REPORT

on the

WATER POLLUTION INVESTIGATION

of

SPRING CREEK

Below Strawberry Point, Iowa

Hearing Dec 19/1958

DIVISION OF PUBLIC HEALTH ENGINEERING

IOWA STATE DEPARTMENT OF HEALTH

DES MOINES, IOWA

June, 1958

Iowa
State Department of Health
EDMUND G. ZIMMERER, M. D., M. P. H., COMMISSIONER
Des Moines 19

DIVISION OF
Public Health Engineering
Paul J. Houser, M. S.
DIRECTOR

November 5, 1958

Edmund G. Zimmerer, M. D.
Commissioner
State Department of Health
Des Moines, Iowa

Dear Dr. Zimmerer:

I am transmitting herewith a report of your Division of Public Health Engineering covering an investigation of the Pollution of Spring Creek below Strawberry Point, Iowa.

This investigation was instituted in accordance with Sections 135.18 to 135.29 of the Iowa Stream and Lake Pollution Law.

Very truly yours,

P. J. Houser

P. J. Houser, Director
Division of Public Health Engineering

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WATER POLLUTION INVESTIGATION

SPRING CREEK BELOW

STRAWBERRY POINT, IOWA

I. INTRODUCTION:

On July 24, 1957, a water pollution investigation of Spring Creek, a tributary of the Volga River near Strawberry Point, Iowa, was initiated following the receipt of a petition by this Department from the Cass Township Board of Trustees, Clayton County, Iowa, dated May 10, 1957. The petition states that the pollution of this stream is causing very offensive odors and all fish in this stream have died. Under date of February 12, 1958, a supplementary investigation was made by this Department to collect additional stream samples and to view the physical conditions of the stream.

In a letter dated March 8, 1958, Mr. J. R. Stoker, Area Fisheries Manager of the State Conservation Commission, informed this Department in part as follows concerning Spring Creek:

> "In the past three years we have had to stop stocking the stream due to a pollution problem that has come into it. The source seems to be the Co-op Creamery located in Strawberry Point.
>
> "Earl Hubbard, the Fish Culturist at Backbone Hatchery, did try to stock last year but the condition of the water was such that he could not do so and expect the fish to live and produce recreation. Mr. Hubbard also tells me that there is a very objectionable odor from the stream in the upper parts.
>
> "I believe that an attempt should be made to restore this stream to usefulness and again it will furnish its share of recreation to the people of Iowa."

The principal source of pollution contributed to the stream is the industrial waste flow from the Maquoketa Valley Cooperative Creamery located within Strawberry Point. Mr. William Behrens, Arlington, Iowa, is general manager of the Maquoketa Valley Cooperative Creamery, and on July 24, 1957, the writer conferred with Mr. C. L. Squires, manager of the Strawberry Point Branch of the creamery. He advised that the creamery receives an average of 70,000 lbs per day of whole milk with a maximum daily raw milk intake of 115,000 lbs. The milk is separated and butter is manufactured from the cream and the skim milk is dried through a spray-type dryer. The average waste flow from the creamery is 340 gallons per minute for 8 hours during the day and 175 gallons per minute for the balance of 16 hours. No treatment is provided this industrial waste and the entire flow is directed through one outlet to Spring Creek.

A second source of pollution contributed to the stream is the waste outlet from the north sewage treatment plant for the Town of Strawberry Point. This waste treatment plant was constructed in 1919-1920 under the supervision of Howard R. Green Company, Consulting Engineers, Cedar Rapids, Iowa. The plant consists of a septic tank 14' long by 14' wide by 8' side wall depth plus a hopper 6' deep in the center, a dosing tank 12' long by 14' wide equipped with a siphon having a drawing depth of 2' 11", a sand filter (completely reconditioned in 1955) 50' by 75'. According to Ted Schuchmann, Superintendent of Utilities, and Walter Zwanziger, Clerk of the Town of Strawberry Point, the connected load to this plant consists of 50 residences with a total estimated population of 200, using an average of 50 gallons per capita per day of water. The waste treatment plant was being operated in a normal manner on July 24, 1957, and appeared to be functioning properly for this type of plant.

