KANSAS FARMSTEAD WELL WATER QUALITY STUDY

by

ALAN THOMAS HEIMAN

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James Steichen
Major Professor

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Kansas Farmstead Well Water Quality Study
(Alan T. Heiman, B.S. 1985)

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INTRODUCTION

Citizens of the State of Kansas have become increasingly concerned about water. Topics at the center of the debate are quantity and quality. Water is a resource of great value. It is similar to other natural resources in that it is susceptible to deterioration from many sources, particularly man made ones. Groundwater constitutes the major portion of drinking water supplies in Kansas. When this resource becomes contaminated by chemicals, organic and inorganic materials and other pollutants, it loses value that can not be easily remedied. In recent years there have been many reports of groundwater contamination throughout the United States.

Water quantity has been the subject of water controversy throughout the 1980's. The Kansas Water Authority, the state's highest water advisory board, issued a report in 1982 stating that water demands in Kansas would exceed available supplies in the next 40 to 50 years. All but the northeast corner of Kansas should experience supply problems (Kansas Water Authority, 1982). The impact of this report resulted in increased concern on what water resources are available and how to insure quality of present supplies.

Groundwater forms the cornerstone of Kansas's water supplies. Eighty percent of Kansas water systems use groundwater and a little over 50 percent of the population is supplied by groundwater. Over 90 percent of the rural population is supplied by ground water. Groundwater storage in Kansas has been estimated to equal 385 million acre feet. This amount equals over three years of normal precipitation or thirty five times the amount stored in all the state's major reservoirs (Fund, 1984)! It becomes readily apparent that Kansas will continue to rely heavily upon groundwater in the future.

The majority of Kansas's groundwater lies in the western half of the state in sand and gravel aquifers common to the area. The largest of these is the Ogallala aquifer which encompasses parts of six states. It is susceptible to critical depletion in some areas due to consumptive uses, mainly irrigation. Recharge is insufficient to maintain water tables. This case provides proof that groundwater is a finite resource that must be watched for contamination and excessive use. Kansas passed the Groundwater Management District Act in 1972 (K.S.A. 82a-1020 thru 1040). Since then, five districts have been established in western and central Kansas with the purpose of managing groundwater.

Groundwater, in the past, has been assumed pure. Water that normally comes from aquifers is clear compared to surface waters. To many people, the earth's crust acts as a filter, depository and protective layer above the saturated layer in unconfined aquifers. People in the past have relied on this sense of security in their approach to land use practices. Only in the last decade has it become possible to detect chemical constituents at the very low concentrations needed for a thorough analysis of contaminants in water.

Contaminants are considered to be any synthetic chemical at any detectable concentration and naturally occurring chemicals at concentrations above drinking water standards. Water from nearly all privately-owned wells are not tested on a regular basis. When problems with the water occurs, such as taste and odors, it is often too late to stop or reverse the contamination. "In the classic case, people notice that their water smells or tastes bad" (Maranto, 1985).

Agriculture has advanced rapidly due to technology in the last three decades and brought potential pollution problems along with it to farmsteads. Many farming activities can have negative impacts upon groundwater quality. Agricultural production at present levels would not be possible without the pesticides and fertilizers commonly used on farmsteads in Kansas. Carbon tetrachloride, a known carcinogen, has been widely used to fumigate grain in storage. Large feedlots have become commonplace, concentrating many animals and their byproducts into relatively small areas. Farmshops use many chemicals including solvents, paint thinners and degreasers that contain chemicals that haven't been evaluated for their toxicity when consumed at low levels over long periods of time. Septic tanks may be improperly constructed and/or placed in locations too near a water well. Chemical containing solvents may be used to "improve" the adsorption beds in these systems.

The water well itself may be a cause of contamination because it can be a direct "vent" into an aquifer. Private wells may be poorly constructed, have inadequate surface protection and be unknowingly located near contaminant sources. Chemigation, the injection of chemicals into irrigation systems, in the past has been largely unregulated and may have resulted in back siphoning of agricultural chemicals into the well, tainting an aquifer for long periods of time.

The degree of contamination of wells nationwide has been estimated in the range of 2 to 10 percent (Maranto, 1985; Pye and Patrick, 1983). The four pollutants most commonly reported--chloride, nitrate, heavy metals and hydrocarbons--may be a reflection of the monitoring practices prevailing at the time the surveys were conducted (Pye and Patrick, 1983). About 80 percent of all groundwater pollution problems are caused by chlorinated compounds used in industrial solvents and degreasers; trichloroethelyene (TCE) and carbon tetrachloride, for example. TCE reaches groundwater not only through industrial waste disposal, but also through backyard septic tanks as it is a component of many septic tank cleaning aids (Tangley, 1982a).

The Kansas Department of Health and Environment (KDHE) and United States Geological Survey (USGS) have cooperatively operated a groundwater quality monitoring network since 1976. Approximately 250 network wells have been tested over the ten-year period. Pesticides have been detected in 2 per cent of the samples (Robbins, 1986). Atrazine was the most commonly detected pesticide, followed by 2,4-D.

Volatile Organic Compounds (VOCs) have been detected in groundwater throughout the U.S. A survey of 945 water supplies (Westick et al., 1984) showed the percentages of supplies containing at least one VOC ranged from 16.8% to 37.3% depending upon population size served by the water supply and whether the sample was random or nonrandom. Benzene, a component of gasoline, is a prime example of a VOC.

How VOCs get into farmstead wells is unknown. VOCs are volatile substances and many are easily degraded in open air environments, however, some VOCs (esp. fumigants) are much more dense than water and move rapidly down through the soil under gravitational forces.

With pesticides a similar dilemma presents itself because most have been tested for their ability to destabilize and dissociate in the environment. Typically the testing was done in an aerobic soil environment and not in an anearobic, saturated environment below the root zone. Potential to contaminate groundwater was not even considered until recently. None of the currently available pesticides were given any significant review for groundwater pollution potential (Robbins, 1987).

While sampling public water supply wells for contamination with VOCs, KDHE sampled private wells in the vicinity of contaminated wells for extent of the contamination plume. In one case a farmstead well was found to contain carbon tetrachloride, yet all surrounding wells were uncontaminated. This led KDHE to believe the source came from the farmstead itself. The question arose as to how widespread and severe this problem may be. This led to the intitiation of this project.

The main purpose of this study was to determine the extent of contamination with VOCs, pesticides and inorganic constituents in Kansas farmstead wells. A second purpose was to determine correlations, if any, between practices around wells and water quality from the wells.

REVIEW OF LITERATURE

Pesticides, Volatile Organic Chemicals (VOCs) and inorganic chemicals have been detected in many water supplies through out the United States. Laboratory technology has only in the past decade become able to detect many of these contaminants at the low concentrations in which they commonly occur. Through the use of gas chromatography, electron capture detectors and mass spectrometers, laboratory technicians are able to detect concentrations in parts per billion (ppb).

Pesticides

One of the key books of the 1960's environmental movement, Silent Spring, by Rachel Carson sounded the alarm on man's impact upon the environment. At that time, the pesticide industry in the U.S. was about ten years old. Significant regulation regarding testing and application had yet to catch up with the increasing amount of pesticides being introduced into the environment. The amount of pesticides being used in the environment has increased by 1,800 percent since 1947 (King, 1985).

Agriculture is a major user of pesticides and has been found to contribute to the groundwater problems in many states. Many instances of contamination have occurred in the Central Valley region of California. King (1985) reports, that as of 1985, there were more than 3,500 wells in a ten county area found to contain dibromochloropropane (DBPC). In 1982, the California State Health Department released a report that linked DBCP to increased stomach cancer in this area. DBCP is a fumigant injected into the soil to kill nematodes which attack roots of plants. Since then its use, as well as another closely related fumigant, ethylene dibromide (EDB), has been restricted by the Environmental Protection Agency (EPA).

In the State of Wisconsin the use of aldicarb, another nematocide, has been restricted in the Central Sand Region.

After a ban on the use of aldicarb, placed by that state's health department in the Central Sands Region in 1981, the number of wells above 10 ppm decreased from 130 to 38 (U.S. Water News, 1985). Aldicard was used by potato farmers in this area to protect their crop. This proves that non-point sources (i.e. agriculture) may be quickly cleared up. Aldicarb is a fumigant not readily soluble in water, yet it becomes clear that we are in trouble concerning pesticides that require water to become active.

Pesticides have usually been considered an insignificant contributor to groundwater contamination since most of them are thought to be bound up by soil particles and then decomposed by various processes in the soil. Areas that have a shallow water table and porous soil type are considered more likely to have problems with contamination. The occurrence of pesticides in groundwater is usually localized and related to excessive and/or improper use of these chemicals.

The Iowa Department of Water, Air and Waste Management conducted a survey of synthetic organic compounds in public drinking water supplies along the Little Souix River in May of 1985 (Iowa, 1985a). Twenty five wells were tested for 64 synthetic organic compounds and nine contained one or more contaminants. There were five herbicides and two insecticides encountered. The most common pesticide found was the insecticide Counter, which is known to break down rapidly in water. This lead the researchers to conclude "any pesticide, regardless of decay rate, can leach to the groundwater and thus affect water quality, even if only for a short period of time." It was also found there is an inverse relationship between well depth and appearance of contaminants.

Most pesticides are toxic to humans and animals if consumed in significant quantities. There have been many pesticides in use over the past three decades. King (1985) reports as of 1972, there were over 50,000 pesticides on the market. In 1972, the EPA was required by an amendment to the 1947 Federal Insecticide, Fungicide and Rodenticide Act to approve all new pesticides and new uses of existing pesticides. This proved to be a monumental task. As of 1984, the EPA had reregistered less than one percent of the 50,000.

Drinking water standards have been set for six pesticides. While there are standards for a few of the many pesticides, toxicity information is available for most types. This available data can be extrapolated and converted to concentrations to give chronic toxicity to be avoided (Robbins, 1985).

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are products of modern society. VOCs are ingredients in many household, commercial and industrial products such as solvents, cleaning aids, drain openers, degreasers, metal cleaners, septic tank cleaners, petroleum products and dyes. They are commonly used in the manufacture of detergents, pharmaceuticals, insecticides and other industrial products. VOCs, often called purgeable organics, are compounds with an appreciable vapor pressure such that they vaporize when exposed to air. Many VOCs commonly enter groundwater through waste disposal practices such as landfills, septic tanks and spreading of waste on land.

VOCs are reaching national recognition as a problem not easily solved. A case is being tested in the courts on the liability of two factories in Woburn, Massachusetts (Therrien, 1985). Contamination of groundwater by Trichloroethylene, a suspected carcinogen, is being linked to the increased rate of leukemia, three times the national average, among the town's children.

In Kansas, the Environmental Protection Agency conducted a Community Water Supply Survey on 330 water supplies and 466 wells in the Ground Water Supply Survey. In these random samples one or more VOCs were detected in 15.2 and 21.3 per cent respectively (Kovach, 1985). These figures show that VOCs are present in Kansas water supplies.

VOCs are of concern due to their potential health effects. Some of these chemicals have been shown to be carcinogenic and/or have damaging effects on the central nervous system, liver, kidneys and the cardiovascular system. The chronic toxicity of many VOCs is not known. The Environmental Protection Agency has proposed Recommended Maximum Contaminant Levels for 9 VOCs as of 1984 (Table 1).

Table 1. Recommended Maximum Contaminant Levels (MCL) For VOCs Proposed 40 CFR 141.50, Federal Register, 6-12-84

VOC	Proposed MCL, ppb
Trichlorethylene	0
Tetrachloroethylene	0
Tetrachloromethane	0
1,1,1-Trichloroethane	200
Vinyl Chloride	0
1,2-Dichloroethane	0
Benzene	0
1,1-Dichloroethylene	0
para-Dichlorobenzene	750

While these VOCs have been proven to have adverse effects upon human health, combinations of these and other VOCs are being studied as well. "Toxicologists have not been able to provide a scientific basis upon which to assess the possible synergistic, antagonistic or additive health effects from exposure to one or more VOCs" (Kovach, 1984).

Inorganic Constituents

The most commonly found contaminants in water supplies are inorganic chemicals. In agriculture, inorganic amendments are added to soils with the purpose of improving properties for plant growth. Plant nutrients (fertilizers) are used extensively in modern agricultural systems. Many inorganic chemicals occur naturally as a result of geological formations. The soil type and depth to water table affect the amount of inorganic chemicals present in groundwater.

Inorganic chemicals may be divided into two general categories: normally occurring and heavy metals. Normally occurring contaminants are usually chemical constituents that have little adverse health effects and in some cases are beneficial to overall health. This category includes iron, manganese and calcium. All of these normally occurring contaminants, with the exception of nitrate and fluoride, have established Secondary Drinking Water Limits as proposed by the EPA (1984). These secondary standards were established to preserve the aesthetic quality of water supplies. Heavy metals on the other hand are known for their adverse health effects. Common to the heavy metals class of inorganics are: arsenic, barium, lead and selenium. Two heavy metals, copper and zinc, are needed in trace amounts to maintain normal health. The EPA has established Primary Drinking Water Standards for 8 of the 10 heavy metals commonly tested. These standards are presented along with nitrate and fluoride in Table 2.

Primary Drinking Water Standards were established as a guideline for states to model their own water quality standards. They were established by the EPA under authority of Public Law 92-500 which led to the passage of the Safe Drinking Water Act in 1974 (Wanielista et. al., 1984).

Table 2. Maximum Contaminant Levels (MCL) for Federal Primary Drinking Water Standards
USEPA, National Primary Drinking Water Regulations

Chemical	MCL (mg/l)
Nitrate (NO_3-N)	10.0
Fluoride (F)	1.8
Arsenic (As)	0.05
Barium (Ba)	1.0
Cadmium (Cd)	0.01
Chromium (Cr)	0.05
Lead (Pb)	0.05
Mercury (Hg)	0.002
Selenium (Se)	0.01
Silver (Ag)	0.05

A study conducted by the American Water Works Association (AWWA, 1984) investigated the frequency and extent of inorganic contaminants in U.S. drinking water supplies. According to this report there have been many occurrences of inorganic contaminants in excess of MCLs in Kansas. The notable contaminants found were fluoride, nitrate and selenium. In the case of selenium, exceedance of the MCL occurred in over 20 per cent of the cases studied.

Nitrates

Fertilizers, septic tank systems, feedlots and other waste disposal systems are the main sources of nitrate contamination entering groundwater on Kansas farmsteads. In the case of fertilizers, most of the plant nutrients are bound up in the soil and/or taken up by plant and animal species. Phosphorus is a nutrient that exhibits these properties well. Nitrates, in contrast, are easily leached through soil and as a consequence have shown up in many water supplies.

The increasing demands by agriculture to increase yields of nitrogen-intensive crops have lead to excess applications in many cases (Halberg, 1986). The low cost of fertilizer in relation to increased returns has made excess applications feasible.

Feedlots and septic tank systems are examples of organic sources of nitrates. Once the waste is placed in the ground it continues on in an everlasting chain called the nitrogen cycle. There are organisms in the soil that readily decompose organic forms into leachable inorganic forms.

The health effects of nitrates are not yet totally understood (Winneberger, 1982). Nitrates have been linked with birth defects, cancer, nervous system impairments and methemoglobinemia. Only methemoglobinemia has been well proven to be an adverse health effect. Nitrates have been found to be a normal body constituent. Many people derive nitrates from vegetables with water being a lesser source.

Methemoglobinemia, sometimes called blue baby disease, affects infants under one year of age. It has been fatal in some cases. King (1985) reports there have been 278 reported cases of blue baby syndrome linked to nitrates in water since 1945. In all, there were 39 infants that have died, although few have occurred in recent years. Tevis (1987) reports that in 1986 a two-month old infant in South Dakota died from this disease. This represents the first known infant death from nitrate poisoning in three decades. The well water used for the infants formula contained approximately 38 ppm nitrate-N, three times present drinking water standards. Adults and children over the age of one year are not affected by nitrate, except in large amounts. Methemoglobinemia affects infants in particular, because of the higher pH in their upper digestive tracts than in older persons. This higher pH results in the conversion of nitrates into nitrites which are then adsorbed into the blood stream where nitrites interact with hemoglobin to form methoglobin which cannot carry oxygen.

Complete records on methemoglobinemia are not available because it is is not a reportable disease. Therefore, many incidents may only be reported in physicians' records.

Selenium and Fluorides

Selenium and fluorides are the result of geologic formations. Both can be thought of as necessary evils in that the human body requires them in small amounts yet in larger amounts they can become detrimental to health. The levels in which they become toxic are considered to be rather small, especially in the case of selenium.

Selenium is derived from soil developed on sporadic outcrops of seleniferous geological formations. Selenium has been documented by Oldfield (1986) to be at the heart of a political and environmental controversy in California.

The Kesterson reservoir in the state's agriculturally rich San Joaquin Valley serves as a National Wildlife Refuge for birds. Presently, birds there have experienced deformities and deaths attributed to selenium toxicity. Wells in the area have shown levels as high as 4 ppm, roughly 400 times the EPA drinking water standard.

In excess, selenium can cause depression, nervousness, giddiness, gastrointestinal disturbances and other maladies. In livestock insufficient selenium has been shown to cause white muscle disease which can be very detrimental to the animal's health. Excess selenium in animals has been called selenium toxicity which causes damage to the hooves, deformities, and loss of hair.

Fluoride in small amounts has been proven to prevent the occurrence of dental cavities. In amounts greater than the PDWS it may cause mottling of teeth and bone changes. Long term consumption at high levels may cause crippling fluorosis.

Movement of Contaminants in Soil Water Systems

In an effort to provide an approach for assessing the groundwater pollution potential for any area, researchers at the Robert S. Kerr Environmental Research Laboratory have developed a model using hydrogeologic settings called DRASTIC (Thornhill, 1985). This system has two parts: designation of hydrogeographic settings and superimposition of a relative ranking system into these settings. The most important factors that determine groundwater pollution potential were as follows: depth to water table, net (aquifer) recharge, aquifer media, soil media, topography, impact of the vadose zone and hydraulic conductivity of the aquifer. This shows many factors are thought to be involved in determining susceptibility of an aquifer to pollution

In order for contaminants to reach groundwater they must travel through unsaturated zones in the soil. This flow is not understood in detail due to the many variables in soil environments. Organic matter in the top layers tends to decrease with soil depth as well as does soil bulk porosity. The chemical properties of contaminants also prove to be hard to ascertain in the soil-water environments.

Under normal conditions chemicals are usually in solution rather than by gaseous transfer through the soil pores (CAST, 1986). The movement of dissolved chemicals by water flow has been described to include mass flow in the surrounding medium and diffusion of ions of dissolved chemicals. Both processes occur simultaneously in an overall process called hydrodynamic dispersion. Mass flow is effectively the only transport mechanism over long distances.

