SONOMA COUNTY
SANITARY SURVEY

FEBRUARY 1944

FOR SONOMA COUNTY DEPARTMENT OF PUBLIC HEALTH

CHARLES H. LEE, CONSULTING SANITARY ENGINEER

REPORT ON

SANITARY SURVEY OF SONOMA COUNTY, CALIFORNIA
with
RECOMMENDATIONS FOR CONTROL OF EPIDEMICS

February 1,1944

FOR THE

BOARD OF SUPERVISORS, COUNTY OF SONOMA

and the

SONOMA COUNTY DEPARTMENT OF PUBLIC HEALTH

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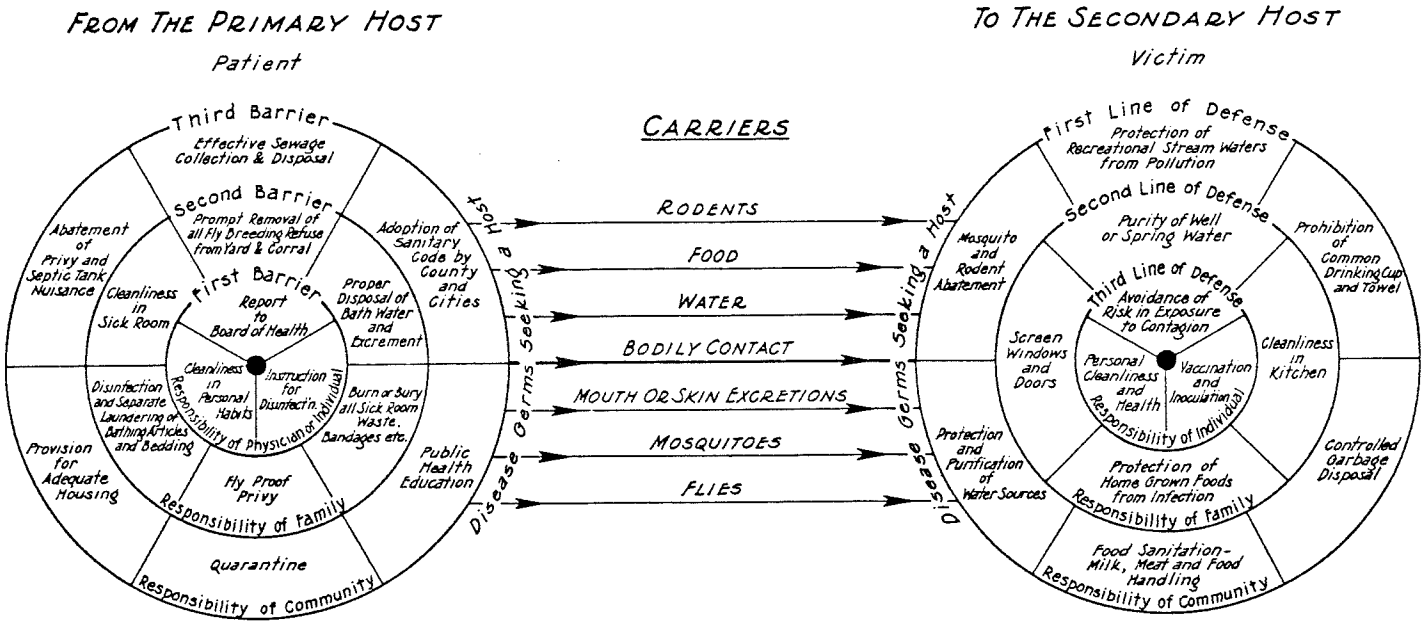

TRANSMISSION AND CONTROL OF COMMUNICABLE DISEASES

Prepared by
Charles H. Lee
Consulting Engineer

FOREWORD

From time immemorial cleanliness has been recognized as essential in preventing the spread of contagious diseases. The Mosaic sanitary code of the Book of Leviticus, a model of its kind, is built upon cleanliness as a fundamental principle. For centuries this code has been observed by peoples in every part of the civilized world. Similarly the famous phrase from a sermon by John Wesley, "Cleanliness is indeed next to Godliness", has become a by-word among all English speaking people.

Modern sanitary practice began with the establishment of the germ causation of disease. This was a radical departure from previous belief, but the two ideas were adjusted in the so-called "filth theory", namely, that the germs of disease commonly grow in decaying organic matter. With the increase in scientific knowledge this theory had to be abandoned, for it was found that disease germs are parasitic and seldom grow outside of the living body.

Present day information indicates that communicable diseases do not originate in man's environment but are passed from person to person, sometimes by direct contact but more frequently through the agency of a carrier. Such carriers include human wastes, insects, rodents, flowing water, and food.

Thus again we come back to the age-old fact of the importance of cleanliness in disease prevention. For what <u>is</u> cleanliness but the absence of accumulating human wastes upon or about the person, the absence of accumulations of refuse and filth which become the breeding place for insects and rodents, the absence of pollution in water and of infection in food?

The essence of modern sanitation is cleanliness of person, cleanliness in the home, cleanliness in community surroundings. The message of this report is -

TO PREVENT EPIDEMICS:

1. CLEAN UP
2. KEEP CLEAN

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February 1,1944

To the Honorable
Board of Supervisors and
County Health Officer,
Sonoma County,
Santa Rosa, California

Gentlemen:

I submit herewith my report on a Sanitary Survey of Sonoma County, California, with Recommendations for Control of Epidemics, in response to the Board's Resolution of July 19, 1943 and instructions from the County Health Officer acting under authority of said Resolution.

Recommendations based upon the field survey and my studies follow this letter of transmittal. The detailed report is illustrated with photographs, maps and diagrams and is accompanied by statistical tabulations which are too lengthy to include in the text.

Respectfully submitted,

Charles H. Lee

Charles H. Lee

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(SEAL)

RECOMMENDATIONS

The following are recommendations of action to be taken by the appropriate governing bodies or officers of the County of Sonoma and the various cities and districts in the County for the purpose of prevention and more effective control of future epidemics. These recommendations are based upon study of the data assembled in the course of this survey and the information presented in this report.

County of Sonoma

1. A Code of Health and Sanitation should be adopted by the Board of Supervisors. This Code should include all applicable provisions of codes adopted by other counties which have proved workable and effective and any additional provisions which conditions in Sonoma County require. The Health Codes of Stanislaus and San Bernardino Counties are well prepared and include most of the phases of sanitary control which should be the subject of an ordinance in Sonoma County. Provision for licensing of septic tank service men is suggested as a means of curbing the unnecessary pumping out of septic tanks now prevalent.

2. The formation of a joint County-City Health Department with Santa Rosa and with any other incorporated City of the County desirous of such service should be encouraged.

3. Formation of the Central Sonoma Mosquito Abatement District should be encouraged to include the thickly populated portion of the County from Healdsburg to Petaluma and from Santa Rosa to Sebastopol and all adjacent contiguous areas where mosquitoes are known to breed. (See Diagram 5).

4. County or joint City and County garbage dumps should be acquired at appropriate locations in various parts of the County and an ordinance adopted by the Board of Supervisors prohibiting the dumping of refuse in unincorporated territory at points other than the officially provided community garbage dumps. Such dumps should be placed in charge of a dump tender and maintained in a sanitary condition with minimum of odor and with control of flies and rats. Wet garbage alone is unsuitable for dumping unless mixed with ashes or rubbish or buried with earth. The dumping of unsegregated garbage, ashes and rubbish, allowing hogs to feed for 24 hours and then burning, is fairly satisfactory if flies and rodents are under control but it results in injury and mortality among hogs due to broken glass, razor blades, ant poison, etc. The feeding of segregated wet garbage to hogs is preferable but should be done on feeding floors with facilities for washing. In this connection the adoption of the two-garbage-can system of garbage collection, as is now practiced in Palo Alto, is desirable, with prohibition of the feeding of hogs on any but wet garbage. The cooking of garbage is the only insurance against spread of trichina among hogs fed on garbage.

Any one of four methods of refuse disposal is recommended, the order of preference being: (1) earth fill, (2) segregation of wet garbage and

rubbish, the garbage being fed to hogs and rubbish burned, (3) mixed wet garbage and rubbish fed to hogs for 24 hours before burning, (4) burning of mixed rubbish and householders garbage, the latter being thoroughly wrapped in paper by the householder as deposited in the garbage can.

The site of the existing garbage dump used by the City of Santa Rosa and the County is very satisfactory for the Santa Rosa territory. A desirable joint site for the Sonoma area can be found in the reclaimed marsh area south of Shellville. Sites for County dumps should be selected in the Petaluma, Sebastopol, Occidental, Guerneville, Healdsburg and Cloverdale areas.

5. Formation of County Sanitary Districts at Guerneville and Bodega Bay is recommended at this time rather than incorporation. This will provide for sewage collection and disposal, which is the most urgent community need, without the cost of complete municipal service. The districts should include all existing contiguous built-up areas and sub-divisions which are naturally tributary to a main sewer sustem (Diagram 5). A competent sanitary engineer should be employed to prepare plans for collection systems and sewage disposal plants.

6. Maintenance of an adequate number of qualified sanitary inspectors on the staff of the County Health Department for systematic inspection of food handling establishments, sewage disposal on recreational streams and in thickly populated unincorporated areas, housing conditions, transient labor camps, garbage disposal, public water supply and other potential fields of disease transmission.

At least one member of the staff should be practically familiar with the sanitary disposal of effluent from house septic tanks and capable of advising house owners facing difficult conditions of disposal.

7. Preparation of pamphlets for distribution by the County Health Department on practical subjects such as small septic tank installation and operation, rat catching, control of house fly, fly-proof privies, etc.

8. Educational campaign under the guidance of the County Health Department presenting the importance of sanitary living conditions free from insects and rats, the danger of using untreated water from natural streams for domestic purposes, the importance of protection of shallow well waters from pollution, etc.

9. Studies should be made in cooperation with the State Health Department to devise methods for handling the voluminous sludge carrying effluent from fruit and vegetable dehydrating plants. Primary sedimentation with removal of sludge at least daily and disposal of effluent by irrigation or seepage ponds is suggested. Effective handling of the effluent from plants at Healdsburg and Sebastopol should be enforced as soon as methods are perfected.

10. Drainage channel improvements designed to prevent spread of sewage polluted storm water over farm and meadow lands southwest of Santa Rosa and adjacent to and along the Laguna should be planned. Such improvements will also serve to protect government and private as well as county property from flood inconveniences and damage. Benefit thus accrues to various interests including the general public, and effort should be made to obtain the cooperation of all interests in obtaining rights-of-way and financial assistance. To this end allocation of cost should be made in proportion to benefits received. Where Army or Navy posts are involved, improved sanitary conditions, protection of property, freedom from interruption in traffic or use of runways, all may be sources of benefit.

City of Santa Rosa

1. Annexation at an early date of subdivided and appreciably built-up suburbs north and south of the City as approximately shown on the Outline Map of Santa Rosa (Diagram 7). This can best be accomplished through the efforts of local citizens' committees aided by City officials in furnishing advice and legal, economic and technical information.

2. Preparation of engineering plans by the City Engineer with the advice of a competent sanitary engineer for north and south side trunk and intercepter sewers for relief of existing City sewers and collection of sewage from areas to be annexed. Suggested locations of north and south side trunk and intercepter sewers are shown on Diagram 7. Construction should immediately follow annexation of new areas to be served.

3. Preparation of engineering plans by a competent sanitary engineer employed by the City for enlarged and improved sewage disposal facilities at the existing Municipal Sewer Farm. The enlarged capacity should be great enough to serve the total population of the City as increased by annexation with provision for future expansion. The improved facilities should be capable of producing a reasonably clear and sterile effluent free from undigested organic matter. The effluent when discharged into Santa Rosa Creek should not create nuisance and should meet State Health Department requirements in biochemical oxygen demand and bacterial content for sewage effluent discharged into natural streams.

For primary settlement of solids the use of properly designed modern septic tanks of ample capacity is recommended. Suggested layout is indicated on Diagram 9 and design on Diagram 10. For oxidation and sterilization of effluent and secondary settlement, open ponds carrying water depth of about 3 feet and having an aggregate capacity sufficient for 30 to 40 days' storage detention are recommended. Accessory equipment should include sludge pump, sludge drying beds and chlorinators, the latter to be of ample capacity for emergency use and provided with mixing and contact chambers which will insure thorough mixing and at least 25 minutes contact time. Existing settling tanks may be continued in use but should be covered and provided with baffle boards and wall. A complete water supply with well, pump, elevated tank and distribution pipe of 2-inch size to hose connections at convenient points for

washing down division boxes and septic tanks should also be provided. Construction should be carried on simultaneously with enlargement of sewer system so as to be completed in advance of arrival of increased sewage flow.

4. A schedule of operation for the Sewer Farm with improvements as called for by the plans should be prepared by the Sanitary Engineer including specifications for personnel and a statement of duties.

5. An agreement should be negotiated between the City and the owner of the garbage dump now being used jointly by the City and County providing for permanent use of the land for garbage dump by the City.

6. An ordinance should be adopted similar to the weed burning ordinance providing for preservation of cleanly and sanitary condition of the banks and bed of Santa Rosa Creek. Responsibility for enforcement should be assigned to one City department.

7. The economic and other advantages of a joint County-City Health Department should be investigated and contact made with the County Health Department with reference to working out terms of a contract or resolution. The formation of such a joint department is recommended.

City of Petaluma

1. An improved method of supporting the 24-inch sanitary intercepter sewer where it crosses Petaluma Creek just above the head of navigation should be provided to eliminate the catching of drift during winter storms with possibility of breakage of the line.

2. The economic and other advantages of a joint County-City Health Department should be investigated and contact made with the County Health Department with reference to working out terms of a contract or resolution. The formation of such a joint department is recommended.

City of Healdsburg

1. Sludge digestion capacity at the sewage disposal plant should be increased to permit of handling industrial wastes from fruit packing plants.

2. Emergency chlorination equipment should be provided at the municipal water works pumping plant for use in case of emergency during winter floods.

City of Cloverdale

Emergency chlorinator equipment should be provided at the municipal water works plant for use in case of emergency during winter floods.

RECOMMENDATIONS

City of Sebastopol

1. Steps should be taken to reconstruct the existing fine sand and silt levees enclosing oxidation ponds at the sewage disposal plant. These levees should be constructed of selected graded material which will compact under mechanical rolling at optimum moisture content to form an impermeable levee capable of maintaining its shape and structural integrity when in contact with sewage effluent in the ponds or when submerged by flood water. Before construction of levees the ground should be cleared of vegetation and roots and the first course thoroughly bonded to the subgrade. The present pond area although just sufficient for the purpose of oxidation and sterilization of sewage flow during the summer is inadequate during the winter and lacks reserve capacity for use in emergency or when levee repairs or clearing of ponds is in progress. It is recommended that land for additional pond area amounting to 5 acres be acquired on ground immediately north of the present ponds and that levees for new ponds be constructed there. When completed these ponds can be placed in service and the existing levees removed and rebuilt with selected material.

2. A new site for the City garbage dump should be selected at greater distance from thickly populated areas and removed from proximity to any stream. A joint City-County site is recommended to be located at least one mile from any habitation.

City of Sonoma

Site for a joint City and County refuse disposal site should be acquired and developed in cooperation with County authorities. The site should be more remote than the existing City garbage dump and the latter should be abandoned. Location for a new site can be found in the reclaimed salt marsh area south of Shellville. It should be at least one mile from nearest human habitation.

Geyserville

Septic tank effluents should be combined from as many septic tanks as possible and piped down the slope and out onto the flat bottom land where it can be used for irrigation or spread over waste land which is underlain by permeable subsoil.

Sonoma Valley Recreation District

Formation of a Recreation District in Sonoma Valley is recommended with construction and operation of sewage collection and disposal works as one of the activities of the District incident to enjoyment of the full recreational opportunities of the territory. The sewage collection system at this time should include Richard's Subdivision, Town of Aqua Caliente, Aqua Caliente

Park, Sonoma Highlands, Woodleaf Park, Boyes Spring Park, The Oaks Park, Boyes Spring Hotel grounds, Verano Court, Baron's Villa Tract, and Verano Townsite, all east of Sonoma Creek; and Sonoma Mission Golf and Country Club, Carlsheim, Sonoma Vista Park, Eaton Park, Creek Front Addition, Riverside Addition, El Verano Villa Association tract, Craig Addition, Carriger Subdivision and El Verano, all west of the creek (See Diagram 5). A desirable sewage disposal site exists on the west side of the creek south of El Verano. Two existing bridges, one at Boyes Springs and the other just south of Verano are both of satisfactory construction for support of a trunk line from the east side. The large area and isolation of the sewage disposal site adapt it to the use of oxidation ponds for sterilization and stabilization of suspended and dissolved organic solids in the effluent. Sedimentation can be provided for in well designed septic tanks of ample capacity. The whole sewage system should be capable of gravity operation. The initial cost of the system should be reasonable and maintenance and operation cost not burdensome. A competent sanitary engineer should be employed by the district to prepare plans for the sewage collection system and the sewage disposal plant and to furnish a schedule for operation of the whole system. The extension of the collection system to Glen Ellen should await some future date. The boundaries of the Recreation District should not lie much outside of the area to be ultimately served by the sewage collection system.

Central Sonoma Mosquito Abatement District (Proposed)

The formation of this district is recommended with approximate boundaries as indicated upon Diagram 5. The boundary largely follows county roads except where in contact with the Southern Sonoma Mosquito Abatement District and county boundaries. The district as laid out includes the principal mosquito breeding areas of the central portion of Sonoma County. A technical study of the area should be made after the district is organized to determine the breeding areas and the best methods of control.

Gold Ridge Soil Conservation District

If within the scope of work which can be undertaken, it is recommended that the District encourage the annexation of some 8,000 acres of land east of and including the Laguna for the purpose of opening up portions of the channel of the Laguna below Sebastopol which are choked at several points by deposition of debris from lateral streams and at one point by rock in the channel bottom which retards erosion. This improvement will permit of more rapid drainage of lands adjacent to the Laguna and earlier commencement of farming operations in the spring. Such rapid drainage will also aid in improving sanitary conditions in the meadows adjacent to the Laguna when flooded by storm water polluted with sewage.

C O N T E N T S

C O N T E N T S - continued

C O N T E N T S - continued

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TABLES

DIAGRAMS

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PHOTOGRAPHS

P H O T O G R A P H S - continued

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REPORT ON SURVEY OF SANITARY CONDITIONS

IN SONOMA COUNTY, CALIFORNIA

WITH RECOMMENDATIONS FOR CONTROL OF EPIDEMICS

INTRODUCTION

Sonoma County is one of California's original 27 counties created in 1850, and it holds a prominent place in the early history of the State. It is the leading non-irrigated agricultural county in California and is noted for its poultry, dairy and deciduous fruit products. The Coast Redwood Belt extends well into the County and covers much of the northwest portion. Sonoma County is easily accessible from the congested Bay Region and its clear streams, beautiful valleys and stately trees have long been popular recreational attractions.

The epidemic of poliomyelitis which occurred throughout much of California during the summer of 1943 was at the start more severe in Sonoma County than in any other part of the State. In response to popular demand for remedial action, the Board of Supervisors of Sonoma County, July 19, 1943, passed a Resolution recognizing the emergency and authorizing the County Health Officer to survey and investigate sanitary conditions throughout the County and to take such measures as necessary to correct conditions disclosed by the survey to be inimicable to public health. A fund of $10,000 was appropriated for carrying out the terms of the resolution and all county departments were authorized and directed to cooperate with the Health Department in eradicating unhealthy conditions found to exist.

Exercising his authority under this resolution, the County Health Officer immediately commenced a sanitary survey of recreational stream banks. Two sanitary inspectors were assigned to this work and the number later increased to four. The scope of the work was finally enlarged to include suburban areas and food handling.

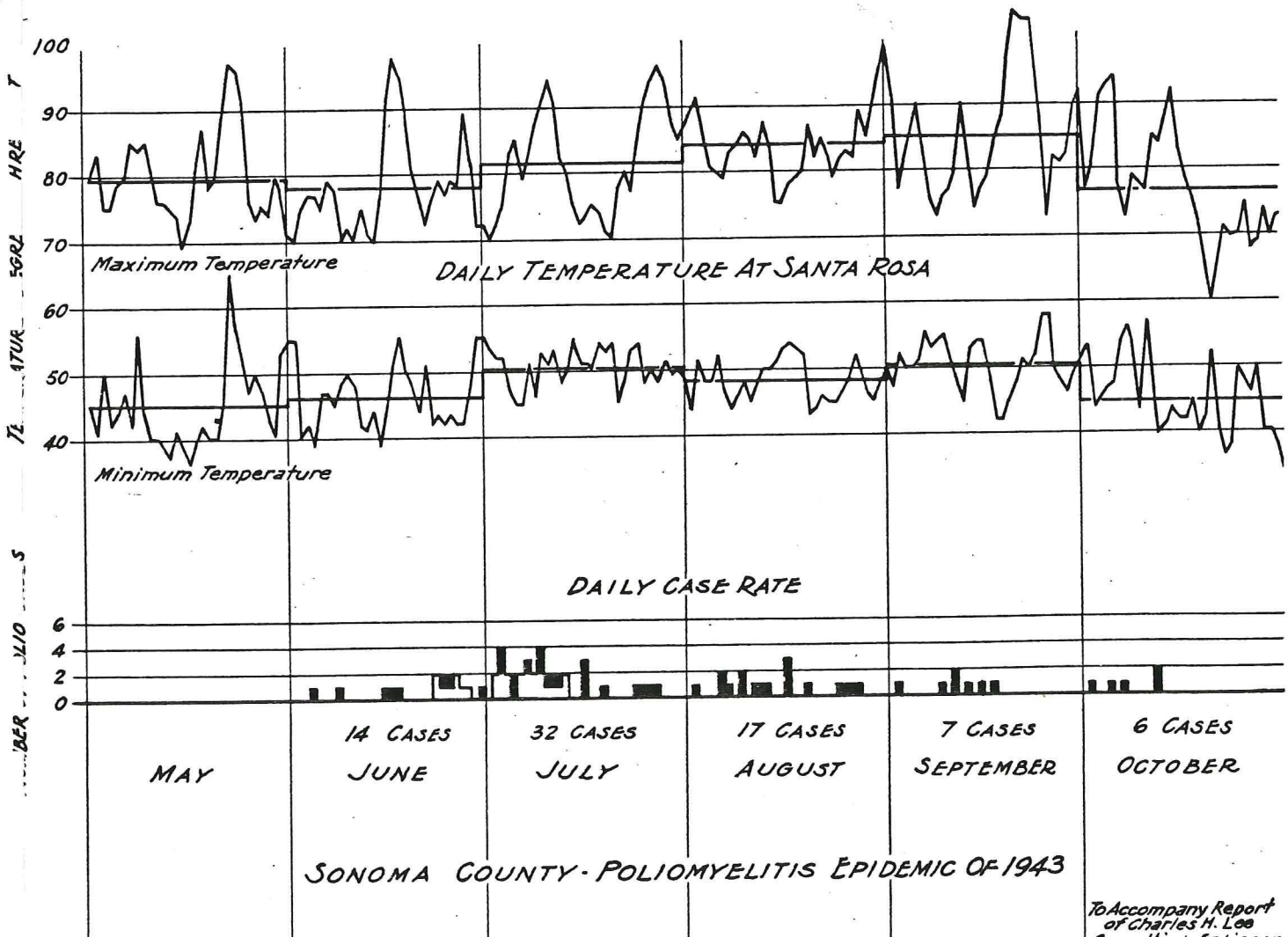
On July 23, 1943, the writer was engaged as sanitary engineering advisor and made recommendations for immediate action in improving unsanitary conditions which might have relation to the current epidemic (Appendix I). These improvements were promptly executed by the County and City authorities with beneficial results. Following this the writer made personal inspections throughout the county, assembling and analyzing data and advising regarding the scope and conduct of the detailed field investigations being made by sanitary inspectors of the Health Department.

This report with accompanying illustrations summarizes and analyzes the findings of the field survey and the writer's investigations. It is

accompanied by specific recommendations for the permanent improvement of sanitary conditions in Sonoma County having in view particularly the eradication of conditions favorable to the spreading of communicable diseases. Some of these recommendations can be carried out in the immediate future. Others are of more comprehensive nature involving large expenditure of public funds, and while detailed planning can be undertaken at once, the execution of the work will cover a longer period and can probably be integrated with a general post-war improvement program.

Acknowledgment is made of the cooperation of the individual members of the County Board of Supervisors and of the helpful assistance of Dr. E. D. Barnett, County Health Officer; Mr. Marshall Wallace, County Surveyor; Mr. Toland C. McGettigan, District Attorney; and various members of their staffs. The cooperation is acknowledged of various City Officials in the six incorporated cities of the County and of the City Engineers in furnishing useful information regarding sewage systems. Similar data was furnished by the Director, Sonoma State Home. Helpful suggestions were also received from Mr. E. A. Reinke, Senior Sanitary Engineer, California State Department of Public Health and useful data from Mr. W. C. Reeves of the Hooper Research Laboratories.

Diagram 1



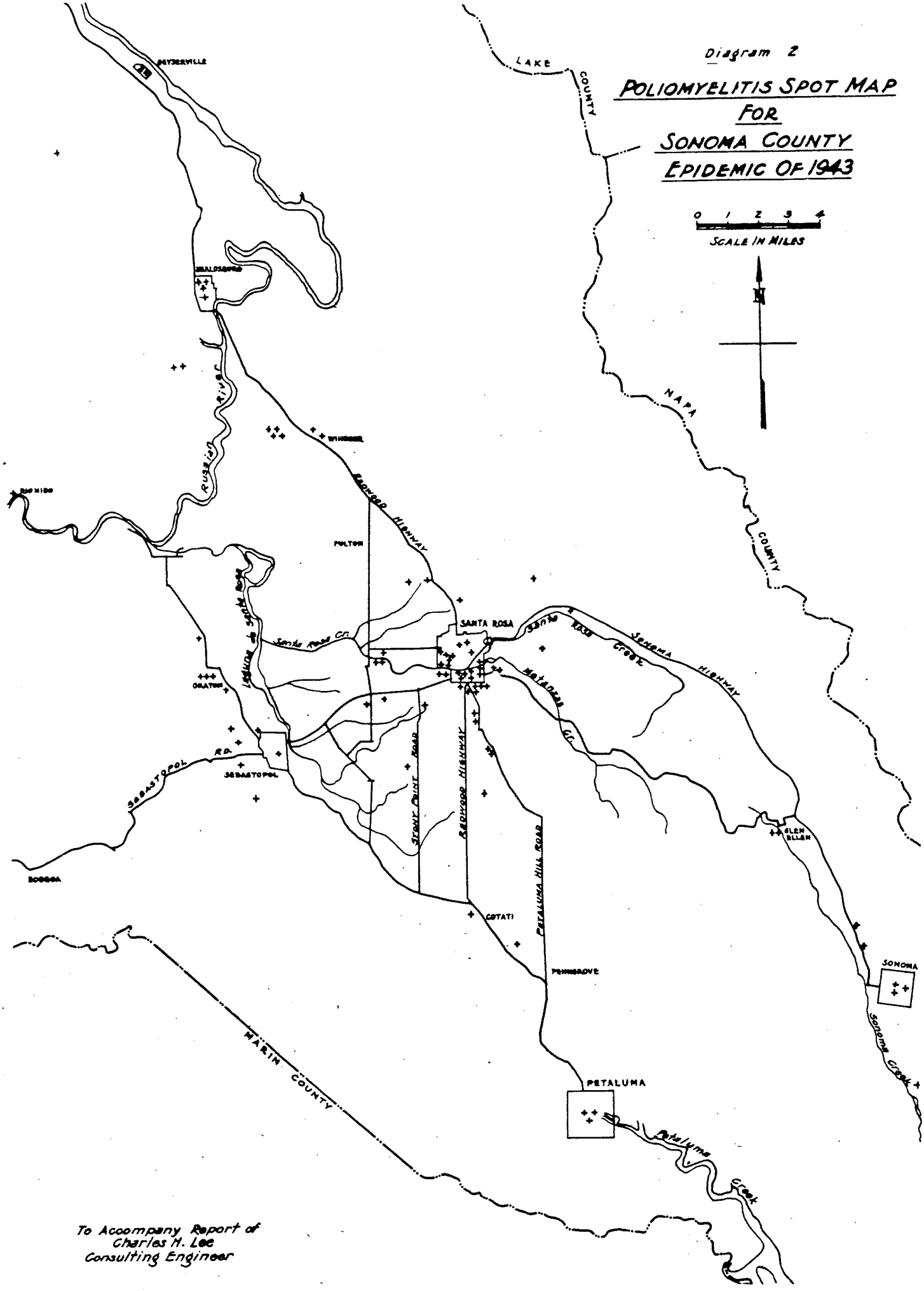
POLIO EPIDEMIC OF 1943

The number of cases of poliomyelitis in Sonoma County began to attain epidemic proportions early in June 1943, and reached a climax during the week ending July 10th, when new cases were reported at the rate of two to four per day for several days in succession (Diagram 1). According to County Health Department records the number of cases per month originating in Sonoma County was:

June	-- 14
July	-- 34
August	-- 17
September	-- 7
October	-- 6
November	-- 1
Total	79

Geographically the epidemic centered at Santa Rosa. The distribution by communities is shown on the accompanying polio "spot map" (Diagram 2). The distribution of cases numerically is as follows:

Santa Rosa City	-- 17
Santa Rosa Rural	-- 28
Sebastopol City	-- 1
Sebastopol Rural	-- 5
Healdsburg City	-- 3
Healdsburg Rural	-- 4
Sonoma City	-- 2
Sonoma Rural	-- 4
Petaluma City	-- 3
Petaluma Rural	-- None
Graton	-- 5
Geyserville	-- 2
Glen Ellen	-- 2



To Accompany Report of
Charles H. Lee
Consulting Engineer

Rio Nido	--	1
Cotati	--	1
Penngrove	--	1
Total		79

The majority of patients were children under 12 years of age, the number being 47. There were 20 adolescents between the ages of 12 and 18, and 12 adults.

The origin of the epidemic and agencies of transmission are obscure. Of the cases at Santa Rosa, over 60 per cent occurred in families living south of Santa Rosa Creek and west of the Northwestern Pacific Railway. Many of these live in subdivisions outside the City limits. Within this area there were several distinct spots of concentration from which infection spread. Cases in other parts of Santa Rosa and vicinity were in general widely scattered. Conditions of living in the area first described are the least sanitary in the Santa Rosa District. Flies are plentiful and outside the City limits there are no sewer connections. It is probable that unsanitary living conditions within and around the dwellings and in some cases overcrowding were responsible for the rapid spread of polio in this area.

