Northern Pacific Railway Company. Engineering Department Records.

Copyright Notice:

Version 3
August 20, 2018

N. P. 1757
6-24

OFFICE OF CHIEF ENGINEER

FILE NO. 12762

SUBJECT:

BRUCE, Wash.

Vegetable Dehydrating Plant for

Yoshino Brothers

12762

Spokane, Washington
July 15, 1965

Mr. J. L. Goss:

Referring to your letter of July 6, File 12762, regarding complaint about water meter readings serving the Yoshino Produce Company at Bruce, Washington.

This meter was removed July 12 and tested at Pasco July 13 by the Pasco City Water Department. The following is a result of testing:

At 100 G.P.M. consumption the meter checked 100% correct. At 13 and 16 G.P.M. consumption, the meter checked 97% and 99% respectively.

These tests indicated at high consumption rates that the meter is perfect. At low consumption rates Yoshino Brothers are getting from 1 to 3 gallons of free water for every 100 gallons used.

The meter expert for the City of Pasco stated this is typical when a large meter is used at a low consumption rate. He also stated that the meter was in exceptionally good condition and no repairs should be contemplated at this time. Meter was reinstalled July 14.

On the basis of this test I believe Yoshino Brothers should be required to pay up in full.

As for the question as to water used while plant was shut down, the plant could be readily shut down, using the last of the meter reading thus explaining the difference between the billed reading and the amount that he thought he had used.

I do not have anything in my file indicating how these lines in the building are prevented from freezing when plant is shut down. Therefore, there is a possibility that the taps are left running during the winter months to provide protection from freeze-ups in his daily washings in the industry.

I see no reason for revising our billing of water consumption and wish to state that water serving this industry can readily be shut off if Yoshino Brothers would rather not use our water.

C. R. Wold
B&B Supervisor

cc: Mr. D. H. King
Mr. R. A. Juba

12762

Spokane, Wn., July 12, 1965

Mr. J. L. Goss:

Your letter July 6, file 12762, regarding complaint about water meter readings Yoshino Produce Company, Bruce, Washington.

Testing the meter as outlined in your letter has my approval, and Mr. Wold will arrange to handle accordingly.

D

D. K. King
Superintendent

cc: Mr. O. R. Wold
Mr. R. A. Juba

St. Paul, Minnesota
July 6, 1965

12762

Mr. O. R. Wold:

Reference is made to your letter of July 2 regarding complaint about water meter readings serving the Yoshino Produce Company building at Bruce, Washington.

Attached is copy of a letter from Mr. Vic Yoshino in which he detailed his reasons for claiming an overcharge on water usage during the 1963-1964 period. I did not send this information to you as I understood Mr. F. R. Erwin had already discussed this matter with Mr. Noctor at Pasco. It might be well to go over Mr. Noctor's meter reading records to see if they are the same as specified in Mr. Yoshino's letter.

When Mr. Powe talked to Mr. Stanton regarding this matter recently and the decision to test the meter was made, it was assumed all the charges would be borne by the Railway, and no bill for collection would be made against the Yoshino Produce Company. If Mr. King approves, we suggest testing of the meter be handled accordingly. It was also hoped that Mr. Noctor could take out the meter on one of his regular trips to Bruce rather than make a special trip to handle this work.

J. L. GOSS

Engineer of Water Service,
Power and Heating Plants

JLG:bm

Enc. 1

cc: Mr. D. H. King
Mr. R. A. Juba

RAJ: The above as per your telephone recommendation today.

JLG

12762

Spokane, Washington
July 2, 1965

Mr. J. L. Goss:

Referring to your letter of June 28th regarding complaint about water meter serving the Yoshino Produce Company.

You did not state the amount of water bills for 1963 and 1964. This could throw a little more light on the subject as to whether the meter is out of adjustment. These leases are written up stating that the industry is responsible for any repair or maintenance on the meter.