Clay minerals and organic matter provide anionic surfaces which attract many cations and bind them up in the soil matrices through adsorption. Being anions, nitrate and chloride are noted for their leaching ability. They are not readily adsorbed onto the anionic surfaces formed by clay particles in flocculated soil conditions.

For pesticides and VOCs, there are four major processes that may impact potential occurrence in groundwater. Volatilization of chemicals to the atmosphere appears to be the main fate of many fumigants and VOCs. Decomposition of many chemicals occur through exposure to sunlight. Water can cause chemicals to change into other compounds. Microorganisms also decompose chemicals in soil-water systems. Retention by soil as mentioned above and transport of water determine how the chemicals enter saturated zones.

Nitrate contamination has been determined by Schwab (1987) to be the result of three conditions. They are: a source of nitrate, coarse soils and excessive moisture. Conclusions reached include: soils of all textures have potential for leaching and proper soil management will prevent contamination.

OBJECTIVES

KDHE is conducting a sampling and analysis program for groundwater in public supplies. Approximately four hundred public water supplies have been investigated. Preliminary results have indicated ten to twenty percent contain detectable amounts of VOCs. KDHE decided more data was needed on the extent of contamination in private wells, particularly on active farmsteads in Kansas. It is estimated there are more than 40,000 farmstead wells (1982 Census of Agriculture - County Data) in Kansas. Because of this large population and the expense involved in testing a water sample for most identifiable chemical constituents, a selective plan to provide the best possible estimate of extent of contaminants was needed. Therefore, KDHE sought the help from scientists at Kansas State University to design the sampling plan and analyze the data collected. The results of this study will help the KDHE decide on what further testing, if any, should be done and whether action, education, or a combination of programs should be implemented to protect public health and groundwater quality in rural areas.

The objectives for this project are:

1) Develop a plan to identify wells that are a representative sample population of farmstead wells used for domestic purposes in Kansas.

2) Obtain permission of the owners to test the well.

3) Develop and distribute a questionnaire to obtain information about the well and activities surrounding it that may influence groundwater quality.

4) Sample and analyze the water for VOCs, pesticides and other selected chemical constituents.

5) Develop best estimates of the extent of contamination with various constituents in Kansas farmstead wells.

6) Perform statistical analyses on chemical analyses and questionnaire data to find relationships that would correlate activities around the well and well history to quality of water from the wells.

7) Determine what, if any, additional action is needed to protect public health and groundwater quality on Kansas farmsteads.

PROCEDURE

Sample Selection

The purpose of this research was to determine the percentage of private farmstead wells in Kansas that have detectable levels of VOCs, pesticides and other chemicals. The usual procedure for obtaining an estimate of the characteristics of a population is to collect a random sample of the population. Increasing the number of observational units sampled results in greater accuracy. Due to the high cost (about $500) of analyses and limited resources, the limit on number of wells sampled was set at about one hundred.

A statistically random sample requires two things: (1) a "frame" or list of all members of the target population, and (2) a sampling scheme which will select the desired number of subjects so that each has equal probability of being selected. The sampling scheme used does not follow the first rule completely. At the present time no list of all water well owners in Kansas exists. The closest thing available was 1980 and 1982 census data provided by Ott (1985). This alphabetized list approximates the number of farmstead wells in Kansas by county. This list was used as a frame to select counties from which wells would be sampled.

Given the allowable sample size of n=100, and a list approximating 40,000 private farmstead wells for the state, a one in four hundred sampling ratio was followed. A random number between 1 and 400 was selected from a published random number table: the number chosen was 284. To help KDHE reduce the cost of surveying wells it was decided to choose 2 wells per county selected instead of one. Hence, increments of 800 were added to the random number generating the series 284 + 800i. The 105 counties in Kansas were then assigned a cumulative count by the following formula:

$$F_i = \sum_{i=1}^{n} f_i$$

where

$i = (1,2,...,105)$

$n = 105$

f_i = ith county well count

F_i = ith county cumulative well count

A county for which one of the increments 284 + 800i fell between F_{i-1} and F_i was selected for sampling. From these procedures, 48 counties were chosen for sampling.

Two subject farms were then selected for each of 48 counties and four were picked from two counties which had large enough well populations to be selected twice by the

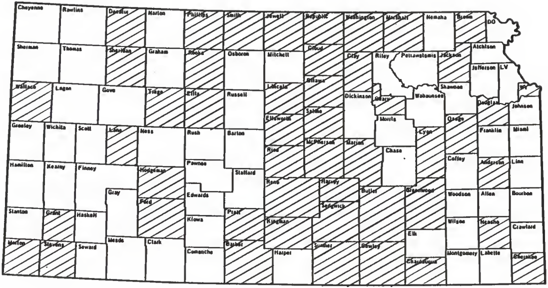


Figure 1. Map highlighting Kansas counties in which wells were sampled.

random procedure. The selected counties are identified on the map in Figure 1. Counties tend to be clustered more in the central and northern parts of the state. This is demographic in nature because of the fact that the density of wells in these counties is higher than the remainder of the state.

Because information about the nature of activities about the well was needed, four criteria were set forth for the wells to be sampled:

1) The well must be located on an active farmstead.

2) The residents needed to be familiar with the activities near the well for the past ten years.

3) The participant must be willing to cooperate in the study.

4) They must use water from the well in their home and for drinking.

Lacking a list of farmstead well owners in each county, County Extension Agricultural and Home Economics Agents were requested by letter to provide names of individuals they thought would meet the four criteria stated above. Nearly all county agents replied. One county was dropped from this list because most farmsteads were serviced by rural water districts and a list of five well owners could not be supplied. A neighboring county was chosen as a substitute. In the two counties with a quota of four wells needed, ten names were requested.

All persons identified as potential candidates were sent a letter of invitation to participate in the study which explained they would need to fill out a questionnaire and allow a sample of water to be drawn for analysis by KDHE. KDHE agreed to provide results of the water analysis to them and anonymity was also assured. The replies to this letter totaled 65 percent of which 90 percent of those replying agreed to participate. This high reply rate may indicate the level of concern on the part of Kansans about the quality of their water.

Water Collection and Analysis

Water samples were collected by KDHE field staff and analyses for contaminants were performed by KDHE laboratory technicians. Samples were collected between December 1985 and February 1986. Sampling was done on the outlet nearest the well to avoid as many extraneous sources of contamination as possible. Water was run for five minutes prior to collection. Five containers were then filled to get a sample for as many different tests: purgeable organics, routine pesticides, heavy metals, ammonia and minerals. All bottles were kept chilled during transport to the laboratory and while awaiting analysis.

All water samples were analyzed by the KDHE laboratory in Topeka for the contaminants listed in Table 3. Purgeable organics were collected and measured with a combination gas chromatograph and mass spectrometer according to EPA Method 624 (USEPA, 1984b). Organochloride pesticides and PCBs were measured as described in EPA Method 608 (USEPA, 1984a). Chlorophenoxy acid herbicides were measured as described by the EPA (USEPA,1978). Both tests for pesticides included extraction and preparation followed by gas chromatography and detection by electron capture. All inorganic chemicals (minerals) were measured by EPA approved methods (USEPA, 1982). If there was no EPA approved method, the procedures described in Standard Methods for the Examination of Water and Wastewater, 16th edition (APHA-AWWA-WPCF, 1985) were used.

Table 3. Contaminants for which Analyses were made on each Water Sample.

Volatile Organic Compounds	Detection Limit ug/l	Pesticides	Detection Limit ug/l
Benzene	0.4	Alachlor	0.250
Bromodichloromethane	0.5	Aldrin	0.025
Bromoform	1.5	Atrazine	1.200
Bromomethane	1.2	Chlordane	0.250
Chlorobenzene	0.4	Dacthal	0.050
Chloroethane	3.7	Dieldrin	0.050
Cis 1,3-dichloropropene	0.9	Dual	0.250
Cloromethane	5.0	Endrin	0.100
Dibromochloromethane	0.7	Heptachlor epoxide	0.020
Dichloromethane	0.9	Lindane	0.025
Ethylbenzene	0.7	Methoxychlor	0.200
Meta-xylene	0.6	O,P' DDT	0.100
Ortho &/ or para-xylene	1.0	P,P' DDT	0.100
Tetrachloroethylene	1.1	P.C.B 's	0.500
Tetrachloromethane	0.7	Ramrod	0.250
Toluene	0.4	Sencor	0.100
Trans 1,2-dichloroethylene	0.5	Silvex	0.200
Trans 1,3-dichloropropene	0.8	Tordon	0.400
Trichloroethylene	0.6	Toxaphene	2.000
Trichloromethane	0.5	2,4,5-T	0.200
Vinyl Chloride	0.8	2,4-D	0.400
1,1,1-trichloroethane	0.7		
1,1,2,2-tetrachloroethane	0.6		
1,1,2-tetrachloroethane	0.6		
1,1-dichloroethane	0.5		
1,1-dichloroethylene	0.6		
1,2-dichloroethane	0.6		
1,2-dichloropropane	0.4		
1,2 &/or 1,4-dichlorobenzene	1.0		

Inorganic Chemicals (minerals)

Alkalinity	Potassium
Ammonia	Selenium
Arsenic	Silica
Barium	Silver
Cadmium	Sodium
Chloride	Specific Conductance
Chromium	Sulfate
Copper	Total Phosphorus
Fluoride	Total dissolved solids
Iron	Total hardness
Lead	Turbidity
Manganese	Zinc
Mercury	pH
Nitrate	

Data Analysis

Introduction

After receiving the data from KDHE and the questionnaires from participants, the data were entered into an electronic spreadsheet on a microcomputer. Parts of this spreadsheet were then uploaded into the main-frame computer at Kansas State University for statistical analysis. (See Appendixes A and B).

The questionnaire was designed to gather supporting information about the nature of farming operations at and originating from the farmsteads, pesticides and VOCs used on the farm, waste disposal practices, characteristics of the well, problems, if any, that might be associated with the well and any other information which the cooperating scientists thought might influence water quality from the wells. Appendix B presents the responses of the nearly 300 questions asked on the questionnaire. The data were encoded with "1" meaning a positive response and "0" meaning a negative response for yes/no questions. The multiple answer questions were encoded on a scale with the worst case(s) condition (contamination factor considered high) given a low rating and and best case(s) receiving a high rating. For example, for soil type around the well the following scale was used: Clay - 25, Loam - 20, Silt - 15, Sand - 10, Gravel - 5. For other ratings see Table 8, Appendix A. Pesticides and VOCs were then collated each into a group with a "1" indicating positive occurrence, "0" a negative occurrence. All missing data were assigned a "." to signify no answer was reported.

Because two contaminated wells could not be confirmed at the time of testing, their corresponding observations were dropped from the analysis. In one well, contamination from lead was found. Upon further investigation the sample was determined in error because the sample was taken after softening was performed on the water. Two follow up samples showed no lead contamination but atrazine was then detected in this well. The other well had chloroform in the first sample, but after further investigation and sampling, it was determined this trihalomethane was not present due to natural contamination because the owner had chlorinated his well prior to testing.

Data Grouping

The data were collated into three major groupings for analysis. These groupings were geological water region, geographic region and precipitation region. The subparagraphs below describe these groupings.

1) Geological Water Regions (Figure 2): To allow water managers to assess possible regional water quality problems within the state, Kansas was divided into 14 groundwater regions. They are relatively homogeneous with respect to topographical, geological, land use and water use features and are similar to physiographic divisions presented in Schoewe (1953).

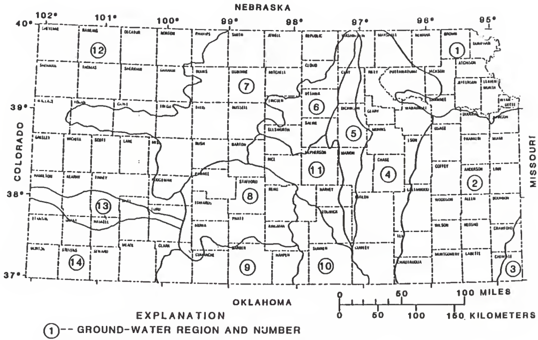


Figure 2. Map depicting geological water regions used in analysis of variance models.

2) Geographical Regions (Figure 3): The state was arbitrarily divided into six approximately equal parts of north east, south east, north central, south central, north west and south west. Counties were not subdivided between regions.

3) Precipitation Regions (Figure 4): The division was based on annual rainfall as follows: region 1 has less than 20.00 inches, region 2 has between 20.00 and 24.99 inches, region 3 has between 25.00 and 29.99 inches, region 4 has between 30.00 and 34.99 inches and region 5 has greater than 35.00 inches. The source of information was Climatic Data Summary for Kansas (1986) and Hjelmfelt and Cassidy (1975). As in the geographical regions, county boundaries remained intact.

RESULTS

Descriptive Statistics

The data from the survey questionnaires are recorded in Appendix B. A few pertinent results are presented below. Many more interesting facts about farmstead activities might be extracted from these data. However doing so is beyond the scope of this project.

Pertinent descriptive statistics follow: 24.3% of the wells were treated in some way (25 out of 102), 23.8% of well users have experienced difficulty with their septic tanks or lagoons (24 out of 101), 3.9% of owners did not

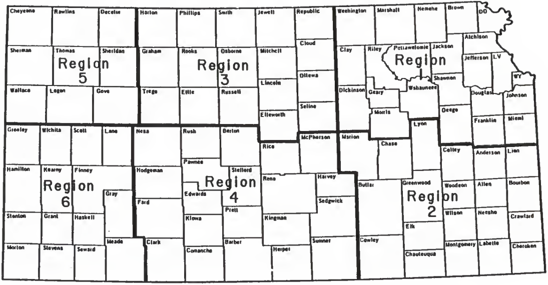
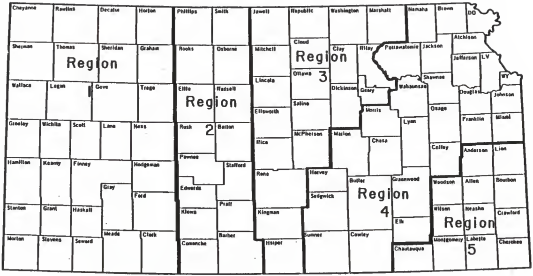


Figure 3. Map of geographic regions used in analysis of variance models.



LEGEND: Region	Ave. Precipitation (Inches)
1	15-20
2	21-25
3	26-30
4	31-35
5	35

Figure 4. Map of precipitation regions used in analysis of variance models.

drink from the well (4 out of 103).

Every farmer reporting used one or more pesticide on the farm. The most widely used herbicides were 2,4-D (78.6%), Atrazine (69.9%), Roundup (57.3%) and 2,4,5-T (32.0%) . The most commonly used pesticides were Furadan (43.7%) and Sevin (42.7%) by virtue of using fossil fuels on their farms, every farm used one or more VOCs. Other statistics are presented in Table 4.

Table 4. Miscellaneous Facts about the Wells.

NUMBER	MIN	MAX	MEAN	STDV
of persons drinking from well	0	13	3.64	2.11
of houses connected to well	0	3	1.10	0.41
of years in use	1	106	31.12	25.20

General characteristics of the wells are presented in the form of figures. Figure 5 is a relative frequency histogram for age of the well. Who constructed the well is shown in Figure 6. Grouting and well construction methods are depicted in Figures 7 and 8 respectively. The depths to water table, top of well screen and well bottom are presented in Figures 9, 10 and 11. Type of construction for the wells sampled agreed closely with census data compiled by Ott (1985). The census data report 19 percent were dug while 15 percent of the wells sampled were reported to be dug.

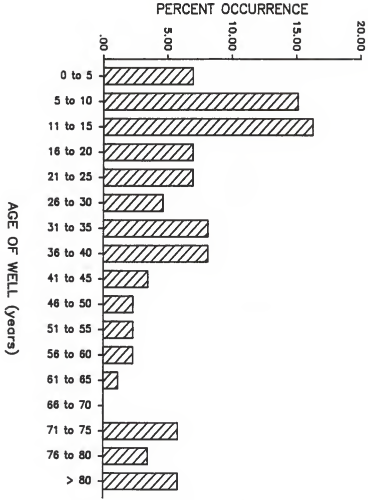


Figure 5. Relative frequency histogram for age of well.

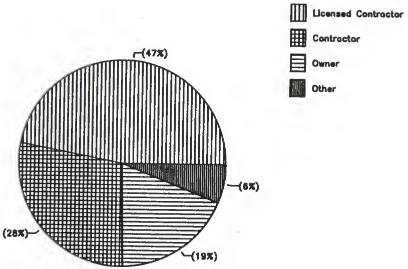


Figure 6. Pie chart for who constructed the well.

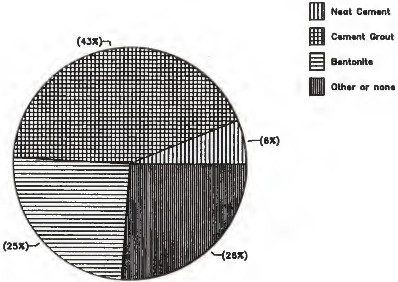


Figure 7. Pie chart for well grouting methods used.

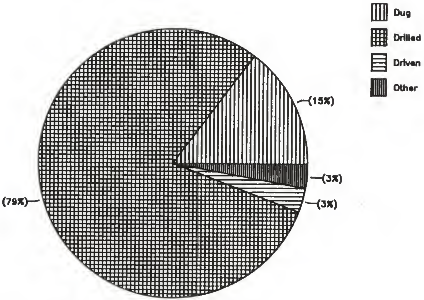


Figure 8. Pie chart for well construction method.

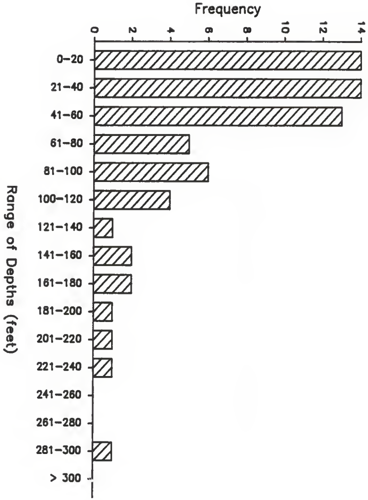


Figure 9. Frequency histogram for depth to water surface.