Of all cases in the County 35 per cent occurred in families where there had been a previous case. Flies are reported at dwellings where 81 per cent of the cases originated. Mosquitoes are reported at only 39 per cent More than 60 per cent of the dwellings were without sewer connections, 22 per cent being provided with pit privy and 35 per cent ceptic tank or cesspool. Only 34 per cent of the patients reported having been swimming prior to onset, of which one-third swam in Santa Rosa Creek, one-third in Russian River and the remainder at scattered creeks and pools. Temperature has no apparent relation to the daily case rate (Diagram 1). From the available evidence it would appear that personal contact with an infected person was the most common source of the disease possibly supplemented by flies in environments of uncleanliness and poor sanitation.

The County Health Department made a thorough investigation of each case throughout the epidemic and compiled complete records. All cases originating in the County and several from the outside were hospitalized at the Sonoma County Hospital. The first step to check the spread of the disease was taken June 20th, when the County Health Officer posted Santa Rosa and Sonoma Creeks with notices of pollution and warning the public not to use the water for domestic or recreational purposes. Soon after the epidemic attained serious proportions inspections were made by State and Federal Public Health Officers and advice given local health officials. The Hooper Foundation also made a technical survey of the Santa Rosa area July 17th to 20th, giving particular attention to mosquitoes.

POLIO EPIDEMIC OF 1943

Beginning July 14th, a sanitary survey of stream banks was commenced by City and County officials to locate septic tank or cesspool outlets, or waste pipes, which might permit fresh sewage to reach flowing water from adjacent dwellings. In case of violation of State Laws or County Ordnances owners were contacted and advised regarding remedial work required. In most cases land owners were very cooperative and unsanitary conditions were promptly corrected. This work was actively prosecuted by the sanitary inspectors of the County Health Department, first on Santa Rosa Creek and ultimately on all recreational streams in Sonoma County.

On July 26th, under direction of the County Surveyor, work of filling stagnant pools and opening up the channel of Santa Rosa Creek was commenced, and by August 2nd, had been completed from Farmers Lane to Fulton Road west of the City limits. Metanzas Creek was similarly opened up from east boundary of Doyle Park to junction with Santa Rosa Creek. This work included removal of moss and vegetation and cutting of a channel for free flow of water. Isolated pools and wet stream banks were also sprayed with oil to kill mosquito larvae, this work being done by the City Health Inspector, within the City, and the County Surveyor in the County. Construction work was also started by the County Surveyor at the County Hospital to prepare basins to retain septic tank effluent until oxidized and sterilized before discharge into Piner Creek. Santa Rosa City officials were also active in remedying unsatisfactory conditions existing at the City Sewer Farm. It is to be noted that there is a distinct decrease in the polio case rate beginning in late July (Diagram 1).

The 1943 polio epidemic extended throughout most of California as indicated by the records of the California State Department of Public Health. The total case rate per 1000 population up to the end of December 1943 was highest in Tehama County - being 1.50. This was closely followed by Mono with 1.47, Lake with 1.32, Kern with 1.24 and Sonoma with 1.12. Nine other counties had case rates between 1.00 and 0.50. Twenty-four counties had case rates between 0.50 and 0.25. The other counties were lower, with Imperial being 0.03. The average rate for the entire State was 0.34 or only one-third of that of Sonoma County. It is of interest to note that the peak of new cases occurred much later in most of the other counties than it did in Sonoma County and that it held at a higher rate for a longer time. In Sonoma County there was an abrupt halting of the upward trend of polio case rates at the end of July with an immediate decline following that date. The peak for the State occurred 60 days later. This early decrease of case rate in Sonoma County may well have resulted from the timely remedial measures taken by the local public officials.

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COMMUNICABLE DISEASES

An epidemic has been defined as a sudden outburst of a communicable disease affecting a large number of people in a community in a short period of time (a). Communicable diseases include all bodily ailments which may be transmitted by any means from person to person or from animals to persons. They include contagious diseases communicated by direct bodily contact and infectious diseases in which the virus, or morbid poison, is transmitted by some intermediary agency.

Cause of Disease

In the case of polio, influenza and a few other diseases the virus has not been positively identified by the medical profession and there is no recognized cause. In most communicable diseases, however, the virus has been found to be of a minute organism of parasitic habit. Some of these organisms are of microscopic size, but more frequently they require special cultures for reproduction and are capable of microscopic study only with difficulty. These organisms are technically known as pathogens.

Bacteria

The most common type of pathogens are certain parasitic bacteria. These organisms are a form of plant life in the fungi group, but are not to be confused with the multitude of harmless microscopic plant organisms, including ordinary bacteria, algae, diatoms, infusoria, etc. Many of the latter are very beneficial to man, performing the functions of scavenger, soil builder, and other useful activities. Bacteria are mostly single cell plants, the more highly developed forms being filamentous or thread-like. They multiply by subdivision, although some types produce resting spores which remain inactive almost indefinitely in environment unfavorable for development.

Parasitic bacteria are identified with such diseases as typhoid, bacilliary dysentery, cholera, Malta fever, bubonic plague, diphtheria, yellow fever, tuberculosis, smallpox, etc. The appropriated home of these bacteria is the human or animal body, technically called the host, which they enter through the mouth, nose or skin lesion. The latter may arise from cut, laceration or insect bite. After a period of growth and development in the host, bacteria may escape through bodily discharges such as urine, feces or droplets of moisture from the mouth. Outside the body, mortality is usually very rapid except in an environment of snow or ice. Other exceptions are the spore forming bacteria which are very resistant and may lie dormant for long periods of time in the soil. Anthrax and tetanus bacteria belong to this class.

Protozoa

Pathogens are also found among microscopic animal organisms, principally the protozoa and vermes (worms). These pathogens are also parasitic and

(a) Municipal and Rural Sanitation, Ehlers & Steel

develop within the human or animal body. They should be distinguished from the myriad types of ordinary protozoa and other forms of microscopic animal life which are beneficial to man as bactericides, rock builders, etc. Protozoa are the lowest organism belonging to the animal kingdom and like bacteria are unicellular. They also multiply by subdivision and some types produce resting spores. They enter the body by the same channels of infection as bacteria. They are identified with diseases such as malaria, amobic dysentery and African sleeping sickness.

Vermes

Vermes are of various sizes, the larger types being visible to the naked eye. They produce from eggs which are of microscopic size. They enter the body by the same channels of infection as bacteria and protozoa. Among them may be listed the tapeworm, living in the intestines of man and causing anemia, the hookworm also living in the intestines, and the trichina worm living in the muscles and causing trichinosis.

Transmission of Disease

The most important source of disease is contagion by direct contact with the infected individual. A secondary source of disease is infection by direct or indirect contact with human or animal waste such as mouth spray, saliva, mucus, pus, and excrement, the latter including urine and feces. Infected wastes may originate either from the body of a patient or from a carrier. The latter is a person who harbors disease organisms, but who shows no symptom of the disease. Flesh of certain animals and fish, and the blood stream as tapped by biting insects, are also to be included. These various waste substances may contain pathogens which before death gain access to another host.

Vehicles of infection are the means by which infection is transported from one host to another and include water, food, insects, animals, inanimate objects, atmospheric dust, and in some instances the soil.

Water

Natural waters are universally used by man and are the most common vehicle of infection. They may be directly polluted by discharge of human waste into flowing streams or lakes or by their absorption into permeable saturated soil. Indirect pollution may arise from the inflow of storm runoff which has washed soil containing infectious material. Seepage inflow into streams from highly permeable soil or rock formations may also be the source of indirect pollution. In thickly populated communities the source of pollution may be effluent from a municipal or industrial sewage system which is discharged into the natural water body without sterilization. In rural areas, kitchen or wash water, waste, septic tank effluent, or overflow from cesspools may be the source.

Water is not a favorable environment for pathogens and the process of sterilization commences as soon as pollution occurs. Lack of food, preying of higher forms of life such as plankton, reduction of turbidity by sedimentation, penetration of sunlight, oxygenation and dilution all tend to improve a polluted water. It is a well established fact, however, that clear sparkling stream water may be grossly polluted with disease organisms. Although a large percentage may die within three or four days of arrival, yet, reasonably complete sterilization does not occur until 30 to 40 days have elapsed.

With modern public health supervision, public water supplies drawn from natural sources are either protected from pollution or thoroughly sterilized before introduction into distribution mains so that there is very little danger of pollution reaching the consumer. Private supplies are not subject to supervision, however, and may be drawn from a polluted source without the knowledge of the user. This is particularly true in the case of isolated houses, hotels, auto courts or camps. Another means of human contact with polluted water is on streams, lakes or ocean beaches used for recreational purposes such as swimming, bathing, and boating. Although there is not the same degree of imbibition as in the case of domestic water supply, yet the possibility exists. Further opportunities occur where milk cows or goats drink water from polluted streams or pools, or sewage effluent is used for irrigation of low growing vegetables. The common drinking cup and towel are also possible sources of transmission.

Food

Food is next to water as a vehicle of infection. It may become infected by contact with the hands of a carrier or a person in the early stages of disease, or by sneezing or coughing in the vicinity of foods. Flies and rodents are common agencies of food infection. Eating utensils which are imperfectly cleaned and objects placed in the mouth, especially among children, are a common source of infection. Milk from tubercular cows and meat or fish not sufficiently cooked to destroy immature tape worm or trichina worms may be a source of infection.

Insects

Insects play an important part in transmission of disease. Flies have already been mentioned in connection with food. The housefly is a mechanical carrier of disease. It breeds in and feeds upon excrement and manure and also any decaying and fermenting organic matter. The housefly's legs are hairy and gather filth from the materials over which it crawls. It also takes this filth into its alimentary canal. Later such filth with any disease bacteria which it contains may be deposited upon exposed food either by dropping from its legs or as excrement or "vomit spots". Houseflies have been identified with spread of smallpox, ophthalmia, parasitic worms, and especially intestinal diseases. The life cycle of the fly from laying of eggs to full growth is 8 to 10 days. The life of the fly under favorable conditions varies from 30 to 60 days. The range of flight ordinarily does not exceed one-quarter to one-half mile although distances up to 13 miles have been reported

with favorable winds.

Certain varieties of mosquitoes have been found to be an essential link in a cycle of infection. Malaria, yellow fever, dengue and filariasis have been found to be spread by the mosquito. Disease organisms are obtained by the mosquito through biting an infected person and feeding upon the blood. After a period of days in the alimentary canal the bacteria reach the salivary gland of the mosquito. The biting of a second person then results in infection by injection of bacteria into the blood stream. Certain species of the Anopheles mosquito carry malaria. The Aedes Aegypti is identified with yellow fever and dengue. The Culex Quinquefasciatus carries filariasis. There are many varieties of mosquitoes but only a few are disease carriers. Most varieties are pests and have no public health significance. Water is the breeding environment of the mosquito. After development, they seek low growing vegetation for shelter from sun, rain and wind, but this is not their breeding place. The life cycle of a mosquito is about seven days and the life span seldom exceeds two weeks. Mosquitoes seldom travel further than one mile from their breeding place. In general they avoid winds, exceptions being the Culex and salt marsh mosquitoes which in favorable winds may travel as far as 30 miles.

Typhus fever and trench fever are Old World diseases carried by the body louse. Endemic typhus or "Brill's Disease" is carried by fleas and rat mites whose normal hosts are rats. Plague, of which there are several varieties, has a similar origin. Relapsing fever occasionally reported in the United States and more frequently in Europe and Africa, is transmitted by ticks, body and head lice and probably bed bugs. Ticks are also identified with the spreading of Rocky Mountain spotted Fever.

Rodents

Rodents, native to the United States, which are considered as possible hosts include field mice, cotton rats, pocket gophers, prairie dogs, ground squirrels and chipmunks. Their damaging activities are largely confined to field crops and do not constitute an active threat to public health. With the development of world-wide shipping during the 18th and 19th centuries, rodents from other parts of the world were introduced into America. These include the house mouse, the brown rat, the black rat and the roof rat. The two latter varieties like grain as food, prefer nesting in trees, and are not so numerous. The brown rat is ferocious and large and is the most common rat in cities. It is an omniverous eater and consumes garbage, grain, vegetables, and any food used for human consumption. It burrows and nests in the ground, preferably under buildings or piles of lumber or rubbish. It is a prolific breeder, producing young 6 to 10 times a year with approximately 10 to the litter. All the imported rats as well as the house mouse and some of the native rodents such as the ground squirrel are subject to bubonic plague. This disease is transmitted among rats by the bites of fleas which infect them. When a rat dies the fleas seek another host and, although preferring rats, may temporarily find refuge with a human host. The bite of an infected flea may

cause plague to develop in a human being.

Rats also constitute a menace to public health as carriers of infectious matter to human food in the same manner as flies. They are often infected with tape worms and intestinal parasites and harbor trichina worms. Infection from diseased rats may lodge on food through their droppings. They are known to have spread infectious jaundice by infection of food by their urine. In addition to their public health menace they are an economic liability through their destruction of agricultural crops, foods, fabrics and furniture.

Control of Disease

The basic idea underlying sanitary control of communicable disease is interruption in the chain of transmission. This is accomplished at the source through bacterial sterilization and the eradication of insect and rodent carriers This principle underlies the various public health activities of Governmental and private health agencies.

Sterilization

Sterilization is attained either by use of lethal agencies such as chemicals or heat, or by exposure to destructive environment. Following modern sanitary practice, all public water supplies in which there is evidence or possibility of pollution are now systematically sterilized by chlorination. Sewage effluent from municipal or industrial systems is also often chlorinated before discharge into natural streams or lakes. Storage for a period of 30 days or more is sometimes substitued for chlorination in the handling of both water supply and sewage effluent. It is important in the case of storage to prevent short circuiting by which some of the liquid might pass through the storage basin in less than 30 days.

Sterilization of small septic tank effluent is accomplished through absorption by the soil in which the bacteria die for lack of food. Seepage from cesspools is similarly rendered sterile. Care must be exercised in the location of septic tank effluent pipe or cesspool that the seepage does not reach an adjacent well or stream before complete sterilization has been attained. In areas where the soil is impermeable or on shallow bedrock, septic tank effluent and cesspool liquor is not readily absorbed by the soil. For such areas, where population is increasing or dense, the only method for prevention of nuisance and control of disease may be the construction of a sewage collection and disposal system.

The disinfection of air in much occupied rooms and hospitals is another means of sterilization.

Eradication of Carriers

The eradication of insect and rodent carriers is variously accomplished. Flies can be controlled by cleaning up or covering their breeding and feed feeding places, by screening of buildings where food is exposed, and by use of fly traps. Mosquitos are best controlled by drainage or spraying with light oil of stagnant pools of water where the larvae develop. Screening of homes where mosquitoes may seek shelter is also desirable. Rodent control is principally by trapping, poisoning, fumigation, rat-proofing or rat-stoppage of buildings, and by sea port regulation.

Public Health Activities

The activities of various public health organizations such as Federal, State, County and City health departments are also instrumental in controlling the spread of disease. These organizations administer the various laws adopted for protection of public health. Among the provisions of such laws are included isolation of persons with contageous diseases, restriction of public assembly, prohibition of expectoration, prohibition of open privies, prohibition of use of common drinking cup and towel, supervision of food producing and distribution, inspection of public eating establishments and public regulation of plumbing.

The general public health laws of the State are enforced through local officers and courts, but in thickly populated areas local laws are also necessary to cope with local conditions and to make possible the quick action necessary to clear up threatening situations before they develop into epidemic proportions.

* * * * *

LEGAL ASPECTS OF DISEASE CONTROL

The legal and administrative framework for control of disease in California is embodied in the Health and Safety Code as adopted by the State Legislature in 1939 and subsequently amended, together with various statutes such as the Food Sanitation Act of 1909 with subsequent amendments. The Code sets up the State Department of Public Health with general administrative powers and duties, it provides legal machinery for local legislation and administration in counties and cities, and it establishes the procedure for organization of districts, and states their powers for performing specific functions in limited areas.

The legal authority of the health boards and officials specified in the Code arises from the power conferred upon them to abate public nuisances dangerous to health. This may be accomplished either through the ordinary legal processes of court action or, in case of emergency, by summary action.

State Department of Public Health

This administrative department is under the control of the State Board of Public Health consisting of seven members appointed by the Governor. Powers and duties of the Department include the following:

1. To examine into the causes of communicable disease likely to occur in the State.

2. To cause special investigation of sources of mortality and effect of environmental factors upon public health.

3. To detect and prevent adulteration of foods and drinks.

4. To provide for sanitary handling of food in processing, storage, distribution and preparation for cooking and serving.

5. To examine water and ice supplies and prevent pollution of their sources.

6. To supervise and regulate the discharge of sewage into water supply, into salt waters within the jurisdiction of the state, or onto any land, such discharge being prohibited except under permit from the Department.

7. To purchase and distribute antitoxins.

8. To counsel, and if public health is menaced, to control and regulate local health authorities.

9. To make reports and suggestions for legislative action.

10. To commence and maintain court actions for the following purposes:

(a) To enforce its rules and regulations.

(b) To enjoin and abate nuisances dangerous to health.

(c) To compel performance enjoined upon any person, board, or officer under the public health laws of the State.

11. To abate public nuisances.

12. To maintain various bureaus including a bureau of sanitary engineering.

13. To establish and maintain for the use of the State Department a hygenic laboratory for bacterial and chemical analysis.

The primary responsibility of the State Department is in problems affecting groups of counties of the state-at-large. This is illustrated by its well-known function in supervising and regulating the discharge of sewage into natural streams which obviously do not terminate at county boundaries but may flow through many counties. The function of the State Department with reference to local problems is largely advisory and educational.

Local Administration

The California Health Code embodies the American idea of local self-government and makes the local authorities primarily responsible for the solution of local health problems. It is only where local legislative bodies or administrative officers fail to assume their responsibilities, so that the lives of peoples are threatened or other communities endangered, that the State Health Department can assume responsibility and control.

County boards of supervisors and city councils are designated by the Code as the legislative bodies responsible for public health in local areas. It is the duty of the board of supervisors of each county to adopt orders and ordinances necessary for preservation of public health in the unincorporated territory of the county and to appoint a County health officer who must be a physician licensed by the State Board of Medical Examiners. The duties of this officer are to enforce and observe in unincorporated territory the following:

(a) Orders and ordinances of the board of supervisors relat-lating to public health and sanitation.

(b) Orders, quarantine regulations, and rules prescribed by the State Department of Public Health.

(c) Statutes relating to public health.

If a city council directs, the county health officer shall enforce

within the city, items (b) and (c) above.

It is the duty of a city council to adopt ordinances, rules, and regulations necessary for sanitary control and it shall supervise all matters pertaining to the sanitary condition of the city. It shall also appoint a health officer who shall enforce the following:

(a) Ordinances of the city council pertaining to public health.

(b) Orders, quarantine regulations, and rules prescribed by the State Department of Public Health.

(c) Statutes pertaining to public health.

The board of supervisors and a city council may enter into contract for the performance by the county health officer of any or all functions relating to enforcement within the city of all city ordinances relative to public health and sanitation. The board of supervisors may also enter into contract with a city council for the performance by the health officer of the city of all functions pertaining to public health in adjacent unincorporated territory.

If a city council neglects to provide a health officer the State Department may compel such appointment or may appoint such officer whose expense shall be a charge against the city.

Sanitary provisions of the Code which can be enforced by either the State Health Department or by local health authorities include:

(a) Supervision of rodent extermination and, in case of necessity, prosecution of the work of destruction on both public and private property.

(b) Enforcement of the State statutes prohibiting the use of common drinking cups and common towels.

(c) Enforcement of the State statutes relative to use of infected packing materials and wiping rags.

(d) Enforcement of State statutes prohibiting the dumping of garbage on public property or on private property without the consent of owner.

Application to Sonoma County

A feature of the Code which could well be more widely applied is the combining of county and city health departments. This might take the form of a city-county health department in the case of a well-financed and populous city in a thinly populated rural district, or of a City-County department

where the communities are relatively small and are surrounded by densely populated rural areas. The formation of such a department permits economies in administration, better qualified and more complete staff, and greater efficiency in health work. Such combinations are often difficult of attainment because of political or sectional prejudices.

It is noteworthy that neither the Board of Supervisors of the City Council of any city in Sonoma County has ever adopted a health and sanitation code. Local legislation pertaining to health and sanitation has been limited to a very few ordinances of minor importance. The Board of Supervisors has, however, appointed a County Health Officer and has financially supported the County Health Department. It appears that from the standpoint of control of communicable disease, if for no other reason, it would be to the great advantage of the people of Sonoma County for the Board of Supervisors to adopt a health and sanitary code. Consideration should also be given to the desirability of adopting certain health ordinances by the City of Santa Rosa, if not a complete health code.

The recent polio epidemic disclosed the importance of Santa Rosa as a center of distribution of communicable disease (Diagram 2). The complete combination of County and City health activities would greatly aid in the control of disease and be of advantage to the people of Santa Rosa as well as of Sonoma County at large. Population distribution is adopted to the formation of a combined county-city health department. It is believed that this form of amalgamation would be most effective.

Districts

The Health and Safety Code provides for formation and functioning of district organizations for various purposes within a county. Such districts may include either or both unincorporated and incorporated territory. Purposes for which local districts can be formed include preservation of health of inhabitants, mosquito abatement, pest abatement, garbage disposal, financing municipal sewers, construction or sewers, and sewage disposal or treatment plant, public cemetaries, fire protection, and police protection. The Public Resources Code also adopted in 1939 provides for County Recreation Districts whose powers, incidental to the main purpose of recreation, include the right to contract for sewage disposal works. The mosquito abatement and county sanitary districts and possibly the county recreational district have usefulness in solving public health problems in Sonoma County.

Mosquito Abatement Districts

There are three possible local governmental agencies which might handle mosquito abatement within a county: The County Surveyor within unincorporated areas, the County Health Officer whose activities would be limited to disease-carrying varieties, and mosquito abatement districts created for the sole purpose of mosquito abatement and embracing both unincorporated and

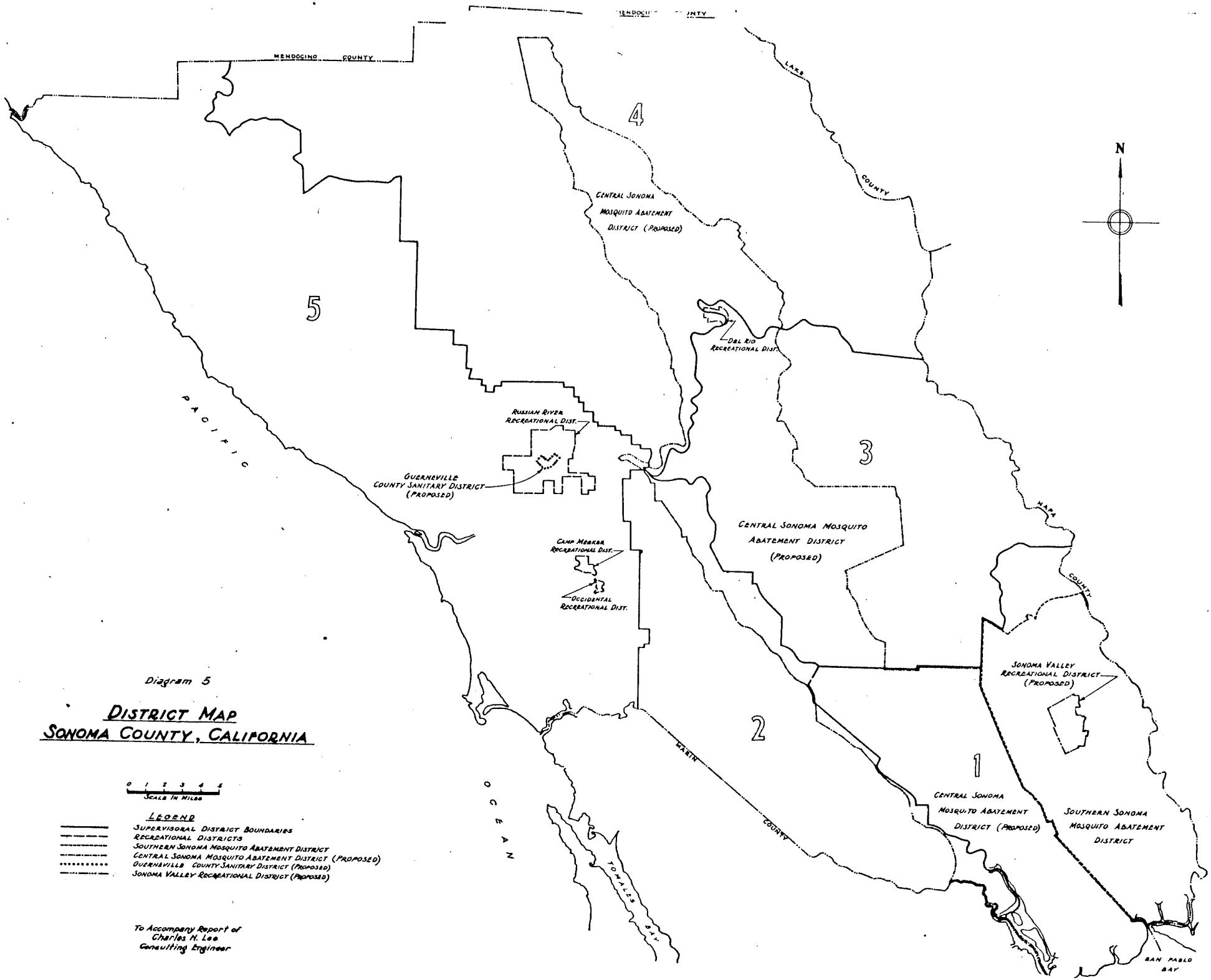

Diagram 5

DISTRICT MAP
SONOMA COUNTY, CALIFORNIA

To Accompany Report of
Charles H. Lee
Consulting Engineer

incorporated territory. Although sometimes objected to as unnecessary duplication in governmental agencies, yet the district in practice has proved to be the most satisfactory means by which permanent results can be obtained. One reason is that existing political organization has crystallized along a certain fixed routine and personnel does not readily adapt itself to handling of new functions.

There are a number of successful districts which have been organized in various parts of the State with very beneficial results in elimination of mosquitoes. In the formation of mosquito abatement districts the size should be as large as practicable in order to provide adequate revenue and permit purchase of equipment and employment of full-time and technically qualified personnel.

In Sonoma County the existing Southern Sonoma Mosquito Abatement District fully covers the Sonoma Valley (Diagram 5). Mosquito abatement is needed in the central part of the County from Healdsburg to Petaluma and Santa Rosa to Sebastopol. This area could well be organized as a single district. If a larger district is feasible, the Southern Sonoma District might be enlarged through annexation by way of Kenwood and Rincon Valley to the Santa Rosa area to form one large district including all populated portions of the County.

County Sanitary Districts

The County Sanitary District Act (Secs. 4700 to 4856) has been thoroughly tested in practice and found to be well adapted to the collection and disposal of domestic sewage from compact thickly populated rural areas with included or adjacent communities, both unincorporated and incorporated. The district has power to construct, maintain and operate within or without the district a sewage system and sewage disposal or treatment plant. A district is initiated by a resolution of intention by the Board of Supervisors with description of territory to be included, followed by a hearing. If written objection signed by two per cent of the registered voters in the district is filed, an election is ordered. If a majority of all votes cast is in favor, the Board may make an order forming the district. The governing body is a board of directors of at least three members. If the district is all within unincorporated territory, the County Board of Supervisors constitutes the district board. If one or more incorporated cities are included, the presiding officers thereof are members of the Board of Supervisors. If wholly within incorporated territory, the additional members are selected from the governing body of each city instead of from the Board of Supervisors.

County Recreation Districts

Such districts, although for the primary purpose of recreation, have the power to construct and operate works for sewage disposal and drainage. A district is initiated by petition to the County Board of Supervisors signed by at least 15 per cent of the electors residing within the district as described in the petition. After a hearing at which protests are considered,

the Board may establish the boundaries of the district and order an election. Only those persons owning land in the proposed district are entitled to vote, each owner being entitled to cast one vote for each $100 of assessed valuation of land owned in the district. If a majority of votes is favorable, the district is created. The governing body is a board of seven trustees appointed by the Board of Supervisors from the voters of the district. Bonds can be issued for the purpose of financing large construction works and taxes levied for servicing bonds, upkeep and new construction. The amount of money required each year is certified to the Board of Supervisors and becomes final if no protest is filed. If there is protest, a hearing is held and the amount is set by the Board after hearing protests.

Four recreation districts have already been created in Sonoma County, namely, the Del Rio, Russian River, Camp Meeker, and Occidental Recreation Districts. The activities of these districts have been confined to the erection of dams across streams for construction of swimming pools, maintenance and sanitation of community parks, beaches, recreational grounds, and buildings, and road and trail work. It is possible for such activities to be extended to sewage collection and disposal. If assessed valuation is ample to support the necessary added taxes and community interest is strong, such a procedure might be advisable as it would obviate duplication of governmental bodies. The boundaries of such a recreation district should not extend far beyond those of the area benefitted by the sewage system.

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PHYSICAL FEATURES OF SONOMA COUNTY

The physical features and climate of a region have an important relation to the types and occurrence of disease epidemics as well as to the selection of workable and economic methods of control of disease. For this reason a study has been made of Sonoma County with reference to topography, drainage, soils, climate, stream flow and groundwater.

Topography and Drainage

Sonoma County is bordered on the west by the Pacific Ocean and bounded on the east by the crest of the Coast Range Mountains reaching an elevation of over 4000 feet. It has an area of 1,101,560 acres of which 93.5 per cent is privately owned.

The Russian River is a predominant feature of its interior topography. This stream in past ages flowed lengthwise of the County from northwest to southwest with outlet into San Pablo Bay. It followed the valley route now roughly outlined by the river north of Healdsburg and further south by the Laguna de Santa Rosa and Petaluma Creek. In the course of geologic time outlet to the south became blocked. The stream then left its old course at some point between Windsor and Mirabel and cut its present channel through the hills to the Ocean at Jenner. The abandoned channel, being of flat grade and lacking adequate drainage outlet has subsequently been subject to flooding, not only by the runoff of Copeland, Santa Rosa, Mark West and Windsor Creeks which drain the main Coast Range, but by backwater from Russian River into the Laguna to a point south of Sebastopol. The present low drainage divide between the Laguna and Petaluma Creeks lies between Cotati and Penngrove. The Laguna has a very flat grade toward Russian River.

