the three-year period, indicating an improving trend in waste management handling. Figure 11 shows the improving trend distribution for all farms surveyed in 1994 and 1997. The distribution of farms is shifting towards the higher ESP scores.

Table 6. Hog ESP mean and median scores for both watersheds.

	1994 ESP	1997 ESP
Mean	61	72
Median	64	81
SE*	5	7

*Standard Error

5.2.3.2 Hog Manure Storage

Manure storage has the highest weighting in the ESP scoring system for hogs. Figure 12 indicates the distribution of manure storage time for hog farms in both watersheds. There is a trend towards a reduction in manure storage time. Median manure storage time dropped from 4.3 months in 1994 to 4.1 months in 1997. However, some of the farms sampled in 1994 declined participation in the 1997 survey. Some farms that weren't surveyed in 1994 were added in 1997, with fewer farms participating overall in 1997. This may account for the statistical reduction in manure storage time.

5.2.3.3 Hog Livestock Densities and Manure Production

Livestock density (SE/ha) had the second highest weighted ranking in the ESP calculation. While this study used SE/ha as a factor in the ESP scoring system, for ease of comparison between the different livestock commodities, SE/ha has been converted to kg nitrogen produced on the farm in manure per hectare per year (kg N/ha/yr). Of the manure produced by 1 sow equivalent, 77% of nitrogen excreted remains in the manure in storage and 83% of that is incorporated into the soil following manure application to the land (BCMAFF, 1997). This calculates out to 80.5 kg N/SE/yr. Manure nitrogen production was compared to the land available for application on each farm and kg N/ha/yr was calculated. The Median application rate of nitrogen was reduced between 1994 and 1997 (515 kg N/ha/yr and 193 kg N/ha/yr respectively). Figure 13 indicates the difference in distribution of the application of nitrogen between 1994 and 1997. Farms that utilize more than one source of manure had the total nitrogen per hectare per year added and accounted for in these statistics when possible. The reduction of nitrogen application rates per hectare per year is due to the fact that hog producers have acquired more land over the three-year period between surveys. In 1994, 16 hog farms reported utilizing 520 hectares of their own or rented land (not including neighbors), while in 1997, 14 hog farms reported utilizing 1,870 hectares of their own or rented land (not including neighbors). On average, this equates to an increase of 100 hectares of land per farm. Again, one needs to consider that the farms surveyed in 1994 and 1997 were different, and fewer farms were surveyed in 1997. The median application rate for manure applied nitrogen was below the annual forage crop requirements of 360 kg N/ha.

5.5 Fertilizer Use

Fertilizer data was collected for all farms surveyed. Type of fertilizer, acreage, application rate, and crop the fertilizer was applied to was collected for the different crops grown on the farm. Dairy producers were the only group reporting using fertilizers as well as manure on their crops. In some instances producers did not know the blend of the fertilizer that they had applied. This was the case with those producers who used liquid fertilizer. Assumptions were made for those farms not knowing the fertilizer blend used on their farm. Table 7 outlines the assumptions made with fertilizers.

Table 7. Fertilizer assumptions for those farms not reporting fertilizer blend used.

Type	Crop	Blend	Source
Liquid	Forage Grass and Silage Corn Sidedress	26.3-0-0+2.5S	Apperloo, T., pers comm
	Forage Grass first crop	23-7-0+5S	Apperloo, T., pers comm
	Corn Starter	15-13-2.5+2.5S	Apperloo,T., pers comm
Granular	Forage Grass	40-0-0+5S	DeJong, J., pers comm
	Forage Grass plant starter	31-0-0+7S	DeJong, J., pers comm
	Corn Starter	9-40-4	DeJong, J., pers comm

5.5.1 Total Nutrient Application

5.5.1.1 Nitrogen

Nutrient application rates were broken down into chemical fertilizer applications and manure applications. Chemical fertilizer applications were calculated from data collected in the survey. In most cases fertilizer application rates varied between fields and crops on individual farms. For comparison purposes nutrient applications were balanced over the entire area of the farm. For example, if a farm reported applying 50 kg/ha of 40-0-0 to 20 hectares of forage grass, on each application for 4 applications per year, and 100 kg/ha of 9-40-4 to 20 hectares of corn in the spring, the total amount of nitrogen applied to the entire farm (40 hectares) was 45 kg N/ha

Example Calculation

(i) 50 kg/ha of 40-0-0 = 20 kg N/ha x 4 applications/yr = 80 kg N/ha x 20 ha = 1600 kg N
(ii) 100 kg/ha of 9-40-4 = 9 kg N/ha x 1 application/yr = 9 kg N/ha x 20 ha = 180 kg N
(iii) Balanced N Application = 1780 kg N ÷ 40 ha = 45 kg N/ha.

Manure nutrient applications were calculated from the livestock density on the individual farm. Nutrients in dairy manure are listed in Table 8.

Table 8. Typical Nutrient Content of Stored Dairy Manure.

Housing System	**Moisture Content (%)**	**Total Nitrogen kg/tonne**	**Phosphorus Total as P_2O_5 Kg/tonne**	**Potassium Total as K_2O kg/tonne**
Free Stall	91.4	2.9	2.1	4.5

(BCMAFF, 1993a)

Manure nutrient applications were also balanced over the entire farm. For example, if the same farm as in the previous example had an livestock density of 2.0 MCE/ha and 1 MCE produces 74.1 kg of nitrogen that is incorporated into the soil per year, and no manure is exported from the farm, that farm applies 148 kg N/ha in manure, over the course of a year. The total nitrogen applied to crops, averaged over the total land base, would be 193kg N/ha (45 kg N/ha from fertilizer and 148 kg N/ha from manure).

The nitrogen application rates for dairy farms in the Matsqui Slough and Sumas River watershed are shown in Figures 14 and 14a and 15 and 15a, respectively. These figures show the mean rate of applied nitrogen in both fertilizers and manure, broken down by 50 kg N/ha application rate ranges. The (a) designated figures report the same information, but in a form easier to see the relative differences between fertilizer and manure application rates. The distribution of farms amongst the application rate ranges is reported as a percentage of farms surveyed. The percentages are additive, for example, in Figure 14 the percentage of farms with an application rate $\leq$ 200 kg N/ha is 52%.

In the Matsqui Slough Watershed, chemical fertilizer was the primary source of nitrogen (Figure 14a). Nine percent of the farms surveyed were applying nitrogen above the application rate range of 350 kg N/ha (Figure 14 and 14a). The crop nutrient requirement for forage grass (yielding 12 tonnes/ha) is 360 kg N/ha (BCMAFF, 1993a). Manure was the primary source of nitrogen applied to crops in the Sumas River Watershed (Figure 15a). Eighteen percent of the farms surveyed were applying nitrogen above the application rate range of 350 kg N/ha (Figure 15 and 15a).

5.5.1.2 Phosphorus

Phosphorus applications were calculated in the same manner as nitrogen. 1 MCE produces 84 kg of phosphorus (as P_2O_5) per year (BCMAFF, 1993a).

The phosphorus application rates for dairy farms in the Matsqui Slough and Sumas River watersheds are shown in Figures 16 and 16a and 17 and 17a, respectively. These figures show the mean application rate of applied phosphorus in both fertilizers and manure, broken down by 50 kg P_2O_5/ha application rate ranges. The distribution of farms amongst the application rate ranges is reported as a percentage of farms surveyed.

In the Matsqui Slough Watershed, manure was the primary source of phosphorus applied to crops (Figure 16a). Sixty two percent of the farms surveyed were applying phosphorus above the application rate range of 100 kg P_2O_5/ha (Figure 16 and 16a). The crop requirement for forage grass is 90 kg P_2O_5/ha (Bittman, S. et al, in preparation). Manure was also the primary source of phosphorus in the Sumas River Watershed (Figure 17a). All of the farms surveyed were applying phosphorus above the application rate range of 100 kg P_2O_5/ha (Figure 17 and 17a).

5.5.1.3 Potassium

Potassium application rates were calculated in the same manner as nitrogen and phosphorus. A single MCE produces 180 kg of potassium (as K_2O) per year (BCMAFF, 1993a).

The potassium application rates for dairy farms in the Matsqui Slough and Sumas River watershed are shown in Figures 18 and 18a and 19 and 19a, respectively. These figures show the mean application rate of applied potassium in both fertilizers and manure, broken down by 50 kg K_2O/ha application rate ranges. In both watersheds the majority of potassium is applied in manure (Figure 18a and 19a).

The distribution of farms amongst the application rate ranges is reported as a percentage of farms surveyed. In the Matsqui Slough watershed, 3% of farms surveyed applied potassium above the crop requirement for forage grass of 450 kg/ha K_2O (Bittman, S. et al, in preparation) (Figure 18). In the Sumas River Watershed, 48% of farms surveyed were applying potassium in above the application rate range of 450 kg K_20/ha (Figure 19). Manure was the main source of potassium in both watersheds.

Potassium does not tend to leach out of the soil and therefore is not of great environmental concern. However, forage grasses are luxury consumers of potassium. That is, forage crops will take up excess potassium in the soil. Research has shown that excess potassium in the diet in dairy cattle results in decreased magnesium absorption, lower plasma levels of calcium, decreased levels of calcium in milk and an increased risk of milk fever (Bittman, S. et at, in preparation).

6.0 Conclusion

A similar method of surveying producers was undertaken in 1997 as was used in 1994. An explanatory letter was sent to each producer prior to the collection of data. This was followed up with the survey that was completed on the farm. Part of the success of the data collection laid in the fact that a surveyor well known to the industry completed the data collection for the dairy and poultry farms. . Eighty-nine percent of dairy producers surveyed in 1994 completed the survey again in 1997.

Different questionnaires were used for the different livestock commodities. These three commodities differ significantly in their waste management practices, thus different questions were asked of each group relevant to their situation. As was the case in 1994, most producers do not maintain records on their manure production, manure application rates, crop yields and protein levels and in the case of poultry and hog operations, fertilizer application rates. In most instances, poultry and hog operations did not utilize chemical fertilizers.

Data was collected for dairy, poultry and hog operations in the Matsqui Slough and Sumas River watersheds. There were relatively smaller numbers of poultry and hog operations participating in the survey than dairy farms and so data within these two commodities was grouped together within the two watersheds.

An ESP score, which is a measure of the likely extent of the adherence of farm practices to the Code of Agricultural Practice for Waste Management, was calculated for each farm. It should be noted that the ESP rating system has not been calibrated with actual measurements of the levels of environmental contamination exported from a farm. Twenty three percent of dairy farms in the Matsqui Slough watershed had an ESP score of greater than 80% (up from 11% in 1994), with no farms scoring below 40% (14% were below 40% in 1994).

Twenty percent of dairy farms in the Sumas River watershed had an ESP score of greater than 80% (up from 14% in 1994), with 1% scoring below 40% (4% were below 40% in 1994). Fifty five percent of poultry farms surveyed scored over 80% (up from 42% in 1994), while 10% scored below 40% (19% were below 40% in 1994). Fifty seven percent of hog farms scored over 80% (up from 19% in 1994), while 14% scored below 40% (19% were below 40% in 1994).

Manure storage time was an important component of the ESP score for dairy and hog farms. Twenty one percent of dairy farms in the Matsqui Slough watershed had manure storage for five months or more (up from 16% in 1994) and 42% had less than three months storage (55% in 1994). Twenty eight percent of dairy farms in the Sumas River watershed had manure storage for five months or more (up from 13% in 1994) and 34% had less than three months storage (53% in 1994). Thirty eight percent of hog farms surveyed had manure storage for five months or more and 30% had less than three months storage. This component of the ESP scoring system caused the greatest loss of score for farms in all commodities. A combined investment of $3.45 million was reported as spent on improving manure storage between 1994 and 1997 on the farms surveyed.