Labor involved in sending Mr. Noctor to Bruce to remove this meter, take it to Pasco for testing and the cost of test and reinstallation would all be bills for collection. Has Mr. Yoshino been advised of these charges?

Would you please advise on these questions before the meter is taken in for testing.

C. R. Wold
B&B Supervisor

cc: Mr. D. H. King
Mr. R. A. Juba

St. Paul, Minnesota
June 28, 1965

12762

Mr. O. R. Wold:

Under date of June 24, we have received a letter from Mr. Powe, General Manager, Properties and Industrial Development, with an attached letter from Mr. Vic Yoshino of the Yoshino Produce Company at Bruce, Washington, in which Mr. Yoshino claims they were overcharged for water during 1963 and 1964.

Mr. Yoshino claims the plant could not have used the amount of water shown on the bills during the periods in question. The City Water Department at Pasco has a test rack for checking water meters. To satisfy all concerned, we suggest the two-inch meter serving the Yoshino Produce Company be tested for accuracy.

The next time Water Service Foreman Nector is at Bruce, would you please arrange to have him pull this meter and take it to Pasco for test. Also, would you please advise me the results of this test so that we can notify Mr. Powe accordingly.

J. L. GOSS

Engineer of Water Service,
Power and Heating Plants

JLG:bm

cc: Mr. R. A. Juba

12762

OFFICE OF
CHIEF ENGINEE

JUN 25 1965

NORTHERN PACIFIC RY. CO
ST. PAUL, MINN.

St. Paul, Minn., June 24, 1965

C.F. 24512

Mr. D. H. Shoemaker
Chief Engineer

Attached is a copy of Mr. Nixon's letter of June 9 to Mr. Woodruff together with copy of letter Mr. Nixon received under date of April 26 from Mr. Vic Yoshino, President of Yoshino Produce Company, Inc., regarding water bill No. 118577-63 in connection with Lease No. 91615 in favor of his company at Bruce, Washington. From the letters you will note Mr. Nixon proposes that the Railway Company compromise by accepting $500 in settlement of this bill rather than $714.38.

This has been discussed with Mr. Stanton; and, while we do not want to be instigators of a disagreement with Yoshino Produce Co., it does seem we are entitled to payment for water used under a written contract. It would appear the only possible complaint Mr. Yoshino might justifiably have would result from a faulty meter. Mr. Juba has discussed this possibility with Mr. Goss who indicated the meter could probably be readily removed and tested by the Water Service Foreman during a routine trip. Please arrange to have this done and advise me the results. At that time we can take whatever steps are necessary to settle the matter with Yoshino.

GEORGE R. POWE

General Manager, Properties
and Industrial Development

RAJ md
Encs.
cc - Mr. M. H. Nixon, WMID, Seattle
Mr. J. L. Goss, Engr. of Water Srvce. & Heat. Plants - with copies of Mr. Nixon's & Mr. Yoshino's letters.
Mr. K. T. Woodruff, Mgr., Dis. Acctg.

Mr. Woodruff:

Please withhold submitting revised bill until further word is received from this office.

G. R. P.

C.F 24812

Seattle, Washington
June 9, 1965

Mr. K. T. Woodruff, Manager
Disbursement Accounting
St. Paul, Minnesota

Referring to previous correspondence in regard to bill No. 118577-63 against Yoshino Produce Company, Inc., for water at Bruce, Washington in connection with Lease No. 91615.

This matter has been discussed with Mr. Vic Yoshino, President of Yoshino Produce Company, numerous times, and he is very definite in his decision that they are being billed for a much larger quantity of water than they could have used. Attached is copy of Mr. Yoshino's letter of April 26, 1965, offering a compromise settlement for payment of 1,500,000 gallons, which would mean a revision of the bill from $714.38 to $375.00. We have since discussed this with Mr. Yoshino, and he is agreeable to increasing this gallonage to 2,000,000 which would give us a $500.00 payment.