II. STREAM DESCRIPTION:

Spring Creek originates within the Town of Strawberry Point and has no flow above the two waste outlets. The creek flows in a northeasterly direction a distance of approximately seven miles, where it enters the Volga River near Mederville in Clayton County. The creek is fed by numerous springs throughout its distance. The stream in the reach surveyed is reported to have been a fishing stream in the past and is also used for livestock watering. The bottom of the stream in most places is over limestone rock formation and the flow in places is very turbulent.

III. SAMPLING STATIONS:

Sampling stations are shown on map contained in this report and geographical descriptions of the stations are listed in the following table with their numerical designations:

Table A - Location of Sampling Stations

Station	Description
1	The outlet from the town's north sewage treatment plant.
2	The outlet of the Maquoketa Valley Cooperative Creamery.
3	Stream at approximately 1200' down stream from creamery outlet.
4	Stream at 50' above the junction of the first major flow from a spring located in Section 10, which is also approximately one mile downstream from creamery outlet.
5	Stream at 50' above junction of second major spring flow into the creek near the Darwin Esch property house located in Section 10.
6	Stream 50' above bridge near the line between Sections 2 and 35.

IV. SCOPE OF TESTS:

Determinations made on the samples consisted of those made in the field at the sampling point immediately after collection of the sample and those made in the State Hygienic Laboratory, University of Iowa, Iowa City. The field work included observations of temperature and pH and stabilizing a portion of the sample for determination of dissolved oxygen in the laboratory. The pH observations were made with a colorimetric field kit using phenol red as the indicator solution. In addition, the physical condition of the stream as to evidence of pollution at the time of sampling was observed and recorded. Samples for the dissolved oxygen determinations, biochemical oxygen demand determinations, and bacterial examinations were kept under refrigeration in the field and transported to the laboratory by car the same day as collected.

All tests in the field and in the laboratory were carried out in accordance with the procedures set forth in the current edition of "Standard Methods for the Examination of Water, Sewage, and Industrial Wastes" published jointly by the American Public Health Association, American Water Works Association, and Federation of Sewage and Industrial Wastes Association.

V. DEFINITIONS AND SIGNIFICANCE OF THE VARIOUS PHYSICAL, CHEMICAL, AND BACTERIOLOGICAL TESTS USED IN SURVEY:

Temperature (°C): Temperature values of the stream water and waste outlets at the sampling points are given in degrees Centigrade. The temperature governs the solubility of oxygen in the stream and influences the rate of purification. As the water temperature decreases, the solubility of oxygen increases.

pH: Hydrogen ion concentration indicates the relative acidity or alkalinity of the water. A value of 7 is considered neutral; those values above 7 are alkaline and those below are acid.

Dissolved Oxygen (DO): Oxygen in the dissolved form is essential to the natural purification of streams and the maintenance of aquatic life. This oxygen is drawn upon to support biochemical oxidation of organic wastes and is replaced by absorption from the atmosphere and photosynthetic action of some water plants, including algae. A deficiency in dissolved oxygen below the saturation level generally indicates the presence of polluting organic substances which are absorbing oxygen from the stream water. The degree of this deficiency is a measure of the deoxygenating effect of the pollutant; hence, an index of the degree of pollution in a particular stream zone. If there is a sufficient quantity of oxygen present in the water, the organic material will be oxidized without creating any objectionable odor nuisance or destruction of fish and other aquatic life. However, if