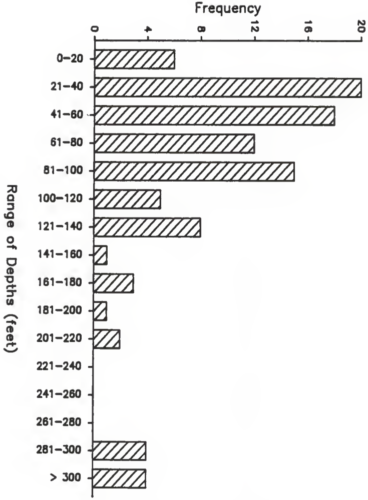


Figure 10. Frequency histogram for depth to top of well screen.

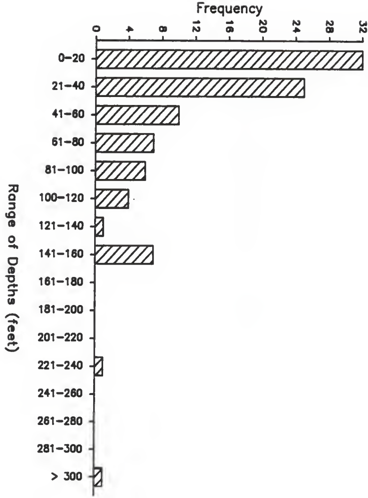


Figure 11. Frequency histogram for depth to bottom of well.

Water Quality Results

VOCs and pesticides were detected in several samples as shown in Table 5. Of the 104 wells sampled: 8 had detectable levels of pesticides present, 2 had detectable levels of VOCs and 38 had one or more inorganic chemicals exceeding MCLs established by the Environmental Protection Agency (1984). Figure 12 shows the geographical distribution of where the various contaminants of interest were found. For all but one of the wells samples with VOCs or pesticides, concentrations were below the KAL (Kansas Action Level--the level at which KDHE considers unacceptable for long-term consumption). All participants in the study received a copy of their well water quality analyses accompanied by an interpretation. In cases were KDHE considered the water quality to present a health concern or to be unacceptable as a drinking water supply, the users were so advised.

Table 5. Summary of Water Quality Analyses

	Number	Percentage	Confidence Coefficient[a]
Wells sampled	103	100	--
Wells with pesticide	8	8	±6%
Wells with VOC	2	2	±3%
Wells with inorganic chemicals exceeding MCL[b]	38	38	±9%

a. Confidence coefficients determined at alpha = 0.05
b. Maximum Contaminant Level as established by the National Interim Primary Drinking Water Standards for Public Drinking Water Supplies

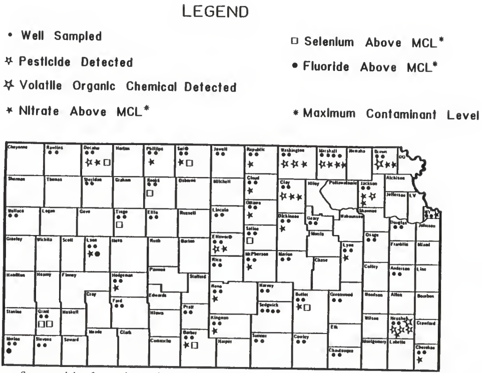


Figure 12. Geographic locations in Kansas of well sampled, wells with detectable amounts of VOCs and pesticides, and wells with inorganic chemicals exceeding MCL for public water supplies.

Tests of Differences

Homogeneity of Variances

After examining the data, the independent (response) variables, nitrate, selenium, pesticides, VOCs and chlorides were chosen for further observation. An inspection of the data indicated the variances of the comparison groups may not be homogeneous, thus violating assumptions for Analysis of Variance (ANOVA). Levine's test for homogeneity of variances (Milliken and Johnson, 1984) was chosen to test this hypothesis due to its robustness and sensitivity for large data sets. All dependent variables variances were found to be heterogeneous. Since the data was collected from a statewide sample with no attempt to control independent variables, it is not surprising the assumption of homogeneity did not hold for most comparisons. In many cases, missing data hindered statistical procedures because whole observations were automatically eliminated by the Statistical Analysis System (SAS, 1982) used on the mainframe computer.

Due to the heterogeneous variances, Satterwait's Approximation (Snedecor and Cochran, 1980) was used for two sample comparisons instead of the multiple comparisons normally provided by either analysis of variance (ANOVA) or general linear model (GLM) techniques. To determine the confidence level of these comparisons, Bonferroni's formula was effectively applied to yield a per comparison error rate or confidence level (Devore, 1982).

Nitrate

There were no differences in nitrate levels between water regions. Significant differences were found for geographic and precipitation regions. Figures 13 and 14 show these differences for geographical and precipitation regions. By using a significance level of 0.025 and Bonferroni's inequality for multiple comparisons, one may be at least 63 percent confident for the geographical and at least 75 percent confident for the precipitation regions that the differences are real.

It can be concluded that farmstead wells in the northeast, northcentral and southcentral regions have a higher probability of nitrate contamination than the remainder of the state.

GR6	GR5	GR2	GR4	GR3	GR1
5.05	5.57	5.75	9.06	11.61	14.98

Confidence Level = 0.63

Figure 13. Mean nitrate-N concentration (in mg/l) by geographic region. (underlined values are statistically equivalent)

PR1	PR5	PR2	PR4	PR3
5.46	5.48	6.31	9.54	14.41

Confidence Level = 0.75

Figure 14. Mean nitrate-N concentration (in mg/l) by precipitation region. (underlined values are statistically equivalent)

Selenium

There were no differences in selenium concentrations between water regions. Significant differences were found, however, for geographic and precipitation regions. Figures 15 and 16 show these differences for precipitation regions and geographic regions. This indicates that wells in the western part of Kansas may be more susceptible to contamination by selenium. By using the same significance level that was used for the nitrate, one may be at least 63 percent confident for the geographic and 75 percent confident for the precipitation regions that the differences are real.

GR2	GR1	GR4	GR5	GR3	GR6
.0014	.0020	.0021	.0034	.0103	.0141

Confidence Level = 0.63

Figure 15. Mean selenium concentration (in mg/l) by geographic region. (underlined values are statistically equivalent)

It can be concluded that farmstead wells in the south west and north central regions have a higher probability of contamination than the rest of the state. It can also be concluded that areas with average yearly rainfall less than 29.9 in. have a higher probability of selenium contamination than areas whose yearly rainfall is greater than 30.0 in..

PR5	PR4	PR3	PR1	PR2
.0006	.0017	.0032	.0088	.0150

Confidence Level = 0.75

Figure 16. Mean selenium concentration (in mg/l) by precipitation region.
(underlined values are statistically equivalent)

Tests For Correlation

Nitrate

Correlations were tested between nitrate and chlorides, nitrate and the presence of pesticides or VOCs, nitrate and distance to possible sources of organic contamination (PSOC), nitrate and the level (Relative elevation at ground level of the possible source of organic contamination compared to ground level of the well, 1 = lower, 3 = same, 1 = higher) of PSOC, nitrate and ammonia, and nitrate and Chlorides (omitting geographic region 3). Region 3 was eliminated from the last analysis due to the high natural chlorides in the soil. The results of these correlations are presented in Table 6.

Table 6. Results of Correlation Analyses.

VARIABLE	VARIABLE	CORRELATION COEFFICIENT
Nitrate	Chlorides	0.088
Nitrate	Chlorides[a]	0.157
Nitrate	Pesticides/VOCs	0.102
Nitrate	PSOC[a]	-0.120
Nitrate	Level[c]	0.062
Nitrate	Ammonia	-0.106
Selenium	Soil Type	-0.026

a. Geographic region 3 omitted.
b. Possible Source of Organic Contamination.
c. Level of PSOC.

Very weak correlations between nitrate and chlorides or PSOC indicate that high nitrate levels have very little linear relationship with possible human or animal waste contamination. Locations of feedlots, septic tank characteristics and drainage characteristics by themselves may not be strong predictors of possible nitrate contamination. The weak linear relationship between nitrate and pesticide/VOC levels indicates that high nitrate may not be an appropriate indicator for possible pesticide/VOC contamination. The fact that these data were collected as part of a random sample which was not planned for testing hypotheses must be kept in mind when judging the power of the statistical correlations in this study.

Selenium

The correlation computed between selenium content of water and soil type around the well yielded a correlation coefficient of -0.026. This indicates that there is almost no linear relationship between these two variables. Other correlations and regression analyses were run without any significant results. For predictors of selenium contamination in well water it is best to use either the geographic or precipitation regions as broad indicators.

Multiple Regression

Nitrate

To insure that every possible predictor variable was considered, the "all models" approach to regression analysis was used. The assumption was made that a new well should not be contaminated. Thus, only no intercept models were examined. Several models were significant at the 0.001 significance level. However, the best model included the age of the well (in years), land use around the well and the distance from the well to any possible source of organic contamination with the latter two being described in Table 8, Appendix B. This model is shown below.

$$\text{NITRATE} = 19.1509 + 0.0941(\text{AGE}) - 0.5091(\text{USE}) - 0.0108(\text{DPOC})$$

where:
Nitrate = NO_3-N, mg/l
Age = age of well, years
Use = rating of land use around the well (Table 8, Appendix B).
DPOC = Distance to nearest possible organic source in feet.

From this model one could predict that a well's water would contain 3.85 milligrams/liter from a well that was 30 years old, land use around the well was primarily pasture (a value of 25 from a set of values 1 to 30), and was 500 feet from a septic tank or a feedlot. This model was selected above its competitors based on it having one of the higher coefficients of correlation (R-SQUARE of 0.180), low mean square error and Logic.

Selenium

The average rainfall for each precipitation region was used as an independent variable to develop a prediction model. A simple regression was run and inches of precipitation (IP) was a significant variable at a 0.003 significance level. This model can be depicted as

$$SELENIUM = 0.0204 - 0.000569(IP).$$

From this model, an estimate of selenium would be 0.010 mg/l for a well in an area where the annual precipitation was 18 inches. This model's coefficient of correlation (r^2) is 0.090. Other than using the precipitation model as predictor, geographic regions 3 and 6 could be used as another way to identify wells that could exceed MCL for selenium.

DISCUSSION

Detailed results are shown in Table 7. Pesticides were found in eight percent of the wells sampled and VOCs in two percent. See Figures 17 and 18. The small number of wells contaminated by the chemicals resulted in low correlation coefficients and significance levels when a statistical analysis was performed. For example, four of the nine wells containing pesticides or VOCs were above the MCL for nitrate. Upon correlation analysis, the correlation coefficient (r_2) equaled 0.102. The herbicide atrazine was the only pesticide detected in more than one well. Atrazine was present in four wells. The other pesticides detected were 2,4-D, 2,4,5-T, tordon, chlordane, heptachlor epoxide and alachlor. Resampling, four to five months later confirmed the presence of these pesticides in each well with the exception of 2,4-D and 2,4,5-T where the well could not be sampled because the well had been abandoned and the pump removed. This also indicates their presence was relatively long term. According to CAST (1986), atrazine, 2,4-D, 2,4,5-T, and alachlor are thought to be slight to moderately mobile in soil environments. Of particular interest are heptachlor epoxide and chlordane which are considered immobile. Chlordane is injected into the soil around buildings to counteract termite infestations in part due to this immobility factor.

Table 7. Contaminants found in farmstead wells.[a]

Chemical	No. of Wells	Concentration Initial	Resample	MCL or KAL[b]
Nitrate-N (mg/l)	29	high=91	high=129	10 (MCL)
Selenium (ug/l)	9	high=56	--	10 (MCL)
Fluoride (mg/l)	2	high=2.3	--	1.8 (MCL)
Lead (mg/l)	1	64	ND[c]	50 (MCL)
Atrazine (ug/l)	4	high=7.4	high=40	88 (KAL)
2,4-D[c] (ug/l)	1	1.3	d	100 (MCL)
Tordon (ug/l)	1	5.6	3.3	175 (KAL)
Chlordane[e] (ug/l)	1	0.47	0.58	0.22 (KAL)
Heptachlor Epoxide[e] (ug/l)	1	0.026	0.023	0.006 (KAL)
Alachlor[f] (ug/l)	1	0.88	1.8	15 (KAL)
1,2-Dichloroethane[f] (ug/l)	1	0.90	1.6	5 (KAL)
Benzene (ug/l)	1	2.3	ND	5 (KAL)
Trichloromethane (ug/l)	1	0.6	ND	100 (MCL)

a. Contaminants were considered any synthetic chemical at any concentration and naturally occurring chemicals above the drinking water standards.
b. MCL is the Maximum Contaminant Level established by the National Primary Drinking Water Standards. KAL (Kansas Action Level) is the level at which KDHE considers the water unacceptable for long-term consumption.
c. Not Detected.
d. 2,4-D and 2,4,5-T were found in the same well.
e. This well could not be resampled as the pump had failed and was no longer in use.
f. Chlordane and heptachlor epoxide were found in the same well.
g. Alachlor and 1,2-dichloroethane were found in the same well.

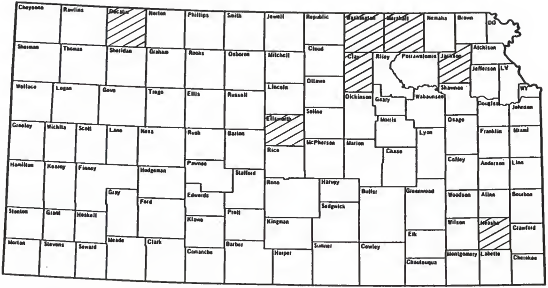


Figure 17. Map highlighting Kansas counties in which wells with pesticides were detected.

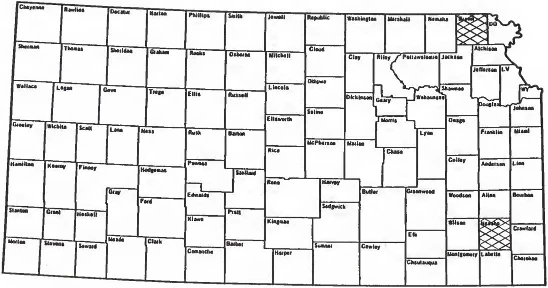


Figure 18. Map highlighting Kansas counties in which wells with detectable VOCs were found.

Two wells had detectable levels of VOCs. The chemicals found were benzene and 1,2-dichloroethane. Resampling confirmed only the presence of 1,2-dichloroethane. Since fuel spills near both of the wells were reported on the questionnaires, both wells are considered confirmed of containing VOCs due to activities surrounding the well. Trichloromethane at a concentration of 0.6 ug/l was measured at a different well. The questionnaire disclosed that the owner chlorinated his well on a regular basis. Resampling did not confirm the presence of this VOC. This well was not considered contaminated.

Nitrate was the most commonly found contaminant. See Figure 19. Nitrate-N was present in 29 wells at a concentration exceeding the MCL of 10 mg/l as N. In half of these wells the concentration exceeded 20 mg/l of nitrate-N. See Figure 20. The highest concentration found was 129 mg/l measured during resampling.

Selenium was the next most common contaminant. See Figure 21. Nine of the wells exceeded the MCL for selenium with the highest being over 5 times the MCL. See Figure 22. Another inorganic contaminant, fluoride, was detected to exceed the MCL twice.

Nitrate, selenium, fluoride and lead are naturally occurring inorganic constituents in groundwater. There are many sources of nitrate, natural and man-made.

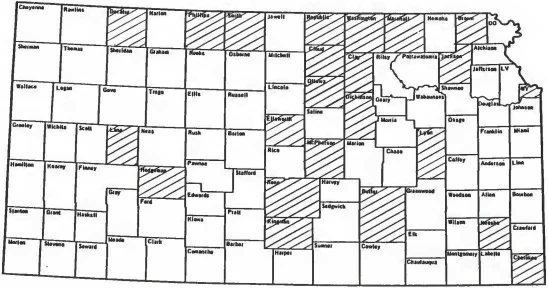


Figure 19. Map highlighting Kansas counties in which wells with nitrate-N greater than 10 ppm were found.

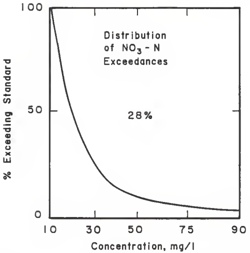


Figure 20. Distribution of nitrate-N exceeding 10 ppm in farmstead wells sampled.

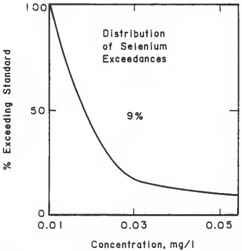


Figure 22. Distribution of selenium exceeding 0.001 ppm in farmstead wells sampled.

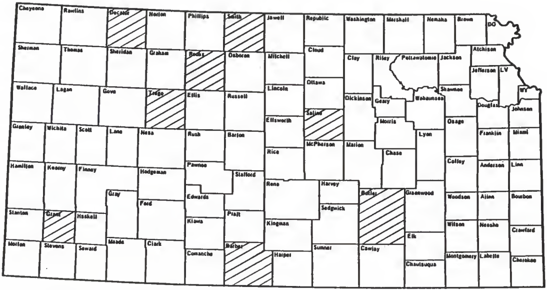


Figure 21. Map highlighting Kansas counties with wells exceeding MCL for selenium were found.

Contamination by septic tanks has been indicated by accompanying high chloride levels (Driscoll, 1986). Chloride and nitrate form anions that may have similar leaching properties in soils. In the sample 25% of high nitrate wells were high in chloride. Statistical analyses yielded a very low correlation coefficient of 0.102 and an insignificant F value at the 90% confidence level. Nitrogen fertilizer is another major source of nitrates. Its effect on nitrates and groundwater quality could not be estimated.

The high selenium and fluoride levels in the groundwater are likely due to naturally occurring soil and rock formations. Selenium levels are generally higher in exposed Cretaceous shales (Oldfield, 1986). If these shales are buried, this may lead to the elevated selenium levels in groundwater. In the statistical analyses soil type did not provide a correlation to give an indication of what soils to look for. Selenium levels in Kansas groundwater were exceeding MCLs in 9% of all wells sampled. These instances were located mainly in southwestern and northcentral Kansas with precipitation regions less than 31 being more likely to have wells with selenium problems (See Figure 18). Whether selenium contamination is a problem in Kansas is of debate. There are many proven instances of livestock problems determined to be due to selenium poisoning, but they have occurred at levels much higher than the MCL of 0.01 ppm. Most of these were caused by livestock eating plants higher than 5 ppm that grow in high selenium soils.

Initially, two wells were found to be contaminated lead above the MCL. It was determinned through discussion with the well users that water from both wells was highly corrosive and had passed through galvanized piping before reaching the sampling point. Careful resampling to minimize any effects of piping reveal no detectable levels of lead. Therefore lead was not considered a contaminant of the water in these wells.