We are sending a copy of this letter to Mr. Powe with our recommendation that this bill be settled on the $500.00 basis, and if he agrees, will you please prepare a new bill against Yoshino Produce Company in the amount of $500.00 and send it to this office for handling.

M. H. Nilsen

Western Manager
Industrial Development

FRE/glb

cc: Mr. G. R. Powe -- Copy of Mr. Yoshino's letter attached. Although our Water Department state that there is no possibility that the meter was wrong in the amount of water used by Yoshino, we recommend that the bill be settled for $500 as Mr. Yoshino is just as definite in his conviction that they did not use the large volume of water he is being billed for.

MHN

PHONES | HUBBARD
8-2922 LD
8-2013 LOCAL

Yoshino Produce Company, Inc.

WASHINGTON POTATOES AND ONIONS

1196 S. BROADWAY
OTHELLO, WASHINGTON
99344

April 26, 1965

NORTHERN PACIFIC RAILWAY CO.
Industrial Development Department
919 Smith Tower
Seattle, Washington 98104

Lease No. 91615
Bruce Warehouse Site

Atth: Mr. M. H. Nixon and Mr. F. R. Erwin

Gentlemen:

Reference is made to your letter of April 21 concerning the unpaid water bill at our Bruce Warehouse. We have reviewed the bill and the operating periods involved and will attempt to give you the information below for your study. We trust that you will then realize why we object to this billing.

Construction was late getting started in 1962 and the plant did not start sorting potatoes until late in August, operating about 8 weeks only, which is covered by your December 5, 1962, meter reading, for a total of 477,200 gallons, or about 60,000 gallons per week while the plant was using washing water. Your next meter reading as of March 12, 1963, is completely out of line, since the plant was shut down from about November 1, 1962, to July 29, 1963. The meter reading as of June 18, 1963, is only 2,800 gallons for a 3-month period, which is reasonable, but by comparison, the period of November 1, 1962, to and including March 12, 1963, should have been comparable, with usage about 3 to 5000 gallons, not 230,000 gallons.

To continue, your meter reading as of October 15, 1963, is really wild, since this was a short season and the plant operated started the end of July, 1963, and closed down on October 8, 1963, for a period of about 10 weeks and your billing indicates a big jump to about 200,000 gallons a week. This is impossible. The plant was then closed down from October 9, 1963, until July 28, 1964. For this reason, we again question your meter reading of November 12, 1963, indicating a usage of 179,800 gallons, whereas it should be only a few thousand.

As a comparison, let us review subsequent billings. Your Bill No. 28468 for the period 10/1/63 to 1/31/64 was a minimum charge of $5.00 per month, the plant being closed the same as

PHONES | HUbbARD 8-2922 LD 8-2013 LOCAL

Yoshino Produce Company, Inc.

WASHINGTON POTATOES AND ONIONS

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during the period covered by your March 12, 1963, and your November 12, 1963, billings. Your Bill No. 58289, Eebruary 1, 1964 to March 31, 1964, was again the minimum $5.00 per month, and your Bill No. 78601½ for 4/1-6/30/64 was the same. This should indicate what the meter readings should be during the winter shut-down periods.

Your Bill No. 118518 for the period of July 1 to Sept. 30, 1964, covers an actual operating period of 9 weeks, or about 117,000 gallons a week. Your final billing, No. 28559, covers a plant operating period of about 5 weeks, or 70,000 gallons a week. We have no objection to any of these bills, although a spread of 70,000 to 117,000 gallons is quite a bit.

We would be most happy to review this matter with any NP representative at any time, or we would like to offer a compromise settlement for 1,500,000 gallons. Kindly advise.

Very truly yours,

YOSHINO PRODUCE CO., INC.

VY/R

VIC YOSHINO, President

12762

OFFICE OF
CHIEF ENGINEER
JUN 25 1965
NORTHERN PACIFIC RY.
ST. PAUL, MINN.