Detailed fertilizer data was collected from dairy operations (poultry and hog operations did not use any commercial fertilizer). The amount of fertilizer (kg) used on the farm was averaged over the total hectares farmed. This was then added to the manure nutrients supplied to the total hectares of the farm for a total, average, application rate of nitrogen, phosphorus and potassium.

In the Matsqui Slough watershed, 9% of farms were applying nitrogen above the application rate of 350 kg/ha. Fertilizer was the main source of nitrogen. Sixty two percent of farms were applying phosphorus above the application rate of 100 kg P_2O_5/ha. Manure was the main source of phosphorus. Three percent of farms were applying potassium above the application rate of 450 kg K_2O/ha. Manure was the main source of potassium.

In the Sumas River watershed, 18% of farms were applying nitrogen above the application rate of 350 kg/ha. Manure was the main source of nitrogen. All of the farms surveyed were applying phosphorus above the application rate of 100 kg P_2O_5/ha. Manure was the main source of phosphorus. Forty eight percent of farms were applying potassium above the application rate of 450 kg K_2O/ha. Manure was the main source of potassium.

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Table 9. Environmental Sustainability Factors and Factor Ranges for Dairy Operations

Factor	Range	Rank	Weighting	Weighted Ranks	Relative % or Priority
Manure Pit Storage Time	> 6 months	0	15	0	
	5 – 6 months	1		15	
	4 – 5 months	2		30	
	3 – 4 months	3		45	
	2 – 3 months	4		60	
	< 2 months	5		75	32.5%
Milking Cow Equivalents per Hectare (MCE/ha)	≤ 2.5	0	18	0	
	2.5 to 3.25	1		18	
	3.25 to 4	2		36	
	> 4	3		54	23.4%
Dry Manure Storage	none	0	5	0	
	concrete/covered	0		0	
	concrete/uncovered	1		5	
	field/covered	2		10	
	field/uncovered	4		20	10.8%
Manure Pit Facility Type	concrete/covered	0	5	0	
	concrete/uncovered	1		5	
	steel/uncovered	1		5	
	earthen	3		15	
	earthen/seepage	5		25	8.7%
Woodwaste Storage	none	0	5	0	
	inside	0		0	
	covered outside	1		5	
	uncovered	2		10	8.7%
Milk Parlour Discharge	none	0	4	0	
	manure pit	0		0	
	tile field	2		8	
	field surface	3		12	
	ditch	5		20	5.2%
Yard Drainage	none	0	3	0	
	manure pit	0		0	
	tile field	1		3	
	field surface	2		6	
	ditch	4		12	4.3%
Silage Runoff	none	0	3	0	
	manure pit	0		0	
	tile field	1		3	
	field surface	2		6	
	ditch	3		9	3.9%
Proximity of Watercourse to Storage Facility	> 60 m	0	2	0	
	30 to 60 m	1		2	
	15 to 30 m	2		4	
	< 15 m	3		6	2.6%
Total				231	100%

Table 10. Environmental Sustainability Factors and Factor Ranges for Poultry Operations

Factor	**Range**	**Rank**	**Weighting**	**Weighted Ranks**	**Relative % or Priority**
Broiler Equivalents per Hectare (BE/ha)	contract haulier/neighbor	0	14	0	
	≤ 1130	0		0	
	1131 to 1514	1		14	
	1515 to 1899	2		28	
	1900 to 2279	3		42	
	> 2280	4		56	48.3%
Manure Disposal	contract haulier	0	14	0	
	neighboring farms	0		0	
	on farm	1		14	12.1%
Dry Manure Storage	none	0	10	0	
	concrete/covered	0		0	
	concrete/uncovered	1		10	
	field/covered	2		20	
	field/uncovered	3		30	25.9%
Woodwaste Storage	none	0	5	0	
	inside	0		0	
	covered/outside	1		5	
	uncovered	2		10	8.6%
Proximity of Watercourse to Storage Facility	> 60 m	0	2	0	
	30 to 60 m	1		2	
	15 to 30 m	2		4	
	< 15 m	3		6	5.1%
Total				116	100%

Table 11. Environmental Sustainability Factors and Factor Ranges for Hog Operations

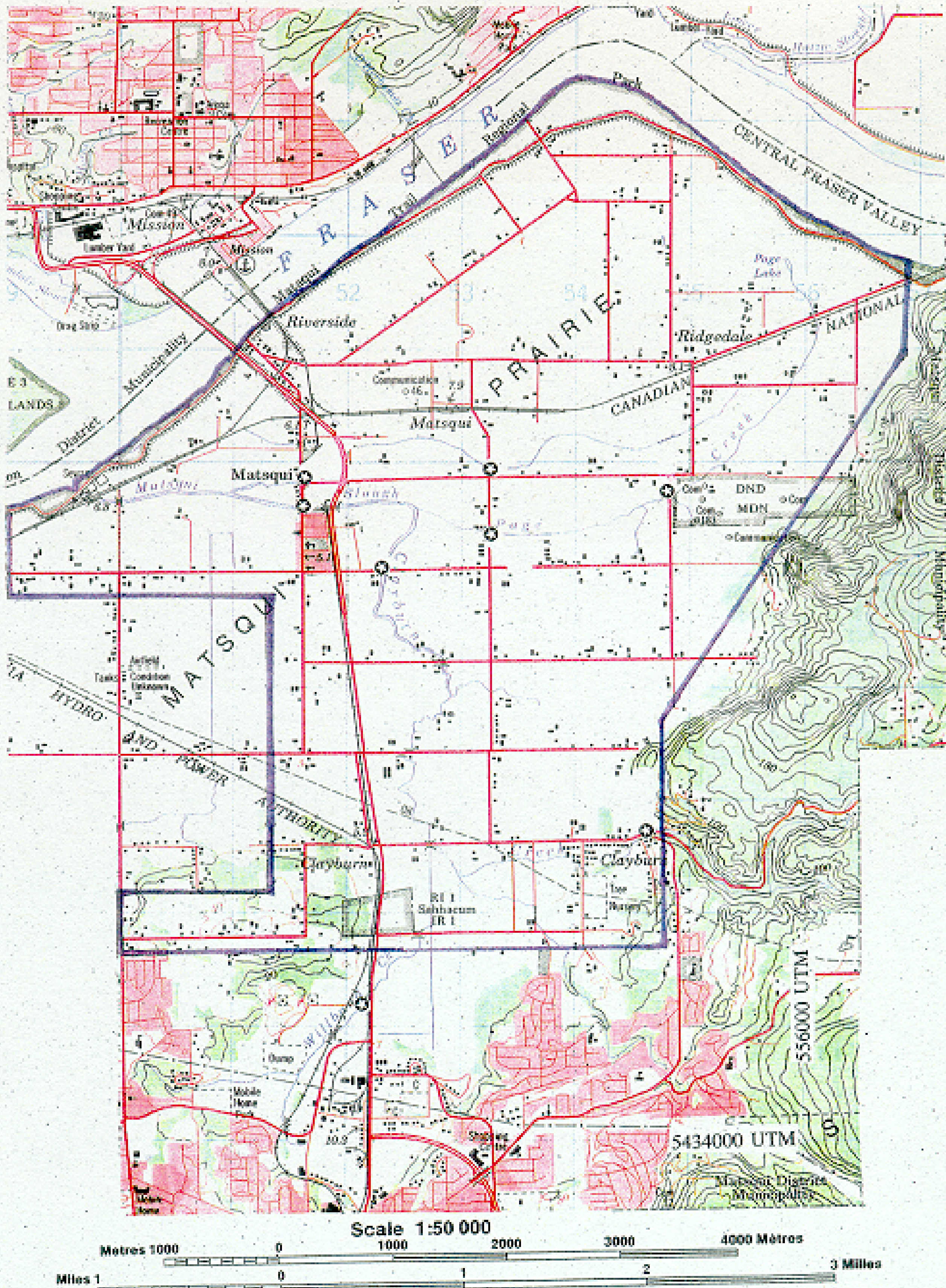
Factor	**Range**	**Rank**	**Weighting**	**Weighted Ranks**	**Relative % or Priority**
Manure Pit Storage Time	> 6 months	0	15	0	
	5 – 6 months	1		15	
	4 – 5 months	2		30	
	3 – 4 months	3		45	
	2 – 3 months	4		60	
	< 2 months	5		75	44.1%
Sow Equivalents per Hectare (SE/ha)	≤ 2.1	0	18	0	
	2.1 to 2.7	1		18	
	2.7 to 3.3	2		36	
	> 3.3	3		54	31.8%
Manure Pit Facility Type	concrete/covered	0	5	0	
	concrete/uncovered	1		5	
	steel/uncovered	1		5	
	earthen	3		15	
	earthen/seepage	5		25	14.7%
Woodwaste Storage	none	0	5	0	
	inside	0		0	
	covered outside	1		5	
	uncovered	2		10	5.9%
Proximity of Watercourse to Storage Facility	> 60 m	0	2	0	
	30 to 60 m	1		2	
	15 to 30 m	2		4	
	< 15 m	3		6	3.5%
Total				170	100%

Table 12. Summary Statistics

	Commodity Group			
	Dairy – Matsqui	Dairy – Sumas	Poultry	Hog
Number of Survey Participants	30	87	28	14
Total Hectares Median Hectares Range	1380 42 14.2 to 101.2	4650 53 8.1 to 168.8	610 11 3.5 to 139.3	1869 100 10 to 417
Total Animals Median Animals Range	5257 127 47 to 410	17371 149 17 to 740	941,442 per cycle 30,500 per cycle 15,500 to 75,335	30,239 1,647 170 to 11,580
Median Animal Equivalents Median Animal Equivalents/hectare	100 MCE** 1.1 MCE/ha	115 MCE** 2.5 MCE/ha	30,500 BE** 1436 BE/ha	228 SE** 2.4 SE/ha
Median manure storage capacity (months) Range (months)	3.3 0.7 to 9	3.6 0.5 to 10.5	1 cycle -	4.1 1.3 to 10.5
Main Storage Facility Type	3% concrete/cov 43% concrete/uncov 53% earthen	16% concrete/cov 54% concrete/uncov 30% earthen	72% concrete/cov* 17% concrete/uncov 7% field/cov 3% field/uncov	57% concrete/cov 29% concrete/uncov 14% earthen
Spreading Practice	97% splash plate 3% solid spreader	96% splash plate 3% solid spreader 1% irrigation	25% contract haulier 21% neighbor 18% on farm 36% on farm & neighbor	93% splash plate 7% irrigation
Regular Soil Test Regular Manure Test	93% 7%	89% 7%	21% 0%	43% 14%
Amount invested in storage facilities 1994 to 1997	$1,195,700	$2,139,800	$81,150	$34,400

* includes poultry farms that store manure in housing barn
** 1 MCE = 309 BE = 0.92 SE based on Nitrogen (BCMAFF, 1993a,b; BCMAFF, 1997)

Figure 1: Matsqui Slough Watershed Study Area



North American Datum 1927. Information current as of 1989
Department of Energy, Mines and Resources Canada