East of the valley drained by Petaluma Creek and the head of the Laguna is the Sonoma Valley drained by Sonoma Creek discharging into San Pablo Bay. To the west of the Laguna are low rolling hills drained by Estero de Americano and Salmon Creek flowing to the Pacific Ocean, and Green Valley and Dutch Bill Creeks, tributaries of Russian River.

The flooding of adjacent bench and valley lands by winter floods along Russian River and Dry Creek, together with the flooding of the Laguna area by backwater from Russian River and local streams constitute a major problem in Sonoma County to which much study has been given. Adequate method for solution has not yet been evolved.

Soils

There are four general types of soils in Sonoma County: (1) the residual soils at higher elevations derived by the weathering, in place, of the igneous and older sedimentary rocks; (2) residual soils at lower elevations derived by weathering, in place, of the younger sedimentary rocks; (3) the transported soils overlying older valley alluvium; and (4) the transported soils derived from recent alluvium and riverwash. From a sanitary standpoint

the drainage characteristics of these soils are of the greatest importance, as these determine the ability of the soil to absorb and transmit septic tank effluent and cesspool seepage.

The residual soils at higher elevation are in general shallow with little or no subsoil. Their interior drainage is dependent upon the permeability of the bedrock which generally is poor.

The residual soils at lower elevations overlie the soft sandstones and conglomerates. These occur principally in the rolling hills west of the Laguna, locally known as the Goldridge District. These soils are mostly friable sandy loams pervious to water with depth of 3 to 8 feet to bedrock. The latter offers little resistance to the movement of water, and roots pass through it readily.

The older valley alluvium soils are loamy in character but are underlaid at shallow depth by subsoil and hardpan which is impervious to water. These soils occupy much of the valley land east of the Laguna from Cotati north to Windsor.

The recent alluvial soils occur mostly in stream bottoms and bordering benches. Hops are extensively raised on these soils. Except in low poorly drained areas where adobe soils occur, they are loamy, of a friable and permeable character, and have excellent interior drainage.

Riverwash areas consist of bare sand and gravel occupying low lying and flood swept areas especially along Russian River and Dry Creek. Such soil is very pervious and absorbs water rapidly.

Climate

Climatological conditions have a direct relation to seasonal concentrations and movements of population and to the exposure of the individual to new environment. The life processes and reproductive activity of plant and animal agencies as related to public health are also affected. Among the meteorological factors involved are precipitation, temperature, wind movements, frost, and growing season. Tabulations accompany this report which present data drawn from the records of the United States Weather Bureau at typical points in Sonoma County (Tables 1 to 7).

Precipitation

This data indicates that the heaviest lowland precipitation in the County occurs along the coast, amounting to 50 inches annually. In the interior valley along the upper Russian River and the rolling hills south of lower Russian River it averages 40 inches. In the open valley south of Russian River it varies from 30 inches at Santa Rosa to 23.5 inches at Petaluma. It is 28 inches in the lower Sonoma Valley at Sonoma. Monthly distribution follows the general pattern typical for this part of the State, with heaviest

precipitation during the six months November to April, the four months June to September being practically rainless. The average number of rainy days each year ranges from 60 to 80 at the various stations.

Temperature

Temperatures are temperate and rather equitable throughout the year, the average monthly minimum never falling below freezing nor maximum above 90° at any of the coastal and valley stations for which records are available. Maximum temperatures occur in July and August. Temperatures in the southern portion of the County at Santa Rosa, Graton and Petaluma, where exposed to the summer fogs and sea breezes, are distinctly cooler than in the sheltered interior valleys at Healdsburg and Cloverdale. The annual growing season between killing frosts is shortest at Santa Rosa with 204 days, and longest at Cloverdale with 263 days.

Wind

Prevailing winds vary in different locations but are generally from the south, southwest or west.

Stream Flow

The streams of Sonoma County (Diagram 4) are its greatest recreational attraction and have an important sanitary significance as potential transmitters of disease germs, especially during the summer season when the visiting population is the largest and stream discharge the lowest. During the winter season, when subject to sudden and sometimes prolonged floods, the streams constitute a menace to improved property and an interruption to traffic. In certain areas they represent a public health menace by spreading fresh sewage escaping from surcharged minicipal sewage systems. A tablulation of monthly stream flow for three typical streams has been compiled from the records of the U. S. Geological Survey for the seasons 1939-40 and 1940-41, and indicates the ordinary range in variations. This tabulation accompanies this report as Table 8.

The natural summer flow of Sonoma County streams is very small after the first or middle of July although very few of those which drain mountain areas dry up entirely. On Santa Rosa Creek there is a gravity diversion made by the Santa Rosa Water Company about 4 miles above the City of Santa Rosa. During low flow period practically the whole flow of the stream is taken so that the channel below the dam is dry for some distance. The formation underlying the channel in this section is permeable gravel. Further downstream clay underlies the channel and water rises in the bed of the stream creating a small continuous flow which extends through the City of Santa Rosa and on to the Laguna.

The natural flow of Russian River is augmented by a power diversion from Eel River above Van Arsdale Dam. The average rate of diversion is 192

second feet with maximum of over 300 second feet. This water passes through a tunnel and an electric power plant near Potter Valley. Part of it is used for irrigation of land in Potter Valley. The remainder reaches the Russian River via the East Fork and maintains the summer flow of the lower river. The latter varies from 100 to over 200 second feet at Guerneville.

Ground Water

The depth to ground water has an important relation to septic tank effluent. If the water table is at shallow depth, the available storage capacity in the soil is very limited. There is also danger of flooding or floating the bank. With deeper water table these difficulties disappear unless the soil is very impermeable.

Although a thorough search has not been made, it is believed that during the summer and autumn months there are no extensive areas of shallow ground water in Sonoma County. In the winter time, however, the copious rains fill the soil in certain areas and raise the water table to within a few feet or inches of the surface. This is the condition west and south of Santa Rosa toward the Laguna and as far south as Cotati. This condition lasts well into the summer in the lower portions of this area. In the Goldridge soil area ground water temporarily saturates the soil and upper layer of bedrock forming a perched water table. This may sometimes interfere with septic tank control and the disposal of effluent. It is also a source of ground water leakage into city sewers.

INDUSTRIES

Agriculture is the principal industry of Sonoma County, the farm population in 1940 being 25,583, or 37 per cent of the total. The farm value of all products sold or traded in 1939, according to the U. S. Census figures, was $17,221,000, giving Sonoma County seventh place among California's leading agricultural counties. The most important products as indicated by the County Agricultural Commissioner's estimates for 1941 on the basis of f.o.b. prices at shipping points, are as follows:

Poultry and eggs	$13,948,037	61%
Dairy Products	4,292,265	19%
Prunes	2,075,350	9%
Apples	1,379,342	6%
Grapes	976,250	4%
	22,670,000	

The poultry industry centers around Petaluma in the southern part of the County. Dairying is carried on in the vicinity of Petaluma, in the Laguna area near Sebastopol, and in the cool coastal region. Prunes are extensively raised in the Santa Rosa and Healdsburg area. Apples are grown in the Santa

Rosa and Sebastopol areas, the latter being famous for the Gravenstein. Grapes thrive in the warmer interior valleys at Santa Rosa, Healdsburg and Sonoma. Hops are raised along the bottom lands of lower Santa Rosa Creek, the Laguna and the Russian River in the vicinity of Healdsburg. Harvesting the fruit, grape and hop crops gives rise to a sanitary problem in connection with housing of transient labor.

The processing of agricultural food products represents an important manufacturing industry of the County. The U. S. Census of 1939 reported 143 such plants engaged in milk processing, meat and poultry packing, wine making, fruit canning, fruit drying and dehydrating. The value of all processed products in 1939 was $17,250,000 and the average number of wage earners in plants was 1564. The disposal of wastes from these plants constitutes a difficult problem in sanitation.

* * * * *

RECREATIONAL ATTRACTIONS

Sonoma County has long been popular as a summer recreational area, principally for the thickly populated urban communities surrounding San Francisco Bay. Railroads formerly furnished mass transportation but most of the travel is now by motor vehicle. Highway distances from San Francisco Bay are 55 miles to Santa Rosa and 71 miles to Healdsburg.

The tree-lined streams, especially in the Redwood Belt, are the greatest attraction, followed by the ocean beaches, and the hot springs and geysers in the mountainous interior. Swimming, boating and fishing are the principal recreational activities. Living accommodations are furnished at public resorts by hotels, but the majority of visitors occupy cabins and tents. Many people have built homes along the stream banks. A survey made by the State Chamber of Commerce in 1937 covering the most important recreational areas of the County, on lower Russian River, indicated that there were in this area over 700 permanent homes, 2200 summer homes and more than 500 summer cottages for rent having a total value of more than $7,000,000. Business properties exceeded 100 and are valued at approximately $1,000,000.

The maintenance of good sanitary conditions is essential to the continued popularity of the recreational areas of the County.

* * * * *

P O P U L A T I O N

The resident population of Sonoma County as indicated by the following U. S. Census data has been steadily increasing for many years.

RESIDENT POPULATION OF SONOMA COUNTY

1910	48,394
1920	52,090
1930	62,222
1940	68,819

The population June 1943 as estimated by the Sonoma County Planning Commission from O.P.A., school and voting registration records was 75,354 (Diagram 3). Broken down into communities this estimate indicated the following for incorporated cities. It is to be noted, however, that there is suburban population living in subdivisions outside city limits which is not included in these figures. This is especially true at Santa Rosa.

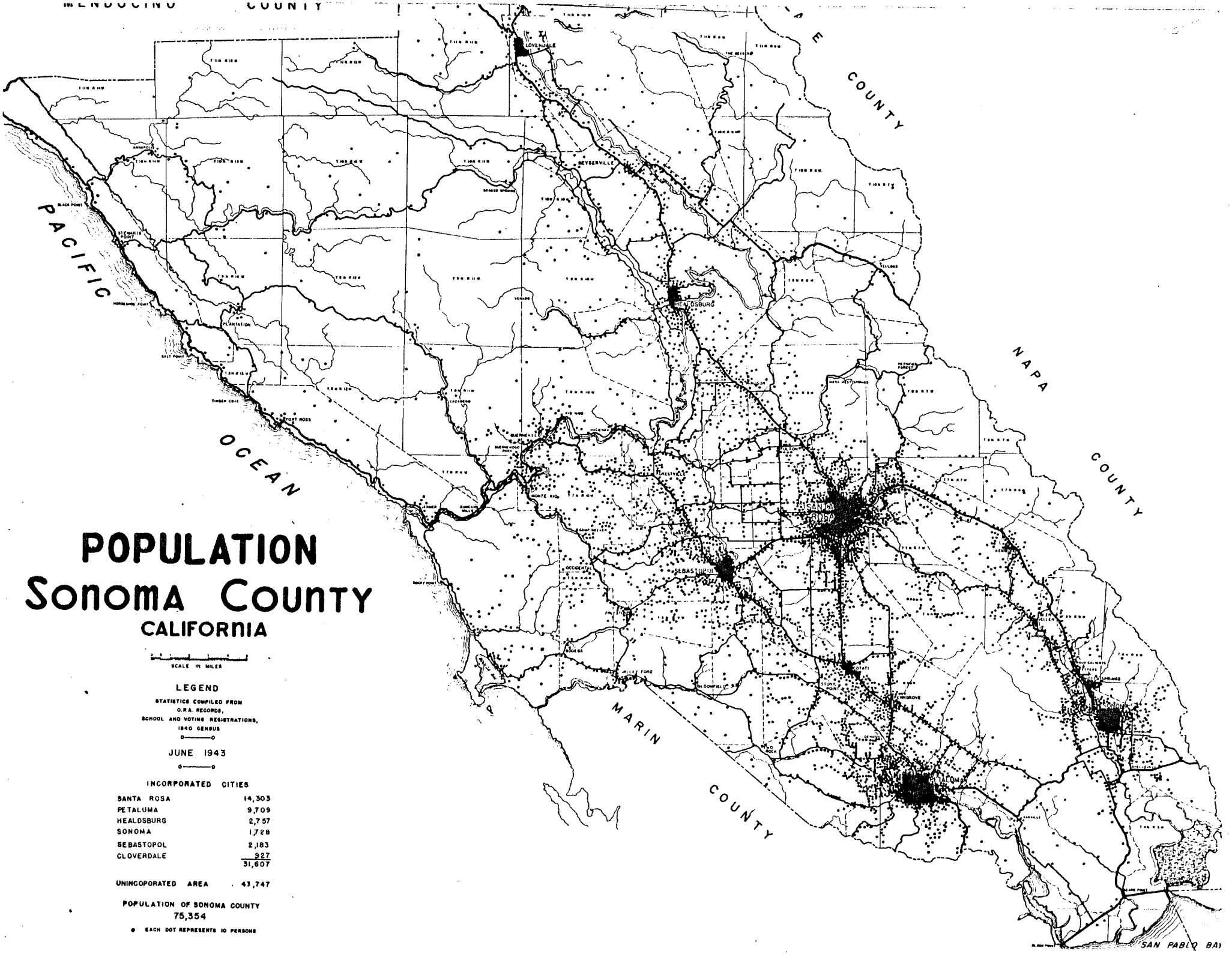
POPULATION BY CITIES

Santa Rosa	14,303
Petaluma	9,709
Healdsburg	2,757
Sonoma	1,728
Sebastopol	2,183
Cloverdale	927
Total	31,607

Approximate populations in 1940 for unincorporated communities were as follows:

POPULATION BY UNINCORPORATED COMMUNITIES

Cotati	1,000	Fulton	250
Guerneville	800	Glen Ellen	250
Geyserville	625	Valley Ford	225
El Verano	550	Penngrove	175
Monte Rio	525	Jenner	175
Forestville	525	Kenwood	155
Graton	450	Cazadero	150
Aqua Caliente	418	Camp Meeker	125
Boyes Spring	400	Freestone	100
Occidental	375	Bodega	100
Windsor	350	Fetters Springs	100
Rio Nido	300	Shellville	100
		Total	8,223



POPULATION
Sonoma County
CALIFORNIA

SCALE IN MILES

LEGEND

STATISTICS COMPILED FROM
O.P.A. RECORDS,
SCHOOL AND VOTING REGISTRATIONS,
1940 CENSUS

JUNE 1943

INCORPORATED CITIES

SANTA ROSA	14,303
PETALUMA	9,709
HEALDSBURG	2,757
SONOMA	1,728
SEBASTOPOL	2,183
CLOVERDALE	927
	31,607
UNINCOPORATED AREA	43,747

POPULATION OF SONOMA COUNTY
75,354

● EACH DOT REPRESENTS 10 PERSONS

P O P U L A T I O N

The resident population of Sonoma County within stream drainage areas, as estimated by the writer from the County Planning Commission data for June 1943, is as follows:

POPULATION BY STREAMS

Stream	Drainage Area Sq. Mi.	Resident Population Total	Per Sq. Mi.
Coast	78	810	10
South Fork Guallala River	221	650	3
Salmon Creek	33	860	26
Estero de Americano	42	910	21
San Antonio Creek	27	1,380	51
Petaluma Creek	82	17,277	210
Sonoma Creek	78	8,618	110
Russian River above Dry Creek	282	8,464	30
Dry Creek	160	1,300	8
Matanzas Creek	16	860	54
Santa Rosa Creek	60	11,605	193
Mark West Creek	58	1,240	21
Windsor Creek	25	1,370	55
Laguna	106	12,690	120
Green Valley Creek	42	3,690	88
Dutch Bill Creek	12	510	42
Austin Creek	49	360	7
Russian River below Dry Creek	128	2,320	18
Tolay	12	440	36
		75,354	

The above population figures do not include non-residents who visit recreational areas during the summer season. The latter for the Russian River alone have been estimated as varying from 8,000 to 12,000 with a peak of 15,000. Non-resident population in other areas, especially at Healdsburg and in Sonoma Valley is also large.

It is to be noted that the densest resident populations are on Petaluma, Santa Rosa, and Sonoma Creeks and the Laguna, all exceeding 100 persons per square mile. Green Valley, Windsor and Matanzas Creeks have moderate densities of from 50 to 100 per square mile. Other streams have densities below 50 per square mile. During the summer months the transient population increases the density on the distinctly recreational streams to well over 100 per square mile (Diagram 4). This applies especially to Russian River and Sonoma and Dutch Bill Creeks. Population density has a direct relation to the number and variety of sanitary problems which may arise.

* * * * *

SANITARY UNITS

For purposes of a sanitary survey, it is convenient to classify a region into various units within which physical conditions and the routine of sanitary inspection and control are similar. Six such units have been recognized in Sonoma County, namely, recreational streams, occasionally flooded bottom-land meadows, incorporated cities including suburbs, rural community centers, hospitals and similar public institutions, and military posts.

Recreational Streams

Recreational streams are those which by reason of permanent flow of clear water and surrounding tree growth are attractive as places of summer residence and recreation. Use of the stream depends upon its size but usually includes wading and swimming, the latter often made possible by construction of temporary dams. On larger streams boating and fishing are also practiced. Direct stream pollution by disease organisms may result from any of these activities.

Living quarters for vacationists are usually constructed either along the stream bank or immediately adjacent thereto on bench land or in a tributary ravine or valley. The public resorts provide accommodations for transients in the form of hotels, auto courts, rental cabins, or tents. The majority of families which visit Sonoma County for recreational purposes own their own homes. These vary from simple cabins to six or eight room houses and are generally concentrated within real estate subdivisions. The latter are located in attractive areas and are laid out with reference to topography and easy access to the stream bank.

Public water supply is provided from springs or stream-bank wells in the larger subdivisions but in isolated locations private supply is the rule. Stream-bank wells are sunk in the alluvium near the margin of the stream. Water so obtained should be safe for human consumption if a sufficient distance intervenes between the flowing stream and the well to insure sterilization of the water. Occasional instances have been observed of use of water for domestic purposes by pumping directly from a stream. This is dangerous practice unless water is purified before drinking.

Facilities for sewage disposal are provided by the lot owners, usually a septic tank or cesspool located within the lot. Septic tank effluent is commonly disposed of by soil absorption through open joint tile drain laid in gravel fill trench. In some instances kitchen sink and hand basin waste is discharged onto the surface of the ground through a waste pipe. Kitchen waste, defective cesspool, or inadequate distribution of septic tank effluent may, any of them, be direct sources of stream pollution by disease organisms.

The principal recreational streams of the County are Russian River and its tributaries, Dutch Bill and Austin Creeks, the headwaters of Salmon Creek, Sonoma Creek and its upper tributaries, and Santa Rosa Creek and its tributaries in and above the City of Santa Rosa. The location of these streams, their drainage areas and their relation to potential sources of bacterial pollution

is shown on the Drainage Map of Sonoma County (Diagram 4).

Russian River

This is the largest and most highly developed stream in the County. There are approximately 40 real estate subdivisions and resorts along this stream in addition to the five community and business centers at Healdsburg, Rio Nido, Guerneville, Monte Rio and Jenner. Most of these subdivisions and resorts maintain beaches for access to the river.

The upper group of subdivisions is located on the steep slopes of the river canyon along Fitch Mountain Road just above Healdsburg. This includes Del Rio Woods, Ewing Tract, Camp Rose, Del Rio and Cadoul Subdivision, with a total river frontage of almost 3 miles. A portion of this area is included in the Del Rio Recreation District. Several years ago the latter constructed a wooden dam in the river to improve swimming and boating conditions but this has been destroyed by floods. River-bank wells and many summer homes built at lower levels have also been destroyed or damaged. At Healdsburg a recreation dam built by private funds provides a much-frequented resort area.

PHOTO 1 - Beach at Rio Nido on Russian River.

Further downstream on Russian River, beginning at the junction of Mark West Creek and extending for a distance of 15.5 miles through the Redwood Belt to the mouth of Austin Creek, is an almost continuous series of subdivisions and resorts. This area includes such well-known vacation sites as Mirabel Park, Summer Home Park, Hacienda, Hilton Odd Fellows Park, Rio Nido, Rolands Subdivision, Guernewood Park, Vacation Beach, Montesano, Bohemian Grove, Monte Rio Park, Villa Grande, Riens Beach, and the resort centers of Guerneville and Monte Rio. There are also several camps for young people including Camp Imelda for girls, between Monte Rio and Ville Grande and St. Joseph's Camp for boys at Moscow between Ville Grande and Duncan. It is the most popular recreational area in Sonoma County. There are 22 public and private beaches on this section of the river (Photo 1). The total number of privately-owned homes exceeds 3000, of which 25 per cent are permanent and the remainder summer homes. The Russian River Recreational District extending from Rio Nido almost to Monte Rio has been organized under State Law to improve and control the recreational advantages of the central portion of this area (Diagram 5).

Dutch Bill and Austin Creeks

These streams are in the heart of the Redwood Belt and are much frequented. Camp Meeker is a large subdivision with more than 200 summer homes located on the upper reaches of Dutch Bill Creek. Most of the homes are on the hillside above the stream but the Camp Meeker Recreation District (Diagram 5) has built a concrete dam on the creek and maintains a swimming pool. Occidental, located on the drainage main divide between Dutch Bill and Salmon Creeks, is a recreation center included within the Occidental Recreation District (Diagram 5). Camp Don Bosco, a Boy Scout Camp, is situated near here on the headwaters of Salmon Creek. Austin Creek drains a large area to the north of Russian River and is the site of several summer camps including Camp Thayer, Camp Cazadero - owned by the City of Berkeley - and the San Francisco Boy Scout Camp. The principal settlement is Cazadero where there is a swimming pool in the creek.

Gualala River

The South Fork of Gualala River drains a large area in the northwestern portion of the County. It is much frequented by fishermen. The Berkeley Y.M.C.A. Camp is located on Wheatfield Fork of this stream.

Sonoma Creek

Sonoma Creek is next in importance to Russian River as a recreational stream. The stream heads above Kenwood in Sonoma Canyon where there are two resorts with swimming pools and also a number of private homes. In the canyon between Kenwood and Glen Ellen there are also two resorts with swimming pools. and many private summer homes. In Graham Canyon west of Glen Ellen are several private homes and a swimming pool. At Glen Ellen are a number of permanent homes along Sonoma Creek as well as summer cottages and also two swimming pools. Most of these swimming pools obtain water from the creek and all discharge into it when emptied. At the Sonoma State Home at Eldridge there is a

population of approximately 3500 inmates and operating staff. Many of the latter have permanent homes along Sonoma Creek.

Further downstream there is a congested recrational center along the Creek, including El Verano on the west side, and Aqua Caliente, Fetters Spring and Boyes Spring on the east. The east side resorts have much frequented indoor swimming pools. Water is obtained from wells but the pools when cleaned are discharged into the Creek. Large subdivisions east of the highway include Richard's Subdivision, Aqua Caliente Park, Sonoma Highlands, Woodleaf Park, and Boyes Spring Park. West of the Creek there are also several subdivisions including Sonoma Vista Tract, Eaton Park, Creek Front Addition, Riverside Addition, and El Verano. This area is normally crowded with vacationists during the summer but with the housing shortage at Vallejo, many dwellings are occupied the year around. There is an active local movement to organize a recreation district to include much of Sonoma Valley from Glen Ellen to Shellville.

Santa Rosa Creek

Santa Rosa Creek, although not a distinctly recreational stream, is used as such by the juvenile population of Santa Rosa and vicinity. Doyle Park at the east edge of Santa Rosa lies between the channels of Metanzas and Santa Rosa Creeks and is operated as a public park by the City of Santa Rosa. Both creek channels are lined with alder and other water-loving trees and during the hot summer days the shade and coolness are attractive. The stream waters are much used by children visiting the park. There are a number of permanent homes, auto courts and a Cat and Dog Hospital on Santa Rosa Creek east of Doyle Park. There is also one private swimming pool which empties into Santa Rosa Creek. Further down stream the Creek is crossed by several sewer lines of the Santa Rosa City system. West of the City the municipal sewage disposal plant borders the Creek.

Flooded Bottom-land Meadows

There are certain low-lying lands in Sonoma County which are subject to flooding every winter and are valuable principally as pasture land or for raising rapidly growing field crops. These lands are used largely for dairying purposes and support cows who graze over the fields and drink water from the sloughs. The latter if containing bacterial pollution might constitute a public health hazard transmitted through the milk. During heavy winter storms raw sewage from surcharged minicipal sewer systems, or from overflowing private septic tanks, may mingle with storm runoff and gather on these lands where, because of poor drainage, it remains for considerable periods of time, thus becoming accessible to cattle.

Laguna de Santa Rosa

The largest area of such land lies in and adjacent to the Laguna de Santa Rosa extending from just below the junction of Copeland Creek to the Russian River. Leading back from the main meadow-lands are the bottoms of Santa Rosa, Mark West and Windsor Creeks which are flooded by these streams

during storm. The total area of flooded meadow-land involved in this locality exceeds 8000 acres. Several large dairies are operated along the Laguna in the vicinity of Sebastopol, and in the bottoms of tributary streams. Sewage from both the Santa Rosa and Sebastopol sewage systems mingles with flood run-off at time of storm and has opportunity to spread over these meadow lands.

There is a proposal among land owners along the Laguna below Sebastopol to open up the channel so that drainage of this area could be attained earlier in the Spring than now occurs. As a means of accomplishing this it has been suggested that about 8,000 acres of land east of the Laguna be annexed to the existing Gold Ridge Soil Conservation District which lies west of the Laguna comprising an area of 99,000 acres. Such an improvement should aid in more rapid drainage of sewage polluted flood water from this area and thus improve sanitary conditions.

Petaluma Creek

The wide bottom land east of Petaluma through which Petaluma Creek flows is more or less subject to winter flooding. Portions of this area are utilized for pasturing dairy cows. There is no direct source of sewage pollution which has access to local flood waters unless damage occurs to the sewage transmission or disposal facilities of the City of Petaluma.

* * * * *

INCORPORATED CITIES

Incorporated cities are prolific sources of human waste. Such waste includes both sewage and refuse. Among the most important municipal services are the collection and disposal of sewage and refuse. Provision for an ample supply of pure water is also of great importance.

Raw sewage, or partially sterilized sewage from a treatment plant, if mingled with surface waters, may become a direct source of stream pollution. Sewage may also be a source of disease organisms spread by flies.

Refuse includes garbage, rubbish, dead animals, etc. Garbage consists of waste from kitchens and food establishments. If carelessly and unsystematically handled, garbage becomes a source of flies and rats. Rubbish includes all dry household and business waste such as paper, rags, wood, glass, crockery and metals. If allowed to accumulate or dumped promiscuously it harbors rats. Municipal garbage dumps located near residential areas may become a public health menace as a source of flies and rats. Hogs fed at garbage dumps without proper supervision may become infected with trichinosis.

The sanitary handling of food at groceries, markets, dairies and abattoirs and the cleanly preparation and serving of food at hotels, restaurants and institutions are public health problems of greatest importance in incorporated cities. They involve protection of food from infection carried by flies or rats as well as by human carriers. Improper cleansing of dishes and eating utensils used in serving food may be a means of disease transmission. Lack of provision and cleanly upkeep of lavatories for cooks and waiters may be a direct cause of infected food. Food sanitation is the responsibility of Federal, State, County and Municipal health departments except at dairies and abattoirs which are under supervision of the State Department of Agriculture. The laws known as the Pure Food and Food Sanitary Acts have been enacted by the California State Legislature. As there is no health code in effect in Sonoma County, the County and Municipal Health Officers exercise their authority under the State laws.

Incorporated cities in Sonoma County in order of size are Santa Rosa, Petaluma, Healdsburg, Sebastopol, Sonoma and Cloverdale. The accompanying tabulations (Tables 9, 10 and 11) give essential information regarding water supply and sewage disposal facilities and the handling of refuse by these cities.

* * * * *

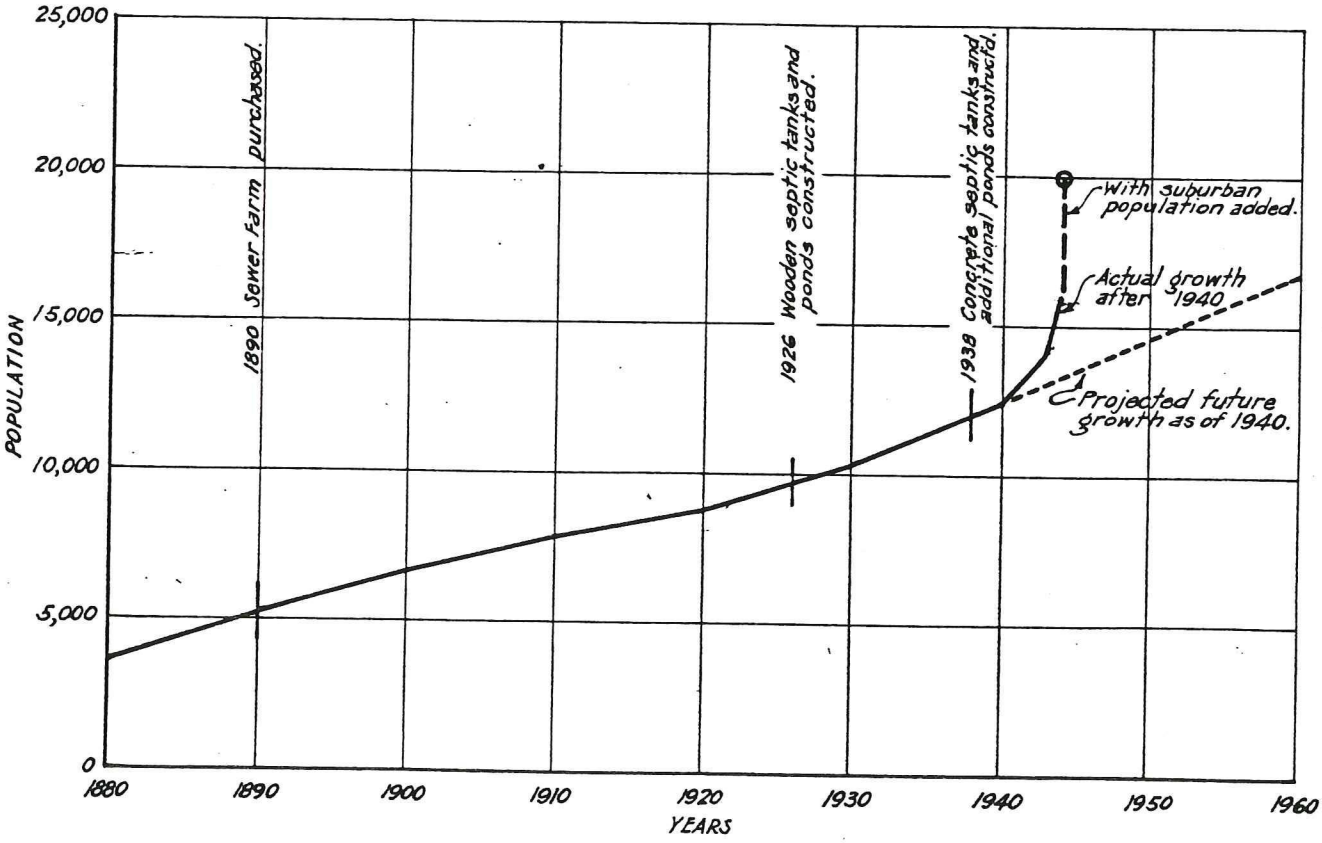
CITY OF SANTA ROSA

Santa Rosa is the largest and most rapidly growing city in the County. It has a population of over 14,000 and is the trading center for more than 26,000. It is surrounded by level valley land producing deciduous fruits, grapes, hops and walnuts. Wineries, fruit canneries, fruit packing plants and several manufacturing plants comprise its industry.