St. Paul, Minn., June 24, 1965

C.F. 24512

Mr. D. H. Shoemaker
Chief Engineer

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George A. Powe,
General Manager, Properties
and Industrial Development

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Encs.
cc - Mr. M. H. Nixon, WMID, Seattle
Mr. J. L. Goss, Engr. of Water Srvce. & Heat. Plants - with copies of Mr. Nixon's & Mr. Yoshino's letters.
Mr. K. T. Woodruff, Mgr., Dis. Acctg.

Mr. Woodruff:

Please withhold submitting revised bill until further word is received from this office.

G. R. P.

C.F 24812

PROP. & IND. DEV.
IND. DIV.
JUN 14 1965
G.R.P.
R.A.J. 6-15
K.H.M.
J.C.C.
M.M.S.
J.J.G.
J.H.I.
F.W.G.
R.W.J. 6-11

Seattle, Washington
June 9, 1965

Mr. K. T. Woodruff, Manager
Disbursement Accounting
St. Paul, Minnesota

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We are sending a copy of this letter to Mr. Powe with our recommendation that this bill be settled on the $500.00 basis, and if he agrees, will you please prepare a new bill against Yoshino Produce Company in the amount of $500.00 and send it to this office for handling.

M. H. Nelson

Western Manager
Industrial Development

FRE/glb

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MHN

Serving Municipalities
Gray & Osborne Consulting Engineers • DON E. GRAY • F. T. OSBORNE
1844 Westlake North • Seattle, Washington 98109 • ATwater 4-0860
228 South 2nd Street • Yakima, Washington 98901 • GLencourt 3-4833
* REPLY TO YAKIMA OFFICE

May 21, 1965

D. H. Shoemaker
Chief Engineer
Northern Pacific Railway Co.
Northern Pacific Building
St. Paul, Minnesota 55101

Re: Your File: 12762

Dear Mr. Shoemaker:

In reply to your letter of May 6, 1965, relative to our agreement for an Engineering Report on Industrial Waste Treatment at Bruce, Washington, please be advised, we did consult with the Pollution Control Commission and Washington State Health Department, prior to writing our engineering report, and were given the impression they would approve a properly treated discharge to wasteway. However, since writing the report, they have 'hedged' on this outright approval.

This came to us as a surprise, also. We are now in the middle of a "discussion" relative to a similar type "discharge to wasteway" in another location and are optimistic as to the outcome. The upshot of this "discussion" may ~~be~~ change the Pollution Control Commission interpretation of their present "regulations" for the Columbia Basin. A copy of these "regulations" are enclosed with certain passages underscored with red pencil.

It is our contention the interpretation of these "regulations" as represented in the Pollution Control Commission's letter of April 8 is not necessarily proper and maybe changed depending upon the outcome of our referenced "discussions". We will keep you advised.

Yours very truly,

GRAY & OSBORNE

Don E. Gray

Don E. Gray

DEG:er
enclosure

Regulations

REGARDING THE DISCHARGE OF WASTE PRODUCTS TO THE CANALS, DRAINS, WASTEWAYS, RESERVOIRS AND GROUND WATERS OF THE COLUMBIA BASIN IRRIGATION PROJECT AREA

and

MINIMUM STANDARDS FOR THE TREATMENT AND DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES IN THAT AREA

STATE OF WASHINGTON
POLLUTION CONTROL COMMISSION
Olympia, Washington
March, 1954

REGULATIONS REGARDING THE DISCHARGE OF WASTE PRODUCTS TO THE CANALS, DRAINS, WASTEWAYS, RESERVOIRS AND GROUND WATERS OF THE COLUMBIA BASIN IRRIGATION PROJECT AREA

and

MINIMUM STANDARDS FOR THE TREATMENT AND DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES IN THAT AREA.