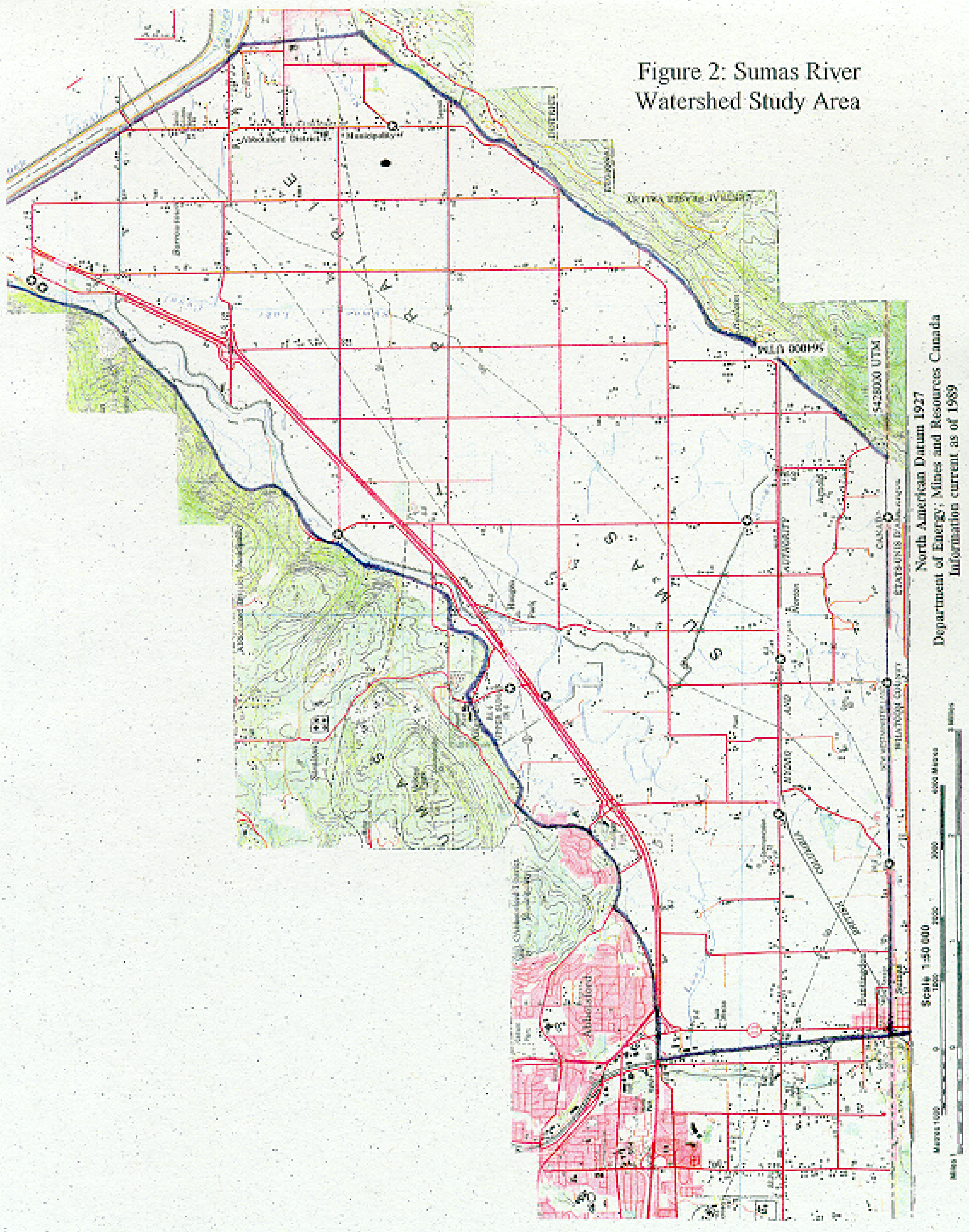


Figure 2: Sumas River Watershed Study Area

Figure 3. Matsqui Slough Watershed
Dairy ESP 1994 vs 1997

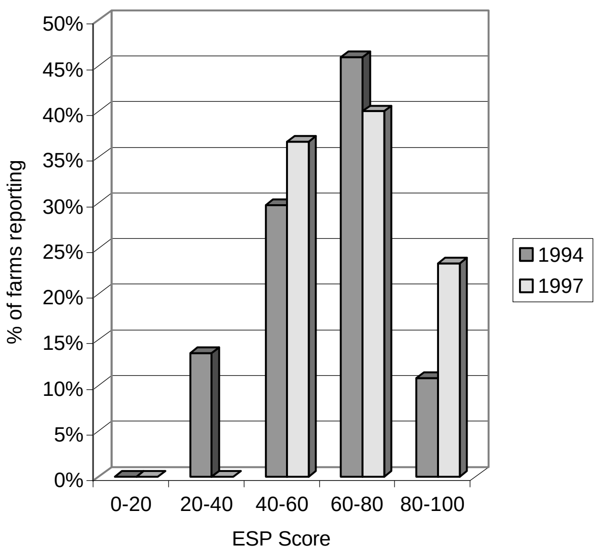


Figure 4. Sumas River Watershed
Dairy ESP 1994 vs 1997

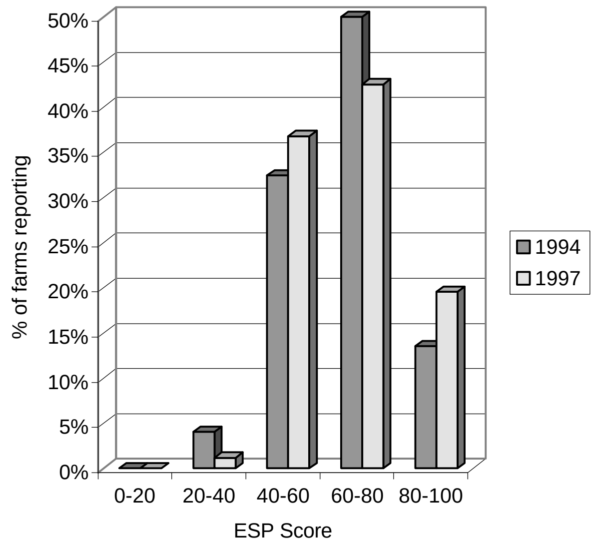


Figure 5. Matsqui Slough Watershed
Dairy Manure Storage 1994 vs 1997

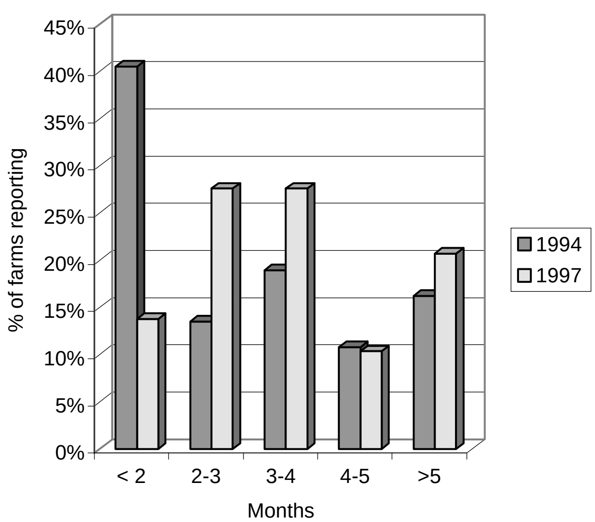


Figure 6. Sumas River Watershed
Dairy Manure Storage 1994 vs 1997

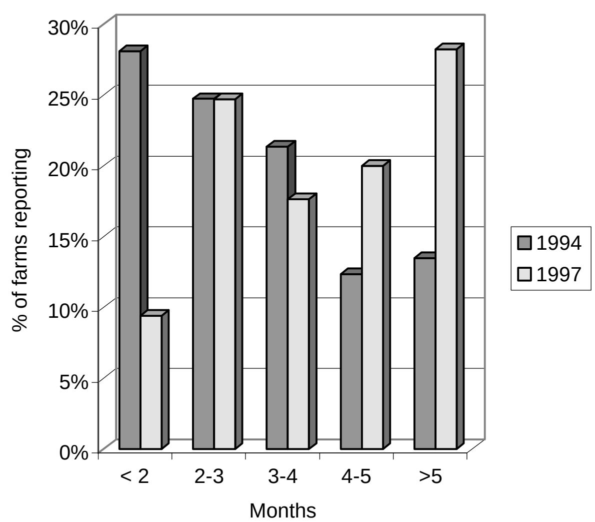


Figure 7. Matsqui Slough Watershed
Dairy Manure Nitrogen Application Rate 1994 vs 1997

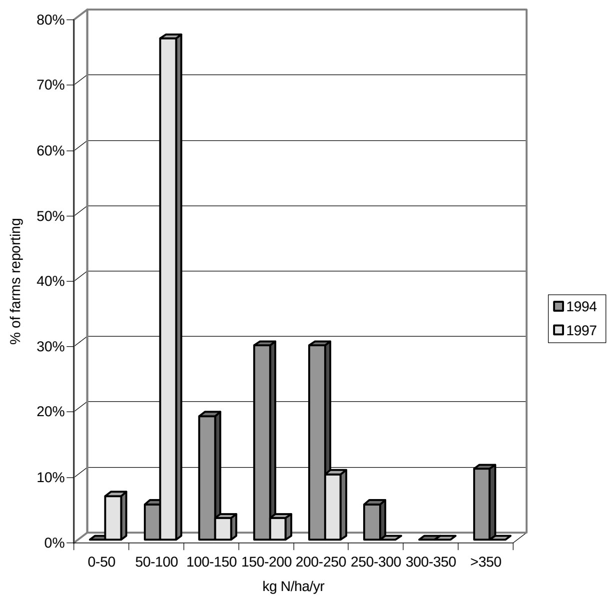


Figure 8. Sumas River Watershed
Dairy Manure Nitrogen Application Rate 1994 vs 1997

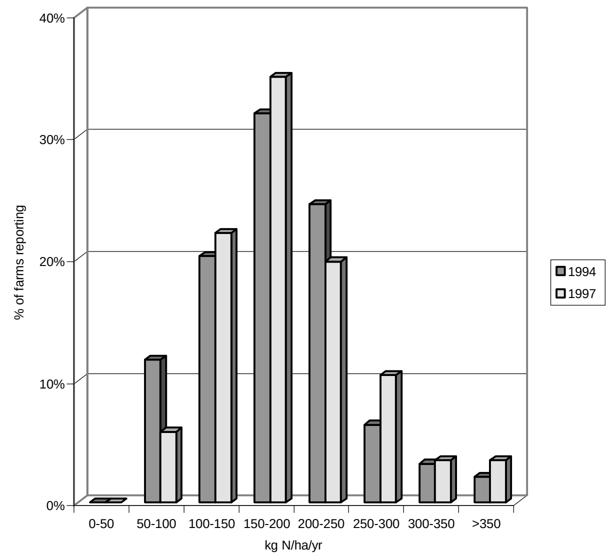


Figure 9. Combined Watersheds
Poultry ESP 1994 vs 1997

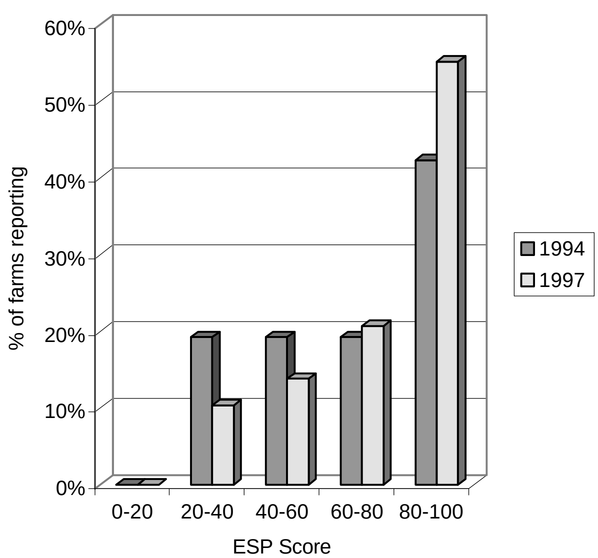


Figure 10. Combined Watershed Poultry Manure
Nitrogen Application Rate 1994 vs 1997