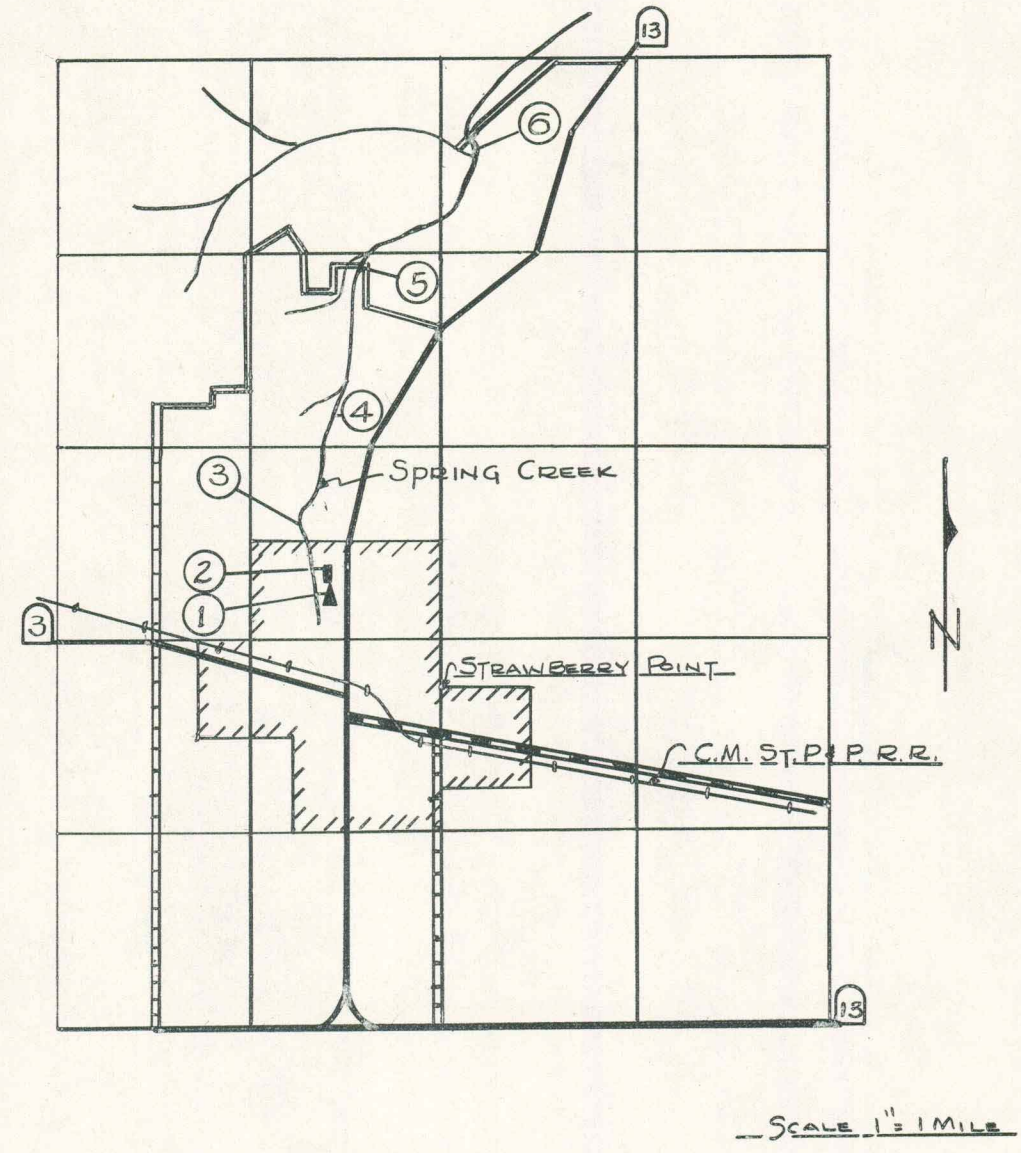

FIGURE NO. 1

LOCATION OF SAMPLING STATIONS

SPRING CREEK

BELOW STRAWBERRY POINT, IOWA

the amount of dilution provided by the stream is too small and there is not a sufficient amount of oxygen present, anaerobic decomposition takes place and the organic material present in the water undergoes putrefaction with an accompanying foul odor and dark appearance of the water which is indicative of a polluted stream.