Foreword

Residents of the Columbia Basin Irrigation Project Area are, and will continue to be, faced with problems involving the disposal of sanitary sewage and wastes from industry. Since there are no continuous streams in the area, waste materials must be disposed of either on land or in reservoirs or in the drains provided for return irrigation water.

Most drains on the upper Project Area discharge to Moses Lake or Potholes Reservoir which supply some of the irrigation water for the lower area. Other return waters will eventually find their way by various drains and waterways to the Columbia.

There are extensive plans for the recreational development of Moses Lake, Potholes Reservoir and other lakes in the Project Area.

The preservation of water quality in the surface and ground waters of this Project is important since such quality will affect the use of the water for irrigation, recreation and water supply. The quality of the Roosevelt Lake water used for irrigation will undoubtedly be altered in some manner by the leaching action in the soils to which it is applied. This change in quality is sure to affect its subsequent use, but is a change which for the most part is beyond control. Changes in water quality due to sewage and wastes, however, are subject to control and it is imperative that such control be exercised.

In addition to the public health problem, one of the most aggravating problems which is sure to exist in a presently undetermined degree is that of algae growths. These growths will appear in drains, lakes and reservoirs in which return water is collected. Soil leachings will provide some of the nutrients for this growth. Sewage and industrial wastes can, if not controlled, substantially add to these nutrients. Algae growths may interfere with the use of the waters for recreation and will substantially increase maintenance on drains, canals, farm laterals, and sprinkler systems.

Another problem involved in the control of wastes discharged to the return water is that of preventing the discharge of certain material in quantities which will affect the soils or crops to which the water is applied. It is not presently known that such materials will result from industrial developments in the area; however, it is desirable that their presence be anticipated and regulations for their control be applied.

Other problems which should be similarly anticipated are the effects of waste materials on domestic and industrial water supplies. Most of the present supplies are taken from underground sources and further demands for increased supplies will result from the development of the area. In this connection, sanitation is a primary factor, but is not the only consideration.

Odors, tastes, color, turbidities and the presence of certain chemical compounds are factors influencing the quality of a water supply. Since sewage and waste disposal must be accomplished in many cases by land surface or subsurface application, the possible effects on ground water supplies require that these methods of disposal be carefully controlled.

In order to provide for the necessary control of the anticipated effects of sewage and waste disposal on water quality in this area, the Pollution Control Commission, under date of February 19, 1954, has adopted the following regulations. These regulations may be altered from time to time as experience dictates.

Attention is here directed to another set of regulations of the Commission which apply in this area. These are "Rules and Regulations for the Submission and Approval of Plans for the Installation of Public Sewage and Industrial Waste Works and for the Operation of Such Works."

REGULATIONS

The following regulations regarding the discharge of waste products to the canals, drains, wasteways, reservoirs and ground waters of the Columbia Basin Irrigation Project Area and the minimum standards for the treatment and disposal of sewage and industrial wastes in this area are hereby adopted and promulgated by the Washington Pollution Control Commission on this 19th day of February, 1954:

SECTION I—REGARDING DOMESTIC SEWAGE

A. Municipal and Community (Including School and Industrial Installations)

1. The discharge of raw sewage is prohibited under any circumstances.
2. The discharge of sewage treatment plant effluent into canals used for irrigation or stock watering is prohibited.
3. The discharge of sewage treatment plant effluent into drains, wasteways, or reservoirs, from which water is subsequently re-used in canals and laterals is prohibited, except by specific approval where special circumstances may require such discharge.
4. The disposal of sewage treatment plant effluent by land application methods is prohibited in locations where such disposal would adversely affect surface or ground water withdrawn for domestic purposes. Discharge at extreme depths is prohibited.
   (NOTE: Rules and Regulations of the State Board of Health prohibit irrigation of certain crops with sewage plant effluent.)
5. The minimum degree of treatment shall, in any case, be at least the equivalent of primary treatment and disinfection of the effluent.
6. Additional treatment, of a degree to be determined for each case, shall be provided where specific approval is granted for discharge to drains, wasteways, or reservoirs.
7. Additional treatment, of a degree to be determined for each case, shall be provided prior to disposal by land application methods

when necessary to prevent possible contamination of ground and surface waters, or creation of a nuisance.