The health activities of the City are divided. The City enforces all municipal health ordinances, but by terms of a resolution of the City Council, February, 1939, the County Health Department was directed to enforce all State and County health regulations, statutes and ordinances. This resolution was rescinded June, 1943, effective July 1, 1944.

Santa Rosa has several important public health problems to be solved. These arise largely from the rapid increase in population during the past three years. The U. S. Census data for population within the City boundary since 1910 shows a steady growth of from 1.2 to 2.1 per cent per year up until 1940. The estimated population for 1943 indicates a rate of increase during the past three years of 4.7 per cent per year (Diagram 6). This does not fully represent the situation, however, for the reason that much of the recent population growth has been in contiguous subdivisions outside of the City.

Diagram 6



POPULATION - CITY OF SANTA ROSA

A count made in the fully and partly built-up suburbs shows approximately 1100 dwellings, most of which are of recent construction. At the rate of 3.5 persons per dwelling this represents an additional population of nearly 4000 not included in city population figures and not served by municipal services and utilities. The total could be further increased by addition to the floating population of visitors including personnel from nearby Army and Navy posts and their friends and relatives.

POPULATION OF SANTA ROSA

Year	Population	Average Yearly increase Per Cent	Approximate Population including Suburbs
1910	7,817		
1920	8,758	1.2	
1930	10,636	2.1	
1940	12,548	1.8	
1943	14,303	4.7	18,500

The most pressing public health problem at Santa Rosa relates to sewage. This problem is a two-fold one: first, of improving and enlarging sewage collection and disposal facilities to adequately serve the population within the present City boundary; second, of providing similar facilities for the adjacent population outside the City. That the latter is a matter of vital concern to the municipality is clearly shown by a study of the facts.

Septic Tank Effluent

The prevailing method of sewage disposal outside the City is by septic tank with an occasional cesspool or open pit privy. (See Table 15, page 72). The liquid effluent from septic tanks is led through tile drain and gravel-filled trench into the soil by absorption. Immediately north of the City the deep alluvial soil, although absorbent, becomes temporarily saturated during prolonged winter rains causing isolated cases of septic tank overflow into the streets, especially where lots are narrow. In the outer zone of northern subdivisions the soil is heavy and shallow with bed rock at no great depth. In this area septic tank effluent is difficult to control, and even in summer it is a common sight to see effluent flowing out from curb drain and down the concrete gutters where children play. South and southwest of the City the soil, although deep, is very heavy and impermeable. Surface overflow from

septic tanks is quite common here. As many of the streets are not paved and guttered, the effluent discharges into open earthen drain ditches where it is held by rank growing vegetation, becoming an eyesore, foul of odor, and a breeding place for mosquitoes.

The escape of septic tank effluent onto public streets is uncleanly and constitutes a public health menace. It threatens not alone the health of people living in these areas but also that of the inhabitants of adjacent built-up areas both outside and inside the City limits. As previously shown, disease may be transmitted in many ways, including personal contact, flies, mosquitoes and rodents. An epidemic starting in an area of shallow or heavy soil is thus not confined in its spread by soil or municipal boundaries but extends to other areas wherever there are people living. It is worthy of note in this connection that much of the business section of the City is within the normal range of fly travel from the south and southwest residential areas where flies are very prevalent and, furthermore, that the prevailing winds blow toward the City from this same area. The existence of unsanitary conditions in any suburb thus vitally concerns every family in the Santa Rosa area whether residing without or within the City limits.

Manhole Overflow

Unsanitary conditions within the City limits, although sporadic in occurrence, are equally bad. They arise from the spreading of municipal sewage over the business streets and main thoroughfares during winter storms. The cause of this unsatisfactory condition is insufficient capacity in sewer pipes which were laid years ago and have become inadequate in size with the growth of the City (Diagram 6). Many of these pipes extend under buildings, railroad yards and other improvements where they are inaccessible for repair and replacement. During winter storms these pipes become surcharged from storm water leaking in at broken joints, manholes and sometimes surreptiously connected roofleaders. The only present relief for surcharged sewers is overflow at manholes with resultant outflow of sewage and temporary pondage on city streets until rain has sufficiently abated to allow it to enter storm sewers or otherwise escape to natural drainage channels such as Santa Rosa Creek and various local storm water sloughs.

In order to visualize the conditions above described, the accompanying outline map of the City of Santa Rosa and suburbs has been prepared (Diagram 7). This map shows the present City limits and the boundary of the suburbs as now subdivided and wholly or partly built up with dwellings. From this map it is evident that the subdivided area outside the City is almost as great as that within the City. When it is realized that none of this outside area is sewered, the magnitude of the public health menace is apparent.

Proposed Remedial Sewers

The existing sewer mains and laterals within the City are also shown upon the outline map (Diagram 7). These have been constructed as the City grew and are not adapted to serving outside areas. They are both too small

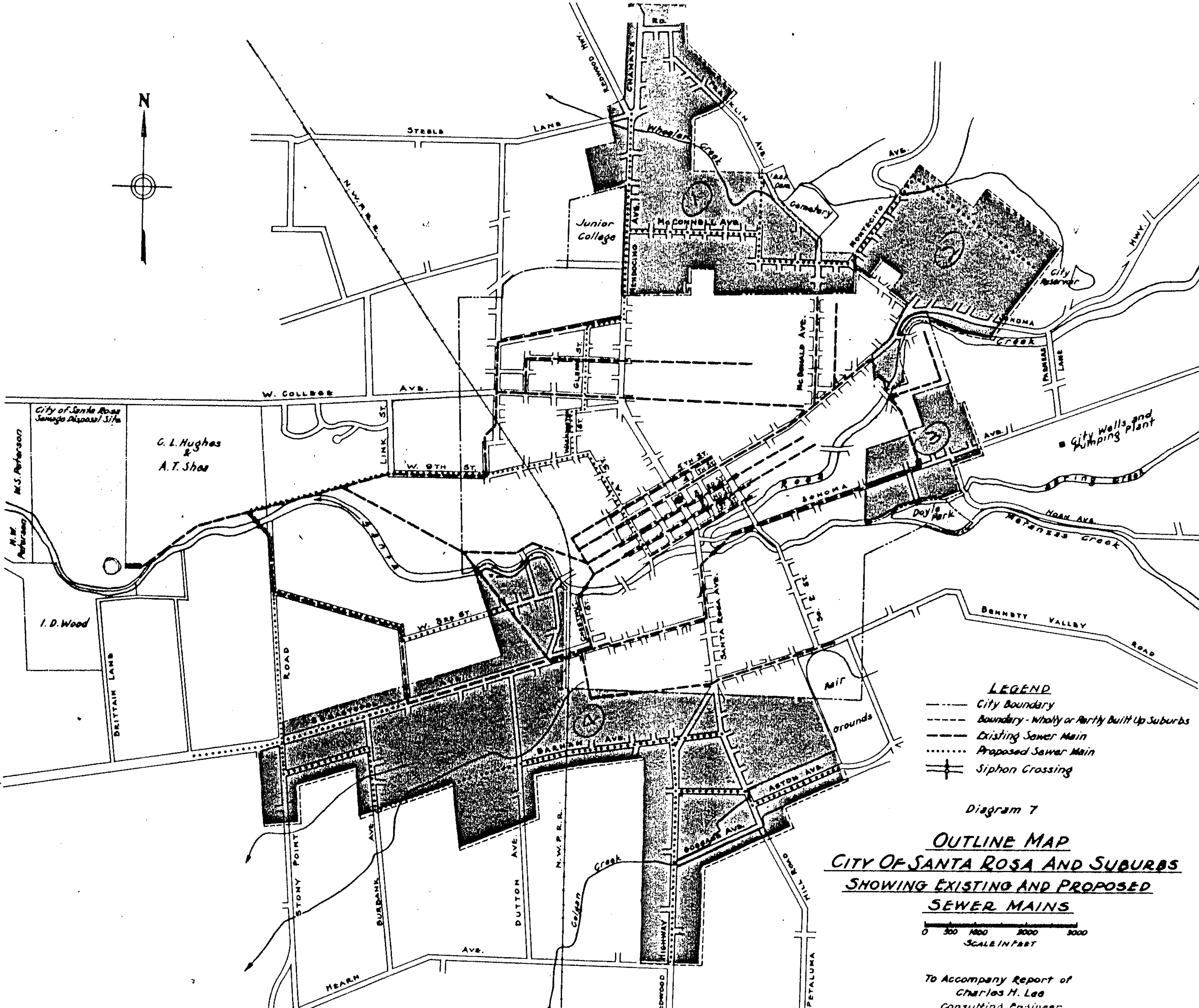
in capacity and, at the City limits, too shallow in depth to be extended farther. The present collection system thus cannot be used as the nucleus for a larger system to serve the area outside of the City. For this purpose it is necessary to construct new mains and laterals which will tap the unsewered areas and act as intercepting sewers to relieve the existing overloaded sewers within the City.

Preliminary studies for additional sewer lines have been made by the City Engineer. The results of these studies have been made available for use in preparing this report. The locations of the proposed mains are shown upon Diagram 7 in order to illustrate the extent of the proposed new sewer lines and their relation to the area which will be served. Two new trunk lines are required, one on the north side and one on the south side of Santa Rosa Creek. The original 21-inch outfall line from the junction of the trunk lines to the Sewer Farm has already been replaced with a 36-inch pipe.

The northside trunk will end near Link Lane and W. 9th Street just west of the City limits and follow W. 9th Street to Washington Street. One branch will extend thence along A Street connecting with existing overloaded sewers in the business district on 5th., 4th, 3rd and 2nd Streets. It will be noted that construction of this intercepter will permit abandonment of the siphon crossing of Santa Rosa Creek at the head of Chestnut Street which frequently gives trouble by breaking. The other will extend north on Glenn Street and Mendocino Avenue, with an important branch east on McConnell Avenue to serve all of the suburban area north and east of the City as far as Rogers Way. Many lot owners in this area are anxious for sewer service and there is an active local committee investigating the possibilities. At one time the construction of an independent sewer system with treatment plant was considered for this district but engineering studies by the City Engineer indicated high cost and the matter was dropped. At the present time this Committee is studying the various aspects of annexation to the City.

The southside trunk will discharge into the outfall line 1000 feet west of Link Lane and W. 9th Street. It will follow the line of an existing sewer which will be enlarged to Roseland Avenue and W. 3rd Street, thence east on W. 3rd Street to connection with an existing sewer at Hull Street. This connection will permit abandonment of the siphon crossing at Santa Rosa Creek at the head of Hull Street which is a frequent source of trouble caused by progressive change of channel, accompanied by bed erosion and bank cutting. There will also be a main branch extending south along Stony Point Road to Rose Avenue, thence east to Burbank Avenue, thence south to Barham Avenue, extending along Barham Avenue to head at Petaluma Hill Road. There will be a branch south on Redwood Highway and one east on Aston Avenue. This system will serve all the southside area outside of the City. It will include enlargement and reconstruction of the siphon crossing at Stony Point Road to withstand the ravages of flood water in winter.

There has thus far been no organized movement among local residents of this area to solve the problem of sewage collection.


N
LEGEND
City Boundary
Boundary - Wholly or Partly Built Up Suburbs
Existing Sewer Main
Proposed Sewer Main
Siphon Crossing
Diagram 7
OUTLINE MAP
CITY OF SANTA ROSA AND SUBURBS
SHOWING EXISTING AND PROPOSED
SEWER MAINS
0 500 1000 2000 3000
SCALE IN FEET
To Accompany Report of
Charles H. Lee
Consulting Engineer
City of Santa Rosa Sewage Disposal Site
C. L. Hughes & A. T. Shea
W. S. Peterson
H. W. Peterson
I. D. Wood
Junior College
Cemetery
City Reservoir
City Wells and Pumping Plant
Doyle Park
Fair Grounds
STEELE LANE
W. COLLEGE AVE.
LINK ST.
W. 9TH ST.
W. 3RD ST.
BRITTAIN LANE
STONY POINT ROAD
BURBANK AVE.
DUTTON AVE.
HEARN AVE.
N.W.P.R.R.
REDWOOD HWY.
PETALUMA HILL ROAD
BENNETT VALLEY ROAD
SONOMA AVE.
HOEN AVE.
SANTA ROSA AVE.
BARHAM AVE.
ASTON AVE.
McCONNELL AVE.
McDONALD AVE.
MONTECITO AVE.
MENDOCINO AVE.
FARMERS LANE
CHANATE RD.
Wheeler Creek
Matanzas Creek
Santa Rosa Creek
Colgan Creek
Spring Creek
5TH ST.
GLENN ST.
E ST.
HWY.

Sewage Disposal

Facilities for disposal of sewage from the City of Santa Rosa have been constructed as specific needs arose over a long period of years. The plant is the product of expediency rather than engineering design and little consideration has been given to future expansion. The site has a feature of inherent value to the City for sewage disposal purposes because of its ample size and relative isolation. The tract is located one and one-half miles west of the City limits and south of West College Avenue. It has an area of 102 acres with 3400 feet frontage on Santa Rosa Creek.

The Sewer Farm has been used by the City for many years. The first purchase of 11.7 acres was made in 1889 and another 5.1 acres in 1891, both bordering the creek at the south end of the present tract (Diagram 8). Two wooden septic tanks and a small pond (No. 18) were constructed on this land and the effluent discharged into Santa Rosa Creek. Apparently no provision was made for sludge. In 1905 a further purchase of 100 acres was made, contiguous and with frontage on West College Avenue. A portion of this was later sold to the State.

In the year 1896 a court injunction was obtained against the City by a local landowner prohibiting it from polluting Santa Rosa Creek. The injunction was never enforced. Complaints arose in later years against odor nuisance from both Sewer Farm and the creek below. In 1924, after two additional suits were filed a bond issue for $165,000 was voted for the purpose of building a complete activated sludge plant. This plan was subsequently abandoned in favor of a program of minor improvements in both plant and operation and the free use of effluent by local farmers in irrigation of hops. After withdrawal of complaint by local landowners and acceptance of the program of improvement by the State Department of Public Health a permit to operate the plant was issued to the City, October 18, 1926.

Construction undertaken at that time consisted of two wooden septic tanks 200 feet by 20 feet (Photo 2), six small earth ponds (Photo 3), and flumes for conveying sewage. Later when it became evident that sewage could not be kept out of the creek during the non-irrigating season, one chlorinator with a small wooden contact chamber was installed at the bank of the creek. The additional ponds were planned as seepage ponds for the purpose of purifying the effluent through natural filtration. The subsoil consists of permeable gravel and seepage was very active when the ponds were first filled. The bottom soon was sealed with organic matter, however, and active filtration ceased even with occasional breaking of the surface with dynamite.

Subsequently the pond area was increased to 5 acres, and a second chlorinator installed at the bank of the creek. The purpose of the additional ponds was to hold water between periods of irrigation pumping and to reduce organic matter by sedimentation, thus obtaining greater economy in the use of chlorine. In 1938 two concrete septic tank units 300 feet by 20 feet by 6 feet were constructed by W.P.A. labor and later a third tank was built by the City (Photos 4 and 5). During the past year the number of ponds has been

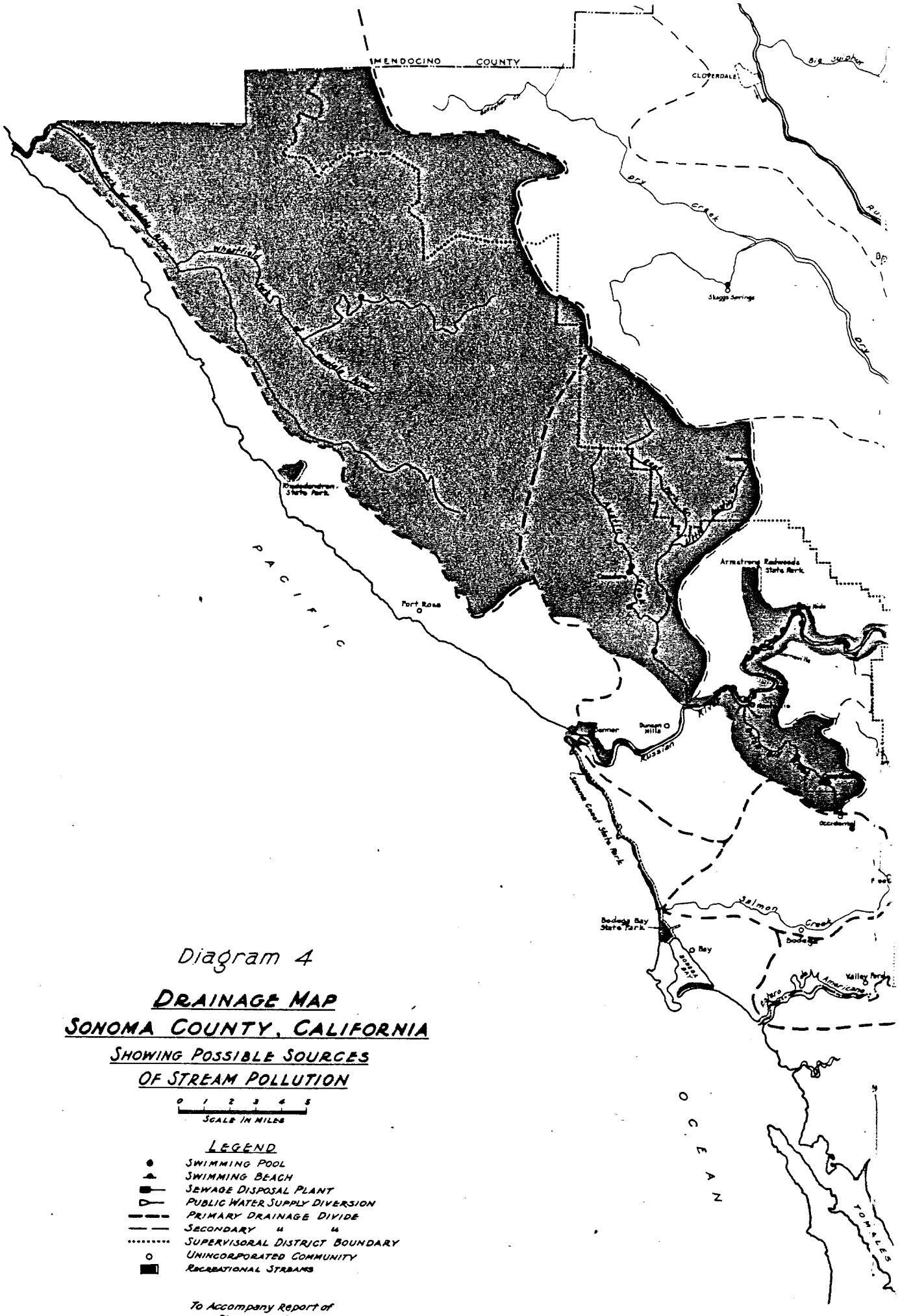


Diagram 4

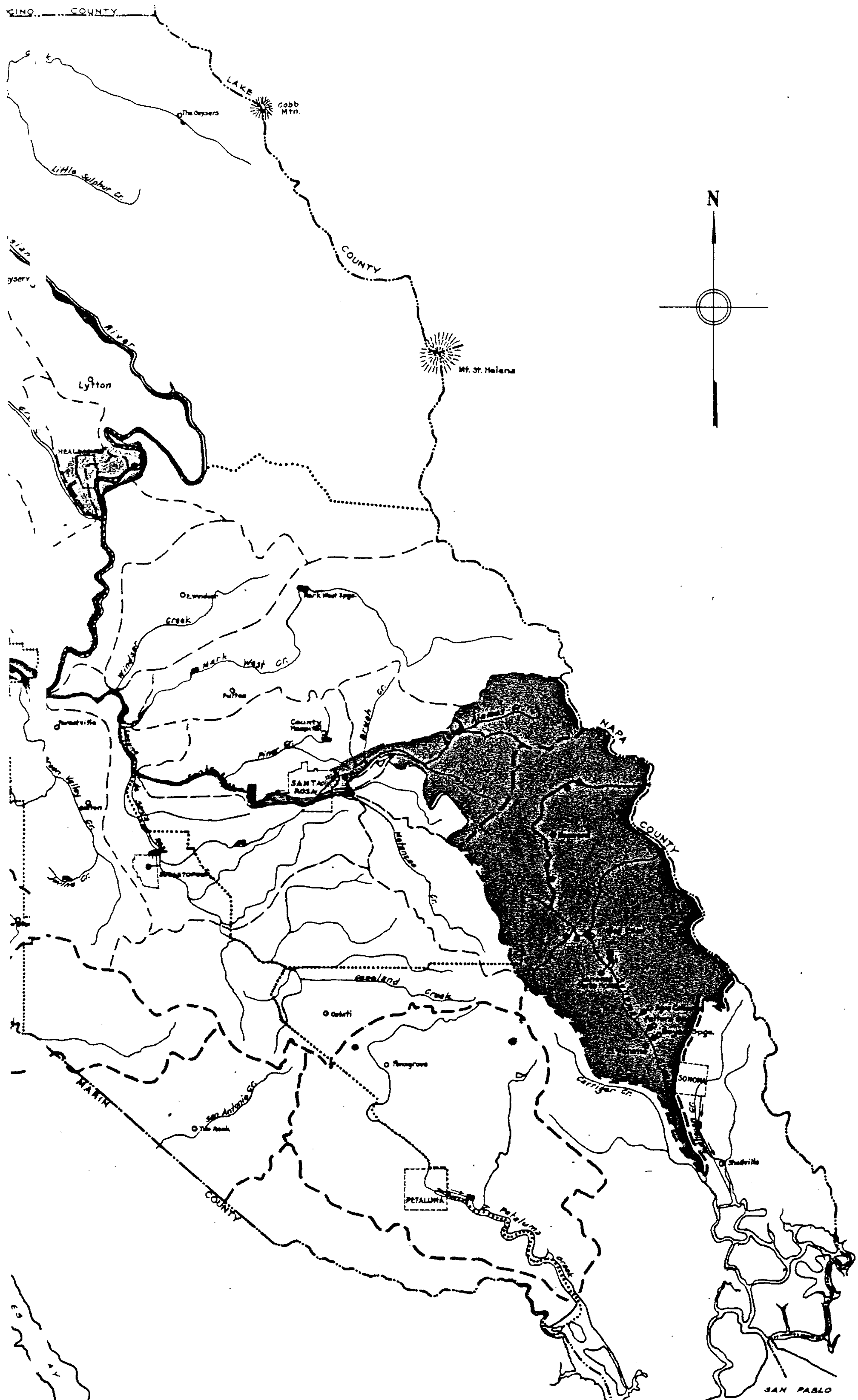
DRAINAGE MAP
SONOMA COUNTY, CALIFORNIA
SHOWING POSSIBLE SOURCES OF STREAM POLLUTION

0 1 2 3 4 5
SCALE IN MILES

LEGEND

- SWIMMING POOL
- SWIMMING BEACH
- SEWAGE DISPOSAL PLANT
- PUBLIC WATER SUPPLY DIVERSION
- PRIMARY DRAINAGE DIVIDE
- SECONDARY " "
- SUPERVISORAL DISTRICT BOUNDARY
- UNINCORPORATED COMMUNITY
- RECREATIONAL STREAMS

To Accompany Report of
Charles H. Lee
Consulting Engineer



COUNTY
LAKE
Cobb Mtn.
The Geysers
Little Sulphur Cr.
COUNTY
N
Mt. St. Helena
River
Lytton
Mark West Spgs.
Windsor
Creek
Mark West Cr.
Fulton
County Hosp.
Brush Cr.
Piner Cr.
SANTA ROSA
NAPA
COUNTY
Forestville
Sebastopol
Matanzas Cr.
Copeland Creek
Cotati
Penngrove
Carriger Cr.
Spgs.
SONOMA
Shellville
MARIN
San Antonio Cr.
Two Rock
COUNTY
PETALUMA
Petaluma Creek
SAN PABLO

PHOTO 2 - Santa Rosa Sewer Farm showing wooden septic tanks. Two chlorinator houses appear as white square spots in distance.

PHOTO 3 - Santa Rosa Sewer Farm showing south settling ponds with aquatic vegetation harboring mosquito breeding.

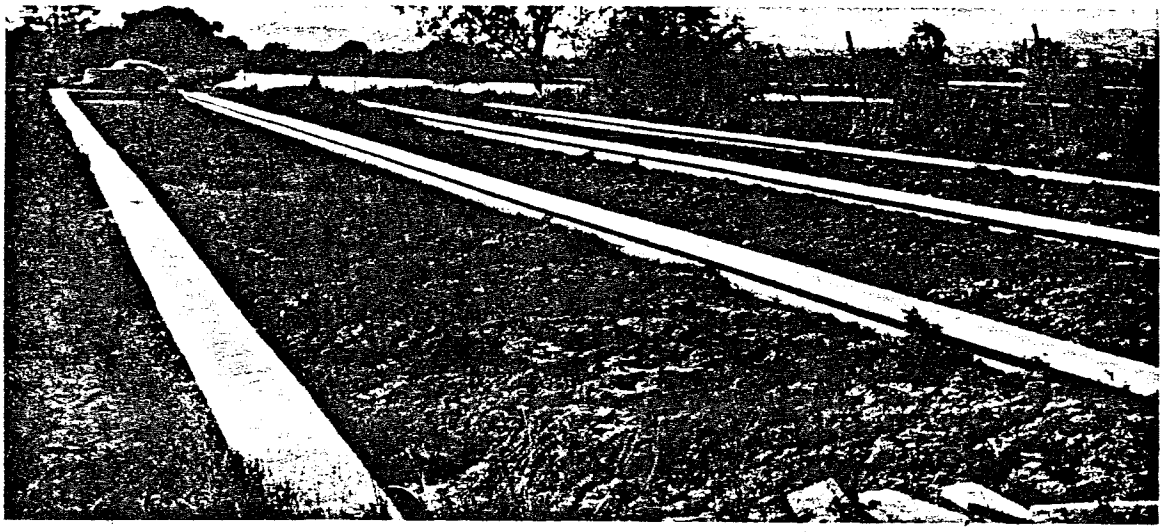


PHOTO 4 - Santa Rosa Sewer Farm showing concrete settling tanks with crust.

further increased giving a present area of 31.7 acres (Diagram 8). The purpose was again to obtain greater removal of organic matter by oxidation in order to reduce bacteria counts without increase in use of chlorine.

The two chlorinators are of the dry feed type, poorly housed and maintained, of inadequate capacity and without proper chlorine mixing and contact facilities (Photo 2). The contact time is only a few minutes instead of the required minimum of 25 to 30 minutes. It is reported that the rate of feed is 9 to 12 pounds of chlorine per day each. The required rate to thoroughly disinfect the effluent for present population is at least ten times this amount. There is no provision for regulating the flow of chlorine to obtain a uniform application throughout the 24 hours. The chlorinators are not operated during the irrigation season as sewage is not discharged into the creek. During the non-irrigation season, on the occasion of three inspections by the writer, the chlorinators were not in operation and the turbid effluent was being discharged into Santa Rosa Creek. At one inspection the caretaker stated that one chlorinator had not been operated for over a year. The diffuser and check valve on the other chlorinator were observed to be too badly corroded for use.

The ponds are poorly constructed. The bottoms are very uneven and not leveled, there being differences in elevation of as much as three feet between high and low sides in some of the larger ponds. This condition makes it impossible to hold a uniform depth of water as is necessary for maximum development of floating algae growth. Many of the levees, including those last constructed, are structurally weak, and have been built without removal of organic material or bonding to subgrade. Active leakage occurs along the outside toe of all the newer levees. Few of the levees are compacted and new levees are rapidly deteriorating by bottom sloughing on the wet side and caving at the top on both sides. Gophers have weakened older levees by burrowing.

Water for irrigation is taken from the ponds at three points. The portion of the I.P.Wood property lying across Santa Rosa Creek south of the Sewer Farm takes water through an inverted pipe siphon under the creek bed with inlet in Pond No.18. The westerly portion of this property is served by a pump located at the northwest corner of Pond No.8 with slip joint pipe supported by a temporary overhead crossing of the creek. This line was last summer observed to be leaking badly at the joints, the escaping sewage discharging into the creek (Photo 7). The Hughes and Shea property, east of the Sewer Farm, is served by a pump located at the northeast corner of Pond No.4. The irrigation season begins June 1 to 15, and continues until two weeks preceding hop picking, about September 15. There is also a fall irrigation prior to the first rains. Taking of water from Pond Nos. 18 and 4 breaks the chain of flow and drains most of the ponds.

The sequence of flow in ponds as now arranged is as follows:

To North Chlorinator - Pond Nos. 1,2,3,4,5,7,8.