The synthetic chemicals found in farmstead wells were certainly introduced by human activity. At the present time the actual sources of all these contaminants have not been determined. In the case of VOCs, the two occurrences were attributed to fuel spills near the well. For pesticides it is not known whether spills or normal agricultural application practices were responsible. Resampling of wells with pesticides or VOCs during May and June, 1986, usually resulted in equal or higher levels than the original samples taken during the winter months. Higher nitrate levels in spring months have been reported by Schwab (1987). This spring increase is thought to result from higher moisture levels in soils and the start of the chemical application season for many fertilizers and pesticides.

Several characteristics of the aquifer and well construction are important. Major factors studied in detail were soil type, depth to water table, depth to well screen, depth to well bottom, distance to potential contaminant sources, well history and well construction method. Factors found to correlate with nitrate contamination were well age, land use around the well and distance to a potential organic contaminant source. An older well is more likely to be contaminated. On land use around a well, pasture has a lower contamination potential than a feedlot or cropland. Distance to a possible organic contamination source is related to land use around a well. Proximity to feedlots and their accompanying wastes corresponds with distance to a water well. If the use around the well is farmyard then one is led to believe a septic tank system may be close by.

Statistical analyses performed to determine relationships between nitrate levels and the various well depths indicated no relationships present. A strong argument may be made for depth to water table but several outliers had the effect of rejecting this hypothesis. Examination of the outliers provided no significant conclusions as to the contamination sources. It is not surprising that many attempted correlations were unsuccessful, since the wells were selected at random without any attempt to concentrate on specific factors thought to cause groundwater contamination. The low correlation coefficients indicate many factors have an influence on groundwater quality and a complete model would be difficult to substantiate.

SUMMARY

The results in a random state-wide survey of 104 farmstead wells revealed that nitrate contamination is a widespread problem. Nitrate concentrations in excess of MCL was observed in 29 wells. Half of these high nitrate wells were over two times MCL. Other inorganic contaminants in exceedance of MCL were found in 9 of the wells.

Wells in the north east, north central and south central regions of Kansas have a higher probability of nitrate contamination. Multiple regression was performed on all predictor variables with a "all models" approach. The best model for nitrate has the variables: age of well, land use around the well and the distance to any possible source of organic contamination.

For selenium it can be concluded that south west and north central regions have a higher probability of contamination. Areas with average rainfall less than 30 inches are more likely to be contaminated.

Wells containing detectable amounts of VOCs and pesticides numbered two and eight percent respectively. Atrazine was the most commonly found pesticide, occurring in four wells. In the case of VOCs, fuel spills are attributed as the cause.

SUGGESTIONS FOR FURTHER RESEARCH

The goal of KDHE is to protect the health of all Kansans. This project was started because of KDHE personnel's concern about finding a few farm wells contaminated with VOCs. KDHE needed data from farm wells to determine extent of the problem and determine a way to help people on farmsteads be assured their drinking water was safe. When this project was conceived, two separate objectives were considered. The first was to obtain a best estimate of the level of contamination for determining the extent of the problem. The second objective was to identify factors which put wells at risk of being or becoming contaminated. No approach, considering the limitations of funds for the study, would give the complete answer to both objectives. We chose to get the best estimate first because so little was known about the extent of contamination.

Our results show that water from 1,200 to 6,000 of the 40,000 farmstead wells in Kansas have detectable amounts of pesticides in them. From none to 2,000 probably yield water with detectable amounts of VOCs and from 14,000 to 28,000 wells provide water with nitrate concentrations above the MCL. Many of these wells should be tested to determine if concentrations of these materials are above safe levels. Thus, the second objective should be studied to determine ways to identify the wells that should be tested. This information would aid KDHE in using its limited funds and laboratory capabilities to best advantage and to provide a basis for a public education program for farmstead and rural residents about water quality from private wells.

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Appendix A.
Survey Questions and Descriptive Statistics

Introductory Comments

Appendix A. consists of two parts. The actual survey questions and summary statistics in the first part. Table 9. is in the end.

Ordering of actual questions is in the way presented to survey participants. These questions were grouped into sections by type. A Page/Column offset identifies the corresponding column in Appendix B. These were used in the initial data gathering phase to identify page and column from which the computer operator read data. For Yes/No questions, the statistics given were number responding to the question (N) and percent responding yes. The minimum, maximum, mean and median were given for quantitative questions. Other questions are in logical fashion, if feasible.

These questionnaires were filled were filled out by a wide variety of participants. Many questions were left unfilled and these have a "." (missing data) in Appendix B. Multiple choice questions often had half or more responses marked. Given the above facts, it is not surprising some statistics made little logical sense (esp. Pesticide/Herbicide Data).

Table 9. follows this first part to show how the data were grouped for statistical analysis. Multiple questions were grouped in order of highest to lowest contamination potential. Other question types were grouped in a similar manner. These values are <u>not</u> reflected in the actual data presented in Appendix B.

FARMSTEAD CHARACTERISTICS:

Page/ Column	Question	Answers and/or Values
1 1	Geological Water Region.	Range = 1-14.
1 2	Number living on farmstead?	Number = 102, Minimum = 1, Maximum = 9 and Mean = 3.9.
1 3	Do you drink from the well?	1 = Yes (96%,N=102), 0 = No.
1 4	Is the water treated before use?	1 = Yes (25%,N=102), 0 = No.
1 5	Number that regularly drink water from the well.	Number = 103, Minimum = 0, Maximum = 13 and Mean = 3.6.
1 6	Number of households connected to the well.	Number = 103, Minimum = 0, Maximum = 3 and Mean = 1.1.

If you raise livestock, indicate the approximate number of each.

		Number	Min.	Max.	Mean	Median
1 7	Number of cattle.	81	10	1000	173	100
1 8	Number of hogs.	23	4	10000	1118	200
1 9	Number of dairy cattle.	5	70	325	157	70
1 10	Number of poultry.	15	7	40000	3361	24
1 11	Number of sheep.	8	6	1000	233	90

If you raise grain or forage, indicate approximate number of each.

		Number	Min.	Max.	Mean	Median
1 12	Acres of wheat.	95	30	1800	385	290
2 1	Acres of soybeans.	44	10	600	129	80
2 2	Acres of corn.	26	5	700	181	100
2 3	Acres of hay.	75	5	500	84	50
2 4	Acres of sorghum.	81	10	1400	274	200
2 5	Acres of other crops.	21	25	225	76	50
2 6	Acres of range/pasture.	89	0	4750	661	330

TOPOGRAPHY, SOIL CHARACTERISTICS, AND LAND USE AROUND THE WELL:

Page/ Column	Question	Answers and/or Values
2 7	Does water ever stand or pool around the well?	1 = Yes (11%,N=102), 0 = No.
2 8	What is the lie of the land near the well?	5 = higher than farmstead area, 3 = about the same level and 1 = lower than farmstead area.
2 9	Term that best describes the soil type near well.	1 = sandy, 2 = silty, 3 = gravelly, 4 = clayey, 5 = loamy and 6 = other.

Note: These are actual survey questionnaire values. Values in the questionnaire table are revised to Table 9 specifications.

TOPOGRAPHY, SOIL CHARACTERISTICS, AND LAND USE AROUND THE WELL(continued):

Page/ Column	Question	Answers and/or Values
2 10	Term that best describes the land use around well.	1 = cropland, 2 pasture or grass, 3 = dry lot, paved lot with surface of: 4 = concrete, 5 = gravel, 6 = asphalt, 7 = farm yard, 8 = feed lot, and 9 = other

Note: These are actual survey questionnaire values. Values in the questionnaire table are revised to Table 9 specifications.

HOUSEHOLD WASTEWATER DISPOSAL METHODS:

For 2/11 to 3/5:

1 = septic tank to open ground, 2 = septic tank with laterals,
3 = septic tank to seepage pit, 4 = open ground,
5 = cesspool 6 = lagoon and "." = no answer.

Page/ Column	Question	Answer 1	2	3	4	5	6	"."
2 11	Sink water.	27	37	1	18	7	7	4
2 12	Dishwater.	21	25	3	14	7	6	27
3 1	Garbage disposal.	7	13	1	3	2	2	75
3 2	Clothes washing machine.	23	26	6	33	5	7	3
3 3	Bath/shower(s).	24	43	6	15	6	7	2
3 4	Toilet(s).	26	47	7	6	19	7	1
3 5	Water softener backwash.	13	12	4	9	2	4	59

3 6	Number of years the disposal method has been in service.	Highest response given for any one of the above disposal methods (6 blanks). Number = 99, Minimum = 3, Maximum = 75 and Mean = 27.
3 7	Have you had difficulty with your waste disposal system?	1 = Yes (24%,N=100), 0 = No.
3 8	Use of septic cleaning aide or chemicals.	1 = Yes (17%N=98), 0 = No.

PROXIMITY TO OTHER FARM USAGE AREAS:

Question: Give the distance as well as you can to the following structures and activities at your farmstead if they are within about a quarter of a mile of your well. Check whether activity is on higher ground, lower ground or the same level as the well. Write NA in distance column for any which are not applicable.

Ratings: Area = Structure or activity:
Answer in table = distance in feet.
Level:
1 = lower, 3 = same and 5 = higher.
NA = "."

PROXIMITY TO OTHER FARM USAGE AREAS (Continued):

Legend:

Page/ Column	Area	Number	Min.	Max.	Mean	Median
3 9	Farm house.	97	5	4000	218.5	80
3 10	Level.	99	1	5	3.3	
3 11	Garden.	81	0	4000	259.6	110
3 12	Level.	83	1	5	2.7	
4 1	Farm shop.	89	10	4000	309.5	150
4 2	Level.	90	1	7	3.0	
4 3	Cattle feed lot.	71	10	4000	337.4	200
4 4	Level.	73	1	5	2.2	
4 5	Swine building.	24	30	1000	314.6	200
4 6	Level.	23	1	5	2.5	
4 7	Swine pen.	20	50	1000	305.0	190
4 8	Level.	20	1	5	1.8	
4 9	Poultry building.	20	30	1000	194.3	150
4 10	Level.	22	1	5	2.5	
4 11	Insecticide storage.	45	3	2700	366.3	200
4 12	Level.	43	1	5	2.7	
5 1	Poultry pens.	8	60	500	156.0	110
5 2	Level.	9	1	5	2.8	
5 3	Herbicide storage.	41	10	1500	286.5	200
5 4	Level.	41	1	5	2.8	
5 5	Soil trt. chemicals.	22	50	1500	409.3	275
5 6	Level.	23	1	5	2.6	
5 7	Fuel, above ground	86	30	4000	347.0	200
5 8	Level.	89	1	5	2.6	
5 9	Fuel, below ground	19	50	500	215.8	175
5 10	Level.	17	1	5	2.4	
5 11	Dairy.	5	10	1000	432.0	200
5 12	Level.	6	1	3	1.7	
6 1	Railroad right of	18	300	5280	1013.0	2250
6 2	Level.	15	1	5	1.8	
6 3	Fertilizer storage	17	75	40000	2617.1	200
6 4	Level.	17	1	5	2.6	
6 5	Machinery wash area.	57	6	1500	297.6	250
6 6	Level.	55	1	5	2.4	
6 7	Livestock insct. dip.	9	3	400	175.9	140
6 8	Level.	8	1	5	2.0	
6 9	Grain storage.	77	10	2000	20.8	250
6 10	Level.	77	1	5	2.4	
6 11	Drainage ditch.	51	10	1000	232.5	180
6 12	Level.	47	1	5	1.5	
7 1	Private waste dump	17	100	3000	982.4	1000
7 2	Level.	16	1	5	2.3	
7 3	Septic tank to ops.	34	45	1200	309.0	200
7 4	Level.	34	1	5	1.7	
7 5	Septic tank/latera	51	30	1800	277.3	175
7 6	Level.	50	1	5	2.1	
7 7	Septic tank/seepage	11	50	1200	453.2	250
7 8	Level. pit.	11	1	5	2.1	
7 9	Public landfill.	7	3000	90000	35182.9	36000
7 10	Level.	5	1	5	2.2	

PROXIMITY TO OTHER FARM USAGE AREAS (Continued):

Legend:

Pege/ Column	Area	Number	Min.	Mex.	Mean	Medien
7 11	Weete legoon.	12	50	500	256.3	250
7 12	Level.	12	1	5	1.5	
8 1	Cesspool.	16	40	1200	229.7	105
8 2	Level.	14	1	5	1.4	
8 3	Privy.	10	50	1200	237.0	105
8 4	Level.	9	1	3	1.7	
8 5	Cietern.	9	10	1200	257.8	100
8 6	Level.	8	1	5	2.8	
8 7	Abandoned well.	34	10	2500	291.4	100
8 8	Level.	31	1	5	2.7	
8 9	Crude oil tenke.	7	450	5280	1904.3	1200
8 10	Level.	5	1	5	3.0	
8 11	Oil well.	12	300	5280	1767.5	1200
8 12	Level.	9	1	5	3.2	
9 1	Oil pipeline.	12	45	5280	1634.6	1100
9 2	Level.	9	1	5	3.0	
9 3	Gae well.	4	750	2500	1612.5	1600
9 4	Level.	4	1	5	3.5	
9 5	Gee pipeline.	17	0	3200	610.9	150
9 6	Level.	16	1	5	2.4	
9 7	Upright eilo.	24	70	1000	388.8	330
9 8	Level.	25	1	5	2.2	
9 9	Trench silo.	29	50	1500	631.9	500
9 10	Level.	28	1	5	2.0	
9 11	Menure pile.	22	90	1200	372.0	250
9 12	Level.	22	1	5	1.9	
10 1	Public roed.	85	20	1600	406.7	250
10 2	Level.	83	1	5	2.9	
10 3	Induetriel ectivity.	4	50	90000	23372.5	1720
10 4	Level.	4	3	5	3.5	
10 5	Electric trensformer.	93	10	1600	219.6	125
10 6	Level.	88	1	5	2.8	
10 7	Dairy weeh dispoeal.	6	100	1200	483.3	200
10 8	Level.	6	1	3	1.7	
10 9	Cettle pens (coral).	71	5	1600	285.5	250
10 10	Level.	69	1	5	2.2	
10 11	Other ________.	5	36	400	203.2	50
10 12	Level.	5	1	5	2.2	

PAST PRACTICES ANO EVENTS:
Peet Oiepoeel Methode For The Following:

For 11/1 to 11/11:
1 = Hed it heuled off the farm,
2 = epreed on ground or road,
3 = poured into a pit,
4 = ferm tresh dump,
5 = burned end
6 = other (specify).
"." = No anewer given.

PAST PRACTICES AND EVENTS (continued):

Number of above values for following questions.

Page/ Column	Question	Answer 1	2	3	4	5	6	"."
11 1	Motor Oil.	7	67	0	2	10	11	6
11 2	Paint.	18	11	2	20	7	3	41
11 3	Paint thinners.	10	21	2	17	7	5	41
11 4	Degreasers.	9	31	0	12	10	2	41
11 5	Bad fuel.	8	18	0	8	22	2	45
11 6	Insecticides.	28	7	1	18	5	6	32
11 7	Empty insecticide containers.	40	1	1	26	12	4	19
11 8	Herbicides.	30	6	0	20	5	5	37
11 9	Empty herbicide containers.	41	1	1	27	12	2	19
11 10	Household trash.	22	1	0	26	38	0	16
11 11	Other wastes.	5	0	0	3	2	0	93

Distance of disposal area from well in feet (if less than 1/4 mile):

Page/ Column	Question	Answers and/or Values Number	Min.	Max.	Mean
11 12	Had it hauled off the farm.	9	6	2500	790
12 1	Spread on ground or road.	20	50	1300	336
12 2	Poured into a pit.	1	600	600	600
12 3	Farm trash dump.	16	150	5280	1174
12 4	Burned.	22	20	2500	573
12 5	Other (specify).	2	600	2500	1550

HERBICIDES AND PESTICIDES:

Question: If you have used herbicides or pesticides, please check appropriate box. Please indicate by checking the appropriate box whether the material by yourself or by a commercial service or cont or outsider.
Ratings: 1 = Yes, 0 = No.