Five-Day Biochemical Oxygen Demand (BOD) at 20°Centigrade: This determination indicates the amount of dissolved oxygen in parts per million (ppm) which may be expected to be utilized in five days at 20° Centigrade (68° Fahrenheit) to support the biochemical oxidation of the organic pollution carried by the stream at the point of sampling.

Coliform Bacteria (MPN): The result of this determination is expressed as the most probable number (MPN) of coliform bacteria per 100 milliliters of sample. This test is perhaps the most delicate specific test for pollution by sewage as it shows the approximate density of a group of bacteria which are always present in large numbers in sewage. Coliform bacteria are normal inhabitants of the intestinal tract of warm-blooded animals and are discharged in large numbers in human feces which constitute the principal sources of bacteria in sewage. These bacteria are also found in varying numbers in certain industrial wastes.

Fungus Growths:

As decomposition processes become established following the entrance of organic wastes into a stream, certain typical growths appear. These growths are referred to as sewage fungi. However, bacteria, fungi, and protozoans are among the organisms that make up this growth. These growths form dense masses and cling to bottom mud and stones, to stream obstructions, and to submerged plants. Newly developed forms may be white; however, the older forms tend towards a putty grey color.

Growths of the type mentioned above are important in stream pollution work since they occur only in streams which are severely polluted with organic wastes. They are, therefore, considered to be good indicators of the pollution conditions.

VI. SIGNIFICANCE OF STREAM POLLUTION:

Pollution of a stream with sewage and industrial wastes is objectionable and detrimental to use of the water for the following reasons:

1. The pollution of a stream is a serious public health problem because of the very high numbers of bacteria which may be present in the water as a result of the discharge of sewage and wastes. Sewage and some industrial wastes contain millions of bacteria, many of which may be pathogenic (disease producing). A public health hazard exists to those coming in contact with the polluted stream.

2. All sewage and most industrial wastes contain unstable organic material which, in being stabilized, utilizes the oxygen that is dissolved in the stream water. Under extreme conditions, the oxygen is depleted with the result that anaerobic decomposition of the organic material occurs with the subsequent development of obnoxious odors and dark appearing stream water.

   The dissolved oxygen may also be reduced under less extreme conditions to a point where fish and other aquatic life are adversely affected.

3. Practically all sewage and industrial wastes contain solid material which settles to the bottom of the stream to form sludge banks. As a result, the bottom of the stream in the affected area is covered with a blanket of organic material which is undergoing anaerobic decomposition with the subsequent development of foul odors. In addition, the sludge tends to destroy stream bottom life which adversely affects the feeding habitat of fish and other aquatic life.

   Due to the large numbers of bacteria present in the sludge deposits, a health hazard exists for persons who may come in contact with these deposits.

VII. PHYSICAL CONDITION OF THE STREAM:

During the July 24, 1957 survey, the weather was partly cloudy and the air temperature ranged between 64°F. at 8 a.m., to 79°F. at 2 p.m.. At the time of the February 12, 1958, survey, the weather conditions were extremely cold with air temperatures ranging between 0° and 10°F. As a result, complete ice coverage of the stream occurred at stations 4, 5, and 6. During the surveys, the physical conditions of the stream were observed. The following is a summary of these observations:

At Station 1, the town's north sewage treatment plant outlet, July 24, 1957, the sample was collected after the sand filter had been dosed and five minutes after the flow appeared at the outlet. The flow was relatively clear and had a slight odor. No sludge banks were noted in the stream at the outlet and no fungus growth was noted on the weeds along the stream. On February 12, 1958, the stream immediately below the sewage treatment plant outlet showed evidence of pollution as indicated by the presence of sludge deposits in the stream bed. There was no flow from the sewage treatment plant outlet at the time of the sampling.