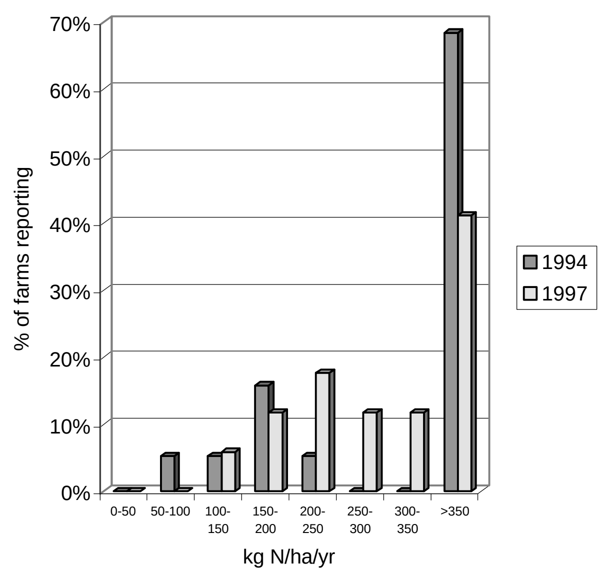


Figure 11. Combined Watersheds
Hog ESP 1994 vs 1997

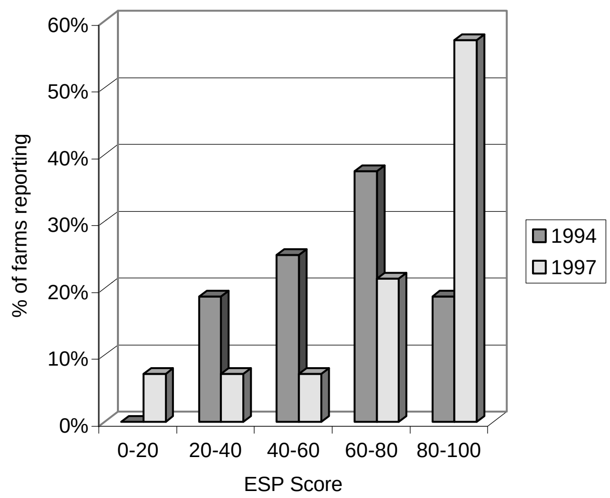


Figure 12. Combined Watersheds
Hog Manure Storage 1994 vs 1997

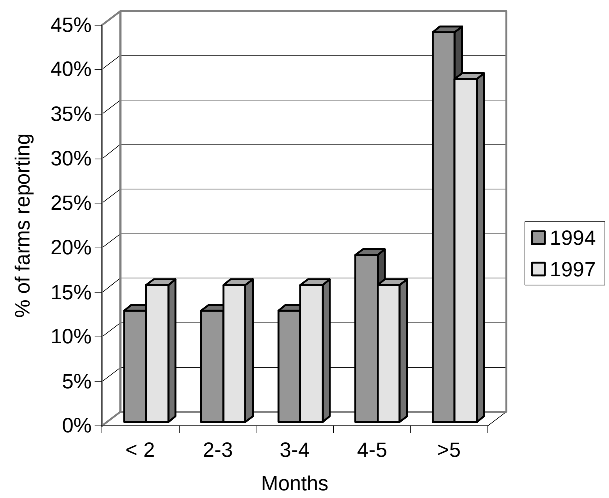
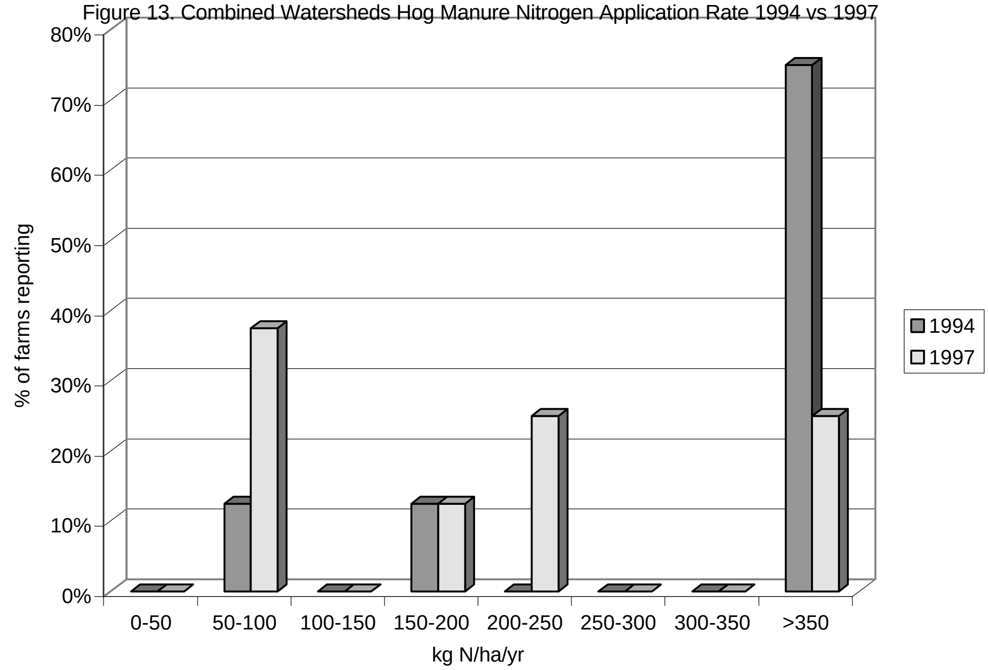


Figure 13. Combined Watersheds Hog Manure Nitrogen Application Rate 1994 vs 1997



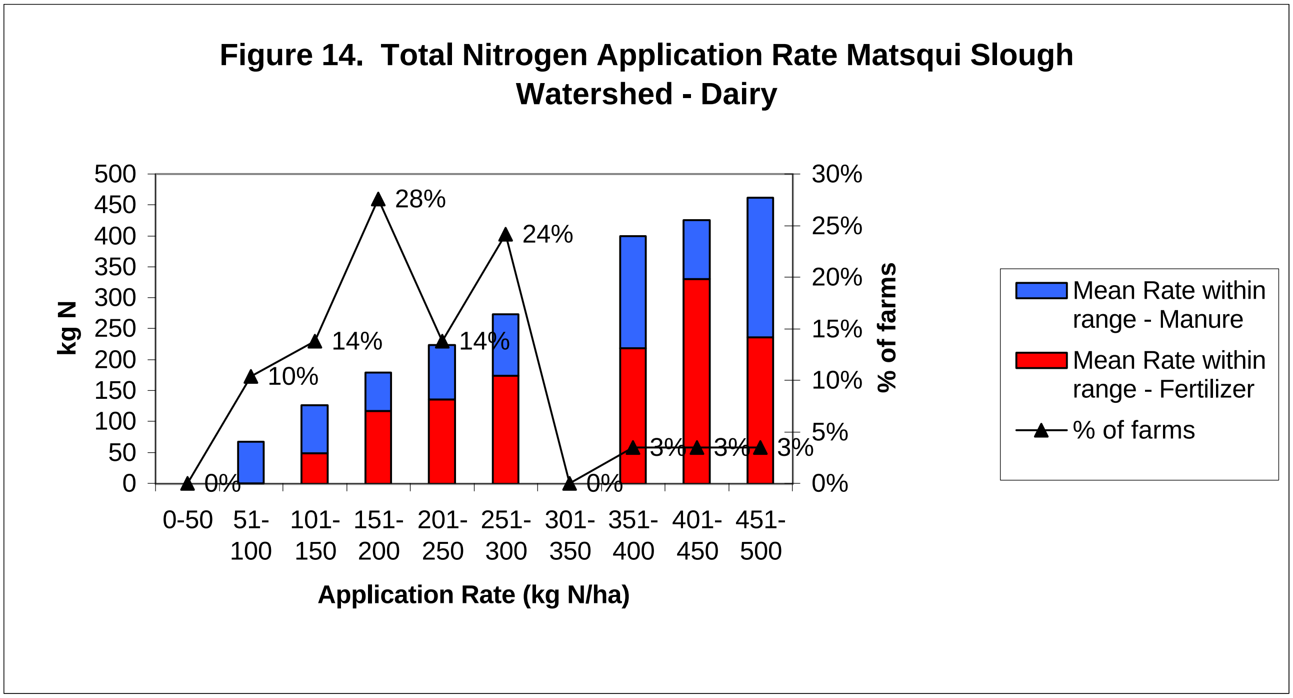


Figure 14. Total Nitrogen Application Rate Matsqui Slough Watershed - Dairy
kg N
% of farms
500
450
400
350
300
250
200
150
100
50
0
30%
25%
20%
15%
10%
5%
0%
28%
24%
14%
14%
10%
3%
3%
3%
0%
0%
0-50
51-100
101-150
151-200
201-250
251-300
301-350
351-400
401-450
451-500
Application Rate (kg N/ha)
Mean Rate within range - Manure
Mean Rate within range - Fertilizer
% of farms

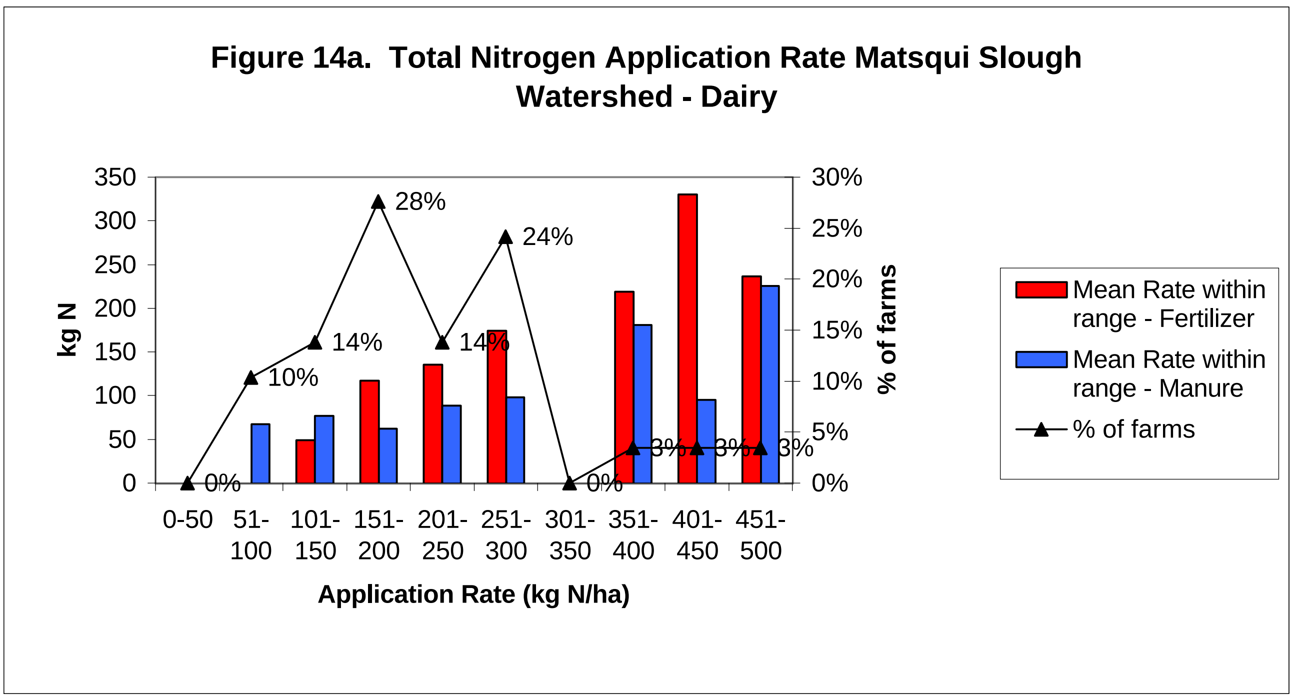


Figure 14a. Total Nitrogen Application Rate Matsqui Slough Watershed - Dairy
kg N
% of farms
350
300
250
200
150
100
50
0
30%
25%
20%
15%
10%
5%
0%
28%
24%
14%
14%
10%
3%
3%
3%
0%
0%
0-50
51-100
101-150
151-200
201-250
251-300
301-350
351-400
401-450
451-500
Application Rate (kg N/ha)
Mean Rate within range - Fertilizer
Mean Rate within range - Manure
% of farms