Page/ Column	Question	Statistics
12 6	Lasso (alachlor)	(34%, N=103)
12 7	Application by self?	(25%, N=103)
12 8	Application by other?	(14%, N=103)
12 9	Atrazine (aatrex)	(70%, N=103)
12 10	Application by self?	(50%, N=102)
12 11	Application by other?	(30%, N=102)
12 12	Dual (metachlor)	(30%, N=102)
13 1	Application by self?	(22%, N=102)
13 2	Application by other?	(16%, N=103)
13 3	Milogaurd (propazine)	(30%, N=103)
13 4	Application by self?	(16%, N=103)
13 5	Application by other?	(18%, N=103)
13 6	Ramrod (propachlor)	(24%, N=103)
13 7	Application by self?	(16%, N=103)

HERBICIDES AND PESTICIDES (continued):

Page/ Column	Question	Statistics
13 8	Application by other?	(12%, N=103)
13 9	Sencor, Lexone (metribuzin)	(24%, N=103)
13 10	Application by self?	(20%, N=102)
13 11	Application by other?	(7%, N=102)
13 12	Silvex (2,4,5-TP)	(6%, N=103)
13 13	Application by self?	(5%, N=103)
14 1	Application by other?	(0%, N=103)
14 2	2,4-D	(79%, N=103)
14 3	Application by self?	(71%, N=103)
14 4	Application by other?	(26%, N=103)
14 5	Treflan (trifluralin)	(34%, N=102)
14 6	Application by self?	(27%, N=102)
14 7	Application by other?	(12%, N=103)
14 8	Princep (simazine)	(7%, N=103)
14 9	Application by self?	(5%, N=103)
14 10	Application by other?	(2%, N=103)
14 11	Bladex (cyanazine)	(11%, N=103)
14 12	Application by self?	(5%, N=103)
15 1	Application by other?	(4%, N=103)
15 2	Roundup (glyphosate)	(57%, N=103)
15 3	Application by self?	(48%, N=102)
15 4	Application by other?	(12%, N=102)
15 5	Paraquat	(7%, N=103)
15 6	Application by self?	(2%, N=103)
15 7	Application by other?	(6%, N=103)
15 8	Eradicane (EPTC)	(15%, N=103)
15 9	Application by self?	(12%, N=103)
15 10	Application by other?	(4%, N=103)
15 11	Banvel (dicamba)	(35%, N=103)
15 12	Application by self?	(31%, N=103)
16 1	Application by other?	(5%, N=103)
16 2	Sutan + (butylate)	(9%, N=103)
16 3	Application by self?	(10%, N=103)
16 4	Application by other?	(2%, N=103)
16 5	Tordon	(26%, N=103)
16 6	Application by self?	(20%, N=103)
16 7	Application by other?	(5%, N=103)
16 8	Lorox (linuron)	(0%, N=103)
16 9	Application by self?	(0%, N=103)
16 10	Application by other?	(0%, N=103)
16 11	Prowl (pendimethalin)	(3%, N=103)
16 12	Application by self?	(3%, N=103)
17 1	Application by other?	(1%, N=103)
17 2	Dacthal	(7%, N=103)
17 3	Application by self?	(7%, N=103)
17 4	Application by other?	(0%, N=103)
17 5	Others	(4%, N=103)
17 6	Application by self?	(2%, N=103)
17 7	Application by other?	(2%, N=103)
17 8	2,4,5-T	(32%, N=103)
17 9	Application by self?	(28%, N=103)
17 10	Application by other?	(5%, N=103)

HERBICIDES AND PESTICIDES (continued):

Page/ Column		Question	Statistics
17	11	Thiodan (endosulfan)	(0%, N=103)
17	12	Application by self?	(0%, N=103)
18	1	Application by other?	(0%, N=103)
18	2	Lintox (lindane)	(7%, N=103)
18	3	Application by self?	(7%, N=103)
18	4	Application by other?	(1%, N=103)
18	5	Marlate (methoxychlor)	(4%, N=103)
18	6	Application by self?	(4%, N=103)
18	7	Application by other?	(1%, N=103)
18	8	Parathion	(27%, N=103)
18	9	Application by self?	(3%, N=103)
18	10	Application by other?	(24%, N=103)
18	11	Strobane T (toxaphene)	(5%, N=103)
18	12	Application by self?	(5%, N=103)
19	1	Application by other?	(0%, N=103)
19	2	Cythion (malathion)	(15%, N=103)
19	3	Application by self?	(15%, N=103)
19	4	Application by other?	(2%, N=103)
19	5	Temik (aldicarb)	(1%, N=103)
19	6	Application by self?	(0%, N=103)
19	7	Application by other?	(0%, N=103)
19	8	Sevin (carbaryl)	(43%, N=103)
19	9	Application by self?	(41%, N=102)
19	10	Application by other?	(6%, N=102)
19	11	Furadan (carbofuran)	(44%, N=103)
19	12	Application by self?	(33%, N=102)
20	1	Application by other?	(12%, N=101)
20	2	Lead arsenate	(3%, N=103)
20	3	Application by self?	(2%, N=103)
20	4	Application by other?	(1%, N=103)
20	5	Pounce (permethrin)	(1%, N=103)
20	6	Application by self?	(0%, N=103)
20	7	Application by other?	(1%, N=103)
20	8	Thimet (phorate)	(9%, N=103)
20	9	Application by self?	(11%, N=103)
20	10	Application by other?	(3%, N=103)
20	11	Agrotox (trichloronate)	(1%, N=103)
20	12	Application by self?	(1%, N=103)
21	1	Application by other?	(0%, N=103)
21	2	Kepone (chlordecone)	(0%, N=103)
21	3	Application by self?	(0%, N=103)
21	4	Application by other?	(0%, N=103)
21	5	Rotenone	(4%, N=103)
21	6	Application by self?	(4%, N=103)
21	7	Application by other?	(0%, N=103)
21	8	Lorsban	(11%, N=103)
21	9	Application by self?	(10%, N=103)
21	10	Application by other?	(2%, N=103)
21	11	Counter	(8%, N=103)
21	12	Application by self?	(8%, N=103)
22	1	Application by other?	(0%, N=103)
22	2	Spectracide (diazinon)	(8%, N=103)

HERBICIOES AND PESTICIOES (continued):

Page/ Column	Question	Statistics
22 3	Application by self?	(8%, N=103)
22 4	Application by other?	(1%, N=103)
22 5	Miticide (methidetion)	(5%, N=103)
22 6	Applicetion by self?	(4%, N=103)
22 7	Application by other?	(1%, N=103)
22 8	Endrin	(4%, N=103)
22 9	Application by self?	(4%, N=103)
22 10	Applicstion by other?	(0%, N=103)
22 11	Aldrin	(8%, N=103)
22 12	Applicetion by self?	(8%, N=103)
23 1	Application by other?	(0%, N=103)
23 2	OOT	(13%, N=103)
23 3	Application by self?	(14%, N=103)
23 4	Application by other?	(2%, N=103)
23 5	Chlorodane	(21%, N=103)
23 6	Application by self?	(25%, N=103)
23 7	Application by other?	(5%, N=103)
23 8	Oieldrin	(7%, N=103)
23 9	Application by aelf?	(7%, N=103)
23 10	Application by other?	(0%, N=103)
23 11	Dthers	(8%, N=103)
23 12	Application by aelf?	(8%, N=103)
24 1	Application by other?	(2%, N=103)

HERBICIOES AND PESTICIOES (other queations):

Page/ Column	Queation	Answers and/or Values Number	Min.	Max.	Mean	Median
24 2	Oiatence from well to preperation erea (feet)?	78	0	4000	475	200
24 3	Oiatence from well to container washing aree (feet)?	64	0	5000	556	200
24 4	Diatance from well to diapoael eree for excess and containers (feet)?	49	0	5280	2143	1325

24 5 Is grain atored on ferm? 1 = Yss (78%,N=102), 0 = No

24 6 Typs of storege? 1 = steel bins with concrete floor (64%), 2 = wood bin with wood floor (8%), 3 = other (7%) and "." = miasing deta (21%).

24 7 Capacity (in buahela)? Number = 78, Minimum = 200, Maximum = 100000 and Mean = 14735.

24 8 Is it a custom to treat stored grein with fumigents of inaecticidea? 1 = Yes (54%,N=81), 0 = No.

CHARACTERISTICS OF THE HOUSEHOLD WELL:

Page/ Column	Question	Answers and/or Values
24 9	How was the well constructed?	1 = dug (15%), 2 = drilled (79%), 3 = driven (3%), 4 = other (0%), 5 = unknown (3%) and "." = (1%).
24 10	Year the well was constructed.	Number = 88, Minimum = 1, Maximum = 106 and Mean = 31.
24 11	Who constructed the well?	1 = licensed contractor (38%), 2 = contractor (23%), 3 = owner (16%), 4 = other (4%) and "." = (19%).
24 12	What casing material was used?	1 = plastic pipe: (type if known 5 = PVC, 6 = ABS and 7 = RMP), 2 = fiberglass, 8 = steel or iron, 4 = galvanized metal, 3 = concrete, 11 = asbestos-cement 9 = stone, 10 = brick 12 = none and 13 = other.
25 1	What grouting method was used?	1 = neat cement (4%), 2 = cement (28%), 3 = bentonite (17%), 4 = none (0%), 5 = other (15%) and "." = (37%).
25 2	To what depth does the grout extend (feet)?	Number = 32, Minimum = 0, Maximum = 145 and Mean = 25.5
25 3	How is the well protected at the surface?	1 = well house or shed, 2 = concrete pad, 3 = sanitary seal, 4 = covered pit, 5 = wooden cover and 6 = other.

Page/ Column	Question	Number	Min.	Max.	Mean	Median
25 4	How deep is it to the water surface (feet)?	94	4	360	54	40
25 5	How deep is it to the top of the well screen (feet)?	66	5	360	73	46
25 6	How deep is it to the bottom of the well (feet)?	97	14	450	96	65

Page/ Column	Question	Answers and/or Values
25 7	What type of pump is used in the well?	1 = submersible(68%), 2 = jet(22%), 3 = centrifugal (6%), 4 = hand (1%) and 5 = windmill (3%).

CHARACTERISTICS OF THE HOUSEHOLD WELL:

Page/ <u>Column</u>	<u>Question</u>	<u>Answers and/or Values</u>
25 8	Have you experienced any problem with your water?	1 = none, 2 = taste, 3 = odor, 4 = discoloration, 5 = cloudiness, 6 = ran dry and 7 = other. <u>Note</u>: Combinations of the above answers were added together.
25 9	Have you had reason in the past to test your well? water?	1 = Yes (39%,N=98), 0 = No.
25 10	Maximum capacity of well (gallons/minute)?	Number = 62, Minimum = 3, Maximum = 100 and Mean = 19.
25 11	Have there been any known times when the well was contaminated directly by back-siphon, back pressure, etc.?	1 = Yes (4%,N=100), 0 = No.

Table 8. Actual values from questions and revised rating scales.[a]

Variable: Answer	Actual Value	Rating	Answer	Actual Value	Rating
Casing material:					
plastic pipe	1 & 5-7	30	fiberglass	2	28
steel or iron	8	22	galvanized metal	4	20
concrete	3	15	asbestos-cement	11	12
stone	9	6	brick	10	5
none	12	0	other	13	0
Soil type surrounding the well:					
clay	4	25	loamy	5	20
silt	2	5	sand	1	10
gravel	3	0	other	.	.
Grouting method:					
cement	1 & 3	20	bentonite	4	15
other	5	10	none	2	5
Surface protection:					
sanitary seal	4	25	well house	1	20
concrete pad	2	15	covered pit	8	10
wooden cover	16	5	other	32	5
Water problems:					
none	1	20	well ran dry	6	15
taste	2	10	odor	3	8
cloudiness	5	4	discoloration	4	4
other	7	4			
Land use around well:					
pasture or grass	4	30	farmyard	3	25
paved lot	2 & 7-9	20	cropland	1	15
drylot	6	10	feedlot	5	5
Who constructed the well:					
licensed contractor	1	1	contractor	2	0
other	4	0	owner	3	0
Distance to possible organic contaminant source:[b] (mean=246,median=150) septic tank to open field. septic tank with laterals. septic tank with a seepage pit. feedlot. waste lagoon. cesspool. privy. manure pile.					
Level with respect to well:					
higher	5	1	same	3	3
lower	1	5			
Water pooling around the well:					
yes	1	0	no	0	1
Well construction method:					
dug	1	0	drilled	2	1
driven	3	1	other	4	1
unknown	5	.			

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a. The rating scales are designed to minimize negative regression effects in conjunction with well depths (greater depths are considered less likely to be contaminated), distances (further away is less likely to cause contamination), and judgment factors (greater values are considered less likely to cause contamination). All missing data are represented by an ".".

b. The closest occurrence of any of these was chosen.

Appendix B.
Tabulated Data From Survey Questionnaires

Pg/Col Obs#	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100				120	[illegible]	90	170	50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	150					[illegible]	350	100	300	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40					[illegible]		6	35	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					1000	[illegible]	30	250		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70	250				[illegible]	300		100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200					[illegible]			80	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250					[illegible]				[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	700					[illegible]			100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2000	200				[illegible]			100	[illegible]	160	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1000					[illegible]			350	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600					[illegible]			100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]			225	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100			12		[illegible]			50	[illegible]	50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200				6	[illegible]	40	40	30	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40					[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	125		325			[illegible]				[illegible]	75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200	3500				[illegible]	40		40	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60					[illegible]			40	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				30		[illegible]		80		[illegible]	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75	4				[illegible]	100			[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80					[illegible]			32	[illegible]	25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50			25		[illegible]			30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50					[illegible]			60	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	240	8				[illegible]			160	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	450					[illegible]	80			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		300				[illegible]	45		15	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	150					[illegible]			60	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1000	300				[illegible]	300	700		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200					[illegible]	310	462	30	[illegible]	116	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50					[illegible]	200	50		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60					[illegible]	50			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200	10000				[illegible]			100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		1200				[illegible]		100	500	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75					[illegible]			160	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	125			40000		[illegible]			150	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10					[illegible]		5	5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200					[illegible]	50		20	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25	100				[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	35		19	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60	150		20		[illegible]	10	550		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
43	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]				[illegible]	34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	150					[illegible]	400	600		[illegible]	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200	200				[illegible]	40	80	200	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100					[illegible]	30		50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50	800				[illegible]	100		30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
49	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75					[illegible]	40	170	30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	300					[illegible]			30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]			90	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200					[illegible]	50	250		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
53	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]			50	[illegible]	50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
54	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	140	200	70			[illegible]			90	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400					[illegible]			25	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200					[illegible]		60		[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
57	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	150			10000		[illegible]	30	100	75	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
58	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200		140			[illegible]			120	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200		150			[illegible]	60	80	140	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
61	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30					[illegible]	400	400	200	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	100			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
63	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100			20		[illegible]	50			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40					[illegible]			60	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100				40	[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60					[illegible]			240	[illegible]	225	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100			12		[illegible]			40	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400				300	[illegible]			25	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50	900				[illegible]		150		[illegible]	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25			40		[illegible]	100			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	300	25				[illegible]				[illegible]	50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		2000				[illegible]	20		20	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250	5000		50		[illegible]	200		20	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250			25		[illegible]		20	40	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	125					[illegible]			80	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		320				[illegible]			62	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25					[illegible]	30		34	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	160					[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	300					[illegible]	85		133	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100					[illegible]			40	[illegible]	50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60					[illegible]	10		195	[illegible]	200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50					[illegible]			30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
85	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50					[illegible]			25	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15					[illegible]	100	100	8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		80		7		[illegible]	200	39	7	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20	20		100		[illegible]	50			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				24		[illegible]	12			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600	4		50		[illegible]			280	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20					[illegible]			50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					60	[illegible]	166		50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	300		15	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	200		30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		150			40	[illegible]	600		160	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	50			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					300	[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]			100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100					[illegible]	150	100	60	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			100			[illegible]		40		[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
102	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400					[illegible]			100	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
103	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Pg/Col Obs#	2/11	2/12	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	5/1
1	5	5	.	4	4	5	.	.60	1	1	90	3	20	3	.	.	150	1	.	.	.	.	.	.	100	1	.
2	5	4	.	3	2	2	.	.52	0	1	200	3	20	3	220	5	30	3	.	.	.	.	.	.	.	.	.
3	2	.	.	2	2	2	.	.27	0	0	280	3	20	3	20	5	300	3	.	.	.	.	.	.	300	5	.
4	2	2	2	2	2	2	.	.35	.	0	150	5	50	3	300	5	150	5	.	.	.	.	.	.	.	.	.
5	2	.	.	1	1	1	.	.	0	0	50	5	.	.	360	3	500	1	.	.	.	.	.	.	.	.	.
6	1	.	.	1	1	1	1	.25	0	0	15	5	.	.	70	3	500	1	750	3	400	1	.	.	70	3	.
7	1	1	1	2	2	2	.	.30	1	0	5	5	.	.	50	3	400	3	.	.	.	.	.	.	.	.	.
8	2	2	2	2	2	2	2	.43	1	0	20	3	300	3	300	3	150	3	.	.	.	.	.	.	400	3	.
9	.	5	.	2	2	2	.	.34	0	0	120	3	50	3	300	1	300	3	.	.	.	.	.	.	300	1	.
10	4	5	5	3	3	3	4	.10	0	0	1000	5	1000	5	1000	3	1000	1	.	.	1000	5	.	.	1000	3	.
11	5	4	5	3	3	3	.	.20	0	0	1000	5	1000	3	200	3	150	3	.	.	.	.	.	.	.	.	.
12	4	5	5	5	5	5	4	.26	0	0	30	3	60	3	180	3	.	.	.	.	.	.	.	.	.	.	.
13	5	5	5	5	5	5	5	.30	0	0	180	3	110	3	100	3	50	3	.	.	.	.	.	.	.	.	.
14	1	1	1	1	1	1	.	.30	0	0	200	3	200	3	100	3	150	3	.	.	.	.	200	3	.	.	.
15	2	2	2	2	2	2	.	.40	0	0	300	3	300	3	50	3	.	.	.	.	.	.	.	.	.	.	.
16	2	.	.	2	2	2	.	.11	0	0	1000	3	300	3	50	1	.	.	.	.	800	1	.	.	.	.	.
17	2	2	2	2	2	2	.	.8	0	0	1000	3	.	.	1000	1	.	.	.	.	.	.	.	.	.	.	.
18	2	2	2	2	2	2	2	.12	0	9	1300	1	1300	1	1400	.	300	3	200	3	.	.	.	.	1500	1	.
19	2	.	.	2	2	2	.	.20	0	0	120	3	140	3	175	3	.	.	.	.	.	.	300	3	.	.	.
20	2	.	.	2	2	2	.	.15	0	0	25	3	130	3	75	3	.	.	.	.	.	.	.	.	75	3	.
21	2	.	.	2	2	2	.	.7	0	0	70	3	10	3	250	3	125	3	.	.	175	3	.	.	.	.	.
22	2	.	.	2	2	2	.	.30	0	0	50	3	0	.	.	.	500	3	.	.	.	.	.	.	300	1	.
23	2	1	.	4	4	4	2	.38	0	0	700	5	.	.	1000	5	1000	5	.	.	.	.	1000	5	1000	5	.
24	1	1	.	1	1	1	1	.32	0	0	50	5	650	1	215	1	315	5	700	1	650	1	300	1	215	1	.
25	1	1	.	2	2	2	.	.38	0	0	200	5	300	1	250	1	1000	1	500	1	500	1	.	.	500	1	.
26	1	.	.	5	5	5	.	.30	0	0	10	3	.	.	.	.	120	1	600	1	.	.	.	.	.	.	.
27	2	.	.	2	2	2	.	.26	0	0	75	3	25	3	50	5	.	.	100	1	.	.	.	.	.	.	.
28	4	4	.	6	6	6	4	.49	0	0	100	3	200	3	1000	5	80	3	.	.	.	.	.	.	1000	3	.
29	4	.	.	2	2	2	.	.35	0	0	.	.	150	5	100	5	90	3	250	1	.	.	75	3	50	3	.
30	2	2	.	2	2	2	.	.30	0	0	50	3	100	5	100	5	200	3	.	.	.	.	.	.	100	3	.
31	2	.	2	2	2	2	.	.20	0	0	80	5	30	5	60	5	114	3	.	.	.	.	.	.	45	3	.
32	2	2	3	3	3	3	.	.20	0	0	60	5	80	5	40	5	350	1	.	.	.	.	.	.	.	.	.
33	2	.	.	2	2	2	.	.34	0	0	400	3	400	3	500	3	1500	1	700	1	500	1	.	.	.	.	.
34	2	2	.	2	2	2	.	.15	0	0	400	3	400	3	300	3	400	5	.	.	.	.	.	.	.	.	.
35	2	.	4	4	4	4	2	.24	0	0	500	3	350	3	400	3	.	.	.	.	.	.	.	.	.	.	.
36	2	2	2	2	2	2	.	.20	1	1	30	3	30	3	60	3	100	1	50	3	50	3	.	.	400	3	.
37	2	2	2	2	2	2	.	.8	0	0	30	3	.	.	40	3	.	.	.	.	.	.	.	.	100	1	.
38	2	2	.	4	4	4	.	.7	0	0	600	5	700	5	600	5	700	5	150	.	.	.	200	5	.	.	.
39	2	.	.	2	2	2	.	.20	0	0	50	5	150	5	200	5	.	.	.	.	.	.	.	.	.	.	.
40	2	1	.	2	2	2	1	.20	0	0	250	5	40	3	300	5	400	5	250	5	.	.	.	.	300	5	.
41	1	1	.	1	1	1	6	.21	0	0	40	5	50	3	225	7	225	1	200	5	180	5	.	.	80	1	.
42	6	5	.	6	6	6	.	.37	1	1	20	3	20	3	30	3	.	.	100	3	100	3	.	.	250	3	.
43	1	.	.	2	2	2	.	.8	0	0	80	3	30	3	20	3	10	1	.	.	.	.	100	1	.	.	.
44	2	4	.	2	2	2	.	.55	0	0	500	3	.	.	500	3	.	.	.	.	.	.	.	.	.	.	.
45	2	2	2	2	2	2	2	.52	0	0	120	5	95	3	80	3	.	.	.	.	.	.	.	.	.	.	.
46	2	.	.	2	2	2	.	.27	0	0	5	5	.	.	100	5	100	5	30	5	.	.	.	.	.	.	.
47	1	1	.	1	1	1	1	.25	0	0	250	5	500	1	.	.	.	.	.	.	.	.	.	.	.	.	.
48	1	1	.	1	1	1	.	.20	0	0	100	5	40	3	50	3	150	1	100	1	100	1	.	.	.	.	.
49	1	5	2	2	2	2	2	.23	0	0	70	3	40	3	80	3	.	.	.	.	.	.	.	.	.	.	.
50	2	6	.	2	2	2	.	.20	0	0	25	3	100	3	300	1	.	.	.	.	.	.	.	.	90	3	.
51	2	.	.	3	3	3	.	.25	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	3	3	.	3	3	3	3	.13	0	1	15	3	30	3	190	3	.	.	.	.	.	.	.	.	.	.	.
53	2	3	.	2	2	2	3	.17	0	1	100	3	150	3	250	3	150	1	300	1	300	1	.	.	.	.	.
54	2	2	.	2	2	2	2	.13	0	0	800	1	800	1	2700	1	1200	1	60	1	60	1	.	.	2700	1	.
55	2	.	.	2	2	2	.	.35	0	0	50	5	126	5	.	.	154	1	.	.	.	.	.	1	126	1	.
56	2	.	.	2	2	2	.	.35	0	0	50	5	168	5	110	5	50	1	.	.	.	.	60	.	.	.	.
57	2	6	6	6	6	6	6	.7	0	0	20	3	200	1	160	1	250	1	.	.	.	.	300	1	250	1	.
58	2	.	.	2	2	2	.	.3	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	2	.	.	2	2	2	.	.26	0	0	60	3	21	3	135	3	240	3	.	.	.	.	.	.	.	.	.
60	2	.	.	2	2	2	.	.25	0	0	150	5	200	5	50	3	500	3	.	.	.	.	.	.	200	5	.
61	2	2	1	2	2	2	2	.24	0	0	150	5	100	3	20	3	250	3	.	.	.	.	.	.	100	3	.
62	1	.	.	2	2	2	2	.33	0	0	60	3	100	3	360	3	340	3	.	.	.	.	.	.	.	.	.
63	6	.	.	2	2	2	1	.35	0	0	30	3	200	3	200	3	.	.	.	.	.	.	.	.	.	.	.
64	6	6	.	6	6	6	.	.8	0	0	8	3	40	3	200	5	60	3	.	.	.	.	.	.	.	.	.
65	2	2	2	2	2	2	.	.3	0	0	40	5	50	5	150	5	500	5	.	.	.	.	90	3	200	5	90
66	2	2	.	2	2	2	1	.18	0	0	500	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	2	.	.	2	2	2	.	.20	0	0	50	3	110	3	75	3	120	1	.	.	.	.	150	5	.	.	.
68	1	1	1	1	1	1	.	.25	0	0	80	3	.	.	120	3	.	.	.	.	.	.	.	.	.	.	.
69	2	2	.	2	2	2	.	.35	0	0	50	3	.	.	200	3	150	3	.	.	.	.	88	3	75	3	88
70	6	6	.	6	6	6	.	.15	0	0	40	3	145	1	60	3	270	1	800	3	.	.	.	.	100	3	.
71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	60	1	.	.	60
73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	150	1	150	1	.	.	1000	1	.
74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1000	5	200	1	.	.	.	.	500
76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	100	1	.	.	.
77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	250	1	.	.	75	5	.
79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	150	5	.
80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	300	1	.
81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200	1	.	.	.	.	.	.	.	.	.
82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	300	3	.	.	.	.	.	.	.	.	.
83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	150	3	.
84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
85	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	108	3	.	.	120
87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	150	3	.
89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	3	300	1	100	3	300	3	100
90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	185	3	150	3	140
91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	3	100	3	150	3	300	1	.
92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200	3	.	.	200	3	.	.	.
93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	275	1	.	.	.	.	.	.	.	.	.
94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	80	3	.
96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600	5	.	.	.	.	.	.	450	.	.
97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	160	1	160	1	150	1	.	.	150
98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4000	5	.	.	.	.	.	.	.	.	.
99	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80	3	.	.	.	.	.	.	.	.	.
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	.	.	.	.	.	.	.
101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	125	1	.	.	.	.	.	.	.	.	.
102	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.	125	1	.	.	100	3	.
103	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1200	3	.	.	.	.	.	.	1200	3	.