At Station 2, the creamery 6" tile outlet, July 24, 1957, the flow was milky colored and milk solids were observed. Sludge banks were noted in the stream starting 10' below the outlet and fungus growth was noted on the weeds along the stream. A 1" depth of flow was in the 6" tile at the time of sampling. On February 12, 1958, the

presence of sludge deposits on the stream bed and of fungus growths clinging to the side of the stream bed below the creamery outlet indicated a condition of gross pollution.

At Station 3, 1200' downstream from the creamery outlet, July 24, 1957, the stream flow was milky colored. Black sludge deposits were noted along the stream as well as gray and black fungus growth. No fish life was in evidence and odors of creamery waste decomposition were present. On February 12, 1958, approximately 500' below the creamery outlet, sludge deposits from the creamery wastes indicated present and past pollution.

At Station 4, located 50' upstream from the junction with the spring near the center of Section 10, July 24, 1957, a black growth was noted on the rocks in and along the creek and fungus growth on the bottom of the stream. The flow was clearing as compared with the observations at Station 3, and the stream was estimated to be flowing 300 gallons per minute. No fish life was apparent and there was a slight odor of sewage and waste decomposition.

At Station 5, located 50' above the spring junction near the house on the Darwin Esch property, July 24, 1957, the flow was clearer and there were no noticeable odors. Green algae growth appeared on the rocks along the limestone bottom and sides of the creek. No fish life was observed.

At Station 6, located 50' above the bridge on the north side of Section 2, July 24, 1957, the flow was relatively clear. Minnows were observed in the water. Here the stream has a limestone rock bottom and some green algae growth was apparent on the rocks along the sides of the stream.

VIII. INTERPRETATION OF CHEMICAL AND BACTERIOLOGICAL DATA:

The data contained in Table B confirms in a chemical and bacteriological sense observations made relative to the physical conditions of the stream..

Table B - Chemical and Bacteriological Data

July 24, 1957 Survey

Sta	Temp°C	pH	DO	Percent Saturation DO	BOD	MPN	Time
1	22	<6.8	5.6	63.4	20	24,000,000	8 a.m.
2	21	7.4	4.9	54.5	>300	620,000	8:30 a.m.
3	21	6.8	1.3	14.5	790	2,300,000	9:15 a.m.
4	20	7.6	2.4	26.2	7	60,000	10:45 a.m.
5	20	7.8	10.7	117	6	<6,000	11:30 a.m.
6	21	8.2	12.0	133	4	<600	1:30 p.m.

Table B - Chemical and Bacteriological Data (cont'd)

February 12, 1958 Survey

Sta	Temp°C	pH	DO	Percent Saturation DO	BOD	MPN
1	1	7.2	0.1	7.0	100	6,200,000
2	27	7.2	5.8	62.9	90	600,000
3	25	7.2	1.0	11.9	65	6,200,000

Since there is no normal flow in the watercourse above the waste treatment plant outlet referred to as Station 1, no samples above the points of pollution could be obtained during the two surveys. The sample collected from the town's north sewage treatment plant outlet (Station 1), July 24, 1957, showed that the treatment plant was functioning in a satisfactory manner as evidenced by the relatively low BOD. The sample collected at Station 1, immediately below the sewage treatment plant outlet, February 12, 1958, showed the presence of pollution as evidenced by a low dissolved oxygen value of 0.1 ppm and a high BOD value of 100 ppm. The above-noted determinations and the presence of sludge deposits indicated that partially treated wastes had previously been discharged from the sewage treatment plant facilities. Winter operation of sand filters for secondary treatment of waste requires very close operation attention in order to provide the maximum possible treatment through such units. Even with adequate operation, the degree of treatment will be less during extreme cold weather because of the lower temperatures.