Total area - 16.78 acres

To South Chlorinator (long route) - Pond Nos. 1, 2, 3, 4, 5, 7, 8, 16, 15, 14, 13, 12

Total area - 22.29 acres

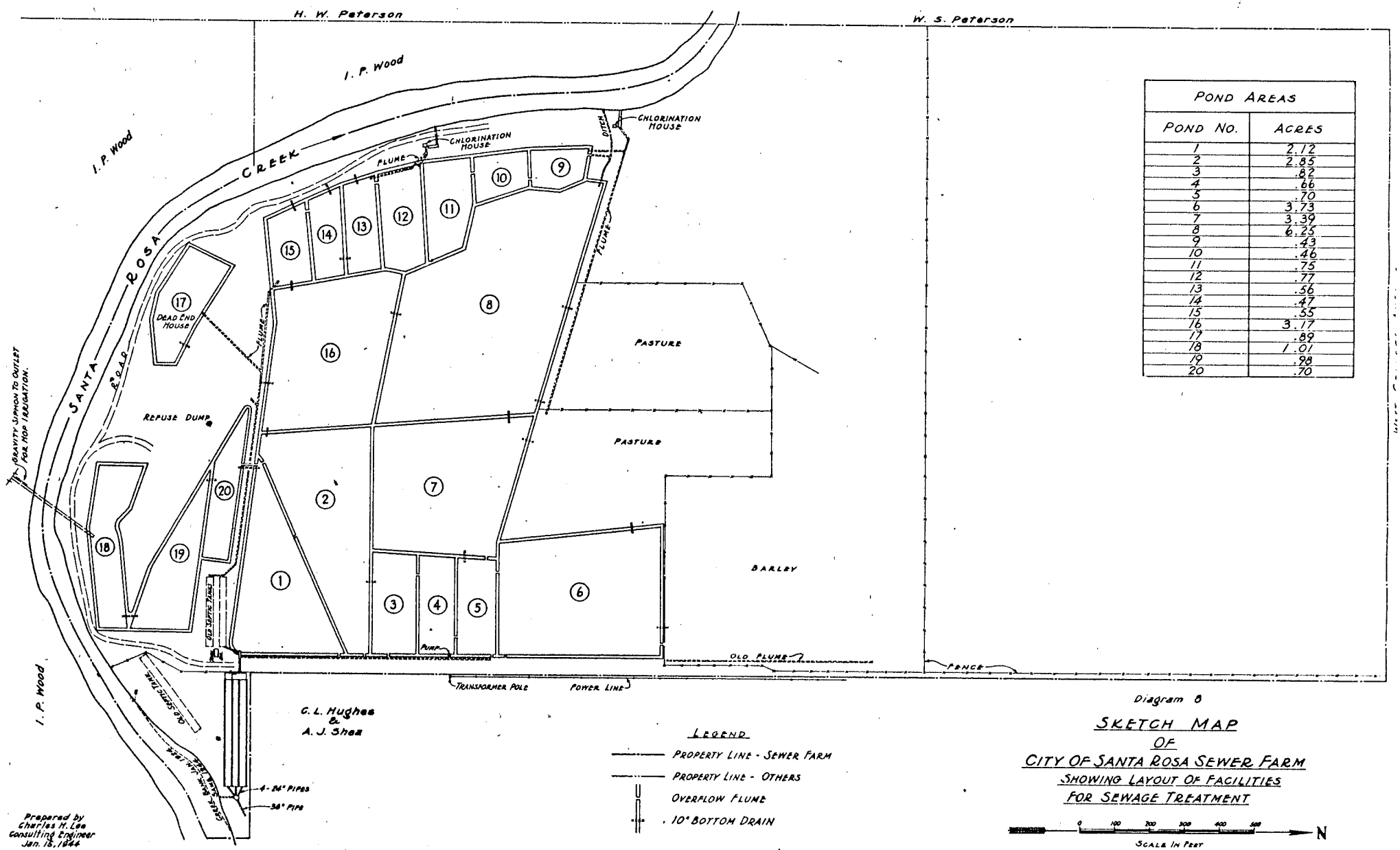
To South Chlorinator (short route) - Ponds 1, 2, 16, 15, 14, 13, 12.

Total area - 10.48 acres

The pond area at 3 ft. depth for a flow of 1,200,000 gallons per day (16,000 x 75 gals.) which would be required for sterilization of sewage from the present population of 16,000 is 50 acres. The area required for oxidation alone is a little less. It is obvious, however, that even for the longest chain of ponds the area now available is less than 50 per cent of that required even assuming that pond bottoms are properly graded and leveled.

The present method of operation of ponds with delivery of water for irrigation from Pond Nos. 18 and 4 is inconsistent with obtaining greater removal of organic solids and reduction of biochemical oxygen demand to an acceptable value. To accomplish this, chemical stabilization of residual suspended and dissolved solids by oxidation is necessary. Floating algae are the most important source of oxygen being several times as effective as absorption of oxygen from the atmosphere. Algae propagation is most active during May and June and it is during this period that algae colonies become firmly established. During the irrigation season the flow of sewage through the ponds is interrupted and many of them are dried up, thus destroying the algae. Reseeding does not occur again until the following spring so that during the non-irrigation season when the algae are needed they are not available. As a result, septic tank effluent reaches the outlet of the last pond, dark in color, more or less turbid, and with a high biochemical oxygen demand. In such condition large quantities of chlorine are needed for sterilization. Large quantities of chlorine have never been used at any time in the history of the Sewer Farm and chlorination at best has apparently been intermittent with long periods during which the effluent discharged into the creek without sterilization.

Raw sewage from the 36-inch outfall sewer enters the Sewer Farm at the east end where it discharges into an open concrete division box. From here it flows into three parallel concrete settling tanks, each 300 feet by 20 feet by 6 feet deep (Photos 4 and 5). These tanks are open, have no baffle walls or boards, and are operated with a side water depth of 50 inches as controlled by overflow weir. When first visited, July 23, 1943, there was a crust 2.5 feet thick at the upper end with surface at least one foot above the liquid surface. Liquid depth was 1.5 feet. Sludge at the upper end was about one foot deep on the bottom. Raw sewage was flowing through flat tubes formed between crust and sludge in prolongation of the influent pipes for some distance into the tanks. Toward the lower ends of the tanks, crust was approximately 6



POND AREAS	
POND NO.	ACRES
1	2.12
2	2.85
3	.82
4	.66
5	.70
6	3.73
7	3.39
8	6.25
9	.43
10	.46
11	.75
12	.77
13	.56
14	.47
15	.55
16	3.17
17	.89
18	1.01
19	.98
20	.70

LEGEND

PROPERTY LINE - SEWER FARM

PROPERTY LINE - OTHERS

OVERFLOW FLUME

10" BOTTOM DRAIN

Prepared by
Charles H. Lee
Consulting Engineer
Jan. 15, 1944

Diagram B

SKETCH MAP
OF
CITY OF SANTA ROSA SEWER FARM
SHOWING LAYOUT OF FACILITIES FOR SEWAGE TREATMENT

0 100 200 300 400 500

N

SCALE IN FEET

inches thick and sludge had about the same depth. Much of the tank capacity was thus occupied by sludge and crust. As a result, the effluent, instead of being fairly clear and without floating solids, was dark gray in color and contained much floating partially digested organic matter. Larvae of the house fly were observed breeding in the lower part of the crust (Photo 6) and flies were present in great numbers around the division box and tanks. There was also considerable odor. As piped water is not available at the plant there was no means of washing down the division box and tanks or of breaking up the crust in tanks.

The average per capita daily sewage contribution for Santa Rosa is estimated at 75 gallons. This is based upon the total per capita daily water consumption during the non-irrigation period October 1, 1942 to April 30, 1943, from both municipal and Santa Rosa Water Works systems amounting to 77 gallons, corrected for system and other losses and increased for greater use for domestic purposes in summer. The population for this period including transients was estimated at 16,000. For an average detention period of 15 hours, which is customary practice for septic tanks, it is computed that on July 23, 1943, only 46 per cent of the required tank capacity was available for removing settleable solids from raw sewage. If the tanks had been clean the capacity would have been 75 per cent of that required. It is thus obvious that with present population, tank capacity is inadequate for settling out of solids and that continuous septic action of solids in digestion is impossible.

In general comment on the sewage treatment plant it may be said:-

1. The settling tanks are of inadequate size and of improper design to act as septic tanks, giving a turbid effluent unnecessarily high with organic content and biochemical oxygen demand.

2. Arrangement of ponds is poor and capacity is insufficient for either stabilization of residual organic matter or for sterilization.

3. Chlorination equipment is undependable, poorly maintained and of insufficient capacity to meet State Board of Health requirements for sterilization of the effluent to Santa Rosa Creek.

4. Operation of settling tanks is careless, with resulting high contents of solids in effluent, odor and flies.

5. Operation of ponds is careless with destruction of algae colonies and growth of vegetation around margins permitting mosquitoes to breed.

6. Operation of chlorinators is careless with frequent discharge of effluent into Santa Rosa Creek without any attempt at sterilization.

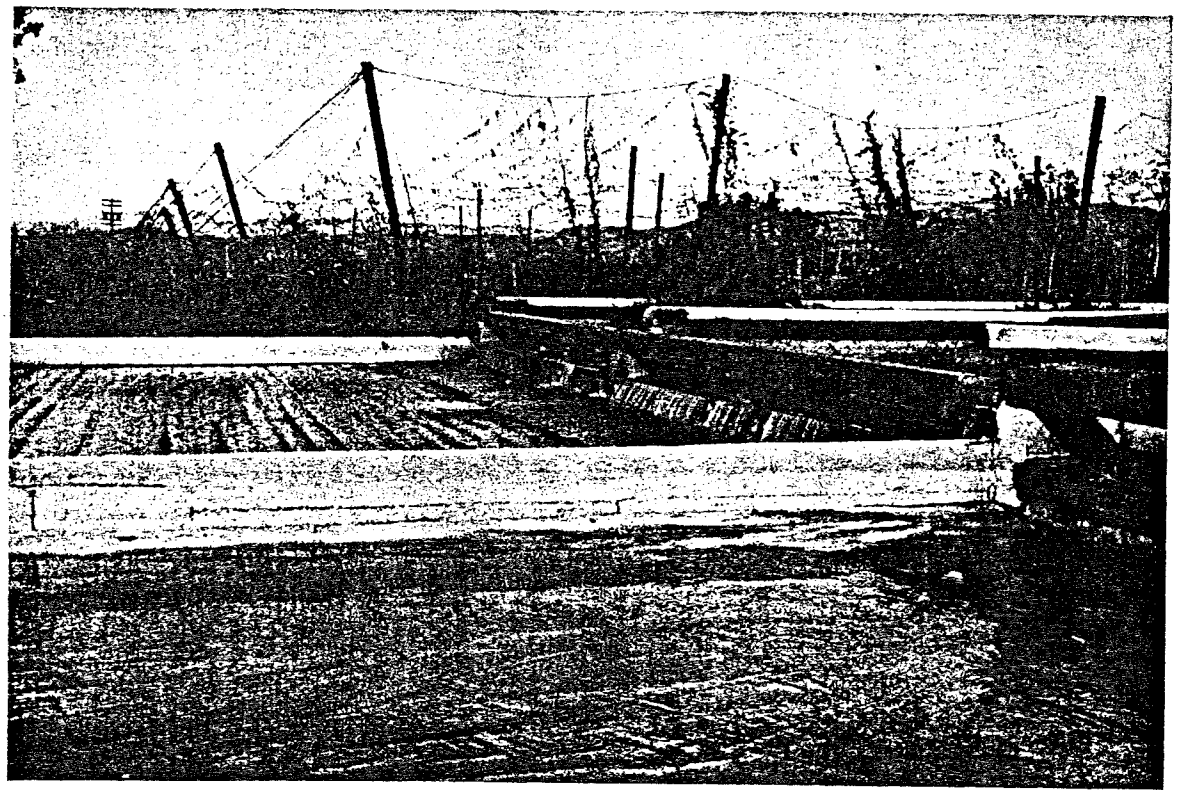


PHOTO 5 - Santa Rosa Sewer Farm showing effluent from lower end of septic tanks.

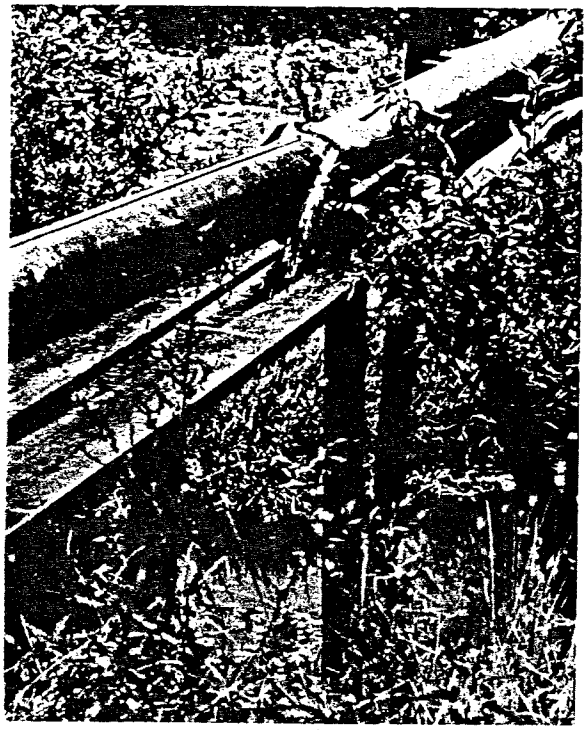


PHOTO 6 - Santa Rosa Sewer Farm close-up of crust on settling tank showing fly larvae in deep crevices.

PHOTO 7 - Santa Rosa Sewer Farm showing pump discharge line across Santa Rosa Creek with leaking pipe joint.

Disregarding present equipment and operating practice, the Sewer Farm site has advantage of size and location and is well adapted to working out a simple method of low-cost treatment. The City of Santa Rosa can well afford to make the necessary improvements in equipment and operating procedure to eliminate from this plant the present unsanitary and offensive features. Suggestions for accomplishing this are presented under the heading of Recommendations.

Food Handling

The food handling situation at Santa Rosa has been a public health menace but has improved as the result of more active enforcement of the California State Food Sanitation Act during recent months. This Act states that all food handling establishments shall be sanitary in construction and finish and be provided with adequate toilet and lavatory facilities for employees; that such establishments and all equipment, facilities and the clothing of employees shall be kept clean; that food being processed or exposed for sale or distribution shall be protected from flies, dust, dirt or any unsanitary condition; and that diseased persons shall not be employed in such establishments. Right of inspection is given state and local health officers with power to bring action in local courts for abatement of violations as public nuisances dangerous to health. Penalties for violation of the provisions of the Act are also included.

Upon discovery that unsanitary conditions existed in certain restaurants in Santa Rosa, the Sonoma County Health Department, early in October, 1943, in cooperation with the Food Inspection Division of the State Department of Public Health and the City Health Inspector, instituted systematic inspection of all food dispensing establishments including restaurants, eating houses, fountains, bars, creameries, grocery stores, meat markets, produce stores, bakeries and road-side fruit stands. After inspection, a certificate of compliance is being issued as soon as provisions of the law are complied with. This procedure, with the publicity connected with refusal to issue certificate to establishments which do not comply, is rapidly cleaning up the unsanitary conditions which were found to exist.

Refuse Disposal

Refuse at Santa Rosa is collected by private agencies and most of it deposited at a privately owned dump. City ordinance regulates the charges for collection. It establishes a base rate of 60 cents per week for one collection and provides that where wet garbage exceeds 10 gallons per day at any place of business it shall be considered sufficient to compensate for removal of rubbish. Rose City Garbage Company was awarded contract September 8, 1943, paying the City $400 per month for exclusive franchise. Royal Tallow Company of Petaluma has a subcontract and makes collection of restaurant garbage, feeding it to hogs at its Petaluma Plant. Babbini Garbage Company also has a

subcontract. It disposed of garbage at a private dump until the latter was abated. It is reported by the County Health Department that cleaning of collection cans used for wet garbage by restaurants and hotels is very lax, giving rise to flies, rats and bad odors in the back alleys and courts.

Rose City Garbage Company disposes of refuse at a dump on the Faught Ranch, a 3000 acre tract of hill land east of Windsor. The company pays the owner $75 per month for the privilege of dumping but is required to include all wet garbage. There is no financial relation between the City and the ranch owner but it is understood that there is an agreement that garbage may be dumped there only so long as wet garbage is included. The County, in exchange for free dumping privileges for rural population living outside of Santa Rosa, has built and maintains a private road connecting the dump with the County road.

An associate of the owner of the ranch feeds about 350 hogs on the garbage, the hogs being allowed to root around in the freshly deposited refuse for 24 hours before burning. Very good sanitary conditions are maintained. When inspected September 30, 1943, there was very little odor and few flies. It was reported by the owner of the hogs that systematic trapping by a government agency has reduced rats to a minimum. The nearest residences to the dump are one mile west and two and one-half miles east. No complaints are reported. There is some injury to hogs due to cutting by razor blades and broken glass encountered in the garbage. Losses have also occurred from eating ant poison.

The disposal site, the management of the dump and hog feeding are at present reasonably satisfactory. The City, however, has only a permissive right to use the dump which could be terminated at will by the owner. A more binding arrangement would be of advantage to the City and should be secured at as early a date as possible.

The disposal of industrial waste and of bulky rubbish has been a problem of Santa Rosa for many years. A prevailing habit, more or less curbed by the public authorities, has been promiscuous dumping along the banks of Santa Rosa Creek. This occurs at several industrial plants having frontage on the Creek (Photos 8, 9 and 10). It is also practiced by others at the rear of vacant lots, at dead end streets and from streets bordering the creek, where truckloads of garden cuttings, waste concrete, old automobiles, hot water tanks, abandoned metal equipment, and miscellaneous rubbish are dumped. This practice not alone makes the stream bank unsihgtly, but forms a fire hazard, harbors rats, and chokes the stream channel in winter, causing bank erosion and property damage. It is a practice which should be permanently discontinued.

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PHOTO 8 - Rotting hair and hide scrapings from Levin Tanning Company dumped along bank of Santa Rosa Creek.

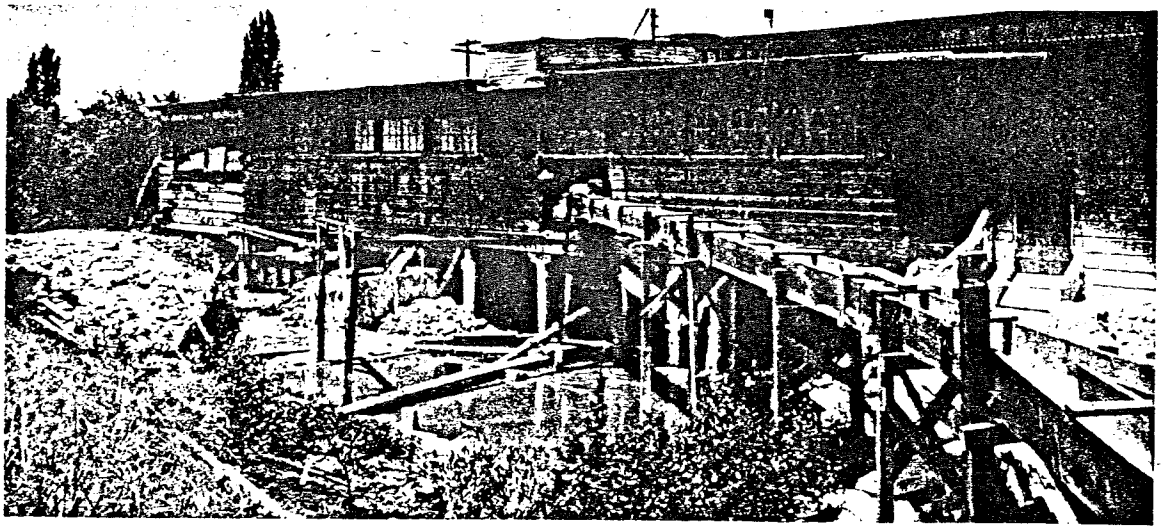


PHOTO 9 - Refuse at building of Levin Tanning Company on bank of Santa Rosa Creek.

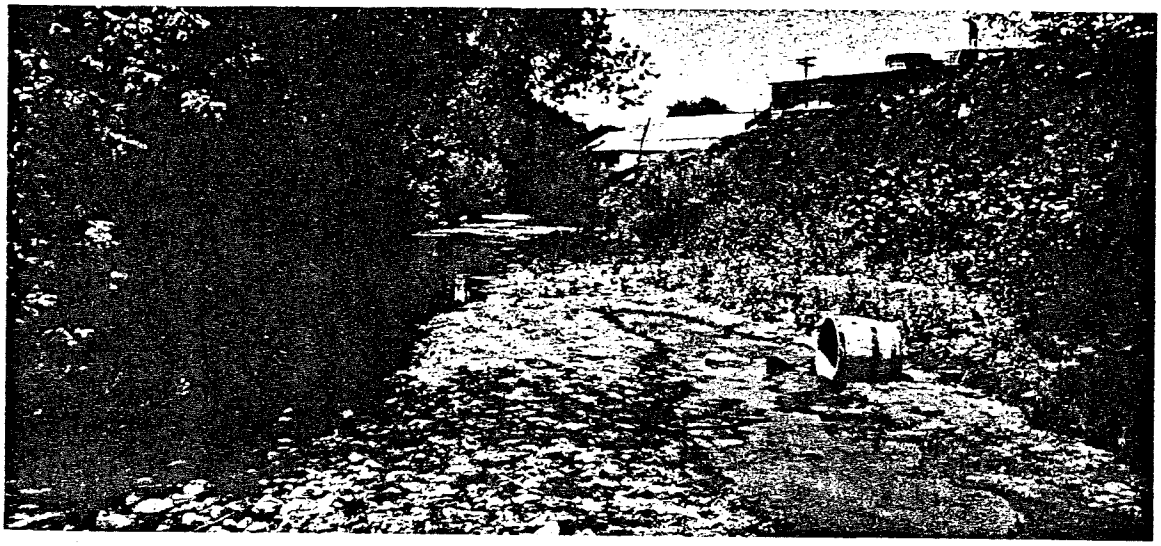


PHOTO 10 - Rubbish along Santa Rosa Creek from plant of Levin Tanning Company

CITIES OF PETALUMA AND HEALDSBURG

Petaluma

Petaluma is next in size to Santa Rosa and is an active growing City with present population of approximately 10,000. It is the trading center for a population of over 15,500 engaged principally in poultry raising and dairying. Local industries include feed mills, egg and poultry packing plants, creameries and cheese factory. Industrial wastes reach the sewers from several sources including creameries and poultry and molasses processing plants. The City has its own health department with part-time health officer and one sanitary inspector. There are no public health nurses available so that the City has no personnel to care for the public health services such as maternity and child health cases. There is also no personnel trained for adequate venereal disease investigation and control.

Public health conditions within the City do not offer any unusual problems. Important additions were made to the sewer system in 1938 including an intercepter line, sewage pumping plant, and an entire new sewage disposal plant (Photos 11 and 12). The latter is located on a 7.5 acre tract in an open area east of the City. It is of the two-stage bio-filtration type with primary clarifier, trickling filter and separate sludge digestion tank, and emergency chlorination equipment. The effluent discharges into tidal water in Petaluma Creek 3/4 mile below the City. The plant is of adequate capacity for the population but in the past there has been occasional difficulty because of insufficient digester capacity for handling industrial wastes. The City Engineer reports that trouble from this source has been remedied by heating sludge digestion tanks to 100° F.

Petaluma Creek is used for navigation by light commercial shipping. There is little recreational use at present but if such should develop it might become desirable to install permanent chlorination equipment. The new 24-inch sanitary intercepter sewer crosses Petaluma Creek just above the head of navigation. It is supported on wooden piles above tide level and gives trouble by catching drift during winter storms. An improved method of supporting this pipe would eliminate the possibility of breakage with resultant mingling of raw sewage and flood waters. It is reported by the City Engineer that plans are under consideration for remedying this situation.

The use of cesspools and ceptic tanks is prohibited by City Ordinance. Due to soil conditions some difficulty has been experienced in disposal of septic tank effluent from auto courts and dwellings outside the City limits. This has been met in at least one case through acquisition of additional land by the owner for extension of effluent lines.

Healdsburg

Healdsburg is a town of approximately 2700 population. It is on the Redwood Highway and the Russian River and is a shipping point for fruits and grapes. It is the business center for the upper Russian River resorts and a rural population of over 7500. Industries include wineries, fruit packing plants, fruit canneries and a vegetable dehydrating plant. Public health

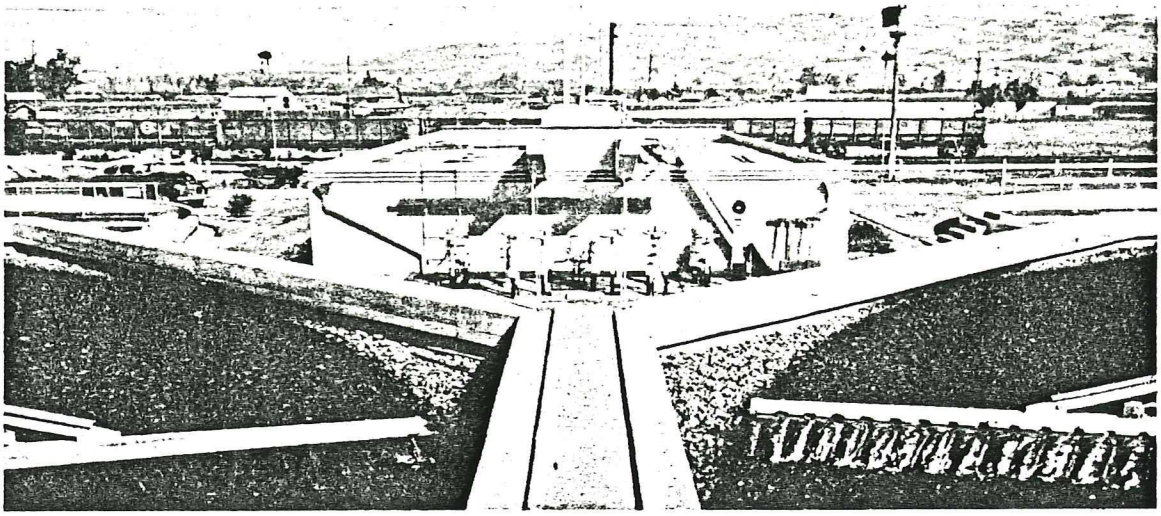


PHOTO 11 - Petaluma Sewage Disposal Plant. Trickling filters in foreground. Administration Building pumps and sludge digestion tank in center and primary and secondary settling tanks on left and right.

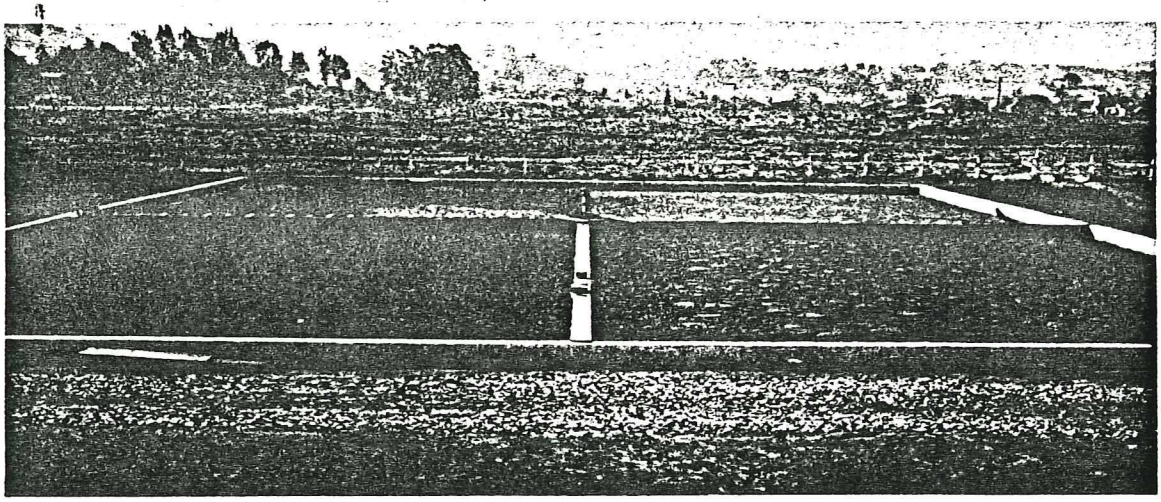


PHOTO 12 - Petaluma Sewage Disposal Plant. Sludge drying beds.

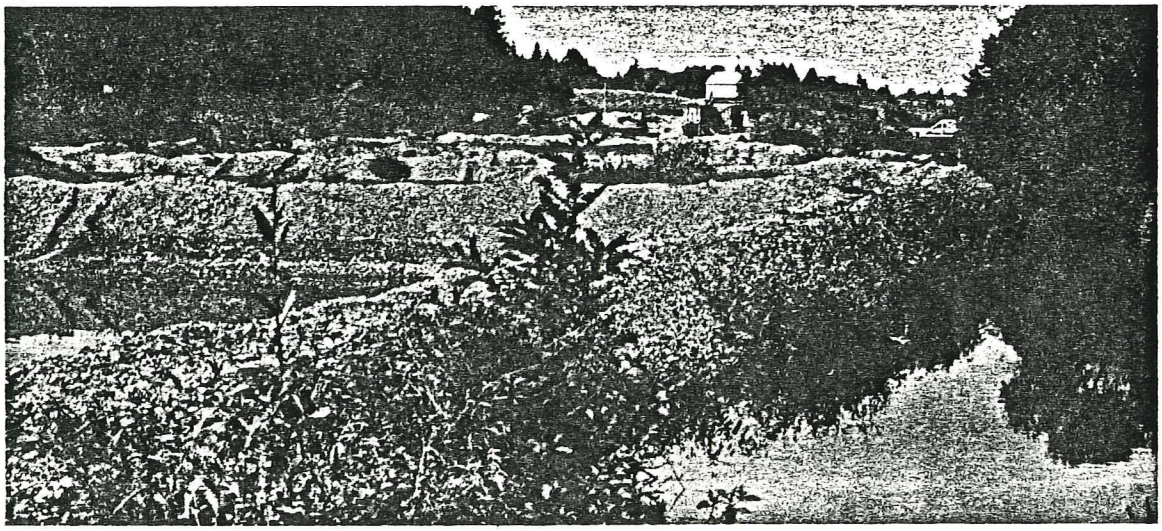


PHOTO 13 - Effluent from Healdsburg Sewage Disposal Plant and Seepage Basin. Effluent dark in color and has some odor. Basins are swept away by winter floods in Dry Creek.

activities are handled as at Santa Rosa, the City Health Officer enforcing City ordinances only.

Public health conditions are normal. The sewage collection system was improved in 1937 by construction of an intercepter line with auxiliary feeder, a pumping plant and force main. A sewage treatment plant was also constructed of the two-stage bio-filtration type with clarifiers, trickling filters and sludge digestion tank. This plant is located west of the City and near a County road and has been a source of odor complaint. Plant capacity is adequate except for sludge digestion, the one small covered digester having been supplemented by an open sludge lagoon. During summer the chlorinated plant effluent is discharged into prepared gravel basins in the bed of Dry Creek (Photo 13). The effluent is very turbid at times tending to clog the gravel. This is especially the case when prune plant wastes are being discharged into the sewers. At such times sewage is by-passed into the gravel beds causing the latter to become a source of odor and flies. The gravels are submerged during winter and percolation capacity is restored by the erosive and washing action of flood waters. In winter the effluent is discharged directly into Dry Creek without chlorination. The point of discharge is 2 miles above the junction of Dry Creek with Russian River and 8 miles above Mirabel, the first of the lower river resorts. The average daily sewage flow of the plant during summer is 174,000 gals. per day. Winter sewage flow is greatly increased by ground water.