Pg/Col Obs#	52	53	54	55	56	57	58	59	510	511	512	61	62	63	64	65	66	67	68	69	610	611	612	71
1						50	1					300	1			90	1			110	1	120	1	
2						30	5													300	5	200	1	
3						300	1							300	1	500	1			200	1	500	1	
4		300	5			50	5									250	5			50	3	25	1	
5						300	3					12000	1			350	3			300	3			500
6		70	3	70	3	700	1					2500	1			700	1			100	1			
7		20	3			60	3					1000	1							60	3			150
8		400	3			200	3	200	3											450	3			
9		300	1	300	1	250	1									300	1			100	1	25	1	
10																								
11		1000	3	1000	3	1000	3									1000	3			1000	1			
12		300	3			200	3	200	3			1320	5	300	3	300	1	150	1	300	5	150	1	1000
13						400	3													120	3			
14						50	3					2500								300		50		1200
15								100	3	10	3					20	3			400	3			
16						800	1									500	1			900	5			
17						1000	1			1000	1					1000	1			1000	1			
18		1500	1	1500	1	1400	1					52800	1	1500	1	1500	1			1600	1	40	1	
19						300	3					52800				200								
20		75	3			300	1									100	3			300	1	100	1	
21		250	3			200	3									250	3							
22		300	1	300	1	200	3	175	3											200	1	150	1	
23						1000	5									600	5			600	5	600	5	100
24		215	1	215	1	215	1									220	1	325	1	320	1	165	3	
25		500	1			500	1									350	3			600	1			
26						180	1																	
27						100	1									100	1					100	1	3000
28		1000				140	5													100	1	300		
29		50	3	50	3	75	1					2640	1	75	1	50	1			300	3	200	1	
30		100	5	100	5	35	3									100	5			150	5	150	1	
31		45	3			60	3							75	3					45	3			
32						340	1													500	1	550	1	
33						600	3													700	1			
34								500																
35		400	3	400	3	400	3	400	3							450	5	400	3	200	3	200	3	
36		100	1			150	1							100		70								
37						150	5																	
38						600	5																	
39						250	3																	
40						250	5													300	5			
41		225	1			225	1	175	1					200	1	250	1			200	1	80	1	
42						150	3					1500	1			50	3			300	3	350	3	
43						50	1													300	1	200	1	
44						500	1	500	1							300	3			300	3			500
45								100	3											200	3	200	3	
46						100	5					2500	1											
47		400	5	400	5	500	5									400	5					20	5	
48						200	1									50	1	100	1	300	1			
49		90	3			140	3									100	1			100	1			
50						250	3									150	1			250	3			
51																						250	1	
52		100	3					200	3							150	3			200	3	150	1	250
53						100	3									250	5			50	3	500	1	
54						2000	1			850	1	40000	1	40000	1	300	1			90	1			1200
55						126	1	126	1															
56						100	1									6	3			100	1	300	1	
57		250	1	250	1	250	1									200	1			400	1			
58	1		1		1		1		1		1													
59						75	5													75	3			
60		200	5			100	5			200	3									100	3			
61		100	3			75	3					1500	1			50		3		50	5			
62						175	3													360	3			
63						400	1					800	3									150	1	
64	3	200	5	200	5	200	5	150	3			300	5			50	1	75	1					
65																						70	1	
66								200	5											500	5			
67						600	3					600	3							50	3			
68	3	10	3			85	5									15	3			200	5	210	1	
69																100	1			300	1			
70		100	3			100	3									250	3			250	3	350	1	100
71	3					30	3													10	3	600	1	
72		100	1	100	1	50	3							100	3									
73																								
74	5			1250	5	300	5															100	1	1800
75																150	3			150	3			
76						200	3	150	3											50	3			
77		75	5			50	5									200	5	50	5			200	1	
78		150	5			50	1									125	1			200	3			
79		300	1	300	1	200	1							300	3	70	3			150	3			
80																				150	1	300	3	
81							3																	
82						400	3									300	3			300	3	150	1	
83						400	3							500	3	500	1			500	1	500	1	
84						200	1													100	1			1600
85	3					90	3													135	3	210	1	
86		150	3	150	3	150	3					2000	1			150	3	130	3			1000	1	1500
87		150	3	150	3	200	3									300	3			260	3			
88	3	300	3	300	3	150	3	100	3					200	3	300	1			250	3	300	1	
89						165	1													170	1			
90	3	300	1			300	1	500	1							300	1			300	1	700	1	900
91																				100	3	20		
92						500	3	50												500	1			
93		240	5	240	5	240	5	200	1					240	5	180	3			130	1	250	1	
94		80	1	80	1	100	1							150	1	70	1			170	1	180	1	
95				450	1	460	5								5	600	5			2000	1	20	1	1500
96	1					300	1	75						250	3	300	1	350	1	350	1	150	5	100
97						4000	5															20		
98														100	3					100	3	70	1	
99																								
100						550	3					5280				500	3			600	3	600	3	
101						100	1			100	1									300	1			
102		100	3			125	3							100	5	50	5			250	3	10	1	1300
103		1200	3	1200	3	1200	3									1200	3			1200	3	25	1	

Pg/Col Obs#	7/2	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	9/1
1												200	1			100	3	20	3					
2		600	1	250	1																			
3				500	1																			
4				200	5																			
5	1	200	1	200	1	200	1	90000				250	1											
6		250	1					18000	3															
7	1	150	1															10	3					
8				150	3									50										
9												110	1	110	1			10	1					1000
10						1200	5											600	5					
11				1200	1	1200	1					1200	1	1200	1	1200		2500	1					3600
12	5																	20	1					
13												160	1											
14		100																						
15				300	3													300	3	3000	3	3000	3	
16				200	1																			
17						1000	1																	
18				1800	1			54000	1	300	1							1300	1					
19				200																				
20		100	1	90	1																			
21				175	1																			
22				100	3													150	3			1200		
23	5			600	5													100	3					
24		230	1													220	3	220	3					
25				100	1																			
26		65	1									65	1									300	1	
27	1	400	1											80	1									
28		200	1																					
29				30	1			36000	1	500	1							30	3					
30				100	3													60						
31				110	3													150	1					
32				80	1																			
33		1000	1															500	3					
34				300	1																			
35										250	1	700	1					400	3					
36				50																				
37				75	1																			
38				800	5																			
39				100	3																			
40		300	3			300	3																	
41				90	1					100	1					100	1	80	1					45
42												75	3					20	3					
43		120	1									50	1			10	1							
44	1																	300	3	450	5	3000	5	3000
45				400	3	380	3											100	5					
46				60	5																			
47		1000	1															700	5					
48				35	1																			
49				200	1																	2000	5	2000
50												75						75		5280		5280		5280
51																								400
52	1					200	1																	
53						75	1					400	1	100	1									
54	1			700	1			40000	1															
55					1																			
56		300	1									50	5	150	3	50	5							
57		125	3											250	1			50	3					
58																								
59				63	5													18						
60										350	1													
61				300	3													75	3					
62		350	3																					
63				100	1																	1500	5	
64										100	1							70	5					
65																								
66				150	5																			
67		700	3													500	3							
68				375	1																			
69		500	1									150	1											
70	1									350	1													
71		180	3	180	1											110	3	66	3	1000	3	1000	3	1000
72																								
73																								
74	5	500	5	500	5					400	5							300	5					
75		150	1																					
76										250	1			300	3									
77		150	5																					
78				50								50												
79				150	1																			
80				150	1													15	3					
81					3																			
82		200	1																					
83						250	1																	
84	1	200	3					5280																
85		45	1	190	1																			
86	5	130	3	130	3	130	3	3000	5									100	3					
87		250	3	200	3													200	3					
88		400	1									100	1											1250
89			1															100	1					
90	1			200	1																			
91				70	3					200	3													
92		100	1																					
93										225	1													
94		70	1	70	1											30	3							
95	1			480	1															1200	1	1200	1	
96	1									50	1	40	1	80	1									240
97																				1200		1200		1200
98				100	3																			
99				200	3																	330	3	
100						50	3							50	3									
101		90	1	90	1																			
102	5	150	1															70	1					
103		1200	1	1200	1													1200	1	1200	3	1200	3	600

Pg(Col Obs#	9 2	9 3	9 4	9 5	9 6	9 7	9 8	9 9	9 10	9 11	9 12	10 1	10 2	10 3	10 4	10 5	10 6	10 7	10 8	10 9	10 10	10 11	10 12	11 1	11 2
1				200	1					90	1	250	1			170	1			70	1			2	
2												300	1			400	5			700	5			5	1
3												300	1											5	
4				500	5			500	5	250	5	100	5			25	5							2	4
5								1200	1			1100	5	90000	3	100	5			500	1			5	
6				600	1			300	1			200	1			75	3			400	1			5	5
7												75	3			75	3			100				5	4
8												1320				200	3			200				5	
9	1					500	1			500	1	25	1			75	5			200	1			5	
10												1600	5			30	3							5	
11	5							1200	1	1200	1	1600	1			1600	5			1600				5	5
12				75	3	330	3	1000	3	200	3	1320	5			200	1			200	1			2	4
13						600	3					300	3			80	1			300	3			6	
14																					3				
15						400	3	400	3			150	3			150	3	100	3	100	3				
16												1300	5			50	1			800	1			5	
17				1300	1	1000	1	50	1	950	1	400	3			100	1	950	1	950	1			5	5
18												50	1			400	1							5	3
19																								5	2
20		2500	3	3200	3											60	3							5	1
21								500		125		1500	3			25	3			125	3			5	
22								200	1			650	1			120	3							5	
23								100	5	200	5	600	3			660	5			100	5			5	1
24								700	3	650	1	165	3			80	1			315	1			5	2
25								700	3			660	5			300	5			500	3			6	
26												100	3			65	1			100	1			5	1
27								1500	3			150	3			150	3							5	4
28												280	3			280	5			60	1			5	
29						300	3	500	1			300	3			30	3			30	3			5	
30										200	3	225	5	50	3	125	1			25	3			5	5
31												200	5			200	1			120	3			5	
32												300	1			380	1			300	3			5	
33												50	3			500	3			1500	3			5	1
34								600	3							500				400	3			5	
35												700	3			800	3							5	2
36												150	1			100	1			100	1			5	2
37												100	1			75	3			75	5			5	
38												20	3			700	5			800	5			5	
39												1200	3			300	3							5	
40						250	5			250	5	20	3			300	5			500	5			5	1
41	1			45	1	250	1					80				125	5			225	1			5	
42				15	3							250	3			300	3					100	3	5	
43												200	3			120	3			50	1			5	4
44												600	3			450	3							6	
45		2400	5									200	3			20	3							2	2
46																									
47												1500	5			1000	3			5	3			1	4
48								400	1			100	5			150	3			150	1			6	
49	5											500	1			120	3			50	3				4
50								300				200	1			200	3			75	1				
51	3			150	3							100	3			100	3					400	1		4
52				10	3							300	3			300	1								
53								1000	1			1000	3			125	1			50	1				
54												80	1			40	1	1200	1	400	1				6
55							1		1				3												
56								100	1	300	1	100	3			100	5			50	1				1
57						400	1			450	1	200	1			100	3			250	1				
58																									4
59											1	220	1			220				240					4
60						200	1			200	1	50	1			75	1	150	1	150	1				4
61						100	3					300	1			300	1			250	1				2
62												300	3			60	3								
63		800	1	0	1	250	1					150	5			200	5			100				1	6
64										150	1	140	5			150	5			100	1			2	2
65												75	1			60	1							2	
66						450	5			600	5	500	5			50	5			500	5			2	5
67												100	3	800	3	100	3			50	3				
68		750	5	305	3							375	3			100	3			30	3			1	4
69								1000	1			400	1			200				300	1			2	2
70						750	1	400	1			500	3			100	3			150	3			2	1
71	3									500	1	285	1			330	1			270	3			2	2
72												400	1			150	1			20	1			2	1
73																								2	3
74																600	5					400	5	2	2
75						250	1					150	3				3				1				6
76						70	3									60	3			75	3				
77								275	1							100	5			10	3				1
78												400				50									
79				10	1			700	1			400	3			30	1			250	1				4
80												1500	1			200	1			250	1				2
81																									
82						600	3	700	3			1250	3			500	3			20	3				
83				150	3			900	1							200	3			600	1				
84												250	1							20	3				
85				1320	5	230	5					215	1			212	1			310	5				
86												100	3			150	3	200	3	100	3				
87												300	3			320	3								
88	1					500	1			500	1	400	3			150	1			450	1				
89										120	1	715	3			85	1			100	1				
90										200	1	500	3			700	1			50	1				4
91												150	5			300				100	3				
92						500	1					200	3			100	3								1
93								200	3	250	1					145	5			300	1	36	1		
94																100	1					80	1		1
95								400	1							600	5			600	5				
96	5					450	1	1200	1			200	5			400	1			250	1				3
97						250	3									20									
98																125	3								
99				6								60	5			275									
100						400	1					500	5			50	5			500	3			2	1
101						300	3			300	1	200	3			10	3	300	1	300	1				5
102								1300	5			90	3	2640	5	90	1			150	3				2
103	3			2500	1							25	3			25	3			1200	1			2	2