Figure 15. Total Nitrogen Application Rate Sumas River Watershed - Dairy

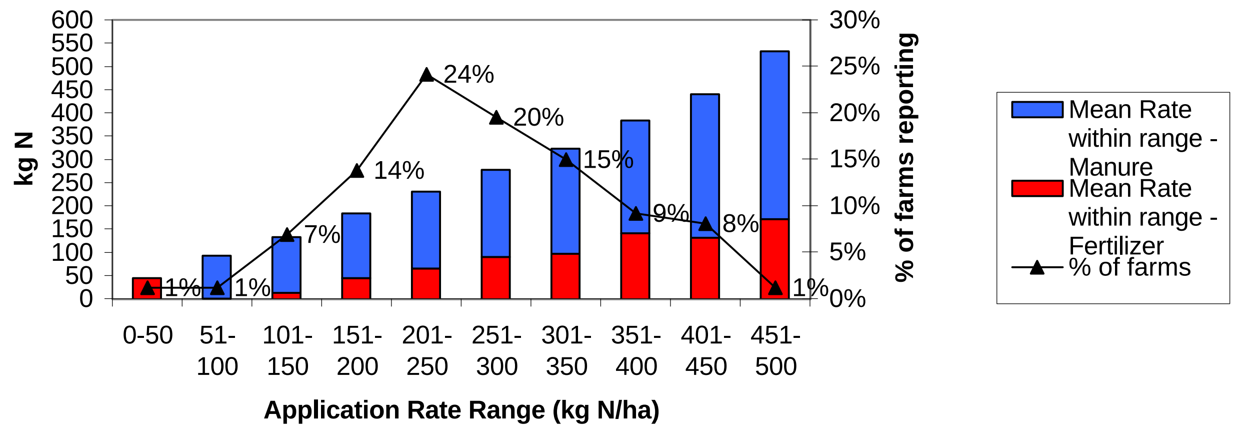


Figure 15a. Total Nitrogen Application Rate Sumas River Watershed - Dairy

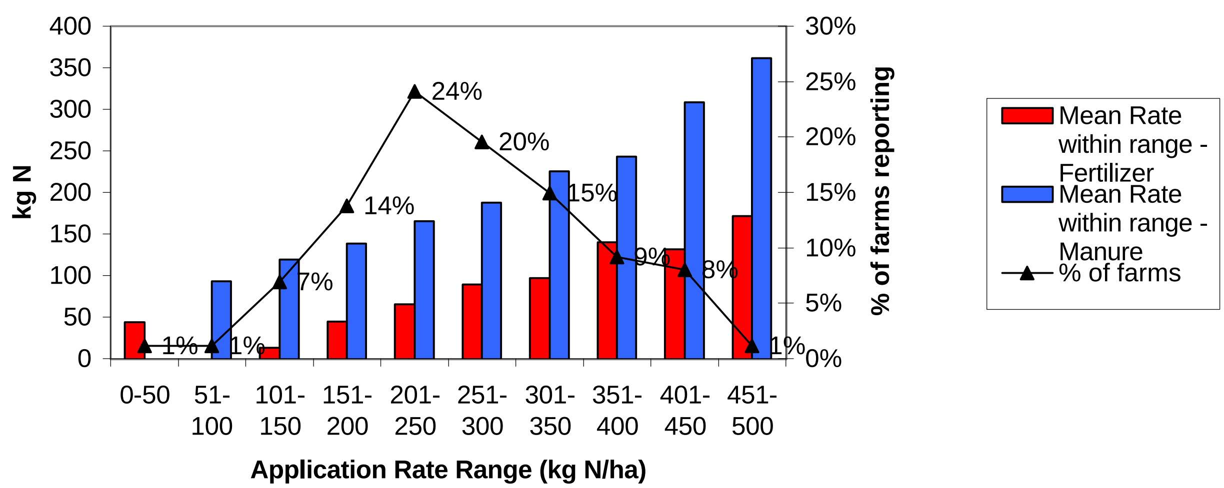


Figure 16. Total Phosphorus Application Rate Matsqui Slough Watershed - Dairy

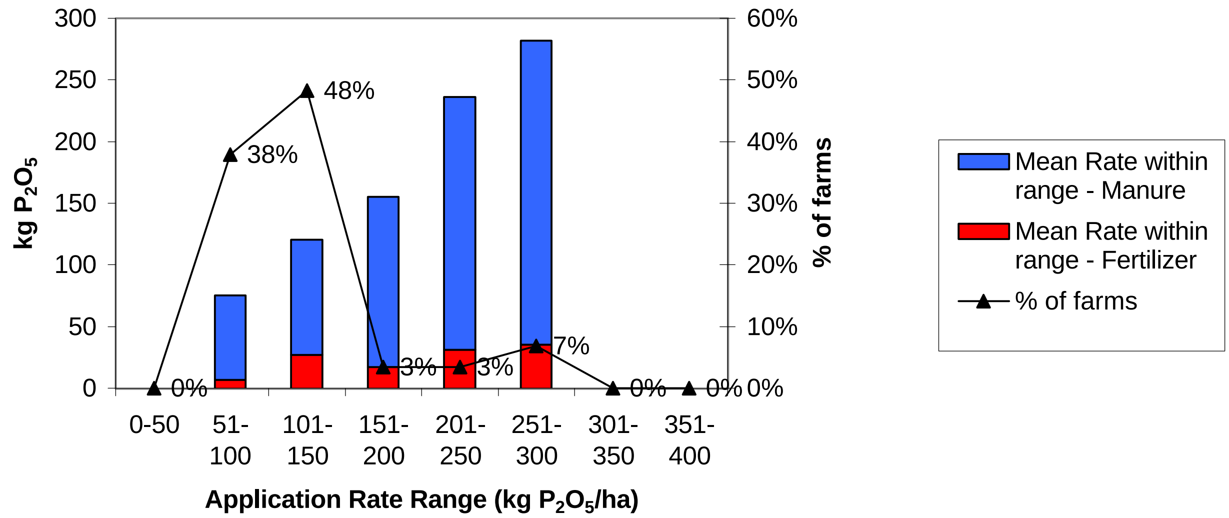


Figure 16a. Total Phosphorus Application Rate Matsqui Slough Watershed - Dairy

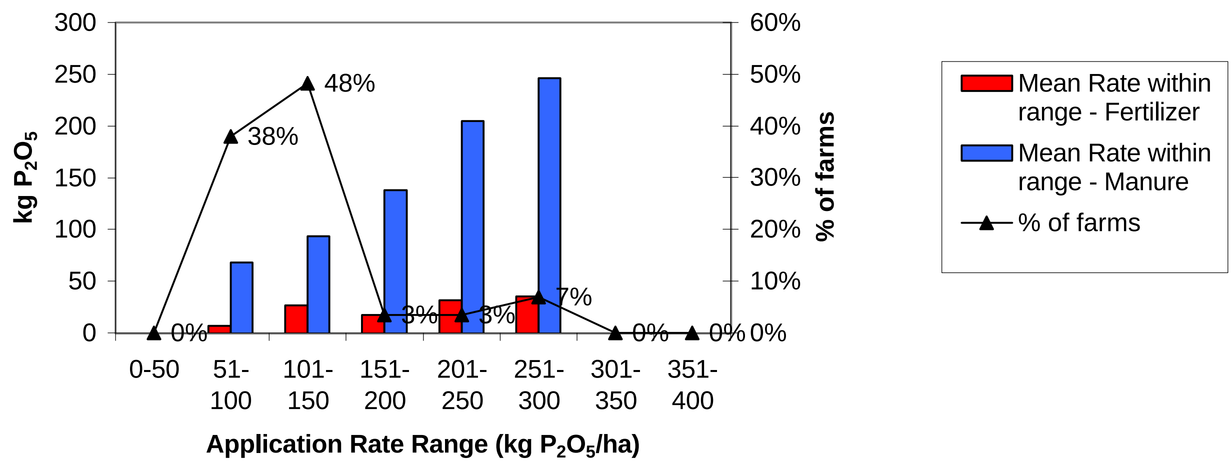


Figure 17. Total Phosphorus Application Rate Sumas River Watershed - Dairy

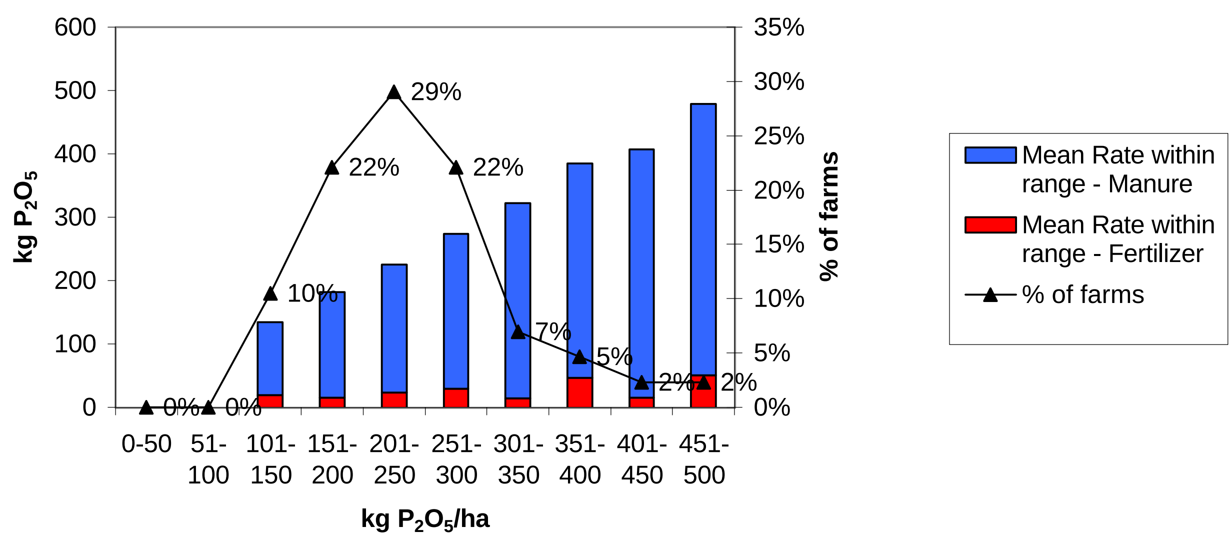


Figure 17a. Total Phosphorus Application Rate Sumas River Watershed - Dairy

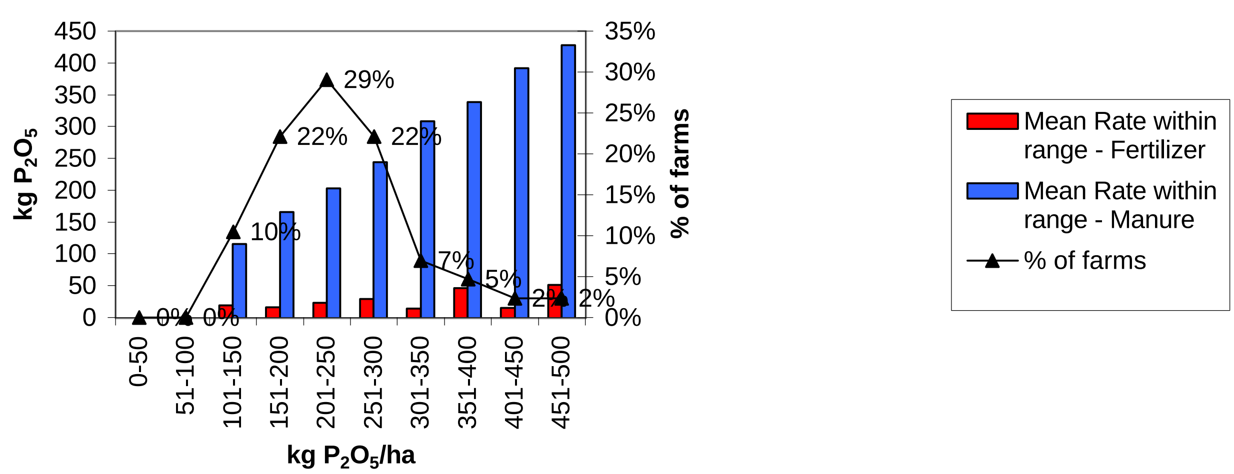