The effluent from a dehydrating plant at the west edge of Healdsburg carries a high organic content which when deposited as sludge becomes very odoriferous. For a time early this year the effluent was discharged into Foss Creek which flows through the southwestern part of the City to a junction with Dry Creek. The accumulation of sludge in Foss Creek gave rise to an odor nuisance and led to action by public health authorities requiring that the discharge be made into an earthen basin in vacant land near the plant (Photo 14). This was done but the effluent is of such volume that the basin although of large capacity proved inadequate and overflow has occurred onto surrounding open fields. The handling of this effluent so as to avoid nuisance and public health hazard is a problem which should be given attention.

Sebastopol

Sebastopol has a population of 2200 and is located in a thickly populated rural district devoted to raising of deciduous fruits, principally apples. The tributary population is estimated at 6000. There are two apple packing plants, two apple dehydrating plants and an apple processing plant in the City. Public health problems are not out of the ordinary. The City has no health department nor health officer, the County Health Department being the only local public health agency.

The sewage disposal plant has fair isolation and consists of mechanical clarifier, separate sludge digestion and oxidation ponds, the latter discharging into the Laguna (Photos 15 and 16). There are five oxidation ponds with a total area of 6.26 acres. The plant is of adequate capacity for the

PHOTO 14 - Effluent pond Healdsburg Dehydrating Plant, processing potatoes and carrots. High organic content and very odoriferous. Pond on left has overflowed onto field at right.

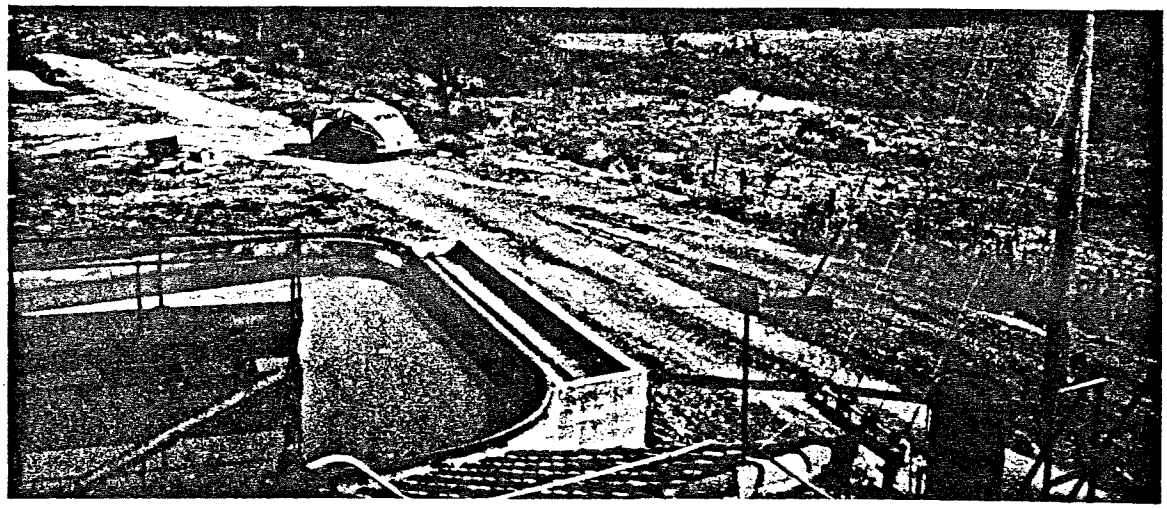


PHOTO 15 - Sebastopol Sewage Disposal Plant showing primary settling tank. Municipal garbage dump in left distance. Channel on right carries effluent from sludge pond Speas Mfg. Co. and, in winter, raw sewage which by-passes Plant during and after storm periods.

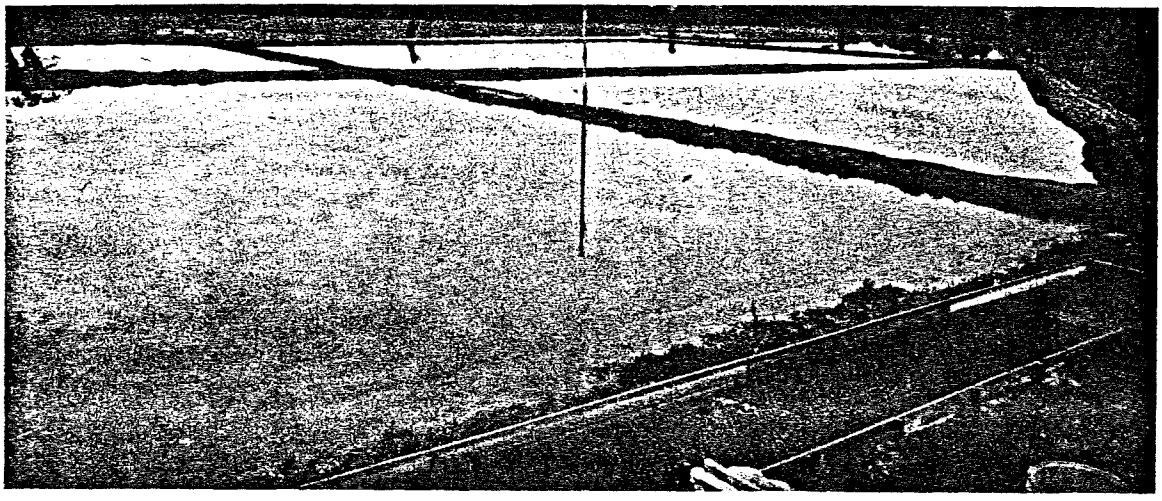


PHOTO 16 - Sebastopol Sewage Disposal Plant. Sludge drying beds and oxidation ponds. Effluent from latter to Laguna at farthest corner in right distance.

population although sludge drying beds are small. The oxidation ponds were inspected August 13 and September 8, 1943, and appeared to be operating satisfactorily with effective stabilization of organic matter and reasonable bacterial sterilization.

Waste from apple processing and packing plants was a former source of difficulty due both to acid in wash water and to excessive organic matter. Wash water from these plants is now discharged into Calder Creek and another waterway, both tributary to the Laguna. Sludge is run directly into a pond south of the sewage disposal plant from which the effluent and excess sludge flows across the pasture and into the Laguna (Photos 17 and 18). This pond has been the cause of recent complaint due to odor which is offensive to people living several blocks away.

There are two elements of inherent weakness in the Sebastopol sewage disposal plant from the public health standpoint. The first results from the absorptive character of the soil and underlying bed rock upon which the City is built. This formation becomes saturated during the winter storms and continues thus into spring and early summer, greatly increasing flow into the sewers by infiltration of ground water at joints. During and following storms the increase is so great that the disposal plant must be by-passed and raw sewage is discharged into the Laguna often for periods of a week or more at a time. This problem has been studied by City officials and steps taken to eliminate all roof-leader connections, manhole leakage and other sources of storm water. Apparently the only remedy is complete reconstruction of the sewage collection system.

Another element of weakness is the location of the site of the oxidation ponds which is exposed to flood and submergence from water in the Laguna during periods of backwater from Russian River. This condition, combined with the fact that the levees around the ponds are constructed of silt without compaction and are structurally unstable when submerged or exposed to running water, constitutes a public health hazard of great potentiality. Corrective measures are suggested under the heading of Recommendations.

Sonoma

Sonoma has a population of nearly 1800 and is the trade center of an agricultural and dairying area including the whole Sonoma Valley with a resident population of over 8300. There are several local industries including a winery, cannery, cheese factory and creamery, all of which produce liquid wastes and sludge. There are no unusual public health problems. The City has no separate health department, the arrangement with the County being the same as at Sebastopol. The City is almost entirely sewered, there being only 30 residences located at inaccessible points, which are served by septic tanks. Raw sewage is discharged into a septic tank at a sewer farm about one mile south of town in the center of a small farm area. The tank is cleaned to Natheson Creek during floods. The effluent was formerly discharged into adjacent oxidation ponds but since 1935 it has been transmitted to tide water at the head of Schell Slough through a 3-mile outfall. Although there is

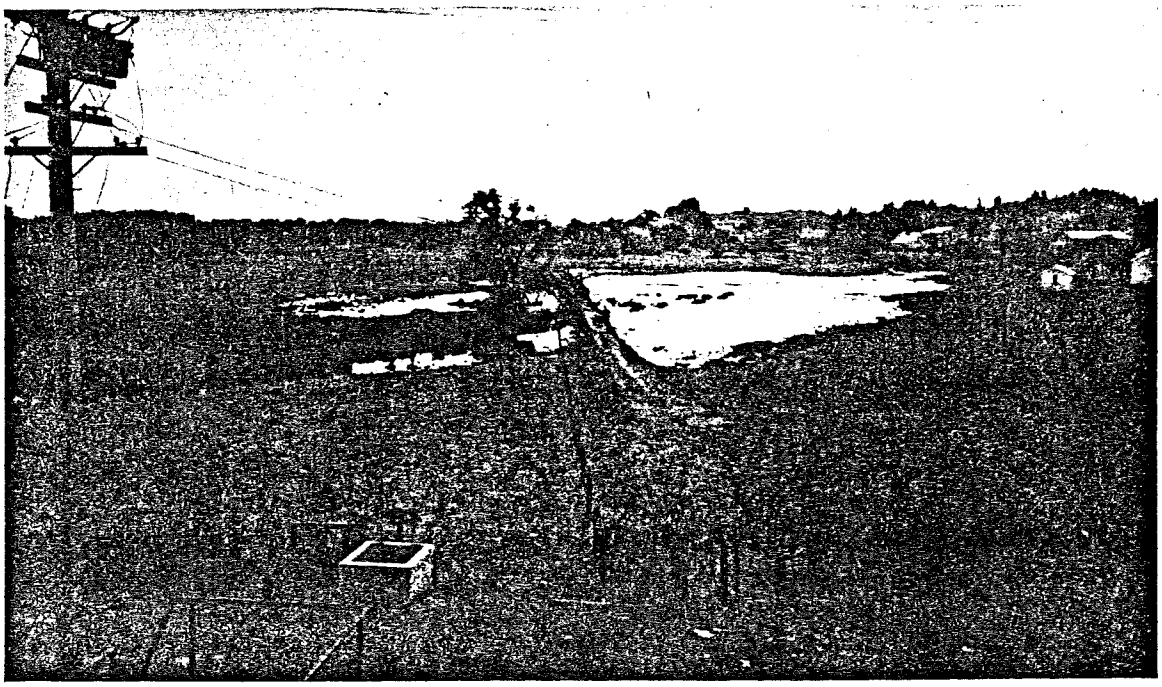


PHOTO 17 - Pond receiving effluent from Speas Mfg. Co. at Sebastopol. Covers about 15 acres - very odoriferous. Note cows wading in it.

PHOTO 18 - Laguna adjacent to Sebastopol garbage dump containing foul water and sludge largely from Speas Mfg. Co.

PHOTO 19 - Imhoff tank and sludge drying bed at Cloverdale Sewage Disposal Plant.

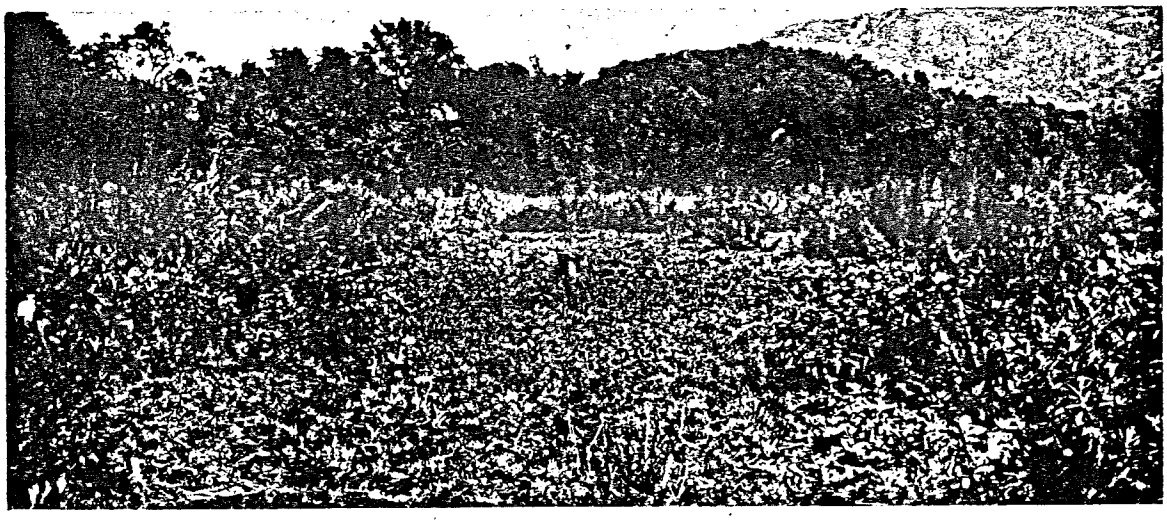


PHOTO 20 - Seepage Basin for effluent of Imhoff tank at Cloverdale Sewage Disposal Plant.

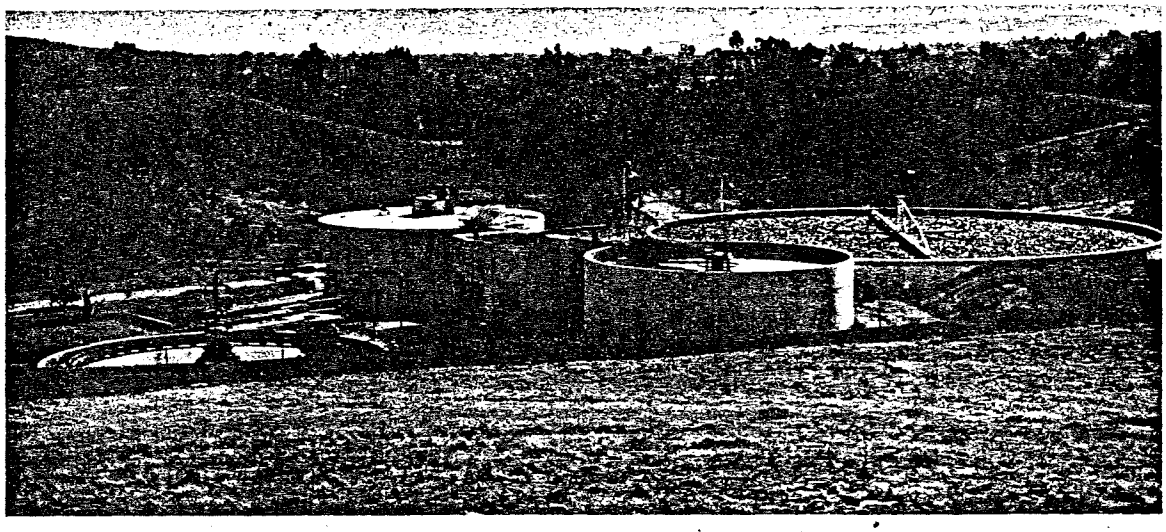


PHOTO 21 - Biofiltration Plant of Sonoma State Home.

considerable industrial waste throughout the year there is no gasing and very little sludge at the outlet due to active tidal flow.

Refuse from Sonoma is disposed of and burned at a City-owned dump three-quarters of a mile north of town. The County has no dump in this vicinity and the City permits the dumping of refuse by outsiders. The location is visible from the cemetery and nearby road and its unsightliness has been the cause of much complaint. It is also a source of rats close to the City. Although it does not appear to be a public health hazard, there is sufficient reason for removal from a nuisance standpoint. A joint City and County dump at a more remote location is under consideration.

Cloverdale

Cloverdale, located at the head of the Russian River Valley, has a population of 900 and is the trading center for a population of 2800 engaged in fruit culture and sheep raising. There are no industries. Public health activities are handled as at Santa Rosa, the City Health Officer enforcing City ordinances only. The town is sewered except for eight houses which are too low and are served by septic tanks. The sewage disposal plant is located one-half mile south of town at the edge of the upper bottom lands of Russian River. It consists of an Imhoff tank from which the effluent is discharged either onto a sewer farm on the gravely flood plane of Russian River or used to irrigate intervening pasture and vineyard (Photos 19 and 20). No effluent reaches Russian River except at time of extreme flood. The possible use of effluent in irrigation of low growing crops is questionable. The Imhoff tank is well operated and although a source of minor complaint from odor, is not a public health hazard. Foaming occurs during the wine-making season for a short period due to acid condition.

The City water supply is derived from a shallow well near Russian River. The site is often submerged during winter floods with possibility of pollution of the well.

* * * * *

Public health problems in unincorporated population centers, due to smaller size and absence of congestion, do not attain magnitude and complexity and can be handled through individual action. Domestic sewage can usually be disposed of in family septic tanks or cesspools. Garbage is largely consumed by domestic animals. Rubbish is either burned, deposited on County dumps, or dumped in out-of-the-way places. The latter practice creates a serious public nuisance problem, and a public health hazard, principally from rats. Much has been done to reduce it through the efforts of the County Roadside Inspector who has supervision over all County roads and County property and in addition, aids private property owners who are troubled with the surreptitious dumping of refuse on their lands.

Unincorporated communities located on streams in popular recreational areas where population becomes congested during the summer season are exceptions to the rule. The largest of such communities is Guerneville on Russian River with normal population of 800. Several problems have here reached the stage where community action is necessary and a movement has been started looking toward incorporation. It is understood that the most important need is for sewage collection and disposal. For this purpose organization of a County Sanitary District would serve the purpose without incurring the responsibilities and costs of incorporation.

At Geyserville there are many septic tanks in close proximity whose effluent is being absorbed by soil overlying a shallow water-bearing formation. This formation is penetrated by domestic wells and is the source of numerous springs of clear water. Many of the wells and springs have become grossly polluted from septic tank effluent.

At Occidental septic tank effluents and waste water from houses discharge directly into the headwaters of Dutch Bill Creek.

At Bodega Bay all sewage from buildings along the water front discharges directly into the Bay. The latter has recently been improved by construction of jetties and dredging of a 14 ft. channel and turning basin to form a commercial fishing harbor. Commercial development is in progress and rapid community growth is expected. Oyster culture is carried on in the shallow portions of the Bay. Bay pollution and shore line nuisance from sewage may soon be a problem.

Other similar communities such as Monte Rio on Russian River with population of 525, and El Verano on Sonoma Creek with 550, may find it desirable to set up some form of local governmental agency in conjunction with neighboring communities for control of public health and fire. At the present time and for the immediate future such small communities as Cotati, Forestville, Graton, Windsor, Rio Nido, Fulton, Valley Ford, Penngrove, Jenner, Kenwood, Cazadero, Camp Meeker, and Freestone can be considered as enjoying satisfactory public health status under supervision of County authorities. Conditions at Boyes Springs, Aqua Caliente, Glen Ellen and El Verano might be improved by organization of some form of local district under authority of State laws.

THICKLY POPULATED RURAL AREAS

There are four thickly populated rural areas in Sonoma County which have a public health significance resulting especially from the type of local industry or the presence of transient labor at certain times of the year. These are as follows:

1. Petaluma - Two Rock - Cotati area devoted principally to poultry raising with some dairying.

2. Graton - Sebastopol area devoted to fruit and vegetable raising, especially apples.

3. Santa Rosa - Fulton - Windsor area devoted to raising of deciduous fruits, grapes and hops.

4. Healdsburg - Geyserville area devoted to raising of fruits, grapes and hops.

There are no unusual sanitary problems in any of these areas except in the vicinity of Graton and Sebastopol where transient labor is employed during the apple picking season. Two labor camps were maintained in this area during the current year. A Federal camp at Graton was maintained in good sanitary condition. A private camp at the highway intersection one mile east of Graton was inspected August 8, 1943 and was found to be in very bad condition. The grounds were littered with fly-attracting refuse and garbage, the open privy pit toilets were very dirty and swarming with flies. There were no lavatory facilities. Such conditions in a camp crowded with transient laborers, often with families, is a potential source of communicable disease which could easily spread over the adjacent rural areas and community centers.

* * * * *

I N S T I T U T I O N S

The principal institutions in Sonoma County are hospitals. These include the Sonoma State Home at Eldridge, the Sonoma County Hospital near Santa Rosa, and private hospitals at Santa Rosa, Petaluma, Healdsburg, Sebastopol and Vineburg. Essential data regarding these institutions is assembled in the following table.

TABLE 12

HOSPITAL STATISTICS FOR SONOMA COUNTY

Hospital	Location	Number of Beds	Employed Staff	Sewage Disposal
Sonoma State Home	Eldridge	3252	100	Bio-filtration, separate sludge digestion, chlorination, effluent to Sonoma Creek
Sonoma County Hospital	near Santa Rosa	432	287	Septic tanks, oxidation basins, effluent to Piner Creek
Eliza Tanner	Santa Rosa	20	20	City Sewer
General (a)	Santa Rosa	24	26	City Sewer
Palm Drive (a)	Sebastopol	15	7	City Sewer
Burndale	Vineburg	12	10	Septic Tank
General	Healdsburg	14	10	City Sewer
General (a)	Petaluma	33	13	City Sewer

(a) Not registered by American Medical Association Committee on Hospital Standardization.

The hospitals are all conducted under medical control and their only public health significance is principally in connection with sewage disposal. The two largest institutions take communicable disease and tuberculosis cases which necessitates some definite planning against spread of disease from these sources. These two institutions discharge treated sewage effluent directly into natural streams.

Sonoma State Home

Sewage from the Sonoma State Home is collected by gravity lines to a point on the west bank of Sonoma Creek just north of the bridge and pumped thence through a 10-inch force main across the creek to the sewage disposal site on the hill-slope 75 feet above, a distance of 2300 feet. Sewage from the Dairy, Hog Farm and Chicken Yard lying to the east of the plant is also pumped to the plant through 4-inch force main. The plant (Photo 21) consists of primary clarifier, bio-filter, secondary clarifier with magnetite filter, manually operated chlorinator, covered sludge digestion tank, and four sludge drying beds. The chlorinated effluent is discharged by gravity through a 12-inch concrete irrigation pipe to Sonoma Creek a few hundred feet below Eldridge Bridge. The amount of flow varies, the average being 300,000, and maximum 1,000,000 gals. per day. The effluent is cloudy and at times quite turbid, but sufficient chlorine is being applied for complete sterilization of average flow (20 to 30 lbs. per day). Provision for automatic chlorination would insure a chlorine feed at all times proportional to sewage flow and thus eliminate the possibility of insufficient chlorine being applied at peak flow.

Sonoma County Hospital

This consists of three groups of buildings, the main one housing administrative offices and acute cases, the other tubercular and chronic cases. Raw sewage from the first two groups flows to a septic tank on the west side of Piner Creek. The effluent from the latter joins with laundry waste and flows to two rock filters. The latter were intended as Dunbar Filters but were of inadequate size and the sand layer at the top was never placed. As a result the clarified effluent flowed through the rock without effective oxidation or sterilization and discharged into Piner Creek. Sewage from the Chronic Hospital also discharges into a septic tank and the effluent flows directly into Piner Creek.

To correct this situation which produced pollution in Piner Creek, it was suggested by the Sanitary Engineer, State Board of Health, that clarified effluent be discharged into open tile drain feeding into long contour ditches back-filled with gravel, the residue remainging after seepage being led to oxidation basins for oxidation and sterilization. Work was begun about August 1, 1943, by constructing a temporary one-half acre basin on the west side of Piner Creek to receive the effluent from the Dunbar Filter (Photo 22). This removed a source of existing pollution from the stream and gave time for constructing more permanent basins on the east side of the Creek. The area of the latter is 2.8 acres, which is ample for the effluent from both septic tanks giving 40 days storage period. The quantity of sewage being handled is about 75,000 gals. per day.

Cat and Dog Hospital

The Cat and Dog Hospital just east of Santa Rosa is located upon the bank of the Creek and discharges sewage into a septic tank. The effluent from

the latter flows direct to the stream a few feet away. Because of shallow depth of lot and steep bank over which the building is erected, there is no apparent remedy but connection with the City sewer system. This would require about 400 ft. of connecting sewer. If this is not feasible because of grade elevation at the end of the existing sewer being too high, then a pump could be installed.

Lytton Home

The Salvation Army maintains a Home for boys and girls at Lytton a few miles north of Healdsburg. There are at present 123 inmates in this Home and a staff of 40. There is no regular medical staff. Raw sewage is discharged into a large septic tank from which the effluent drains into an open ditch about 1000 ft. long and 3 ft. wide. The effluent when observed was found to contain considerable organic matter. Upon bringing the matter to the attention of the management steps have been taken to place drain tile so that the effluent will be disposed into the soil.

* * * * *

MILITARY POSTS

Santa Rosa Army Air Base

War conditions have occasioned the establishment of seven temporary Army and Navy Posts in Sonoma County. The two largest of these are the Santa Rosa Army Air Base and the Santa Rosa Naval Air Field. The Army Air Base is located 6 miles northwest of Santa Rosa. Sewage from the Post is assembled by gravity at a common sump and then pumped to a treatment plant on the north bank of Mark West Creek. The plant consists of an Imhoff tank, trickling filter, secondary sedimentation tank, pump station with sludge and recirculating pumps, and chlorinators of which one is automatic and one manual. At the time of inspection the former had not been connected up. There are also a sludge drying basin and a settling basin. The latter is 1.5 acres in area and 3 ft. deep and insures complete mixing of chlorinated effluent as well as final clarification. The period of detention in the basin for the present sewage flow is 7 days. The plant can be by-passed in case of emergency and raw sewage pumped directly into Mark West Creek.

The effluent, amounting to about 200,000 gals. per day, was observed to be clear as it flowed from the secondary sedimentation tank. Floating algae gave it a greenish color as it discharged from the settling basin into Mark West Creek. The flow of the Creek at this point was clear and exceeded several times that of the influent sewage. The point of discharge of the effluent into Mark West Creek is 3 miles above Laguna and 8 miles above Russian River.

Systematic field tests are reported to be made for settleable solids at inlet and outlet of Imhoff tank, for residual chlorine before entering basin and for p^H (Hydrogen ion concentration) of raw and primary effluents. There is strict medical supervision of the results of treatment and of the character of final effluent. The plant is well operated and no odor or flies were noted. The margin of the settling basin is frequently sprayed with oil to kill mosquitoes. Placing the automatic chlorinator in operation will aid in maintaining continued sterility of the final effluent.

Santa Rosa Naval Air Base

This is located two miles west of Santa Rosa. The Air Base is traversed by two natural sloughs which drain storm water from the southwest section of Santa Rosa southwesterly to the Laguna. Sewage collection is by gravity to a group of three septic tanks. The settled effluent is pumped through a force main to oxidation basins bordering one of the natural drainage sloughs. There are 8 basins each slightly less than one acre in extent. Water level is held at 30 inches depth. The capacity is more than double that required for oxidation and sterilization of sewage from present population. Effluent has been held in the basins since the Post was first occupied, with no overflow into the slough. Algae growth in the basins is excellent, giving a bright green color to the water. It is reported that the levees in the east tier of four basins were not compacted during construction and that seepage has occurred through them. There is also some question as to their stability in contack with flood water during winter storms. The slough into which the effluent will ultimately discharge extends three and one-half miles west to the Laguna opposite Sebastopol where it spreads out over the flat ground drained by the Laguna.

Miscellaneous Posts

Other military posts include the Two Rock Ranch Army Post, Jenner Post, Bodega Bay Coast Guard Unit and Santa Rosa Headquarters 107th Cavalry. The complement of men at these posts is small and sewage disposal facilities have been installed where required.

* * * * *

FIELD SURVEY

The County-wide sanitary survey has disclosed a number of potential sources of communicable disease in Sonoma County. Although some of these sources have already been pointed out, it is believed that the subject is of sufficient importance to include them in this summary. Sources of communicable disease may be classified under the heading of:

1. Polluted natural stream flow.
2. Raw or partially treated sewage escaping upon the surface of the ground.
3. Refuse piles, garbage dumps, and accumulations of industrial waste.
4. Sewage disposal plants.
5. Stagnant pools of water or stream borders overgrown with moss and vegetation.
6. Privately operated labor camps.
7. Family dwellings and housing units of migratory labor.
8. Unsanitary food handling establishments.

Polluted Stream Flow

There is no stream in Sonoma County where waters do not reach the Ocean within four days of entry or origin. All streams in the County if receiving disease organisms may therefore be considered to be polluted below the point of entry until the water has reached the Ocean. If the source of the pollution is persistent, there may be continuous pollution of the stream below the point of entry.

Natural stream flow carrying pathogens is one of the most insidious forms of disease transmission. The natural mental reaction to a sparkling clear flowing stream of water is the thought of purity. Yet, the clearest of water may be polluted with deadly disease germs without any visible evidence. Oxidation of organic matter in flowing water through absorption of air during tumbling and cascading serves to improve the appearance of water but does not appreciably affect its bacterial content. For this reason the direct taking of water for drinking purposes from a clear mountain or canyon stream is dangerous if there be the possibility of human activity on the stream above the point of taking. With the passage of time this danger decreases due to germ mortality. Water taken from a well adjacent to a stream where several weeks is required for travel of water from the stream to the well can be considered as reasonably safe. The rate of flow is dependent upon the permeability of the alluvium and the rate of withdrawal from the well. For family use from a well in gravel or sand a minimum distance of 30 to 50 feet should be sufficient.

FIELD SURVEY

Specific sources of bacterial pollution of natural stream flow in Sonoma County were found to include municipal sewage, institutional sewage, domestic sewage from isolated dwellings or auto courts, swimming, and polluted drainage water. Among potential sources should also be included military sewage and industrial waste.

Municipal Sewage

Sewage from the City of Santa Rosa has at various times been a source of pollution of Santa Rosa Creek. There are four points at which important sewer lines cross the creek. In recent years, with development of stream erosion and channel-cutting during winter storms, the pipes have been uncovered at these crossings and at two of them breaks have occurred permitting raw sewage to discharge into the creek until repairs could be made. Possibility of pollution from this source will continue until these crossings are eliminated or the pipes are protected by heavy construction.