Pg/Col Obs#	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	13/1	13/2	13/3	13/4	13/5	13/6	13/7
[illegible]	1	5	6	1		1	1	5			70			60		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	4	4	4	4	4	2								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	2	6	6	6	6	4	5		60		150 300			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		1	1	1	1	1	1	1								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5	5	5	1	1	1	1	1					1000			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		5	5					5					900			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6	5	5	5	5	6	5	5		300	1300			1000 1400		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		2	2	1									200			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	4	4	4	4	4	4	4				150	660		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	1	2	1	1	1	1	1	1		900		2000	300		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	5	1	4	4	5	5	5							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5	5	5		5	2	1	5	1							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	1	1	2	2	2	2			1000					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	2	1		1	1	5			600			700 50		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1				4			4		600	600	600	600	600	###	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5	5	2	5	5	5	5	5		200				200		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	5	1	1	1	1	5			400					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	4	4	4	4	4	4	4	1250			1250			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	4	1		1	1	5		6	150		800	30		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	2	4	4	4	4	4	2								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6	5	5	4	4	4	4	4		1200						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	1	2	1	1	1	1	1								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	5					4			250			300		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5	5	5	5	6	1	5	5						20		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6	6	1	1	1	1	1	1	1		150			180		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5	5	5	4	4	4	4	5					2500	2500	###	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	2	5	4	4	1	1	1								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	1	1	1	1	1	1	1			300					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6	6	6	4	5	4	4	4	4				1200	1200		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	2	3	1	1	3	1		2500	200			200		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	2	1	2	2	2	2			100 50 300		5280	200 50 350		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	5	5	4	4	4	4	4						2500		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4	4	2	4		4	4	4					900	85		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				4		4	4	4		250	100		250			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	2	2	6	6	6	5	1	1	800	70			30		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3	1	1		5		5	4								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2			2	5	2	5	4			50					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100			5	1	1	1	1	1								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
103	2	2	2	4	4	4	4	5			70		1300			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Obs# \ Pg/Col	13/8	13/9	13/10	13/11	13/12	13/13	14/1	14/2	14/3	14/4	14/5	14/6	14/7	14/8	14/9	14/10	14/11	14/12	15/1	15/2	15/3	15/4	15/5	15/6	15/7	15/8	15/9	15/10	15/11	15/12	16/1	16/2
1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
3	0	1	.	.	0	0	0	1	1	0	.	.	0	0	0	0	0	0	0	1	.	.	0	0	0	0	0	0	0	0	0	0
4	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	1	0	1
5	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0
6	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0
8	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	1	1	1	0	1	1	0	0
10	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0
11	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0
13	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
15	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	1	0	1
16	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
21	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
24	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
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Pg/Col Obs#	16 3	16 4	16 5	16 6	16 7	16 8	16 9	16 10	16 11	16 12	17 1	17 2	17 3	17 4	17 5	17 6	17 7	17 8	17 9	17 10	17 11	17 12	18 1	18 2	18 3	18 4	18 5	18 6	18 7	18 8	18 9	18 10
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Pg/ Col Obs#	18 11	18 12	19 1	19 2	19 3	19 4	19 5	19 6	19 7	19 8	19 9	19 10	19 11	19 12	20 1	20 2	20 3	20 4	20 5	20 6	20 7	20 8	20 9	20 10	20 11	20 12
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81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Pg/ Col Obs#	21 1	21 2	21 3	21 4	21 5	21 6	21 7	21 8	21 9	21 10	21 11	21 12	22 1	22 2	22 3	22 4	22 5	22 6	22 7	22 8	22 9	22 10	22 11	22 12	23 1	23 2	23 3	23 4	23 5	23 6	23 7	23 8
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
7	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Pg/Col	Values (Obs# in printed order, top to bottom)
23/9	[illegible]
23/10	[illegible]
23/11	[illegible]
23/12	[illegible]
24/1	[illegible]
24/2	85 30 500 250 350 50 400 300 1250 1250 200 180 20 1600 60 75 250 300 600 215 350 300 100 100 100 150 150 150 1200 1250 400 60 200 120 100 600 500 1250 70 4000 150 300 1200 800 0 50 4000 100 50 600 60 2500 10 200 300 50 2600 400 75 75 100 200 20 200 100 150 300 400 150 350 100 190 70 300 20 500 70 1200
24/3	30 250 350 50 350 5000 1250 200 20 1400 60 75 300 600 240 300 200 100 200 150 150 1200 400 200 120 100 500 1250 90 4000 150 300 1200 0 300 4000 100 50 600 60 2500 10 200 300 50 2600 200 75 100 75 20 400 100 150 300 400 350 10 190 70 300 20 70 1200
24/4	5000 5000 800 5000 150 5000 5000 5000 5000 1000 4000 1400 60 5000 300 2400 1400 4000 3000 5280 2700 200 5280 200 250 5280 1250 350 4000 100 1250 2500 2500 1000 1250 1250 1250 2500 1250 100 1600 2500 1250 900 250 80 100 100 0
24/5	[illegible]
24/6	[illegible]
24/7	1000 5000 10000 20000 30000 15000 1000 6000 5000 11000 30000 12000 6000 17000 13000 35000 1100 13000 1500 4000 8000 8000 2400 55000 55000 2250 16000 55000 200 28000 6400 4300 24000 800 19000 640 16000 12000 6000 8000 3000 50000 3250 2500 41000 14800 3500 50000 33000 8000 800 2000 12000 6500 7500 30000 3000 2000 20000 14700 14000 10000 1000 200 10000 6000 2800 8000 300 2500 40000 100000 9000 3000 25600 7000 14000 12000
24/8	[illegible]
24/9	[illegible]
24/10	16 14 36 20 37 7 41 11 12 3 18 13 12 11 9 7 35 31 28 10 11 92 15 70 28 1 3 21 84 26 21 36 13 36 11 11 46 59 13 25 86 21 45 66 34 74 30 7 6 77 6 106 1 36 20 4 35 12 6 21 37 76 33 12 42 20 40 22 66 19 35 66 59 33 53 70 96 39 54 56 42 9 12 11 1
24/11	[illegible]
24/12	[illegible]
25/1	[illegible]
25/2	2 10 98 90 3 10 145 8 15 2 2 12 10 10 2 4 25 10 30 100 8 20 20 20 10 69
25/3	[illegible]
25/4	18 150 50 10 68 60 37 110 10 15 25 160 14 90 100 60 155 250 150 25 13 40 75 22 60 60 40 10 50 100 30 40 110 8 70 20 25 100 150 120 360 40 10 50 25 100 20 160 40 80 100 40 35 30 150 35 39 4 30 8 25 10 70 22 20 10 105 15 12 48 20 55 40 40 10 13 65 18 10 140 30 20 15 25 10 45 5 15 10 6 27 12 17
25/5	38 220 60 25 100 62 120 30 25 180 80 180 33 120 160 225 60 15 60 25 80 15 140 8 90 30 160 360 29 120 30 46 100 45 65 290 45 14 14 85 45 25 43 120 20 26 50 25 90 20 30 16 5 20 200 78 20 40 60 50 20 35 15 30 59
25/6	48 80 35 150 110 72 220 40 35 290 28 110 300 140 45 300 450 375 65 17 65 98 125 26 90 93 55 16 100 100 200 145 26 93 35 88 165 135 415 45 30 170 90 170 33 220 28 120 130 65 50 70 100 300 65 96 14 60 15 42 25 90 45 52 75 45 125 45 108 50 30 65 125 100 60 30 40 20 30 30 347 90 80 90 97 35 42 65 52 22 15 40 28 74 50 69
25/7	[illegible]
25/8	[illegible]
25/9	[illegible]
25/10	6 3 10 1.5 10 25 50 15 25 23 20 40 50 14 10 10 100 10 30 15 10 7 60 40 6 30 15 5 8 30 4 15 12 20 10 8 6 15 10 30 12 60 3 50 20 5 40 5 7.5 10 10 20 10 20 40 15 3.5 5 6 20 15
25/11	[illegible]

APPENDIX C.
Descriptive Statistics From Chemical Analyses

Lagand for Column Haadings

STATISTICAL SUMMARY

Psga/Col	Dascription	Minimum	Maximum	Mean	Standard Daviation
1- 0	Sampla Numbar				
1- 1	Hardnaas as CaCO3, mg/l	14.0	1841.000	371.9703	245.3605
1- 2	Cslcium as CaCO3, mg/l	3.5	509.000	109.1584	70.6941
1- 3	Magnasium as CaCO3, mg/l	1.0	2804.000	59.4851	287.7148
1- 4	Sodium, mg/l	9.1	724.000	72.4911	116.9915
1- 5	Potaasium, mg/l	0.2	21.600	3.8653	3.3187
1- 6	Alkalinity ss CaCO3, mg/l	28.0	448.000	244.5346	79.7009
1- 7	Chloride, mg/l	1.6	795.000	74.8257	116.8928
1- 8	Sulfata, mg/l	12.0	1172.000	112.3663	178.5532
1- 9	Nitrata as N, mg/l	0.0	91.000	9.7400	13.9973
1-10	Fluorida, mg/l	0.1	3.500	0.5342	0.4975
1-11	pH	7.1	8.800	7.7485	0.2852
1-12	Turbidity, TU	0.0	65.000	1.5247	6.7802
2- 1	Spacific cond., micromho/cm	0.0	3560.000	928.1089	571.3556
2- 2	T. dis. solids, mg/l	132.0	2706.000	606.9406	388.8082
2- 3	T. Phoaphsta-P, mg/l	0.0	1.200	0.1962	0.2715
2- 4	Silica (SiO2), mg/l	6.3	70.900	25.9683	15.0476
2- 5	Ammonia-N, mg/l	0.0	0.700	0.0420	0.1305
2- 6	CO3 hardnass as CaCO3, mg/l	0.0	448.000	227.7624	89.4474
2- 7	Non-CO3 hard. aa CaCO3, mg/l	0.0	1575.000	138.4065	223.2984
2- 8	NaHCO3 alk. aa CaCO3, mg/l	0.0	406.000	12.7930	59.6698
2- 9	Iron, mg/l	0.0	8.860	0.2556	0.9536
2-10	Manganaaa, mg/l	0.0	1.090	0.0539	0.1701
2-11	Arsenic, mg/l	0.0	0.015	0.0026	0.0029
2-12	Bsrium, mg/l	0.0	0.930	0.1792	0.1974
3- 1	Csduium, mg/l	0.0	0.021	0.0008	0.0027
3- 2	Chromium, mg/l	0.0	0.010	0.0003	0.0017
3- 3	Coppar, mg/l	0.0	0.700	0.0299	0.0764
3- 4	Lead, mg/l	0.0	0.064	0.0046	0.0121
3- 5	Marcury, mg/l	0.0	0.004	0.0000	0.0004
3- 6	Salanium, mg/l	0.0	0.090	0.0050	0.0116
3- 7	Silvar, mg/l	0.0	0.060	0.0017	0.0063
3- 8	Zinc, mg/l	0.0	8.540	0.3088	1.0949
3- 9	Chloromathane, ug/l	0.0	0.000	0.0000	0.0000
3-10	Bromomethana, ug/l	0.0	0.000	0.0000	0.0000
3-11	Vinyl Chlorida, ug/l	0.0	0.000	0.0000	0.0000
3-12	Chloroathana, ug/l	0.0	0.000	0.0000	0.0000
4- 1	Dichloromethana, ug/l	0.0	5.800	0.1277	0.7571
4- 2	1,1-Dichloroethylana, ug/l	0.0	0.000	0.0000	0.0000
4- 3	1,1-Dichloroethana, ug/l	0.0	0.000	0.0000	0.0000
4- 4	Trans 1,2-Dichloroathylene,ug/l	0.0	0.000	0.0000	0.0000
4- 5	Trichloromsthana, ug/l	0.0	0.600	0.0059	0.0597
4- 6	1,2-Dichloroathane, ug/l	0.0	0.900	0.0089	0.0895
4- 7	1,1,1-Trichloroathana, ug/l	0.0	0.000	0.0000	0.0000
4- 8	Tatrachloromathane, ug/l	0.0	0.000	0.0000	0.0000
4- 9	Bromodichloromathane (THM),ug/l	0.0	0.000	0.0000	0.0000
4-10	1,2-Dichloropropane, ug/l	0.0	0.000	0.0000	0.0000
4-11	Trana 1,3-Dichloropropene, ug/l	0.0	0.000	0.0000	0.0000
4-12	Trichloroathylane, ug/l	0.0	0.000	0.0000	0.0000
5- 1	Benzans, ug/l	0.0	2.300	0.0228	0.2289

Legend for Column Headings STATISTICAL SUMMARY

Page/Col	Description	Minimum	Maximum	Mean	Standard Deviation
5- 2	Dibromochloromethane (THM),ug/l	0.0	0.000	0.0000	0.0000
5- 3	Cis 1,3-Dichloropropene, ug/l	0.0	0.000	0.0000	0.0000
5- 4	1,1,2-Trichloroethane	0.0	0.000	0.0000	0.0000
5- 5	Bromoform (THM), ug/l	0.0	0.000	0.0000	0.0000
5- 6	1,1,2,2-Tetrachloroethane, ug/l	0.0	0.000	0.0000	0.0000
5- 7	Tetrachloroethylene, ug/l	0.0	0.000	0.0000	0.0000
5- 8	Toluene, ug/l	0.0	0.000	0.0000	0.0000
5- 9	Chlorobenzene, ug/l	0.0	0.000	0.0000	0.0000
5-10	Ethylbenzene, ug/l	0.0	0.000	0.0000	0.0000
5-11	Meta-Xylene, ug/l	0.0	0.000	0.0000	0.0000
5-12	Orotho and/or Para-Xylene, ug/l	0.0	0.000	0.0000	0.0000
6- 1	1,4-Dichloroben, ug/l	0.0	0.000	0.0000	0.0000
6- 2	Alachlor, ug/l	0.0	0.880	0.0087	0.0876
6- 3	Aldrin, ug/l	0.0	0.000	0.0000	0.0000
6- 4	Atrazine, ug/l	0.0	1.500	0.0148	0.1493
6- 5	Chlorodane, ug/l	0.0	3.400	0.0337	0.3383
6- 6	Dacthal, ug/l	0.0	0.000	0.0000	0.0000
6- 7	O,P' DDT, ug/l	0.0	0.000	0.0000	0.0000
6- 8	P,P' DDT, ug/l	0.0	0.000	0.0000	0.0000
6- 9	Dilorin, ug/l	0.0	0.000	0.0000	0.0000
6-10	Dual, ug/l	0.0	0.000	0.0000	0.0000
6-11	PCB's, ug/l	0.0	0.000	0.0000	0.0000
6-12	Ramrod, ug/l	0.0	0.000	0.0000	0.0000
7- 1	Sencor, ug/l	0.0	0.000	0.0000	0.0000
7- 2	Endrin, ug/l	0.0	0.000	0.0000	0.0000
7- 3	Lindane, ug/l	0.0	0.000	0.0000	0.0000
7- 4	Methoxychlor, ug/l	0.0	0.000	0.0000	0.0000
7- 5	Toxaphene, ug/l	0.0	0.000	0.0000	0.0000
7- 6	2,4-d as acid, ug/l	0.0	1.300	0.0129	0.1293
7- 7	Silvex as acid, ug/l	0.0	0.000	0.0000	0.0000
7- 8	2,4,5-T as acid, ug/l	0.0	1.100	0.0109	0.1094
7- 9	Tordon, ug/l	0.0	5.600	0.0554	0.5572
7-10	Heptachlor Epoxcide, ug/l	0.0	0.026	0.0003	0.0026