8. Notwithstanding Items 1 to 7, the degree of treatment, the provision for disinfection and method of disposal shall be a matter for the determination and approval of the Pollution Control Commission for each individual case.

B. Individual Farm Unit, Household or Other Source of Domestic Sewage Not Covered by Item A

1. No raw sewage or septic tank effluent shall be discharged to any canal, reservoir, drain or wasteway.
2. Households, farm units, schools, small business concerns or other sources of domestic sewage involving a limited number of persons shall provide sewage disposal facilities as prescribed by the County Health Department of the County in which the source is located.

SECTION II—REGARDING INDUSTRIAL WASTES

A. General Requirements

The following materials shall not be discharged to any drain or wasteway in excess of the concentration specified in each case. In no case will any of these materials be discharged to a canal:

1. No oils, tars, cleaning compounds or inflammables.
2. No phenols or phenolic-like compounds in excess of 0.05 parts per million.
3. No toxic materials such as:
   a. Fruit washing compounds
   b. Wood preservatives
   c. Insecticides—aldrin, rotenone, BHC, DDT, and all other similar products
   d. No weed killers
   e. Metallic or non-metallic products of metal processing or plating —acids, alkalies, cyanides, copper, etc.
4. Total salts, maximum 2500 parts per million
5. No salts or elements injurious to crops, soils or animals—aluminum, boron, arsenic, selenium, lead, manganese, etc.
6. No wastes with a pH less than 6.5 or greater than 8.5.
7. No floating solids.
8. No suspended solids in excess of that which can be removed by approved clarification or settling with a 2-hour detention period.

B. Ground Water Requirements

Wastes containing materials listed in Section II, A, Items 1, 2, 3, 4 and 5 above, shall not be disposed of in such a way as to enter the ground water.

C. Specific Requirements of Each Industry

1. Milk plants:
   a. Condenser water, cooling water and ice machine water may be discharged to drains or waterways, but not to canals.

b. Wastes after proper treatment may be discharged to a drain or wasteway, if such discharge is approved by the Pollution Control Commission. The preferred methods of disposal of milk waste are:
   (1) Small receiving stations or bottling plants—connection to city sewers, or irrigation.
   (2) All others—irrigation or treatment by filtration or activated sludge.
c. Milk waste may be used directly for irrigation under a controlled system whereby no nuisance is caused.

2. Canning, freezing and dehydration:
   a. Cooling waters may be discharged to drain or wasteway.
   b. Wastes shall be screened (20-mesh standard gauge) and disposed of by lagooning, irrigation or in leaching trenches.

3. Meat Packing:
   a. No wastes from slaughterhouses or meat packing plants shall be allowed to enter any drain or wasteway. Recommended methods of disposal are:
      (1) In all cases, blood, paunch manure, fleshings and grease shall be collected for rendering or some other type of utilization.
      (2) Wastes from small operations after complying with item (1) above may be accepted in city sewer system or may be treated by a combination grease trap-septic tank and drain field.
      (3) Wastes from large plants after complying with item (1) above may be treated by filtration and the effluent used for irrigation but not discharged to a canal, drain or wasteway.

4. Beet Sugar:
   a. No lime wastes, process waters or Steffen's waste shall be discharged to any drain or wasteway or in any way such that it may reach ground water.
   b. Flume water may be discharged to a drain or wasteway, but only after grit removal and re-use in the flumes with not more than 40 percent make-up. The waste water discharged to provide for the make-up must be settled in a tank equipped for continuous sludge removal and having a detention period of 2 hours.
   c. Flume water may be lagooned or used for irrigation.