The Santa Rosa Municipal Sewage Farm is a frequent source of creek pollution. During normal operation the effluent from the septic tanks is first routed through certain ponds, then receives chlorination and finally is discharged into the creek. These ponds are of insufficient capacity to provide the minimum of 30 days storage required for sterilization. The application of chlorine is intermittent and not in proportion to rate of sewage flow. No basin is available for thorough mixing of chlorine with sewage. The final effluent discharging into the creek is seldom acceptably low in bacterial count for release into a natural stream. During the irrigation season septic tank effluent is used across the creek for irrigation of hop lands. Temporarily mounted slip joint pipe is used for this purpose and leakage at joints often occurs with discharge of raw sewage directly into the creek (Photo 7). Leakage from ponds has also occurred at the outlets to the creek.

The sewage disposal plant at Sebastopol is burdened with excess flow during and following winter storms due to ground water infiltration into the sewage collection system of the City. The increase in flow is so great that it has been found necessary to by-pass the plant for periods of a week or ten days several times each winter. Raw sewage by-passed in this manner spreads over the adjacent flat land and finally drains into the Laguna (Photo 15). There is also a potential source of pollution of the Laguna from the Sebastopol disposal plant inherent in the exposed location of the oxidation ponds within the flood backwater area of Russian River. The degree of hazard is increased by the silty character of the material of which levees are constructed and the looseness of the material as deposited without compaction. Failure of levees would result in discharge of settled fresh sewage into the Laguna pending completion of repairs.

At the sewage disposal plant of the City of Healdsburg treated sewage effluent is discharged into Dry Creek without chlorination during the winter months. This constitutes a source of pollution in lower Dry Creek and the Russian River during the period of its continuance.

Institutional Sewage

Sonoma County Hospital has in the past been a source of sewage pollution in Piner Creek, a tributary of Santa Rosa Creek. The effluent from two septic tanks serving the three main hospital groups and from the laundry formerly discharged almost directly into the Creek. This has now been corrected by construction of ample ponding capacity for oxidation and sterilization preceding release to the Creek (Photo 22).

Sonoma State Home discharges its treated sewage effluent into Sonoma Creek. The effluent, although cloudy and at times turbid, is systematically chlorinated and is reported to contain a suitable chlorine residual. A potential source of creek pollution is failure of chlorine to fully sterilize the effluent due to irregular flow of sewage and manual operation of chlorinators. It is understood that change from manual to automatic operation is included in the future program at this plant.

Sewage from Military and Naval Posts

Stream pollution from sewage originating in the larger military and naval posts in Sonoma County is improbable. The posts are adequately provided with sewage disposal facilities and permanent civilian operators are employed. The septic tank at Anally C.C.C. Camp may be a source of pollution in Jovine Creek. Sewage from water front buildings at Bodega Bay, including Coast Guard Headquarters and Barracks may become a serious source of pollution along the shore and in the commercial fishing harbor.

Industrial Waste

Although industrial wastes have been a prolific source of complaint in Sonoma County, they have been found to be odor nuisances and places of fly and mosquito breeding rather than sources of stream pollution. A possible exception are the tannery wastes of Levin Tanning Company deposited along the banks of Santa Rosa Creek within the City limits (Photos 8, 9 and 10). These contain much organic matter of animal origin which may contain pathogenic germ life. An inspection made July 19, 1943 disclosed piles of old hides, some of which had been carried downstream by flood water, piles of old wool combings and large open cesspools seeping into the creek. Flies were numerous and odor offensive. The proximity of these deposits to the creek channel makes possible the pollution of the water from this source.

House Sewage

The most common source of pollution of natural stream water was found to be domestic sewage from isolated houses or auto courts built close to stream borders where public sewage systems are not available. Waste from toilets, washing facilities and kitchen sink is ordinarily piped to a septic tank from which the effluent is led through an open tile drain laid in coarse gravel. Frequently wash water and kitchen waste are piped out through the wall or floor and allowed to spill onto the surface of the ground. Cesspools

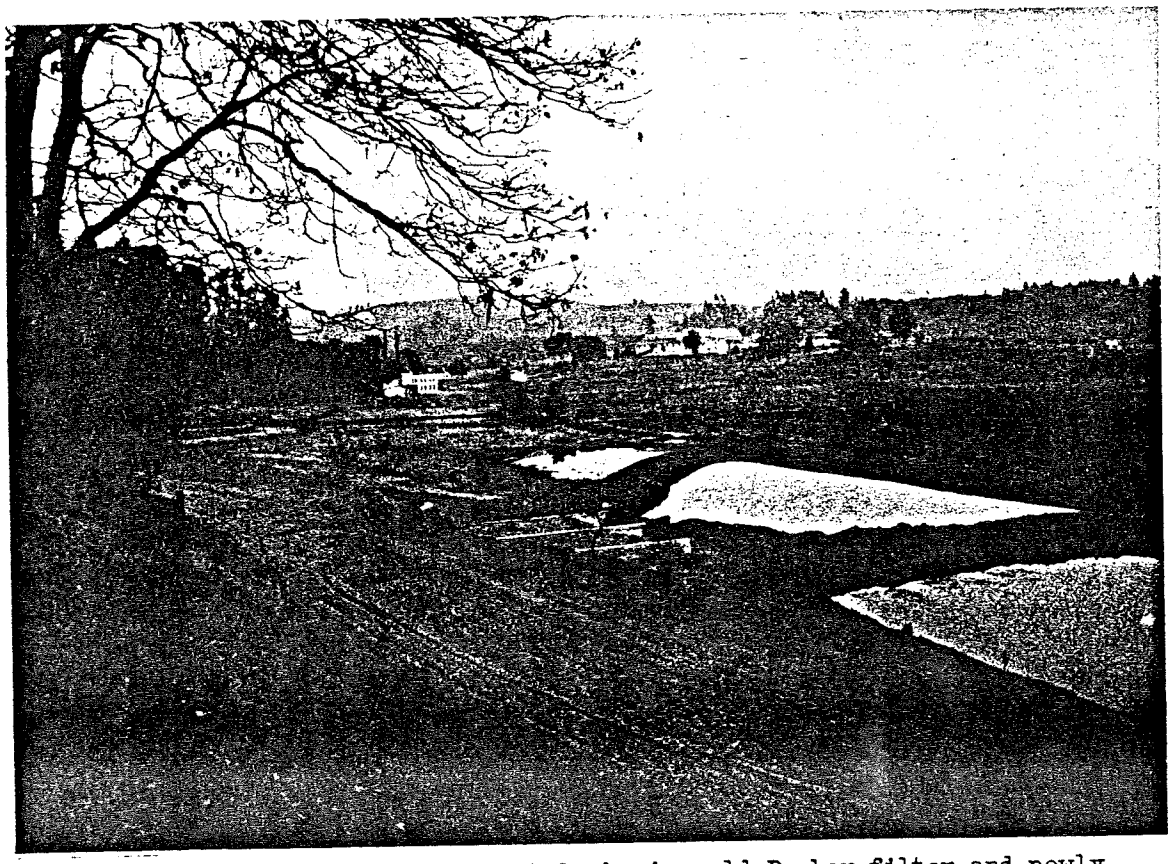
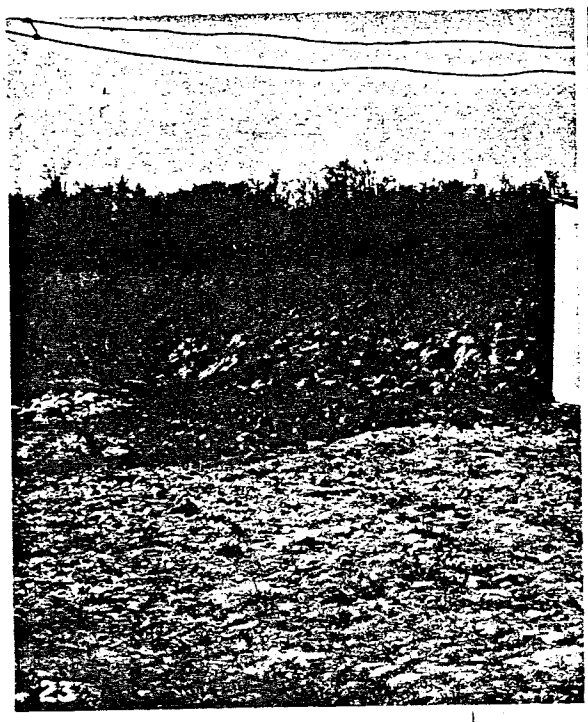


PHOTO 22 - Sonoma County Hospital showing old Dunbar filter and newly constructed oxidation basins.



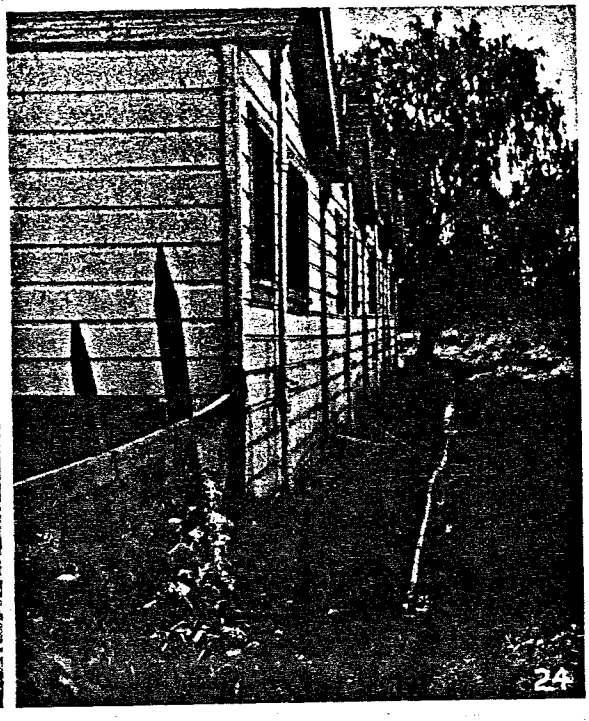


PHOTO 23 - Field in rear of auto court where effluent from septic tank is discharged on surface of ground.

PHOTO 24 - Sink and wash water discharging into open ditch from auto court on South Redwood Highway in suburban Santa Rosa.

were found to be of rare occurrence.

The first work of the sanitary inspectors beginning in July 1943 was a house-to-house canvass of all dwellings along recreational streams to determine the type of sewage disposal and the condition of the installation. This work, together with the inspection of houses in suburban Santa Rosa, extended over four months and was participated in by four sanitary inspectors. The latter were given instructions to note all violations of the law pertaining to pollution of streams or creation of public nuisance. A violation with respect to stream pollution was defined as a case where there was plain evidence of human waste water, raw sewage or of septic tank effluent having reached the stream. The following tabulation summarizes the findings of inspectors along recreational stream banks.

TABLE 13

SUMMARY OF INSPECTORS' DATA
FOR RECREATIONAL STREAMS

STREAM	LOCATION	No. Inspections	Violations No.	Violations %
Sonoma Creek	Source to Shellville	142	60	42
Santa Rosa Creek	Farmers Lane to Laguna	25	16	64
Santa Rosa Creek	Farmers Lane to Source	19	5	38
Matanzas Creek		15	3	20
Russian River	Fitch Mt.	77	8	10
Russian River Austin Creek Dutch Bill Creek	Mirabel to Jenner	550	131	24
Total		828 686	223 71	27

Violations arose from various causes. In many cases septic tanks were close to stream banks and insufficient soil intervened between effluent pipe and stream bank to provide the required detention period. In other cases effluent pipes were too short. Frequently effluent pipes were broken or clogged. Septic tanks or cesspools were in some cases found to have caved in. Violations were reported to landowners with suggestions for remedy where possible. Excellent cooperation has been obtained in correcting violations. This work, although tedious, has been most beneficial in improving sanitary conditions along recreational streams.

Swimming

Another source of stream pollution is swimming. This occurs under a wide range of conditions from casual dip by an individual or small group to continuous occupancy at large popular beaches or swimming pools. A preliminary count indicated the following number of well defined and frequented swimming places on various streams.

TABLE 14

NUMBER OF SWIMMING PLACES ON SONOMA COUNTY STREAMS

Stream	Beach	Channel pool	Off-channel Pool
Russian River Upper	2		2
Russian River Lower	23		1
Austin Creek		3	
Dutch Bill Creek		2	
Laguna			1
Sonoma Creek		2	8
Santa Rosa Creek		1	1
Petaluma Creek			1
Mark West Creek			1
Total	25	8	15

Sanitary control at beaches and channel pools is much more difficult than for off-channel pools. Sterilization of the water is impossible at beaches or channel pools because of the continued flow of water and large volume to be treated (Photo 1). At a channel pool on upper Dutch Bill Creek, however, the stream flow is small and diminishes to the vanishing point by the latter part of the recreational season. This pool can be sterilized for use of swimmers without too great expense as there is little or no overflow at the concrete dam which forms the pool. Off-channel pools are usually dosed with chlorine. They are emptied into the adjacent stream and cleaned at regular intervals. Waste from such pools need not be a source of pollution to the stream if chlorination is adequate and systematically performed.

Drainage Water

A source of pollution in certain streams during the winter is drainage water mingled with raw sewage. Drainage water containing sewage originates in Santa Rosa from overflow of surcharged sewers in the business district at time of storm. Such water discharges into Santa Rosa Creek either through storm sewers or gutters. It is also possible of occurrence at Sebastopol and Healdsburg where the sewers are heavily burdened with ground water at time of winter storm.

Another source of polluted drainage water is gutter and ditch flow originating in the unsewered suburbs of Santa Rosa. Pollution in such water is derived from septic tank and cesspool overflow which is of more frequent occurrence in winter than summer. Drainage water from these areas finds its way into Wheeler Creek on the north side of the City and on the south side into Colgan Creek and two other water-ways to the west which traverse the Naval Air Base.

Surface Flooding

Sewage escaping upon the surface of the ground is more or less offensive to the human senses and hence readily detected. It is also a potential source of communicable disease and may give rise to epidemics. Three sources of escaping sewage have been found in Sonoma County: septic tank effluent, sewage used for irrigation, and sewage mingled with storm runoff.

Septic Tank Effluent

Septic tank effluent escaping upon the surface of the ground is evidenced by abnormal moisture, green vegetation, standing pools of scummy water, or turbid flowing water. It may be accompanied by flies or mosquitoes. It attracts attention because of being out of the ordinary. For this reason it is easily detected and gives rise to complaint. The principal causes of escaping effluent are overflowing cesspools, septic tanks with obstructed outlet, septic tank effluent lines which are too short, too steep in grade, poorly located, clogged, or damaged. Shallow or rising ground water, tight impermeable soil and small building lots are all unfavorable conditions for satisfactory performance of septic tanks or cesspools.

The sanitary survey developed the fact that the worst conditions in the County were to be found in the suburbs of Santa Rosa. These conditions have been described previously under the heading "City of Santa Rosa". The following statistical results of the sanitary survey are also pertinent.

TABLE 15

SUMMARY OF INSPECTORS DATA
SUBURBS OF SANTA ROSA

DISTRICT	SEPTIC TANK TOTAL	SEPTIC TANK IN VIOLATION	CESSPOOL	OUTDOOR PRIVY	WASTE DRAIN
NORTH OF SANTA ROSA CREEK					
North of Lewis Road	46	17	0	0	0
East of McDonald Avenue	114	7	0	0	0
West of McDonald Avenue	290	8	4	3	0
Total	450	32	4	3	0
BETWEEN SANTA ROSA AND MATANZAS CREEKS					
	72	0	0	0	
SOUTH OF SANTA ROSA CREEK					
East of U.S. Highway 101	118	33	10	0	1
Between U.S. Highway 101 and N.W.P. R.R.	52	7	9	10	4
West of N.W.P. R.R.	336	9	28	25	33
Total	506	49	47	35	38
	1028	81	51	38	38

The foregoing data is the result of a house-to-house canvass in the area indicated. In many blocks it was found that septic tanks were located on every lot. In subdivisions north of the City most lots are 50 by 150 ft. in size and the number of septic tanks per block varies from 10 to as high as 21. South of the City, lots are generally larger but in the congested auto court district along Highway 101 the volume tributary to each tank is much greater than from single family dwellings and considerable difficulty is experienced in disposing of effluent. At one court it was found that the effluent was being dumped out onto the surface of the ground in the rear of the buildings (Photo 23) and that wash water was being discharged into an open ditch with no free outlet (Photo 24). Although the percentages of violations were found to be less than in the case of septic tanks located along stream banks, the average being 8 instead of 27 per cent, it is common experience that septic tank difficulties are greater in wet than in dry weather. The survey was completed during the dry season. It is believed that a similar survey during the winter would show a much higher per cent of violation.

Sewage Irrigation

The use for irrigation of sewage or sewage effluent is a questionable practice and is not allowed by the State Department of Public Health for low growing crops such as vegetables, strawberries, etc. The City of Santa Rosa may make available unchlorinated sewage effluent for irrigation of hops on adjacent private farm lands but the State permit specifies that "it shall regulate the use of sewage effluent or polluted creek water on hops so that the ground watered thereby is thoroughly dry before hop picking begins." The purpose of this is to destroy disease organisms by dryness and thus protect hop pickers from contacting sewage-borne disease. Making the effluent avilable to adjacent farms has created a more lenient attitude on the part of local residents toward shortcomings of the Sewer Farm such as odor and flies.

The City of Cloverdale permits use of Imhoff tank effluent for irrigation of pasture and vineyard on an adjacent tract of land in exchange for right of way privileges for effluent line (Photo 20). The City of Sebastopol also occasionally delivers effluent from oxidizing basins for irrigation of adjacent pasture.

Mingled Storm Runoff and Sewage

The principal sources of sewage mingled with storm runoff are overflow from manholes in areas of surcharged sewer lines in the City of Santa Rosa and sewage by-passing the Sebastopol sewage disposal plant. Flood water polluted with such sewage may spread over the meadows and bottom land of Santa Rosa Creek and the Laguna in the vicinity of Sebastopol. As previously stated, this area is a dairy country and such waters constitute a hazard for cows drinking the water.

Refuse Piles

Refuse piles are a source of disease principally through flies and rats which breed there and spread to adjacent feeding grounds where they may contaminate exposed foods, etc.

Refuse piles include accumulations of garbage, mixed garbage, mixed garbage and rubbish, rubbish, and ashes. Garbage and mixed refuse occur principally at established garbage dumps used for depositing municipal refuse. Those for the six incorporated cities in Sonoma County have been fully discussed elsewhere in this report. In general, these dumps were found to be reasonably well operated with regular burning and a minimum of flies and rats.

A private garbage dump was found on farm property 1-1/4 miles northwest of Santa Rosa, where the owner was obtaining garbage for hog food by charging rates for dumping privilege lower than those charged at the municipal dump (Photo 25). Garbage was being delivered by the Babbini Garbage Company. No attempt was made to maintain sanitary conditions or to burn combustible material. There was foul odor and flies were very numerous. The dump contained wet garbage and rubbish of all kinds. Hogs were rooting into the dump at will without control or supervision. In addition to being a public nuisance and a health menace, this dump was located along the bank of Piner Creek and would be a source of floating material which might choke the channel and cause flood damage. This dump was later abated by the County Health Department.

The disposal of rubbish from unincorporated and rural communities is a problem which for ultimate solution will require the establishment of County garbage dumps at strategic points throughout the County. To serve the Santa Rosa vicinity the County has already made arrangements with the owner of the Faught Ranch for joint use of the dump with the City of Santa Rosa. The City of Sonoma permits use of the municipal dump by local residents living outside of the City but the present location is not satisfactory and acquisition of another site by the City and County jointly is under consideration. Other similar sites for separate and joint use are needed near Sebastopol, Healdsburg and Petaluma.

Refuse piles accumulating along stream banks at industrial plants, vacant lots, street ends, or other points of access constitute a problem in all cities and unincorporated communities throughout the County. In addition to being unsightly and sometimes odoriferous, they harbor rats and in some cases are a source of flies. The latter are especially bad at tanneries, poultry packing, and fruit and vegetable processing plants where sludge accumulates. Much has been done to discourage dumping outside of incorporated cities through the efforts of the County Roadside Inspector appointed several years ago by the Board of Supervisors. Within incorporated cities considerable improvement is still possible. One difficulty seems to be that specific responsibility is not placed with any one municipal department to clean up stream banks and stop further dumping. Lack of cooperation because of inertia and the argument that it always has been done is also encountered. The experience

PHOTO 25 - Garbage dump at the Hardy Ranch in suburban Santa Rosa. Is a fly menace, odor nuisance and flood hazard.

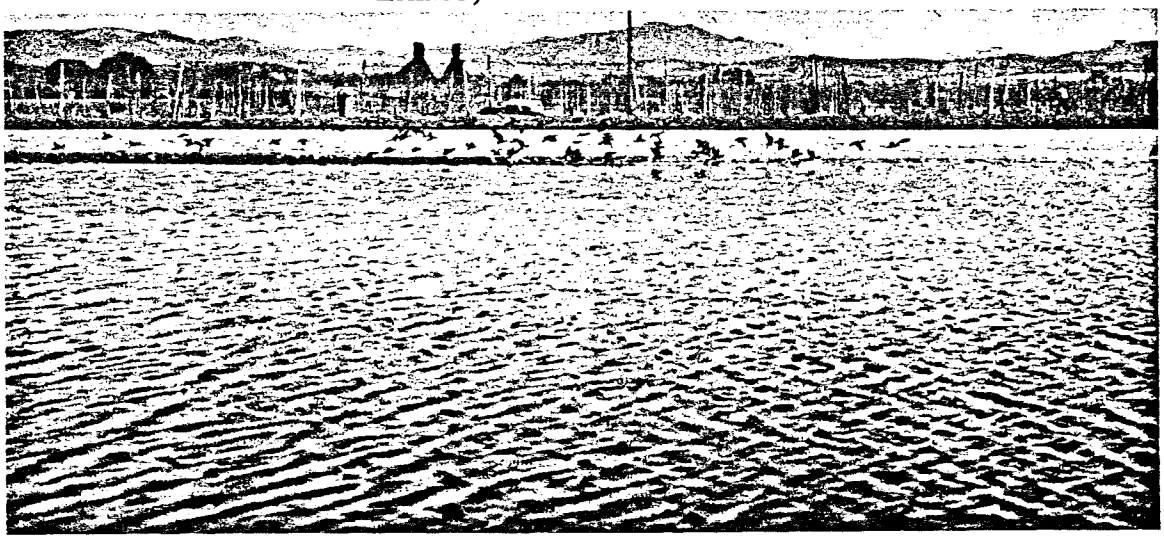


PHOTO 26 - Santa Rosa Sewer Farm showing settling pond with wild ducks.

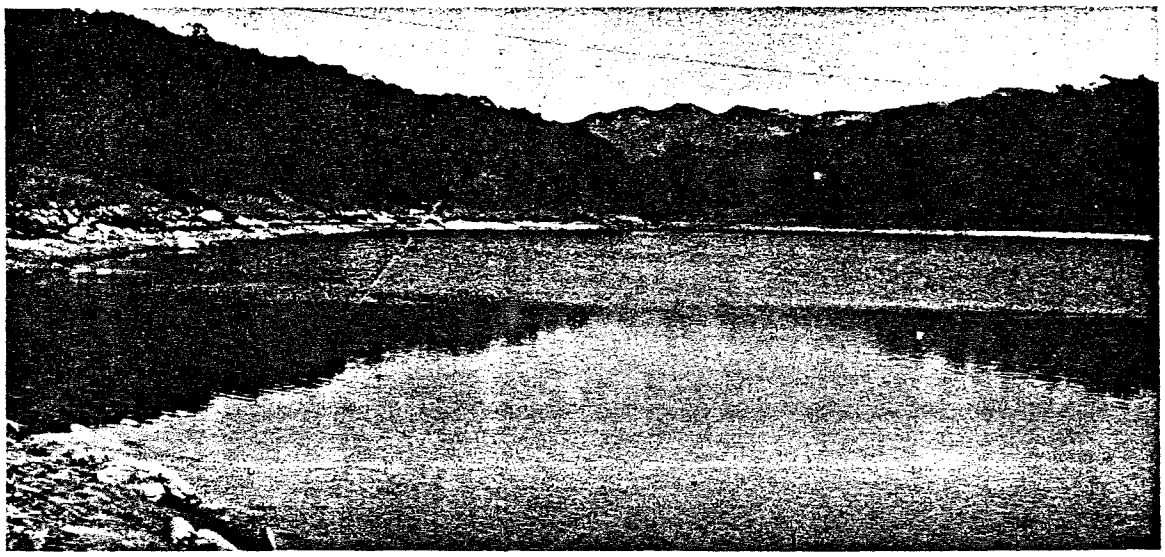


PHOTO 27 - Collecting Reservoir of Santa Rosa Water Works at low stage. Receives water from Santa Rosa Creek.

of the County in unincorporated territory however, shows that much can be done to eradicate this practice by systematic inspection and court action against persistent offenders.

Sewage Disposal Plants

Sewage disposal plants may be a source of communicable disease through transmission of pathogens by flies, mosquitoes and wild fowl. Carelessness of operation permits flies to collect and exposed crust or moist solid material affords opportunity for breeding. When first examined, July 23, 1943, the sewage disposal plant of the City of Santa Rosa was a prolific source of flies (Photo 6). This has since been largely corrected. Mosquito larvae were also noted in a number of ponds at the Sewer Farm and adults were found in the tool shed. The larvae were most numerous in isolated stagnant ponds and along the borders of active ponds where protected by vegetation (Photo 3). They were later greatly reduced in number by removal of vegetation and spraying the surface with oil. Wild ducks have frequented the ponds in great numbers during the late fall and winter (Photo 26). These may be a means of transmission of disease germs to sources of drinking water (Photo 27)

Stagnant Pools

Pools of standing water or stream borders overgrown with moss and vegetation were found to be a source of mosquitoes. The flow of all streams in Sonoma County, except Russion River, dimishes during the summer season to the point where pools form or shallow water becomes fouled with vegetation. This is particularly the case on the lower reaches of Santa Rosa and Sonoma Creeks. During an inspection of Santa Rosa Creek made July 17-20, 1943, by a representative of Hooper Research Laboratories, University of California Medical Center, San Francisco, the following species of mosquito were collected in considerable number:

Culex Stigmatosoma
Culex Tarsalis
Theobaldia Incidens
Anopheles Punctipennis

Specimens of rarer species were also collected as follows:

Culex Pipiens
Culex Apicalis
Theobaldia Maccrackenae
Anopheles Maculipennis
Anopheles Maculipennis Occidentalis
Anopheles Psendopunctipennis

The genus Anopheles is in general, a malaria carrier. Anopheles Occidentalis seldom enters dwellings and maralia has never become endemic in areas where this variety is the only anopheline. Anopheles Psendopunctipennis is also a field mosquito and seldom found related to malarial cases. There is a

possibility that these varieties might be effective carriers where a large number of people slept out of doors or in poorly constructed shacks. They have but little influence upon malaria transmission in areas where the population is relatively well housed.

Anopheles Punctipennis is a woodland anopheline. It bites human beings readily but seldom enters houses and is classed as a "porch biter". It is relatively more numerous in spring and early summer and of rare occurrence in late summer and autumn when malaria is most prevalent and other anophelines are more numerous. It is not important as a malaria carrier.

Anopheles Maculipennis Freeborni is the predominant malaria carrier of the Pacific Coast. It is domestic in habit, entering houses freely and is a vicious indoor biter. It breeds in small shallow pools where water is fresh, partially exposed to sunlight and protected by vegetation such as floating algae. Hoofprints in seepage areas, recesses at borders of flowing streams, cut-off pools near receding streams, roadside pools from careless irrigation, all are favorite spots. These stream conditions are found typical of Sonoma County creeks in the late summer and autumn and afford ideal breeding places for this variety. The fact that malaria is not prevalent in Sonoma County may be due either to the insignificant number of this variety or to the local absence of the malaria virus.

Culex Tarsalis is a variety which breeds principally in stagnant pools of water, particularly water rich in organic matter. Ponds, sumps or drain ditches containing liquid dairy or cannery wastes, wet privy pits, cesspools, septic tanks, liquid manure tanks, drain ditches picking up escaping septic tank effluent, sewage ponds, etc., all are very favorable breeding places for Culex Tarsalis. Many such spots are to be found in Sonoma County. Temperature conditions permit breeding throughout the year. This mosquito has been shown to carry the virus of St. Louis and of western equine encephalitis. The latter may have some relation to encephalitis of man.

Other varieties of mosquitoes identified along Santa Rosa Creek and vicinity as listed above are not known to be disease carriers and although they are nuisances, they are harmless.

Labor Camps

Transient labor camps in the fruit raising districts of the County are a potential public health hazard. This arises from two causes: first, the possible diseased condition of persons occupying the camps; and second, unsanitary conditions at the camps - particularly those privately operated. One of the latter located one mile east of Graton, as previously described, was found to be very dirty and swarming with flies which were crawling over garbage and refuse on the ground and the contents of open privy pits.

FIELD SURVEY

Living Quarters of Migratory Labor

Unsanitary living conditions at dwelling houses occupied by the families of migratory laborers and at housing units in which single men are quartered, probably have the greatest potentiality of any source of communicable disease found in Sonoma County (Photos 28, 29 and 30). It is noteworthy in this connection that during last summer's polio epidemic unsanitary living conditions prevailed in the homes at which most of the cases originated, and that the local spread of polio from centers of infection was noticeable only in areas where unsanitary conditions prevailed in many of the adjacent homes.

A primary characteristic of unsanitary living conditions is the accumulation of human waste. This begins with bodily uncleanliness and extends to clothing, bedding, toilet and lavatory facilities, cooking and eating utensils, garbage disposal facilities, floors and walls of living quarters, surrounding ground, out-houses, quarters for animals, etc. The accumulation of waste and filth creates conditions favorable for the assembling and breeding of insects many of whom are carriers of disease. The latter include flies, mosquitoes, ants, fleas, lice, bedbugs, cockroaches and ticks. Rodent carriers such as mice and rats, are also attracted. The keeping of chickens, ducks, rabbits, cows, pigs, horses and dogs adds to the filth and provides additional hosts for insects as well as breeding places.

The apathetic attitude toward accumulation of human waste is a condition of thought prevalent among people living under primitive conditions - especially where the mental stimulus of freedom and opportunity is latent or absent. As the mental faculties are aroused to constructive activity, this apathy is progressively outgrown. Much of the transient labor in the West, especially since the depression of the early 30's, has been from the more primitive agricultural areas of the United States. Many of these people are coming in contact for the first time with modern community life and are just beginning to be stirred by the opportunities for education and self-advancement. It is believed that much can be done to eradicate unsanitary living conditions through educational programs designed to show the relation between disease and dirt. Experience in other localities has shown that the example of more progressive neighbors is also a very effective influence.