Appendix D.
Tabulated Data From Chemical Analyses

Pg/Col/Obs#	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	2/1	2/2	2/3	2/4	2/5
1	281	[illegible]	13.8	[illegible]	12.1	[illegible]	20.0	[illegible]	[illegible]	0.3[illegible]	7.7	0.2	[illegible]	[illegible]	0.27	35.0	0.03
2	[illegible]	[illegible]	7.3	[illegible]	0.2	[illegible]	58.9	[illegible]	[illegible]	[illegible]	8.8	0.1	[illegible]	[illegible]	[illegible]	9.2	0.14
3	218	[illegible]	12.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.5	0.2	[illegible]	[illegible]	[illegible]	5.9	0.52
4	123	[illegible]	28.2	[illegible]	7.7	[illegible]	62.0	[illegible]	33.[illegible]	[illegible]	[illegible]	0.2	[illegible]	[illegible]	[illegible]	51.9	0.25
5	176	[illegible]	5.4	[illegible]	2.6	[illegible]	13.0	[illegible]	[illegible]	[illegible]	7.4	0.2	[illegible]	[illegible]	[illegible]	22.1	0.00
6	193	[illegible]	27.5	[illegible]	1.1	[illegible]	53.0	[illegible]	16.[illegible]	[illegible]	8.1	0.3	[illegible]	[illegible]	0.00	21.6	0.00
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	12.5	[illegible]	2.0	[illegible]	123.0	[illegible]	[illegible]	[illegible]	8.1	0.6	[illegible]	[illegible]	[illegible]	22.9	0.00
9	[illegible]	[illegible]	17.3	[illegible]	5.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.5	0.0	[illegible]	[illegible]	[illegible]	37.3	0.00
10	[illegible]	[illegible]	21.9	[illegible]	4.7	[illegible]	105.0	[illegible]	0.47	[illegible]	7.7	0.2	[illegible]	[illegible]	[illegible]	23.5	0.00
11	180	[illegible]	15.5	[illegible]	2.5	[illegible]	26.0	[illegible]	[illegible]	[illegible]	7.8	15.0	[illegible]	[illegible]	[illegible]	35.2	0.00
12	201	[illegible]	15.9	[illegible]	2.4	[illegible]	83.0	[illegible]	[illegible]	[illegible]	8.1	0.0	[illegible]	[illegible]	[illegible]	27.4	0.00
13	211	[illegible]	46.4	[illegible]	3.8	[illegible]	12.0	[illegible]	0.[illegible]	[illegible]	7.6	0.0	[illegible]	[illegible]	[illegible]	26.9	0.03
14	[illegible]	[illegible]	40.6	[illegible]	21.6	[illegible]	56.0	[illegible]	16.[illegible]	[illegible]	7.4	0.6	[illegible]	[illegible]	0.00	56.7	0.00
15	[illegible]	[illegible]	50.3	[illegible]	2.9	[illegible]	63.0	[illegible]	[illegible]	[illegible]	8.1	0.5	[illegible]	[illegible]	0.00	39.8	0.00
16	[illegible]	[illegible]	21.0	[illegible]	7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.3	0.0	[illegible]	[illegible]	[illegible]	23.0	0.00
17	[illegible]	[illegible]	12.4	[illegible]	4.0	[illegible]	53.0	[illegible]	[illegible]	[illegible]	8.0	0.0	[illegible]	[illegible]	[illegible]	26.0	0.00
18	[illegible]	[illegible]	6.3	[illegible]	3.0	[illegible]	35.0	[illegible]	0.[illegible]	[illegible]	7.9	0.2	[illegible]	[illegible]	[illegible]	59.9	0.00
19	[illegible]	[illegible]	13.0	[illegible]	2.7	[illegible]	66.0	[illegible]	[illegible]	[illegible]	8.5	0.0	[illegible]	[illegible]	[illegible]	38.0	0.00
20	[illegible]	[illegible]	33.2	[illegible]	2.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.6	0.3	[illegible]	[illegible]	[illegible]	29.4	0.00
21	[illegible]	[illegible]	33.2	[illegible]	2.1	[illegible]	30.0	[illegible]	[illegible]	[illegible]	7.3	0.3	[illegible]	[illegible]	[illegible]	23.9	0.00
22	[illegible]	[illegible]	33.0	[illegible]	7.9	[illegible]	153.0	[illegible]	[illegible]	[illegible]	7.7	8.0	[illegible]	[illegible]	[illegible]	22.0	0.00
23	[illegible]	[illegible]	17.9	[illegible]	4.9	[illegible]	139.0	[illegible]	[illegible]	[illegible]	8.0	0.4	[illegible]	[illegible]	[illegible]	21.4	0.00
24	[illegible]	[illegible]	13.8	[illegible]	5.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.3	0.3	[illegible]	[illegible]	[illegible]	22.8	0.00
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	41.2	[illegible]	13.3	[illegible]	48.0	[illegible]	11.[illegible]	[illegible]	8.2	0.5	[illegible]	[illegible]	[illegible]	28.9	0.00
27	[illegible]	[illegible]	16.3	[illegible]	8.1	[illegible]	43.0	[illegible]	17.[illegible]	[illegible]	7.8	0.0	[illegible]	[illegible]	[illegible]	30.9	0.00
28	[illegible]	[illegible]	37.3	[illegible]	2.3	[illegible]	32.0	[illegible]	27.[illegible]	[illegible]	8.3	0.0	[illegible]	[illegible]	[illegible]	26.9	0.00
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	32.9	[illegible]	1.5	[illegible]	37.0	[illegible]	18.[illegible]	[illegible]	8.0	0.2	[illegible]	[illegible]	[illegible]	19.6	0.00
31	[illegible]	[illegible]	6.9	[illegible]	0.6	[illegible]	31.0	[illegible]	[illegible]	[illegible]	8.1	0.2	[illegible]	[illegible]	[illegible]	22.2	0.00
32	[illegible]	[illegible]	29.0	[illegible]	2.7	[illegible]	120.0	[illegible]	91.[illegible]	[illegible]	7.9	0.4	[illegible]	[illegible]	[illegible]	26.3	0.00
33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
34	210	[illegible]	11.9	[illegible]	2.6	[illegible]	11.0	[illegible]	[illegible]	[illegible]	7.9	0.3	[illegible]	[illegible]	[illegible]	31.0	0.00
35	2[illegible]	[illegible]	15.5	[illegible]	4.0	[illegible]	30.0	[illegible]	[illegible]	[illegible]	8.0	0.2	[illegible]	[illegible]	[illegible]	23.8	0.00
36	[illegible]	[illegible]	41.5	[illegible]	1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
37–47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
48																	
49	309	[illegible]	11.7	22.7	1.5	[illegible]	65.0	[illegible]	22.[illegible]	0.2[illegible]	7.7	0.2	[illegible]	[illegible]	0.17	36.0	[illegible]
50	195	[illegible]	16.7	26.9	1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.9	0.6	[illegible]	[illegible]	[illegible]	32.7	[illegible]
51	487	[illegible]	16.4	72.9	1.8	[illegible]	142.0	[illegible]	[illegible]	[illegible]	7.8	0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
52	737	[illegible]	13.7	26.3	4.3	[illegible]	22.8	[illegible]	[illegible]	[illegible]	8.0	0.5	[illegible]	[illegible]	[illegible]	22.5	[illegible]
53	420	[illegible]	11.8	10.4	6.7	[illegible]	32.0	[illegible]	22.[illegible]	[illegible]	7.7	0.0	[illegible]	[illegible]	[illegible]	25.3	[illegible]
54–84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
85																	
86	337	105.0	18.2	137.9	3.8	219	211.0	90	0.00	0.60	8.0	0.4	1198	709	0.00	11.6	0.06
87	571	52.5	21.8	324.0	0.5	373	19.0	519	0.15	0.69	8.1	0.1	1734	1184	0.00	7.8	0.20
88	365	111.5	21.2	22.8	0.5	240	36.0	30	24.00	0.33	7.4	0.3	770	497	0.36	23.0	0.00
89	739	20.0	8.2	14.3	0.5	114	[illegible]	65	28.00	0.25	7.6	0.3	406	276	0.00	18.7	0.00
90	434	120.0	12.7	107.3	0.5	157	198.0	105	24.00	0.42	7.7	0.3	1289	805	0.00	12.7	0.00
91	474	117.5	44.7	73.9	0.7	396	74.0	105	3.20	0.84	9.5	0.1	1077	675	0.00	14.6	0.00
92	141	40.5	9.7	18.7	2.9	28	22.0	67	15.00	0.35	7.9	0.6	0	256	0.00	6.9	0.06
93	1487	152.5	24.6	87.8	0.9	355	146.0	35	14.00	0.29	7.7	0.9	1119	704	0.06	19.3	0.00
94	1484	190.0	100.0	66.8	2.2	376	131.0	1018	18.50	0.75	7.6	0.4	2440	1397	0.03	15.3	0.00
95	1398	109.5	2804.0	29.3	2.1	279	22.0	120	7.50	0.28	8.7	0.2	1036	677	0.02	12.7	0.00
96	352	106.5	21.0	25.7	1.3	300	27.0	32	9.00	0.30	7.8	0.3	699	445	0.05	16.7	0.00
97	328	121.0	6.3	9.5	0.5	280	66.0	40	0.00	0.29	8.0	0.3	597	365	0.14	11.8	0.00
98	301	102.5	17.0	88.3	6.6	303	31.2	88	6.40	0.23	7.7	4.3	553	332	0.05	18.8	0.03
99	81	20.0	3.0	3.4	0.6	90	3.0	50	0.20	0.20	7.1	0.2	320	207	0.05	12.0	0.00
100	458	130.0	32.4	415.0	6.5	207	620.0	218	0.00	0.48	7.9	2.3	2640	1558	0.00	11.6	0.10
101	209	71.0	7.8	19.2	1.3	162	11.0	27	0.70	0.19	7.8	0.2	476	301	0.00	22.5	0.00
102	[illegible]	[illegible]	[illegible]	13.2	1.7	151	[illegible]	19	8.50	0.22	7.9	0.2	494	273	0.10	22.7	0.00
103	529	118.5	14.4	68.6	2.6	212	310.6	16	3.20	0.34	7.6	0.2	1385	762	0.03	20.3	0.00

Pg/Col Obs#	2/6	2/7	2/8	2/9	2/10	2/11	2/12	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	4/1	4/2
1	[illegible]	0	37	[illegible]	0.07	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.05	0	0	0	0	0	0
2	[illegible]	0	406	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0	0	0	0	0	0
3	[illegible]	107	0	[illegible]	0.00	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.02	0	0	0	0	0	0
4	[illegible]	174	0	[illegible]	0.01	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.06	0	0	0	0	0	0
5	[illegible]	29	0	[illegible]	0.00	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.03	0	0	0	0	0	0
6	[illegible]	77	0	[illegible]	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.07	0	0	0	0	0	0
7	[illegible]	33	0	[illegible]	0.00	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0	0	0	0	0	0
8	[illegible]	219	0	[illegible]	0.02	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.25	0	0	0	0	0	0
9	[illegible]	127	0	[illegible]	0.00	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.13	0	0	0	0	0	0
10	[illegible]	350	0	[illegible]	0.03	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01	0	0	0	0	0	0
11	[illegible]	215	0	[illegible]	0.03	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11	0	0	0	0	0	0
12	[illegible]	121	0	[illegible]	0.02	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.02	0	0	0	0	0	0
13	[illegible]	330	0	[illegible]	0.02	0.004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.41	0	0	0	0	0	0
14	[illegible]	130	0	[illegible]	0.00	0.006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.68	0	0	0	0	0	0
15	[illegible]	255	0	[illegible]	0.00	0.004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.28	0	0	0	0	0	0
16	[illegible]	0.04	0	[illegible]	0.03	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0	0	0	0	0	0
17	[illegible]	0.02	0	[illegible]	0.18	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0	0	0	0	0	0
18	[illegible]	64	0	[illegible]	0.00	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01	0	0	0	0	0	0
19	[illegible]	0	32	[illegible]	0.00	0.006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.09	0	0	0	0	0	0
20	[illegible]	90	0	[illegible]	0.01	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.36	0	0	0	0	0	0
21	[illegible]	212	0	[illegible]	0.00	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.25	0	0	0	0	0	0
22	[illegible]	399	0	[illegible]	0.27	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10	0	0	0	0	0	0
23	[illegible]	262	0	[illegible]	0.04	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11	0	0	0	0	0	0
24	[illegible]	39	0	[illegible]	0.00	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.08	0	0	0	0	0	0
25	[illegible]	0	20	[illegible]	0.00	0.006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10	0	0	0	0	0	0
26	[illegible]	101	0	[illegible]	0.00	0.015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10	0	0	0	0	0	0
27	[illegible]	142	0	[illegible]	0.01	0.014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.05	0	0	0	0	0	0
28	[illegible]	131	0	[illegible]	0.01	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.04	0	0	0	0	0	0
29	[illegible]	57	0	[illegible]	0.01	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.04	0	0	0	0	0	0
30	[illegible]	70	0	[illegible]	0.05	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.09	0	0	0	0	0	0
31	[illegible]	67	0	[illegible]	0.00	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.04	0	0	0	0	0	0
32	[illegible]	415	0	[illegible]	0.02	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.44	0	0	0	0	0	0
33	[illegible]	0	20	[illegible]	0.19	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0	0	0	0	0	0
34	[illegible]	43	0	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.06	0	0	0	0	0	0
35	[illegible]	41	0	[illegible]	0.00	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01	0	0	0	0	0	0
36	[illegible]	104	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
37	[illegible]	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
43	[illegible]	36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45	[illegible]	138	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
47	[illegible]	31	[illegible]	[illegible]	[illegible]	0.001	0.22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
48																					
49	[illegible]	79	0	[illegible]	0.00	0.004	[illegible]	[illegible]	[illegible]	[illegible]	0.015	0.000	[illegible]	0.001	0.38	0	0	0	0	0	0
50	[illegible]	4	0	[illegible]	0.00	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.002	0.31	0	0	0	0	0	0
51	[illegible]	147	0	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.08	0	0	0	0	0	0
52	[illegible]	0	6	[illegible]	0.00	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.06	0	0	0	0	0	0
53	[illegible]	131	0	[illegible]	0.00	0.006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.08	0	0	0	0	0	0
54	[illegible]	18	0	[illegible]	0.00	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.00	0	0	0	0	0	0
55	[illegible]	82	0	[illegible]	0.03	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.08	0	0	0	0	0	0
56	[illegible]	86	0	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.003	0.02	0	0	0	0	0	0
57	[illegible]	13	0	[illegible]	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.001	0.00	0	0	0	0	0	0
58	[illegible]	12	0	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.06	0	0	0	0	0	0
59	[illegible]	107	0	[illegible]	0.00	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.22	0	0	0	0	0	0
60	[illegible]	0	307	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.23	0	0	0	0	0	0
61	[illegible]	101	0	[illegible]	0.65	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	4.90	0	0	0	0	0	0
62	[illegible]	107	0	[illegible]	0.00	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.23	0	0	0	0	0	0
63	[illegible]	28	0	[illegible]	0.00	0.004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.06	0	0	0	0	0	0
64	[illegible]	239	0	[illegible]	0.01	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.03	0	0	0	0	0	0
65	[illegible]	0	2	[illegible]	0.09	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.08	0	0	0	0	0	0
66	[illegible]	110	0	[illegible]	0.01	0.003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.005	0.01	0	0	0	0	0	0
67	[illegible]	24	0	[illegible]	0.03	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.006	0.27	0	0	0	0	0	0
68	[illegible]	40	0	[illegible]	0.00	0.004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.23	0	0	0	0	0	0
69	[illegible]	62	0	[illegible]	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.00	0	0	0	0	0	0
[illegible]	[illegible]	633	0	[illegible]	0.02	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.013	0.00	0	0	0	0	0	0
[illegible]	[illegible]	1575	0	[illegible]	0.01	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.004	0.05	0	0	0	0	0	0
[illegible]	[illegible]	214	0	[illegible]	0.02	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.09	0	0	0	0	0	0
[illegible]	[illegible]	86	0	[illegible]	0.02	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.006	0.03	0	0	0	0	0	0
[illegible]	[illegible]	34	0	[illegible]	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.05	0	0	0	0	0	0
[illegible]	[illegible]	35	0	[illegible]	0.01	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.17	0	0	0	0	0	0
[illegible]	[illegible]	99	0	[illegible]	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.03	0	0	0	0	0	0
[illegible]	[illegible]	221	0	[illegible]	0.01	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.05	0	0	0	0	0	0
[illegible]	[illegible]	124	0	[illegible]	0.01	0.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.001	0.03	0	0	0	0	0	0
[illegible]	[illegible]	0	20	[illegible]	0.49	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.31	0	0	0	0	0	0
[illegible]	[illegible]	119	0	[illegible]	0.14	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.00	0	0	0	0	0	0
[illegible]	[illegible]	76	0	[illegible]	0.01	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.000	0.21	0	0	0	0	0	0
[illegible]	[illegible]	557	0	[illegible]	0.01	0.002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.005	0.03	0	0	0	0	0	0
[illegible]	[illegible]	67	0	[illegible]	0.01	0.004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	0.009	0.00	0	0	0	0	0	0
[illegible]	191	33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]																					
[illegible]	219	118	0	0.10	0.23	0.002	0.05	0.000	0.000	0.010	0.000	0.000	0.001	0.006	0.04	0	0	0	0	0	0
[illegible]	241	0	132	0.48	0.07	0.002	0.07	0.000	0.000	0.020	0.001	0.000	0.001	0.000	0.32	0	0	0	0	0	0
[illegible]	240	125	0	0.04	0.01	0.001	0.28	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.02	0	0	0	0	0	0
[illegible]	114	45	0	0.06	0.02	0.000	0.04	0.000	0.000	0.010	0.002	0.000	0.003	0.003	0.21	0	0	0	0	0	0
[illegible]	157	277	0	0.10	0.03	0.000	0.00	0.021	0.000	0.020	0.000	0.000	0.007	0.005	5.35	0	0	0	0	0	0
[illegible]	396	81	0	0.05	0.00	0.000	0.25	0.000	0.000	0.030	0.004	0.000	0.000	0.000	0.21	0	0	0	0	0	0
[illegible]	28	113	0	0.11	0.01	0.002	0.03	0.000	0.000	0.010	0.000	0.000	0.000	0.002	0.11	0	0	0	0	0	0
[illegible]	322	165	0	0.08	0.00	0.002	0.29	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.06	0	0	0	0	0	0
[illegible]	219	1265	0	0.09	0.01	0.001	0.00	0.000	0.010	0.070	0.000	0.000	0.003	0.060	0.06	0	0	0	0	0	0
[illegible]	279	100	0	0.02	0.15	0.000	0.08	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.00	0	0	0	0	0	0
[illegible]	300	52	0	0.04	0.02	0.000	0.70	0.000	0.000	0.030	0.001	0.000	0.000	0.006	0.08	0	0	0	0	0	0
[illegible]	280	48	0	0.07	0.02	0.002	0.05	0.000	0.000	0.010	0.002	0.000	0.000	0.002	0.12	0	0	0	0	0	0
[illegible]	301	0	2	0.07	0.05	0.006	0.10	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.79	0	0	0	0	0	0
[illegible]	73	8	0	0.09	0.02	0.000	0.00	0.002	0.000	0.080	0.024	0.000	0.000	0.000	8.54	0	0	0	0	0	0
100	207	251	0	0.66	1.03	0.002	0.00	0.000	0.000	0.010	0.000	0.000	0.001	0.002	0.02	0	0	0	0	0	0
101	162	27	0	0.01	0.01	0.006	0.13	0.000	0.000	0.010	0.000	0.000	0.000	0.003	0.02	0	0	0	0	0	0
102	151	51	0	0.05	0.01	0.000	0.77	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.00	0	0	0	0	0	0
103	212	317	0	0.04	0.00	0.001	0.62	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.12	0	0	0	0	0	0

Pg/ Col / Obs#	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.4	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.047	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Pg/ Col Obs#	6 9	6 10	6 11	6 12	7 1	7 2	7 3	7 4	7 5	7 6	7 7	7 8	7 9	7 10
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48														
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	1.3	0	1.1	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85														
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0

KANSAS FARMSTEAD WELL WATER QUALITY STUDY

by

ALAN THOMAS HEIMAN

B.S., Kansas State University, 1985

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Agricultural Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

ABSTRACT

Water from 103 farmstead wells selected throughout the state of Kansas to be representative of the overall well population was sampled and analyzed for volatile organic compounds (VOCs), pesticides and inorganic compounds by the Kansas Department of Health and Environment. Wells selected for sampling were picked ramdomly by county on the basis of farmstead well density within the state. Participants were picked if they were: using the sampled well for use in the household, performing active farming operations in the vicinity and familiar with activities near the well for the past ten years. Each participant then completed a questionnaire about their farming enterprise and history of the well.

Sampling dates occurred between December 1985 and February 1986. Wells containing detectable amounts of VOCs and pesticides numbered two and eight percent respectively. Inorganic constituents in excess of Maximum Contaminant Levels for public water supplies follow: nitrate at 28%, selenium at 9% and fluoride at 2%. After processing the data, the independent variables, nitrate, selenium, pesticides, VOCs were selected as variables of interest. Analysis of variance was performed upon these variables according to geological, geographical and precipitation regions.

Wells in the north east, north central and south

central regions of Kansas have a higher probability of nitrate contamination. Multiple regression was performed on all predictor variables with a "all models" approach. The best model for nitrate has the variables: age of well, land use around the well and the distance to any possible source of organic contamination.

For selenium it can be concluded that south west and north central regions have a higher probability of contamination. Areas with average rainfall less than 30 inches are more likely to be contaminated.