Figure 18. Total Potassium Application Rate Matsqui Slough Watershed - Dairy

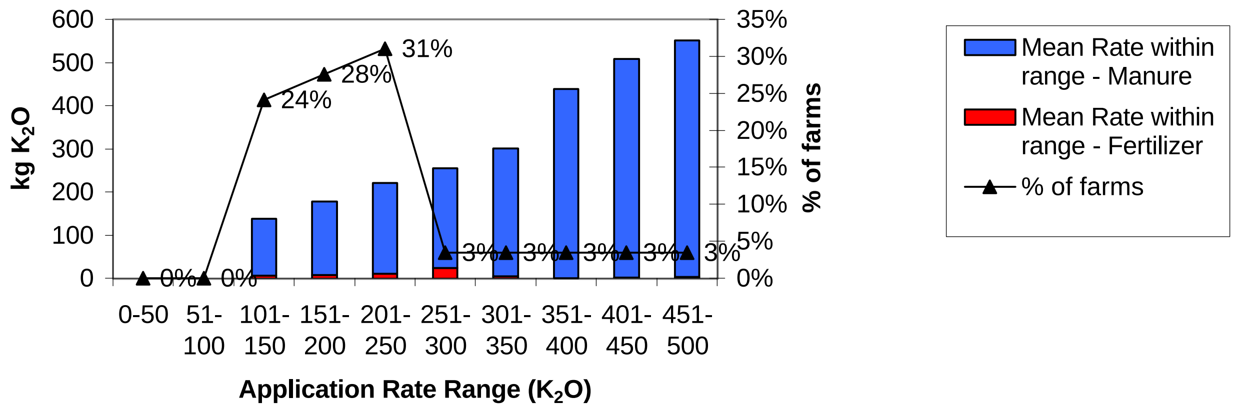


Figure 18a. Total Potassium Application Rate Matsqui Slough Watershed - Dairy

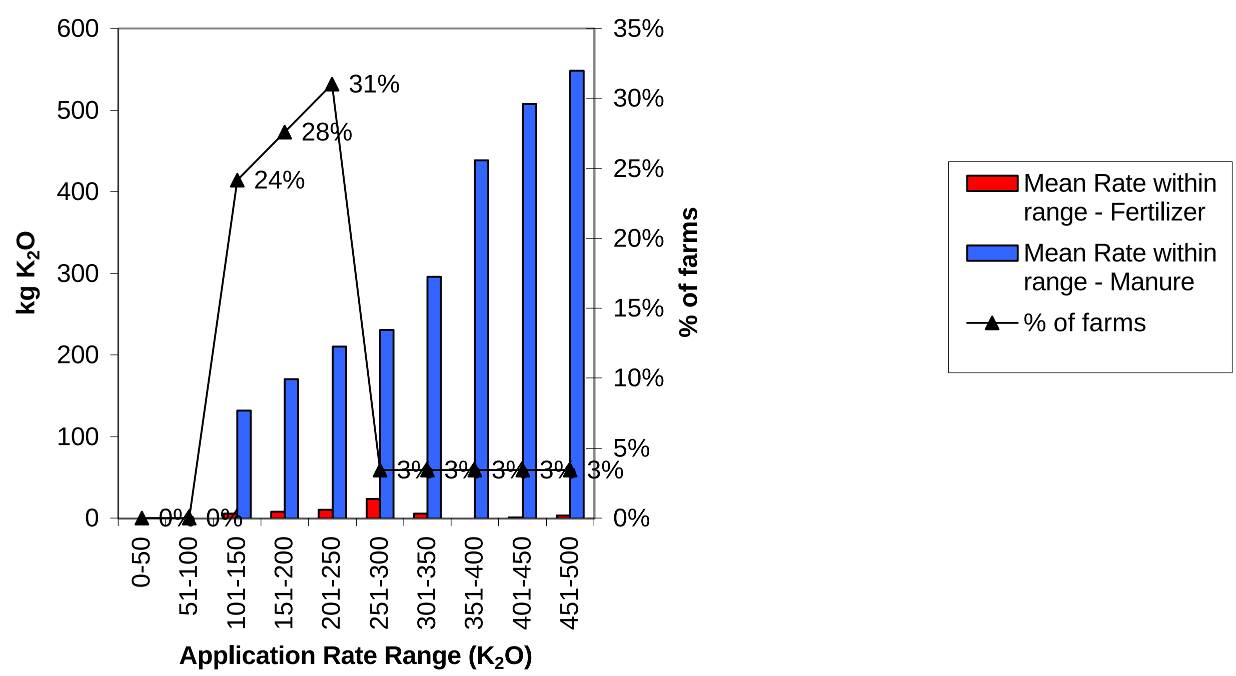


Figure 19. Total Potassium Application Rate Sumas River Watershed - Dairy

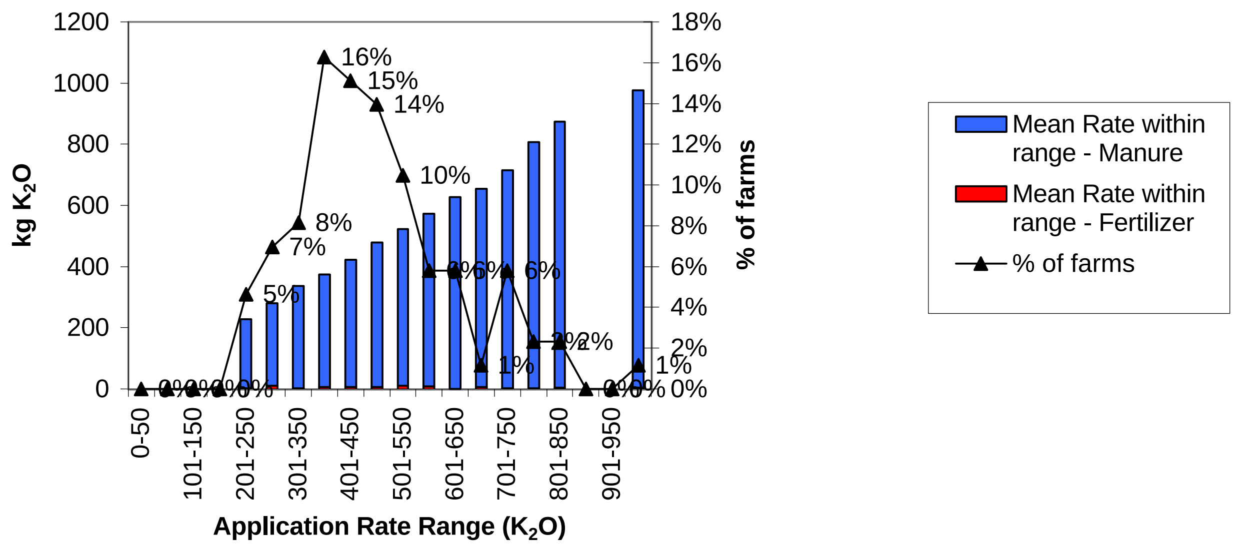
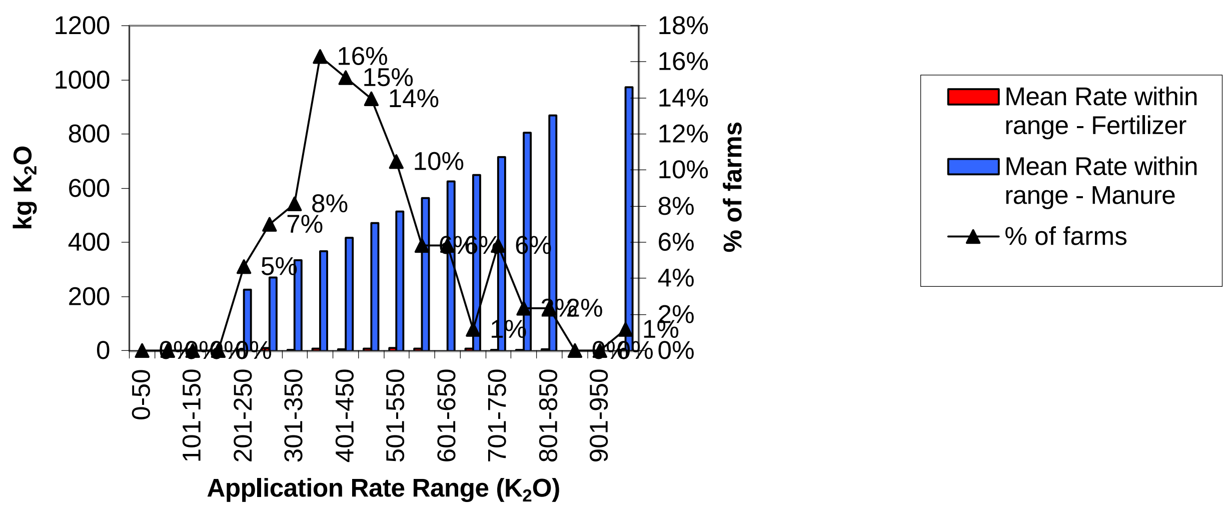


Figure 19a. Total Potassium Application Rate Sumas River Watershed - Dairy



APPENDIX A: DAIRY, POULTRY AND HOG SURVEY SHEETS

FRASER VALLEY WATER QUALITY SURVEY
AGRICULTURAL INVENTORY – FARM INTERVIEW
1997

WATERSHED: MATSQUI______ SUMAS_______ DATE:_____________

GENERAL DATA:

FARM NAME:____

ADDRESS:____

______________________________ TELEPHONE:____________________

OWNER:____

OPERATOR:____

TYPE OF OPERATION:**DAIRY**

LAND BASE:________ACRES

LEASES____________ACRES TO__________________________________

____

RENTS______ACRES FROM_________________________

____

OTHER____________ACRES____

____

AREA USED FOR – CROP PRODUCTION (SPECIFY CROPS)

		YIELD AND PROTEIN LEVELS
_____________	______ACRES	__________________________
_____________	______ACRES	__________________________
_____________	______ACRES	__________________________

# OF ANIMALS:		
	MILKING COWS	______
	DRY COWS	______
	HEIFERS (15-24mo)	______
	HEIFERS (6-15mo)	______
	CALVES (3-6mo)	______
	CALVES (0-3mo)	______

HAS YOUR PRODUCTION CHANGED SINCE 1994?___________________

MANURE DATA:

% SOLID/LIQUID MANURE:____

IMPORT OF MANURE PER YEAR:____

EXPORT OF MANURE PER YEAR:____

WITHIN 5 MILES:____

____

OUTSIDE 5 MILES:____

____

MANURE STORAGE: ______PERMANENT ______TEMPORARY

______COVERED ______UNCOVERED

______EARTHEN ______CONCRETE ______FIELD STORAGE

PHYSICAL DIMENSIONS: ________L ______W ______D/H

______L ______W ______D/H

WASTE TREATMENT FACILITY:____

______AERATION ______ANAEROBIC

______SEPARATION ______CHEMICAL TREATMENT

______BIOLOGICAL TREATMENT

COMPOSTING FACILITY TYPE:___________________________________

% MANURE COMPOSTED_______________________________________

LIVESTOCK OUTDOORS?____

WHERE DOES RUNOFF GO?____________________________________

OTHER LIVESTOCK ON FARM (TYPE AND NUMBERS)

____

MANURE USE (WHERE IS MANURE STORED/APPLIED)_______________

____

MANURE APPLICATION: (AMOUNT, AREA, METHOD AND CROP)

APPLICATION SEASON:____________________________________

_______ON FARM____

____

_______OFF FARM (LOCATION)_______________________________

____

____

MISCELLANEOUS:

HANDLING OF MORTALITIES:________ON FARM ______OFF FARM

LOCATION____

METHOD____

CHEMICAL FERTILIZER APPLICATION

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

HAVE YOU CHANGED YOUR FERTILIZER USAGE SINCE 1994?

____

FROM YOUR USE OF NITROGEN SIDEDRESSING, HOW HAS IT CHANGED YOUR NITROGEN PRACTICES? ARE YOU NOW APPLYING LOWER FERTILIZER RATES TO YOUR CORN CROP?________________________

____

____

WHO DID YOUR MOST RECENT PRE-SIDEDRESS NITROGEN SOIL TEST?

YOURSELF	______
FERTILIZER DEALER	______
EXTENSION AGENT	______
OTHER	______
NO ONE	______

DO YOU TRY TO MATCH MANURE APPLICATION TO CROP REQUIREMENTS?____

HOW DO YOU MATCH CROP NUTRIENT REQUIREMENTS TO FERTILIZER AND MANURE APPLICATIONS?____

____

DO YOU HAVE REGULAR SOIL TESTS DONE?______________________________

DO YOU HAVE REGULAR MANURE TESTS DONE?_________________________

WHAT IMPROVEMENTS TO WASTE MANAGEMENT FACILITIES HAVE YOU MADE SINCE 1994?____

HOW MUCH HAVE YOU SPENT?__________________________________

WHAT ARE YOUR PLANS FOR THE NEXT 12 MONTHS?_____________________

____

IF AN EXISTING FARM DOES NOT MEET THE CODE OF WASTE MANAGEMENT FOR AGRICULTURE, HOW LONG SHOULD THE FARM BE GIVEN TO COMPLY?

0 TO 12 MONTHS	______
12 TO 24 MONTHS	______
24 TO 36 MONTHS	______

IF YOUR FARM DOES NOT MEET CURRENT OR PROPOSED GUIDELINES, INDICATE YOUR TWO MOST IMMEDIATE NEEDS OF ACHIEVING COMPLIANCE: (1=FIRST PRIORITY, 2=SECOND)

TAX INCENTIVES	_______	DEMONSTRATION UNITS	_______
SUBSIDIZED INTEREST LOANS	_______	FINANCIAL GRANTS	_______
TECHNICAL INFORMATION	_______	OTHER (SPECIFY)	_______

WHAT IS HOLDING YOU FROM COMPLETING IMPROVEMENTS TO YOUR FARM?____

____

CONSERVATION PROGRAMS:

HAVE YOU EVER USED INFORMATION OR SERVICE FROM ANY OF THE CONSERVATION PROGRAMS OFFERED UNDER THE GREEN PLAN?

_______SUSTAINABLE POULTRY FARMING GROUP

_______DAIRY PRODUCERS' CONSERVATION GROUP

_______HOG PRODUCERS' SUSTAINABLE FARMING GROUP

_______SUMAS PRAIRIE SOIL CONSERVATION GROUP

_______MATSQUI/LANGLEY SOIL CONSERVATION GROUP

RATE THE FOLLOWING ON A SCALE OF 1 – 5: 1 = GOOD 5 = POOR

1) DID YOU FIND THE INFORMATION OR SERVICES RELEVANT OR USEFUL? (1 – 5) ______________

WHY?____

BY WHAT MEANS DO YOU FEEL INFORMATION ABOUT CONSERVATION/WASTE MANAGEMENT IS BEST PASSED ON TO PRODUCERS?

PRODUCER NEWSLETTERS	_______	ON-FARM DEMONSTRATIONS	_______
AG NEWSPAPERS	_______	FIELD DAYS	_______
PRODUCER MEETINGS	_______	FARM SCALE DEMO	_______

2) ARE FIELD DAYS AND DEMONSTRATIONS USEFUL? (1-5)_________________

DO YOU ATTEND?______________________

3) DO YOU FEEL CONSERVATION PROGRAMS ARE BENEFICIAL:

TO THE INDUSTRY? (1-5)________________

TO THE ENVIRONMENT?(1-5)__________________

TO THE PUBLIC?(1-5)_____________

WHAT ISSUES WOULD YOU LIKE TO SEE CONSERVATION PROGRAMS WORKING ON IN THE FUTURE?____

____

____

WHAT EXTRA INFORMATION DO YOU NEED TO IMPROVE YOUR FACILITY?____

____

DO YOU NEED WASTE MANAGEMENT IMPROVEMENTS ON YOUR FARM?____

WHY?____

WHAT DO YOU ESTIMATE YOUR COSTS TO BE TO MAKE IMPROVEMENTS TO YOUR FARM?____

WHAT DO YOU FEEL IS A REASONABLE PRODUCER $ INPUT TO CONSERVATION EFFORTS?____

SHOULD INDUSTRY DOLLARS SUPPORT FOR SUSTAINABLE PROGRAMS:

REMAIN THE SAME? ______

INCREASE? ______

DECREASE? ______

RANK THE FOLLOWING ISSUES WITH REGARDS TO THEIR RELEVANCE TO ENVIRONMENTAL STEWARDSHIP:

______CONSERVATION PROGRAMS

______FEED RESEARCH

______MARKETING

______FACILITY RESEARCH (BARNS, MANURE STORAGE, ETC)

______PRODUCER EDUCATION PROGRAMS

______PRODUCER CHANGES IN ATTITUDE

______BEST AGRICULTURAL WASTE MANAGEMENT PLANS

______NUTRIENT MANAGEMENT PLANS

FRASER VALLEY WATER QUALITY SURVEY
AGRICULTURAL INVENTORY – FARM INTERVIEW
1997

WATERSHED: MATSQUI______ SUMAS_______ DATE:______________

GENERAL DATA:

FARM NAME:____

ADDRESS:____

_________________________________ TELEPHONE:_____________________

OWNER:____

OPERATOR:____

TYPE OF OPERATION:**POULTRY**

LAND BASE:________ACRES

LEASES____________ACRES TO____________________________________

____

RENTS______ACRES FROM__________________________

____

AREA USED FOR – CROP PRODUCTION (SPECIFY CROPS)

		YIELD AND PROTEIN LEVELS
_____________	_______ACRES	__________________________
_____________	_______ACRES	__________________________
_____________	_______ACRES	__________________________

GRAZING:_____ACRES – FEEDLOTS:_____ACRES – BUILDINGS:_ACRES

QUOTA: ROASTER_____ BROILER_____ TURKEY______

TABLE EGG LAYERS____ BREEDER LAYERS_____

Kg/CYCLE (# BIRDS, IF LAYERS) ____________________________________

NO. OF CYCLES PER YEAR:____

HAS YOUR QUOTA CHANGED SINCE 1994?________________________________

HOW MUCH?____

DO YOU RAISE PULLETS ON THE FARM?_____________________

HOW MANY CYCLES?____

MANURE DATA:

IMPORT OF MANURE PER YEAR:___________________________________

EXPORT OF MANURE PER YEAR:__________________________________

WITHIN 5 MILES:____

____

OUTSIDE 5 MILES:____

____

MANURE STORAGE:_______PERMANENT ______TEMPORARY

______COVERED ______UNCOVERED

______CONCRETE ______FIELD STORAGE

PHYSICAL DIMENSIONS: _________L ______W ______D/H

IF UNCOVERED WHERE DOES THE RUNOFF GO?_____________

____

DOES CONTRACTOR CLEAN OUT BARN?_HAUL MANURE?___________

CONTRACTOR____

DOES SUSTAINABLE POULTRY FARMING GROUP SHIP YOUR MANURE?_____

____

MANURE APPLICATION: (AMOUNT, AREA, METHOD AND CROP)

APPLICATION SEASON:____

______ON FARM____

____

______OFF FARM (LOCATION)____

____

____

____

MISCELLANEOUS:

HANDLING OF MORTALITIES:________ON FARM ______OFF FARM

LOCATION____

METHOD____

TYPE OF INCINERATOR: DOUBLE BURNER_____________

SINGLE BURNER______________

AGE__________

COMPOSTING FACILITY: _______COVERED ______UNCOVERED

MATERIALS COMPOSTED_______________________________

CHEMICAL FERTILIZER APPLICATION

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

HAVE YOU CHANGED YOUR FERTILIZER USAGE SINCE 1994?

____

WHY?____

DO YOU TRY TO MATCH MANURE APPLICATION TO CROP REQUIREMENTS?____

HOW DO YOU MATCH CROP NUTRIENT REQUIREMENTS TO FERTILIZER AND MANURE APPLICATIONS?_________________________

____

DO YOU HAVE REGULAR SOIL TESTS DONE?___________________________

DO YOU HAVE REGULAR MANURE TESTS DONE?_________________________

WHAT IMPROVEMENTS TO WASTE MANAGEMENT HAVE YOU MADE SINCE 1994?____

HOW MUCH HAVE YOU SPENT?_______________________________________

WHAT ARE YOUR PLANS FOR THE NEXT 12 MONTHS?

____

____

IF AN EXISTING FARM DOES NOT MEET THE CODE OF WASTE MANAGEMENT FOR AGRICULTURE, HOW LONG SHOULD THE FARM BE GIVEN TO COMPLY?