* * * * *

PHOTO 28 - Housing Unit reconstructed from chicken houses, one block west of City limits of Santa Rosa. Building at right, formerly a brooder house, has four rooms and is without windows.

PHOTO 29 - Same location as Photo 28, showing three outdoor privies which serve whole Housing Unit. These are not fly-proof and are swarming with flies.

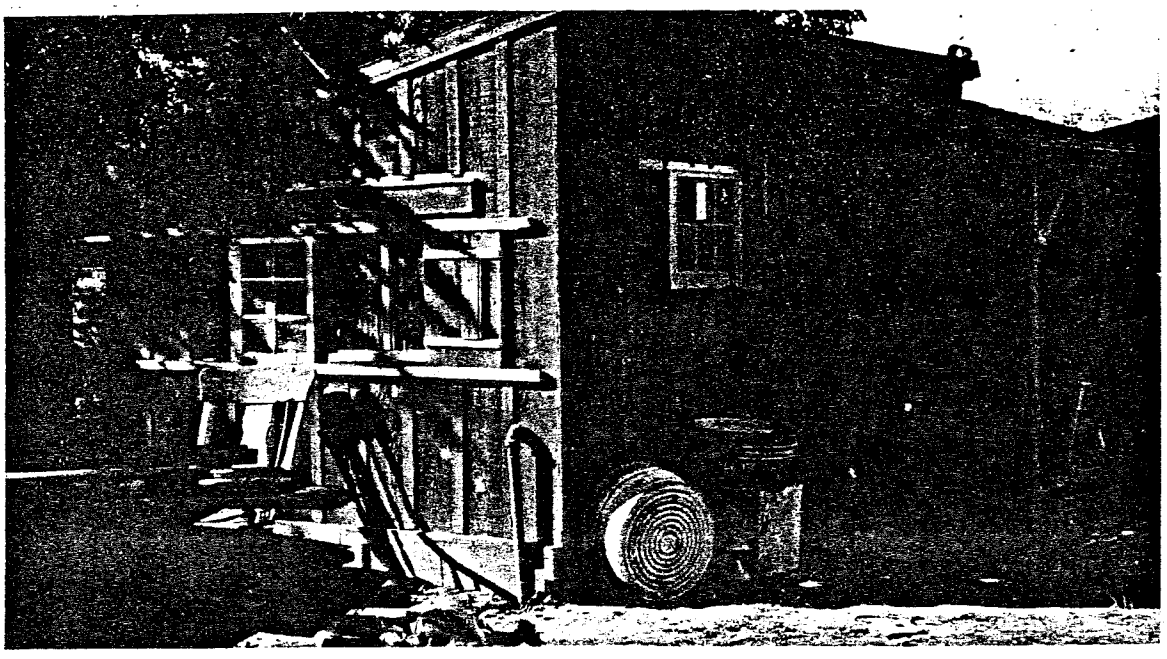


PHOTO 30 - Same location as Photo 28, showing best house in Unit. Has windows and piped water.

TABLE 1

PRECIPITATION IN INCHES AT SONOMA COUNTY STATIONS

July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Annual
						Cloverdale (Elevation 315 ft):						
.03	.02	.73	1.51	4.28	6.97	9.83	6.83	5.41	2.29	1.26	0.34	39.50
						Graton (Elevation 190 ft):						
.03	.03	.60	2.06	4.90	6.88	8.93	7.13	5.20	2.31	1.35	0.37	39.79
						Healdsburg (Elevation 110 ft):						
.04	.02	.53	1.83	4.56	7.07	9.17	7.00	5.56	2.57	1.51	0.31	40.17
						Petaluma (Elevation 10 ft):						
.01	.02	.30	1.10	2.62	4.82	5.20	4.03	2.67	1.73	.77	0.22	23.49
						Santa Rosa (Elevation 167 ft):						
.05	.02	.52	1.53	3.38	5.44	6.32	5.23	4.03	1.83	1.25	0.26	29.86
						Sonoma (Elevation 30 ft):						
.02	.01	.47	1.87	3.21	4.73	4.94	5.21	4.51	1.79	1.15	0.20	28.11
						Fort Ross (Elevation 100 ft):						
.10	.03	.88	2.61	6.07	8.39	10.56	8.26	6.61	3.48	1.92	0.73	49.64

TABLE 2

AVERAGE NUMBER OF DAYS WITH 0.01 INCH OR MORE
OF PRECIPITATION AT SONOMA COUNTY STATIONS

July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Annual
						Cloverdale						
+	+	2	4	7	12	16	12	9	7	4	2	75
						Graton						
1	1	3	5	7	13	17	13	9	6	5	2	82
						Healdsburg						
+	+	1	4	7	9	11	10	9	5	3	1	60
						Petaluma						
+	+	2	3	7	10	10	10	7	5	3	1	58
						Santa Rosa						
+	+	1	5	8	10	13	10	9	5	4	2	67

TABLE 3

AVERAGE TEMPERATURE AT SONOMA COUNTY STATIONS

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
						Cloverdale						
47.0	50.6	53.3	57.3	61.7	68.3	71.2	70.5	67.6	61.9	53.9	47.6	59.2
						Graton						
46.3	50.1	52.2	55.5	58.7	63.2	65.0	64.4	63.8	59.8	53.0	56.8	56.6
						Healdsburg						
46.2	50.4	53.0	56.7	61.0	66.4	68.6	67.7	66.1	61.3	53.7	47.0	58.2
						Petaluma						
46.6	51.0	52.7	55.4	57.6	62.7	65.2	65.1	63.7	60.6	53.2	47.8	56.8
						Santa Rosa						
46.8	50.0	52.0	55.1	59.4	64.5	65.7	65.2	63.9	59.6	53.0	47.4	56.9

TABLE 4

AVERAGE MAXIMUM TEMPERATURE AT SONOMA COUNTY STATIONS

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Anmual
						Cloverdale						
56.0	61.5	65.9	70.7	75.7	84.1	89.7	89.3	84.1	76.4	65.5	57.3	73.0
						Graton						
55.7	61.4	65.1	69.3	72.8	78.6	81.8	82.0	81.3	76.3	66.7	56.8	70.6
						Healdsburg						
56.7	63.1	67.5	72.6	77.8	84.9	88.3	87.5	85.3	78.7	67.3	58.2	74.0
						Petaluma						
56.4	61.6	64.0	66.2	69.9	77.5	80.7	79.9	78.8	75.0	66.4	58.3	69.6
						Santa Rosa						
56.4	61.1	64.9	68.6	73.2	79.8	81.6	81.9	81.0	76.0	67.0	57.9	70.8

TABLE 5
AVERAGE MINIMUM TEMPERATURE AT SONOMA COUNTY STATIONS

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
						Cloverdale						
37.4	40.2	41.2	43.9	47.3	51.7	52.6	51.5	50.6	47.1	42.2	37.7	45.3
						Graton						
36.2	38.6	39.3	41.3	43.4	46.2	47.5	46.9	46.3	43.3	39.0	36.0	42.0
						Healdsburg						
36.3	38.8	39.7	42.1	45.3	48.9	50.0	49.2	47.7	44.2	39.5	36.1	43.2
						Petaluma						
36.9	40.3	41.4	44.6	45.3	47.9	49.7	50.3	48.6	46.1	40.1	37.3	44.0
						Santa Rosa						
35.7	38.2	38.8	40.7	43.3	46.7	48.8	47.2	46.1	42.7	37.5	35.4	41.8

TABLE 6
PREVAILING WIND DIRECTION AT SONOMA COUNTY STATIONS

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
						Cloverdale						
S	S	S	W	W	W	S	S	S	S	N	N	S
						Graton						
SE	S	S	S	SW	SW	SW	SW	SW	S	S	SE	SW
						Healdsburg						
S	S	S	S	NW	S	S	S	S	S	SE	NW	S
						Petaluma						
S	N	W	W	W	W	W	W	W	W	S	S	W
						Santa Rosa						
S	SS	S	S	S	S	S	SW	S	S	S	S	S

TABLE 7
FROST DATA - AVERAGE DATES AND LENGTH OF SEASON
FOR SONOMA COUNTY

Location	Average Date Last Killing Frost in Spring	Average Date First Killing Frost in Autumn	Average Length of Growing Season (Days)
Cloverdale	March 8	November 26	263
Graton	March 24	November 11	232
Healdsburg	March 20	November 16	241
Petaluma	March 17	November 10	238
Santa Rosa	April 10	October 31	204

TABLE 8

DISCHARGE IN SECOND FEET. SONOMA COUNTY STREAMS

Month	Russian River at Guerneville			Santa Rosa Creek at Santa Rosa			Mark West Creek near Windsor		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
Water Year Oct. 1939 to Sept. 1940									
Oct.	--	--	--	--	--	--			
Nov.	--	--	--	--	--	--			
Dec.	2,610	109	393	2	0	0.2			
Jan.	22,200	1150	7,539	1,060	13	191			
Feb.	81,300	2750	14,240	4,830	34	518			
Mar.	44,900	1140	7,681	4,530	16	322			
Apr.	20,300	974	3,365	456	18	69			
May	1,110	372	621	26	4.3	9.4			
June	380	130	229	5.5	1.1	2.2			
July	185	113	142	1.1	0.3	0.6			
Aug.	120	88	103	0.3	0.2	0.2			
Sept.	195	109	161	0.4	0.1	0.2			
Year	--	--	--	--	--	--			
Water Year Oct. 1940 to Sept. 1941									
Oct.	270	180	211	4	0.1	0.3	2.9	0.4	0.8
Nov.	463	232	305	5	0.1	1.1	24	2.1	4.6
Dec.	42,800	188	9,916	2,210	0.4	300	2860	2.1	328
Jan.	33,000	3850	13,320	1,540	70	446	1640	58.	365
Feb.	42,800	3260	11,320	1,500	70	316	1440	56	256
Mar.	37,000	1340	7,478	860	22	191	604	15	133
Apr.	43,700	1510	8,716	3,100	28	292	2380	22	232
May	1,820	694	1,136	50	10	23	38	8	17
June	728	310	462	8	2.5	4.6	8	3.3	4.7
July	300	140	216	2.7	.6	1.3	3.3	1.3	2.1
Aug.	217	142	184	.7	.4	.5	1.3	.6	1.0
Sept.	234	193	207	.6	.1	.2	1.4	.3	.6
Year	43,700	140	4,421	3,100	.1	130.0	2860	.3	111
Drainage Area	1330 sq. miles			53 sq. miles			49 sq. miles		

TABLE 9
WATER SUPPLY STATISTICS
INCORPORATED CITIES IN SONOMA COUNTY

City	Source	Works	Population Served 1000's	M.G.D.
Cloverdale	Shallow well (20 ft)	Pump to 250,000 gal. tank and gravity to system	.9	0.20 to 0.50
Healdsburg	2 deep wells (40 ft) 4 deep wells (52 ft)	Pump to system and 2 balancing reservoirs 500,000 gal. total capacity	2.6	0.30 to 1.08
Petaluma California	Adobe and Lawler Crs. impounded in Lawler Res. 87.5 m.g. Inman Cr. diverted	Gravity to system To aeration, coagulation, filtration chlorination gravity to system and 2.5 m.g. balancing res.	8.9	0.5 to 1.5
	Copeland Creek 13 deep wells (90-400 ft.)	Chlorination, gravity to system		
Santa Rosa City Supply	3 deep wells (210-390 ft.)	Pump to aeration, gravity to 600,000 gal. receiver, booster pump to system, 0.96 and 1.0 m.g. balancing reservoirs	12.0	0.65 to 2.2
Santa Rosa Water Works	Santa Rosa and Los Guilocos Creeks diverted	Gravity to 135 m.g. res., chlorination boosted to 0.2 m.g. dist. res.; aeration gravity to system	3.8	0.30 to 0.85
	Hillman Spring Deep well (139 ft.)	Gravity to 135 m.g. reservoir Boosted to 135 m.g. reservoir		
Sonoma	Lachryma Montes Spring	Pump from basin and cistern to 0.9 m.g. reservoir, gravity to system		0.06 to 0.25
	2 deep wells (100-300 ft.) Deep well (230 ft.)	Pump to cistern Pumps to system		

TABLE 10
SEWAGE DISPOSAL STATISTICS
INCORPORATED CITIES IN SONOMA COUNTY

	Population	Average Sewage Flow m.g.d.	Facilities	Length Outfall Miles	Effluent Discharged Into
Santa Rosa	16,000	1.0 (a)	102 ac. sewer farm: with 3 concrete septic tanks 300'x20'x6'; 13 ponds: total area 5 ac. 2 chlorinators	1.5 gravity	Santa Rosa Cr. at 2 points; and to hop and alfalfa land for irrigation
Petaluma	10,000	0.65(b)	7.5 ac. tract, primary clarifier; primary and secondary digestors heated trickling filters, sludge beds, emergency chlorination facilities	0.6 pumped	Petaluma Cr. tidal water.
Healdsburg	2,700	0.17(b)	5 ac. tract comminutors, primary and secondary clarifiers and trickling filters: sludge lagoon and beds, digestor, chlorinator.	0.6 pumped	Inadequately chlorinated to Dry Creek gravel beds summer; unchlorinated to Dry Creek in winter.
Sebastopol	2,200	0.14(b)	7 ac. tract, clarifier, digestor with gas collection sludge beds, 5 ac. oxidation ponds.	0.4 gravity pumped to plant	Laguna
Sonoma	1,700	0.11(b)	15 ac. sewer farm, septic tank 100'x21'x8.5'; ponds not used.	3.9 gravity	Shell Slough tidal water
Cloverdale	1,000	0.06(b)	Imhoff Tank sludge drying beds.	0.5 gravity	4.8 ac. sewer farm in flood plane Russian River, occasionally to irrigation.

(a) Water pumped Oct. to Apr.
(b) Estimate at 65 g.p.d. per capita.

TABLE 11

REFUSE DISPOSAL STATISTICS

INCORPORATED CITIES IN SONOMA COUNTY

City	Collection By	Ownership and Operation of Dump	Distance to Dump: Miles	Treatment at Dump
Santa Rosa	Rose City Garbage Co. contract with City	Private	8.5	Hogs owned by dump owner range over dump 24 hours before burning.
	Royal Tallow Co. restaurant garbage	Private	16	Fed to hogs
Petaluma	Royal Tallow Co. and Petaluma Garbage Co. Contract with City.	City	2	Burn. Restaurant swill fed to hogs at Royal Tallow Co. plant
Healdsburg	Private (3)	Private	3	Burn and cover. May be fed to hogs at adjoining ranch
Sebastopol	White Refuse Disposal Co.	City	0.5	Burn
	Household garbage and rubbish, private	Private	0.5	Seldom burn. Hogs range on dump
Sonoma	Private	City	0.75	Burn
Cloverdale	Private	City	2	Fill and cover after burning.
	Restaurant swill to hog ranch	Private		Fed to hogs.

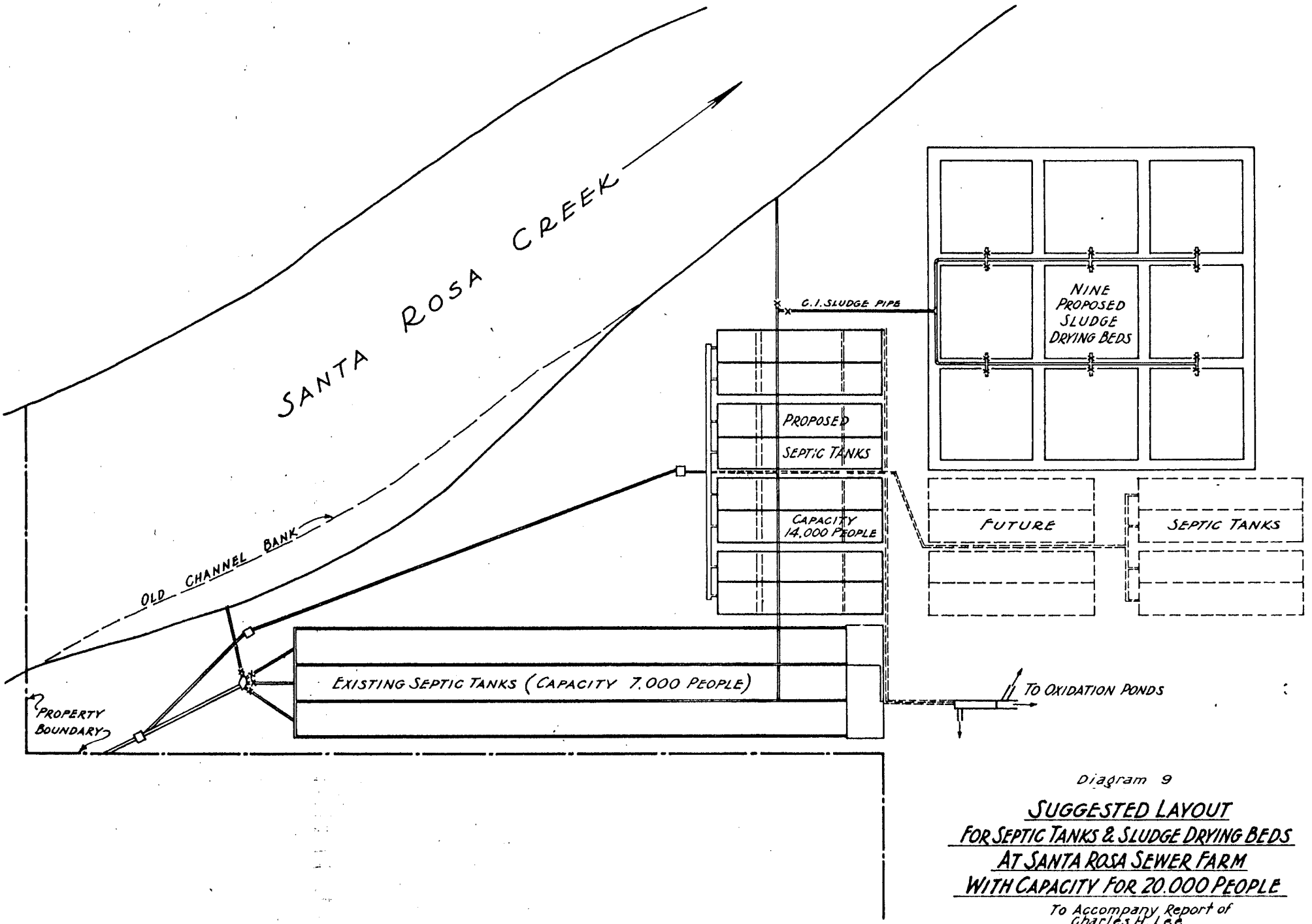
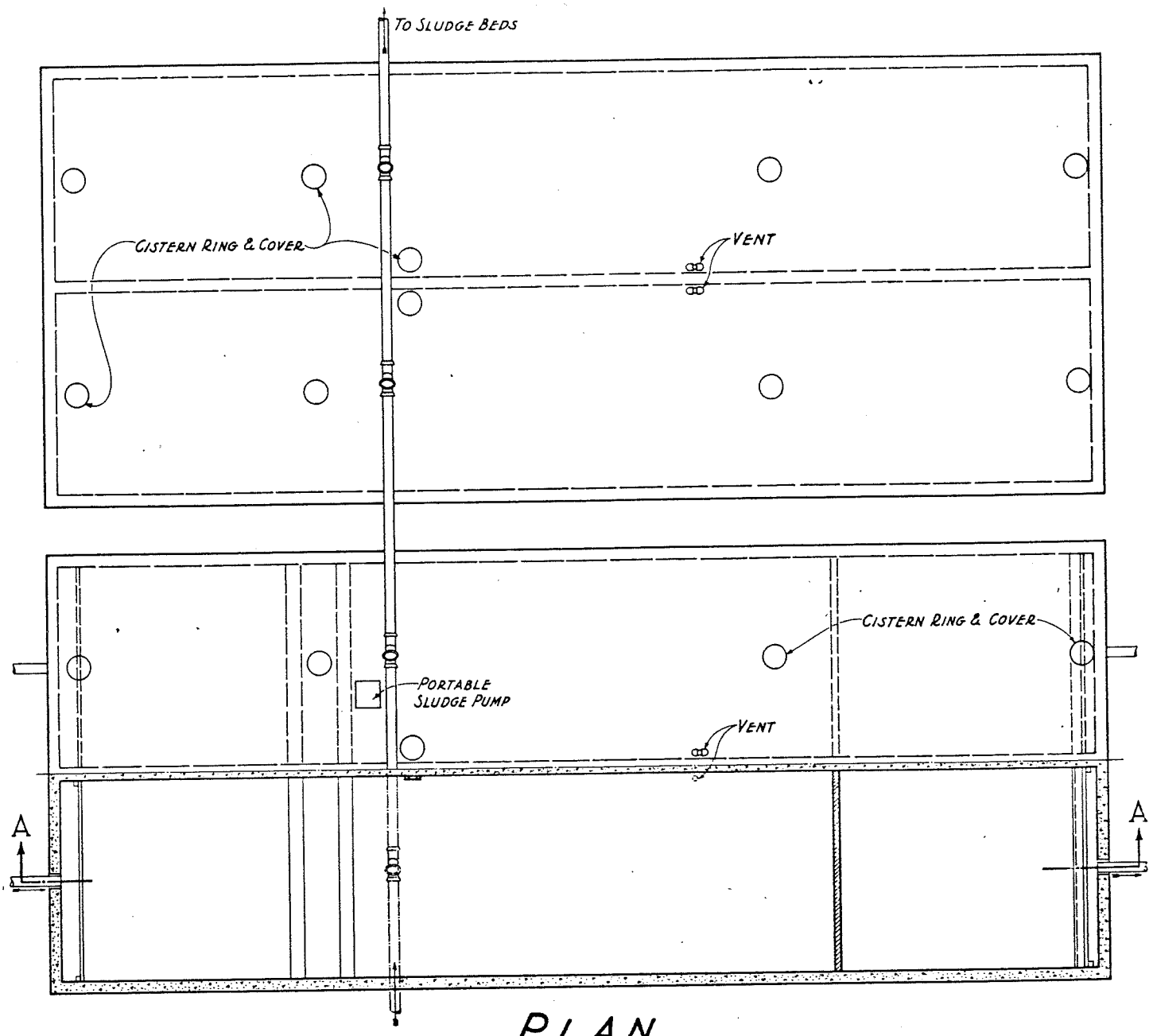


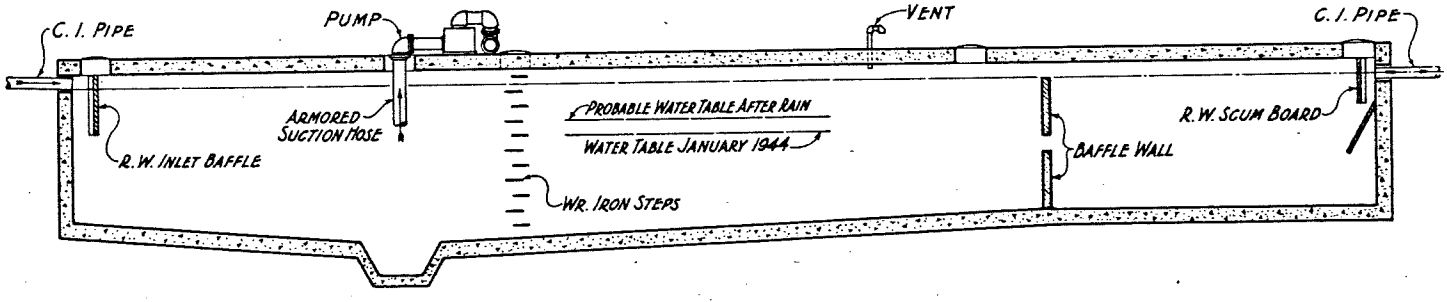
Diagram 9

SUGGESTED LAYOUT FOR SEPTIC TANKS & SLUDGE DRYING BEDS AT SANTA ROSA SEWER FARM WITH CAPACITY FOR 20,000 PEOPLE

To Accompany Report of
Charles H. Lee
Consulting Engineer



PLAN



SECTION "A-A"

Diagram 10

TYPICAL DESIGN FOR BATTERY OF SEPTIC TANKS AT SANTA ROSA SEWER FARM

To Accompany Report of
Charles H. Lee
Consulting Engineer

CHARLES H. LEE
M. AM. SOC. C. E.
CONSULTING ENGINEER
58 SUTTER STREET
SAN FRANCISCO

APPENDIX I

July 24, 1943

Toland C. McGettigan,
District Attorney, Sonoma County,
Court House,
Santa Rosa, California

Dear Sir:

This memorandum report is written to summarize discussion and confirm my recommendations made yesterday at the two conferences in your office, relative to remedying unsanitary conditions said to exist in and about Santa Rosa and in Sonoma County generally. The immediate occasion for the conference was the recent local occurrence of a number of cases of poliomyelitis.

Present at the conference were:

Toland C. McGettigan, District Attorney;
Lloyd Cullen, Supervisor Santa Rosa District;
Dr. E. D. Barnett, County Health Officer;
Marshall Wallace, County Surveyor;
Ed. Helgren, City Health Inspector;
Walter Adams, City Engineer;
Wm. Jury, City Building Inspector;
Charles H. Lee, Consulting Sanitary Engineer.

You opened the morning conference by stating that the immediate situation had created a strong popular desire throughout the County to have existing unsanitary conditions cleared up and that the County Board of Supervisors had passed a Resolution expressing this desire and had appropriated a sum of $10,000 for the purpose, to be expended under the direction of the County Health Officer.

Dr. Barnett then exhibited and explained a "spot map" of polio cases from which it appeared that the source of infection in a number of cases was related in some way to water in creeks and sloughs at points where children gathered for swimming or wading. Dr. Barnett stated that recent tests of stream waters had indicated pollution and that investigation had disclosed the existence of many cesspools and septic tanks so situated or maintained that they could discharge directly into Santa Rosa and other creeks.

It cannot be determined from the available case records nor is medical knowledge or research in agreement as to how polio virus is transmitted. Human carriers, polluted water, mosquitoes, other biting insects and flies have all been studied. Federal, State,

and Foundation Health Agencies are making local investigations which indicate that some of these media might be involved.

General discussion then ensued in which it was pointed out that regardless of the immediate outbreak of polio, epidemics of other local contagious diseases were possible such as malaria and typhoid. There are also the tropical or oriental diseases which soldiers returning from foreign service might have contacted and become carriers for. Most of these diseases thrive in unsanitary conditions and are transmitted either by water, by insects or by rodents. Ample reason, therefore, exists in support of a definite program for permanent removal of existing unsanitary conditions and the elimination of natural agencies by which disease is transmitted.

Among the long range projects which were discussed as necessary for permanent improvement of sanitary conditions in Sonoma County were the following:

1. Annexation of subdivisions adjacent to cities so that sewer connection facilities could be extended to them. This should include the improvement and enlargement of municipal systems where necessary.

2. Improvement and enlargement of municipal sewage disposal plants where necessary.

3. Organization of sanitary districts in unincorporated areas of the County where population density or nonabsorptive soil conditions made difficult the disposal of sewage by septic tank.

4. Organization of mosquito abatement districts where these insects are a pest or menace to public health.

5. Acquisition by Cities of riparian strips along stream channels within their boundaries for control of bank erosion, dumping of refuse, pollution of water and landscaping for park purposes.

6. More rigid enforcement of State laws and local ordinances applicable to maintenance of sanitary conditions.

A trip of inspection was made during the afternoon along Santa Rosa Creek to Fulton Lane, along lower Matanzas Creek, and at the City and County Hospital sewage disposal plants. The inspection party included Dr. Barnett, and Messrs. Wallace, Helgren, Adams, Jury and Lee. Inspection of the flow water at the Santa Rosa Water Works intake and the creek channel below, showed there was insufficient water to flush the creek channel through the City of Santa Rosa or even to reach the City and that no public benefit could be derived by

allowing this water to flow down the creek channel either in total or to the extent of one second foot as it is understood was proposed by the water company.

During the inspection trip, and subsequently at the second conference in your office, I recommended certain things which could be done immediately to improve existing unsanitary conditions, the doing of which might aid in limiting or terminating the further spread of polio.

1. Continue the sanitary survey of stream banks now being made under the direction of Dr. Barnett to locate septic tank, cesspool or privy outlets which permit the discharge of sewage or sewage effluent down the bank, through highly permeable sand or gravel, or directly into the stream. Where there is positive evidence that such discharge has actually occurred, the owner should be notified under authority of appropriate State laws to remedy such condition with penalty for failure to do so within a reasonable period of time.

2. Fill up standing pools of water in the creek channel between Santa Rosa Water Works dam and the east City boundary. This can be done with scraper or small bulldozer using material from adjacent gravel or sand bars.

3. Remove floating moss or vegetation from water flowing in Santa Rosa Creek within the boundaries of the City of Santa Rosa and spray with distillate all slowly moving or standing water and shallow margins. This will destroy the breeding place of mosquitoes.

4. Spray with distillate or other effective liquid all standing or slowly moving moss-filled water along Santa Rosa Creek outside of the City from N. W. Pacific Railway bridge to Willow Lane.

5. In the continuously flowing section of Santa Rosa Creek between N. W. Pacific Railway bridge and Stoney Point Road remove obstructions to low water flow from the channel, and where there are several channels, divert all flow into one channel, trenching in wide shallow runs where necessary to concentrate the stream. This is mostly hand and shovel work for the purpose of draining areas covered by stagnant and slowly moving water.

6. Burn all accumulations of combustible rubbish and dry vegetation along the banks of Santa Rosa Creek within the City boundary, particularly below Main Street Bridge, which may

serve as a shelter for rats.

7. Clean up all important breeding places for flies in the City of Santa Rosa and adjacent County and in particular destroy fly larvae in the under portion of the scum on the septic tanks at the Santa Rosa City sewer farm. Also screen and systematically wash down with pressure hose the division box at the end of the sewer main and the inlets into the septic tanks.

8. Remove accumulated ripe sludge from the bottom of septic tanks at the Santa Rosa City sewer farm so as to increase the cross-sectional flowage area and detention volume. Crust should also be removed as soon as practical. Both crust and sludge should be deposited upon sludge drying beds prepared for this purpose.

9. Prepare plans and construct appropriate seepage ditches and contour basins to dispose of the effluent from the septic tanks at the County Hospital center.

I shall be pleased to meet with you again upon my return from Southern California about Aug. 3, to advise regarding any problems which may have arisen in connection with the execution of the immediate program, and also to discuss more definitely the long term plans for improvement in sanitary conditions throughout Sonoma County.

Very truly yours

Charles H. Lee

Charles H. Lee

CHL/eil

(SEAL)