The samples collected at Stations 2 and 3, July 24, 1957, showed the extent of the gross pollution introduced into the watercourse as a result of the industrial waste from the Maquoketa Valley Cooperative Creamery. The high 5-day BOD of more than 300 ppm at Station 2 and 790 ppm at Station 3, the elevated bacterial count, and the lower dissolved oxygen values bear out this fact. The lowered oxygen condition of the stream was noticeable as far down the watercourse as Station 4. The BOD value of 90 ppm at Station 2, the creamery outlet, February 12, 1958, is less than would normally be anticipated for wastes from such an outlet. However, the flow from the outlet was quite heavy and was noted to h a v e little color or turbidity. Therefore, this sample probably represented clean-up waters from the creamery operation. The adverse effect as a result of the discharges into the stream above Station 3 was evidenced by the low DO value of 1.0 ppm and the high BOD of 65 ppm at this station.

Not until Station 5 had the stream started to recover, July 24, 1957, which is evidenced by the increase in dissolved oxygen and the lower bacterial (MPN) value. This recovery is assisted by the introduction

into the watercourse of an estimated 500 gallons per minute flow from the spring near the center of Section 10. Further recovery of this stream was noted at Station 6 due to the introduction into the watercourse of an additional flow estimated at 1000 gallons per minute apparently from springs.

IX. CONCLUSIONS:

1. The small stream which flows in a northeasterly direction from the Town of Strawberry Point, known as Spring Creek, was found to be grossly polluted for a distance of approximately 1½ miles downstream on July 24, 1957 as evidenced by the presence of sludge deposits, deficient oxygen conditions, the high numbers of coliform bacteria present, and offensive odors of decomposing sewage and waste material. On February 12, 1958, the stream was found to be polluted for a distance 500' below the creamery outlet as evidenced by the presence of sludge deposits, high BOD values, reduced dissolved oxygen concentrations, and fungus growths.

2. The major part of the pollution condition July 24, 1957, was found to be due to the discharge of untreated industrial wastes from the Maquoketa Valley Cooperative Creamery. During the survey February 12, 1958, the pollution conditions were found to exist as a result of the discharges from the town sewage treatment plant and the Maquoketa Valley Cooperative Creamery.

3. The pollution adversely affects the stream's capabilities to support fish life.

4. The heavy pollution renders the water unfit for livestock purposes. Milk from dairy animals having access to the stream presents a public health hazard. Dairy cows wading in the polluted waters may easily pick up disease-producing bacteria on their udders or bodies and such bacteria may be transferred to the milk in the milking process.

5. A hazard exists from a public health standpoint to persons coming in contact with the stream water or from flies that may carry disease organisms from sludge deposits in the stream.

X. RECOMMENDATIONS:

1. It is recommended that the industrial wastes from the Maquoketa Valley Cooperative Creamery receive adequate treatment in order to correct the present gross pollution conditions and to prevent a recurrence of the condition either singly or in combination with the domestic wastes from the Town of Strawberry Point.

2. The domestic sewage tributary to the Strawberry Point north sewage treatment plant must receive adequate and continuous treatment in order to prevent pollution of the receiving stream. Due to the inherent difficulties of providing continuous operation of the present treatment facilities, especially in the winter months, it is recommended that the town give consideration toward engineering and financial planning for the construction of facilities capable of providing adequate and continuous treatment for the domestic, commercial, and industrial wastes from the entire community.

Respectfully submitted,

M. V. Stephenson

M. V. Stephenson
Public Health Engineer

SUPPLEMENTARY REPORT

WATER POLLUTION INVESTIGATION

SPRING CREEK

Below Strawberry Point, Iowa

DIVISION OF PUBLIC HEALTH ENGINEERING
IOWA STATE DEPARTMENT OF HEALTH
Des Moines, Iowa

December 1958

SUPPLEMENTARY REPORT
WATER POLLUTION INVESTIGATION
SPRING CREEK
Below Strawberry Point, Iowa

A. INTRODUCTION:

This report is supplementary to the report of investigation of pollution of Spring Creek below Strawberry Point, Iowa, and pertains to additional information concerning the sources of pollution and the pollution condition of the receiving stream. Samples for chemical and bacterial analyses were collected on December 2, 1958, from the source outlets and from Spring Creek. Sampling procedure during this survey remained the same as for the previous surveys of the investigation.