0 TO 12 MONTHS _______

12 TO 24 MONTHS _______

24 TO 36 MONTHS _______

IF YOUR FARM DOES NOT MEET CURRENT OR PROPOSED GUIDELINES, INDICATE YOUR TWO MOST IMMEDIATE NEEDS OF ACHIEVING COMPLIANCE: (1=FIRST PRIORITY, 2=SECOND)

TAX INCENTIVES	_______	DEMONSTRATION UNITS	_______
SUBSIDIZED INTEREST LOANS	_______	FINANCIAL GRANTS	_______
TECHNICAL INFORMATION	_______	OTHER (SPECIFY)	_______

WHAT IS HOLDING YOU FROM COMPLETING IMPROVEMENTS TO YOUR FARM?____

____

CONSERVATION PROGRAMS:

HAVE YOU EVER USED INFORMATION OR SERVICE FROM ANY OF THE CONSERVATION PROGRAMS OFFERED UNDER THE GREEN PLAN?

_______SUSTAINABLE POULTRY FARMING GROUP

_______DAIRY PRODUCERS' CONSERVATION GROUP

_______HOG PRODUCERS' SUSTAINABLE FARMING GROUP

_______SUMAS PRAIRIE SOIL CONSERVATION GROUP

_______MATSQUI/LANGLEY SOIL CONSERVATION GROUP

RATE THE FOLLOWING ON A SCALE OF 1 – 5: 1= GOOD 5=POOR

1) DID YOU FIND THE INFORMATION OR SERVICES RELEVANT OR USEFUL?________

WHY?____

BY WHAT MEANS DO YOU FEEL INFORMATION ABOUT CONSERVATION/WASTE MANAGEMENT IS BEST PASSED ON TO PRODUCERS?

PRODUCER NEWSLETTERS	_______	ON-FARM DEMONSTRATIONS	_______
AG NEWSPAPERS	_______	FIELD DAYS	_______
PRODUCER MEETINGS	_______	FARM SCALE DEMO	_______

2) ARE FIELD DAYS AND DEMONSTRATIONS USEFUL? (1-5)___________

DO YOU ATTEND?______________________

3) DO YOU FEEL CONSERVATION PROGRAMS ARE BENEFICIAL:

TO THE INDUSTRY? (1-5)________________

TO THE ENVIRONMENT?(1-5)___________________

TO THE PUBLIC?(1-5)_____________

WHAT ISSUES WOULD YOU LIKE TO SEE CONSERVATION PROGRAMS WORKING ON IN THE FUTURE?____

____

____

WHAT EXTRA INFORMATION DO YOU NEED TO IMPROVE YOUR FACILITY?____

____

DO YOU NEED WASTE MANAGEMENT IMPROVEMENTS ON YOUR FARM?____

WHY?____

WHAT DO YOU ESTIMATE YOUR COSTS TO BE TO MAKE IMPROVEMENTS TO YOUR FARM?____

WHAT DO YOU FEEL IS A REASONABLE PRODUCER $ INPUT TO CONSERVATION EFFORTS?____

SHOULD INDUSTRY DOLLARS SUPPORT FOR SUSTAINABLE PROGRAMS:

	REMAIN THE SAME?	______
	INCREASE?	______
	DECREASE?	______

ARE YOU AWARE THAT YOU HAVE CONTRIBUTED IN THE PAST THROUGH A CHECKOFF ($50/FARM)?____________

RANK THE FOLLOWING ISSUES WITH REGARDS TO THEIR RELEVANCE TO ENVIRONMENTAL STEWARDSHIP:

______CONSERVATION PROGRAMS

______FEED RESEARCH

______MARKETING

______FACILITY RESEARCH (BARNS, MANURE STORAGE, ETC)

______PRODUCER EDUCATION PROGRAMS

______PRODUCER CHANGES IN ATTITUDE

______BEST AGRICULTURAL WASTE MANAGEMENT PLANS

______NUTRIENT MANAGEMENT PLANS

FRASER VALLEY WATER QUALITY SURVEY
AGRICULTURAL INVENTORY – FARM INTERVIEW
1997

FVWQS _________ BCPPA ________ BOTH________

WATERSHED: MATSQUI_______ SUMAS________ DATE:_______________

GENERAL DATA:

FARM NAME:____

ADDRESS:____

___________________________________ TELEPHONE:______________________

OWNER:____

OPERATOR:____

TYPE OF OPERATION:**HOG**

LAND BASE:_________ACRES

LEASES_____________ACRES TO____

____

RENTS_______ACRES FROM____

____

OTHER_______ACRES____

____

AREA USED FOR – CROP PRODUCTION (SPECIFY CROPS)

YIELD AND PROTEIN LEVELS

______________ _______ACRES ____________________________

______________ _______ACRES ____________________________

______________ _______ACRES ____________________________

OF ANIMALS: BREEDING STOCK

SOWS ______ BOARS______

STOCK FOR MARKET

WEANERS (5 - 20 KG)__________

GROWER PIGS (20 - 60 KG)_________

FINISHER PIGS (60 - 100 KG)________

GROWER/FINISHER (20 - 100 KG)________

GUILTS _____________

TYPE OF OPERATION:

FARROW - WEANER______ F-F ___________ W-F _________ BREEDING ___________

HAS YOUR PRODUCTION CHANGED SINCE 1994? ________________________________

1991? ________________________________

MANURE DATA:

% SOLID/LIQUID MAURE: ____

IMPORT OF MANURE PER YEAR:____

EXPORT OF MANURE PER YEAR:____

WITHIN 5 MILES:____

____

OUTSIDE 5 MILES:____

____

MANURE STORAGE:_______PERMANENT ______TEMPORARY

______COVERED ______UNCOVERED ______EARTHEN

______CONCRETE ______FIELD STORAGE

PHYSICAL DIMENSIONS: _________L ______W ______D/H

_____________L ______W ______D/H

WASTE TREATMENT FACILITY:____

_______AERATION _______ANAEROBIC

______SEPARATION _______CHEMICAL TREATMENT

______BIOLOGICAL TREATMENT

COMPOSTING FACILITY TYPE: ____

% MANURE COMPOSTED ____

LIVESTOCK OUTDOORS? ____

WHERE DOES RUNOFF GO? ______________________________________

OTHER LIVESTOCK ON FARM (TYPE AND NUMBERS

____

DOES SUSTAINABLE POULTRY FARMING GROUP SHIP YOUR MANURE?_____

____

MANURE USE (WHERE IS MANURE STORED/APPLIED) ______________

____

APPLICATION: (AMOUNT, AREA, METHOD AND CROP)

APPLICATION SEASON:____

______ON FARM____

____

______OFF FARM (LOCATION)____

____

____

____

MISCELLANEOUS:

HANDLING OF MORTALITIES:________ON FARM ______OFF FARM

LOCATION____

METHOD____

CHEMICAL FERTILIZER APPLICATION

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

TYPE____

ACREAGE____

FREQUENCY____

RATE____

CROPS____

HAVE YOU CHANGED YOUR FERTILIZER USAGE SINCE 1994?

____

DO YOU TRY TO MATCH MANURE APPLICATION TO CROP REQUIREMENTS?____

HOW DO YOU MATCH CROP NUTRIENT REQUIREMENTS TO FERTILIZER AND MANURE APPLICATIONS?_______________________________

____

DO YOU HAVE REGULAR SOIL TESTS DONE?_____________________________

DO YOU HAVE REGULAR MANURE TESTS DONE?__________________________

WHAT IMPROVEMENTS TO WASTE MANAGEMENT FACILITIES HAVE YOU MADE SINCE 1994?____

HOW MUCH HAVE YOU SPENT?____________________________________

WHAT ARE YOUR PLANS FOR THE NEXT 12 MONTHS? _____________________

____

IF AN EXISTING FARM DOES NOT MEET THE CODE OF WASTE MANAGEMENT FOR AGRICULTURE, HOW LONG SHOULD THE FARM BE GIVEN TO COMPLY?

0 TO 12 MONTHS	_______
12 TO 24 MONTHS	_______
24 TO 36 MONTHS	_______

IF YOUR FARM DOES NOT MEET CURRENT OR PROPOSED GUIDELINES, INDICATE YOUR TWO MOST IMMEDIATE NEEDS OF ACHIEVING COMPLIANCE: (1=FIRST PRIORITY, 2=SECOND)

TAX INCENTIVES	_______	DEMONSTRATION UNITS	_______
SUBSIDIZED INTEREST LOANS	_______	FINANCIAL GRANTS	_______
TECHNICAL INFORMATION	_______	OTHER (SPECIFY)	_______

WHAT IS HOLDING YOU FROM COMPLETING IMPROVEMENTS TO YOUR FARM?____

____

CONSERVATION PROGRAMS:

HAVE YOU EVER USED INFORMATION OR SERVICE FROM ANY OF THE CONSERVATION PROGRAMS OFFERED UNDER THE GREEN PLAN?

_______SUSTAINABLE POULTRY FARMING GROUP

_______DAIRY PRODUCERS' CONSERVATION GROUP

_______HOG PRODUCERS' SUSTAINABLE FARMING GROUP

_______SUMAS PRAIRIE SOIL CONSERVATION GROUP

_______MATSQUI/LANGLEY SOIL CONSERVATION GROUP

RATE THE FOLLOWING ON A SCALE OF 1 – 5: 1= GOOD 5=POOR

1) DID YOU FIND THE INFORMATION OR SERVICES RELEVANT OR USEFUL?________

WHY?____

BY WHAT MEANS DO YOU FEEL INFORMATION ABOUT CONSERVATION/WASTE MANAGEMENT IS BEST PASSED ON TO PRODUCERS?

PRODUCER NEWSLETTERS	_______	ON-FARM DEMONSTRATIONS	_______
AG NEWSPAPERS	_______	FIELD DAYS	_______
PRODUCER MEETINGS	_______	FARM SCALE DEMO	_______

2) ARE FIELD DAYS AND DEMONSTRATIONS USEFUL? (1-5)___________

DO YOU ATTEND?______________________

3) DO YOU FEEL CONSERVATION PROGRAMS ARE BENEFICIAL:

TO THE INDUSTRY? (1-5)________________

TO THE ENVIRONMENT?(1-5)___________________

TO THE PUBLIC?(1-5)_____________

WHAT ISSUES WOULD YOU LIKE TO SEE CONSERVATION PROGRAMS WORKING ON IN THE FUTURE?____

____

____

WHAT EXTRA INFORMATION DO YOU NEED TO IMPROVE YOUR FACILITY?____

____

DO YOU NEED WASTE MANAGEMENT IMPROVEMENTS ON YOUR FARM?____

WHY?____

WHAT DO YOU ESTIMATE YOUR COSTS TO BE TO MAKE IMPROVEMENTS TO YOUR FARM?____

WHAT DO YOU FEEL IS A REASONABLE PRODUCER $ INPUT TO CONSERVATION EFFORTS?____

SHOULD INDUSTRY DOLLARS SUPPORT FOR SUSTAINABLE PROGRAMS:

	REMAIN THE SAME?	______
	INCREASE?	______
	DECREASE?	______

ARE YOU AWARE THAT YOU HAVE CONTRIBUTED IN THE PAST THROUGH A CHECKOFF ($0.10/HOG)?____________

RANK THE FOLLOWING ISSUES WITH REGARDS TO THEIR RELEVANCE TO ENVIRONMENTAL STEWARDSHIP:

______CONSERVATION PROGRAMS

______FEED RESEARCH

______MARKETING

______FACILITY RESEARCH (BARNS, MANURE STORAGE, ETC)

______PRODUCER EDUCATION PROGRAMS

______PRODUCER CHANGES IN ATTITUDE

______BEST AGRICULTURAL WASTE MANAGEMENT PLANS

______NUTRIENT MANAGEMENT PLANS