5. Potato Washings:
   a. Wash water shall not be discharged to any wasteway or drain if it is possible to dispose of the water by irrigation on land.
   b. If wash water is to be discharged to any wasteway or drain it must first be settled in a tank equipped with continuous sludge removal equipment and having a detention period of 2 hours or in a lagoon with a similar detention period with sufficient additional space for sand and solids accumulation.
   c. Wash water may be lagooned or used for irrigation.

6. Sand and Gravel Washing:
   a. No sand and gravel washings will be discharged to a drain or wasteway unless first passed through a lagoon with a settling period of 2 days.

7. Livestock Wastes
   a. Feed lots or hog wallows shall not be located within 100 feet of any wells used for public water supply.
   b. Feed lots or hog wallows shall be so located that surface runoff or waste water from the lot will not enter any canal, drain, wasteway or reservoir.
   c. Livestock and poultry carcasses shall not be deposited in any canal, drain, wasteway or reservoir.

8. Miscellaneous Operations:
   a. Garbage disposal areas and incinerators shall be so located to preclude discharge of drainage to any canal, drain, wasteway or reservoir.
   b. Operations not covered by these requirements will be considered individually and requirements established as the need arises.

May 6, 1965

File: 12762

Gray & Osborne
Consulting Engineers
228 South Second Street
Yakima, Washington 98901

Gentlemen:

You have our letter agreement of February 16, 1965 regarding Engineering Report, Industrial Waste Treatment, at Bruce, Washington. In the first paragraph of that letter agreement, the following is stated:

> "It is understood that you will consult with the Washington State Health Department and the Washington State Pollution Control Commission and obtain their approvals on the recommendations presented, all to be completed within 30 days hereof."

You now have a copy of Washington State Pollution Control Commission's letter of April 8th signed by Roy M. Harris, Director, wherein he states:

> "Those sections proposing discharge to a wasteway are excluded."

Will you please clarify Mr. Harris' statement, as it would appear that you did not clear with the Pollution Control Board before sending us the Engineering Report and recommendations.

Most sincerely yours,

D. H. SHOEMAKER

Chief Engineer

WRB:ic

cc: Mr. R. A. Juba
Mr. J. E. Hoving

PHONES | HUBBARD 8-2922 LD 8-2013 LOCAL

Yoshino Produce Company, Inc.

WASHINGTON POTATOES AND ONIONS

1196 S. BROADWAY
OTHELLO, WASHINGTON
99344

April 26, 1965

NORTHERN PACIFIC RAILWAY CO.
Industrial Development Department
919 Smith Tower
Seattle, Washington 98104

Lease No. 91615
Bruce Warehouse Site

Attn: Mr. M. H. Nixon and Mr. F. R. Erwin

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PT

APR 28 1965

SEATTLE, WASH.

PHONES | HUbbARD
8-2922 LD
8-2013 LOCAL

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OTHELLO, WASHINGTON
99344

during the period covered by your March 12, 1963, and your November 12, 1963, billings. Your Bill No. 58289, Eebruary 1, 1964 to March 31, 1964, was again the minimum $5.00 per month, and your Bill No. 78601½ for 4/1-6/30/64 was the same. This should indicate what the meter readings should be during the winter shut-down periods.

Your Bill No. 118518 for the period of July 1 to Sept. 30, 1964, covers an actual operating period of 9 weeks, or about 117,000 gallons a week. Your final billing, No. 28559, covers a plant operating period of about 5 weeks, or 70,000 gallons a week. We have no objection to any of these bills, although a spread of 70,000 to 117,000 gallons is quite a bit.

We would be most happy to review this matter with any NP representative at any time, or we would like to offer a compromise settlement for 1,500,000 gallons. Kindly advise.

Very truly yours,

YOSHINO PRODUCE CO., INC.

VY/R

VIC YOSHINO, President

12762

OFFICE OF
CHIEF ENGINEER

APR 19 1965

NORTHERN PACIFIC RY. CO.
ST. PAUL, MINN.