The original report was transmitted to the officials of Strawberry Point, Iowa, and to the officials of the Maquoketa Valley Cooperative Creamery under date of November 24, 1958. Following the filing of the report, this Department was informed by Mr. E. L. Gross, attorney for the creamery, that certain industrial process changes had been made since the date of the last survey that could or may alter the characteristic of the wastes from the creamery outlet.

Sources of pollution contributing to Spring Creek remain the same as previously reported. The outlets of the Strawberry Point north sewage treatment plant and of the Maquoketa Valley Cooperative Creamery discharge into the watercourse referred to as Spring Creek and contribute to the supplemental flow in the watercourse derived from springs in the vicinity of stream stations 4, 5, and 6.

An industrial waste outlet from the H & N Market animal slaughtering operation discharges into the watercourse approximately 750 feet above the north municipal sewage treatment plant outlet. During the course of previous surveys and during the December 2, 1958, survey, there was no flow in the watercourse above the municipal plant outlet. During the course of all the surveys, any flow from the slaughterhouse outlet was not contributing to the flow from the creamery or municipal outlets.

B. SAMPLING STATIONS:

Sampling stations for the December 2, 1958, survey are the same as those described in the previous report. However, in addition to these, samples were also collected at the following locations during this survey:

Station	
A	The outlet from the H & N Market slaughter operation.
2a	Spring Creek approximately 200 feet below the creamery outlet.

C. PHYSICAL CONDITION OF THE OUTLETS AND STREAM:

At the time of this survey, the physical conditions of the waste outlets and the stream were observed.

There was no flow above Station A, the slaughterhouse outlet. Animals were being slaughtered on the date of this survey and the waste flow from Station A at 4:25 p.m. was bloody in color and contained considerable solids. The solids were observed to be skin and grease particles and paunch manure.

The waste from Station A was discernible in the watercourse to a point approximately 450 feet below the outlet which is approximately 300 feet above the municipal sewage treatment plant outlet.

There was no flow in the watercourse above Station 1, the north municipal sewage treatment plant outlet. The flow from this outlet was relatively clear and contained very little if any visible solids. There was no sewage odor noticeable in the flow. Observations made of the treatment units indicated that no apparent by-passing of raw sewage was occurring and that the dosing tank and sand filter were operating. The stream below Station 1 contained a small amount of grey fungus growths.

The flow at Station 2, the creamery outlet, was milky colored and milk solids were observed. The temperature of the waste being discharged was 26°C (79.8°F).

At Station 2a, approximately 200 feet below the creamery outlet, the stream flow was milky colored. The stream bottom was observed to be covered with a black digesting sludge blanket as a result of the waste discharge.

The stream at Station 3, approximately 1200 feet below the creamery outlet, showed evidence of the discharge of the creamery waste. The stream flow had a slight white color. The heavy concentration of milk wastes discharged at Station 2 had not reached this station at the time of this observation. There was further indication of the sewage and wastes discharged at this station as evidenced by the presence of sludge deposits and grey fungus growths.

At Station 4, approximately one mile below the creamery outlet, the stream flow had cleared considerably as compared with the previous station. No sludge deposits were observed. However, a rather extensive grey fungus growth was observed on the rocks in the stream bottom. Approximately 95 percent ice cover existed at this station.

The stream bottom at Station 5, approximately one and three quarter miles below the creamery outlet, was quite similar to previous station. However, fungus growth on rocks had changed to greenish-grey color. Other than fungus growth, the stream was clear and the bottom was free of sludge.

2. The domestic sewage tributary to the Strawberry Point north sewage treatment plant must receive adequate and continuous treatment in order to prevent pollution of the receiving stream.

Results of chemical and bacterial analyses of the sample collected from the plant outlet tend to confirm further the inherent difficulty of providing continuous and adequate treatment with the present facilities.

Respectfully submitted,

M. V. Stephenson
Public Health Engineer