Seattle, Washington
April 14, 1965

Bruce - 11

Mr. D. H. Shoemaker:

There is attached copy of Mr. Nixon's letter of April 9, together with copy of letter dated April 8 from Director Roy M. Harris, Director, Washington State Pollution Control Commission relative to industrial waste disposal at Bruce, Wash. The letter dated April 8 from the State Pollution Control Commission indicates that the report furnished by Gray & Osborne in connection with the industrial waste disposal at Bruce, Wash. had been reviewed and was approved, with the provision that the sections proposing discharge to a wasteway are excluded. You will note that Gray & Osborne received a copy of the letter from the Pollution Control Commission.

JLG
ABC
Mr. Smith JLG
4/27

J E Hovring
Assistant Chief Engineer

JEH:dj
Attmts.

cc: R. G. Brohaugh - w/attmts.

Main Purpose of G+O design was to make waste suitable for discharge to wasteway.
JLG 4-19

WRB
JLG
ABC

April 8, 1965

Northern Pacific Railway Company
Smith Tower Building
Seattle, Washington

Attention: Marvin Nixon

Subject: Industrial Waste Disposal
Bruce, Washington

Gentlemen:

In accordance with the Rules and Regulations of the Pollution Control Commission, the subject report has been reviewed and is hereby approved with the following provision:

1. Those sections proposing discharge to a wasteway are excluded.

Very truly yours,

Roy H. Harris

ROY H. HARRIS
Director

RHH:dn

cc: Gray & Osborne, Yakima
State Department of Health, Olympia, Spokane
Adams County Health Department
Pollution Control Commission, Spokane

12767

Seattle, Washington
April 27, 1965

Bruce - 11

Mr. D. H. Shoemaker:

Regarding report prepared by Gray and Osborne for industrial waste treatment at Bruce, Washington:

With my letter of April 14 I furnished copy of letter dated April 8, 1965 from the Washington State Pollution Control Commission, advising that the report was approved with the provision that the sections proposing discharge to a wasteway are excluded.

In Gray and Osborne's report the discharge was proposed into a wasteway which, according to the Pollution Control Commission, will not be permitted. It may be necessary to discharge into a lagoon area which may involve 40 to 80 acres and, of course, this acreage would be high priced land.

In connection with the Pronto Foods, Inc. plant near Wheeler, the waste is being handled through the sewage treatment plant of the City of Moses Lake.

J. E. Hoving
Assistant Chief Engineer

JEH:dj

12762

Gray & Osborne Consulting Engineers • DON E. GRAY • F. T. OSBORNE
Serving Municipalities
1844 Westlake North • Seattle, Washington 98109 • ATwater 4-0860
228 South 2nd Street • Yakima, Washington 98901 • GLencourt 3-4833
* REPLY TO YAKIMA OFFICE

April 9, 1965

D. H. Shoemaker
Chief Engineer
Northern Pacific Railway Company
Engineering Department
St. Paul, Minnesota 55101

Re: Engineering Report, Industrial Waste Treatment, Bruce, Washington

Dear Mr. Shoemaker:

This will acknowledge receipt of your letter of April 5, stating you do not intend to proceed with the detailed plans and specifications at this time in connection with the industrial waste treatment at Bruce, Washington, but will keep us advised if the project is activated at a later date.

Please be advised, we have not as yet received the fee for the engineering report, in the amount of $ 1,050.

Yours very truly,

GRAY & OSBORNE

Don E. Gray

DEG:er

St. Paul, Minnesota
April 9, 1965

12762

Mr. R. A. Juba:

You requested us by telephone to comment on the Report prepared by Consulting Engineers' firm of Gray & Osborne relative to:

"Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington, dated March 1965."

I am now pleased to attach hereto four copies of memorandum dated this office following a complete review of the Consulting Engineers' Report by Messrs. Goss, Cayou, and Bjorkland.

D. H. SHOEMAKER

Chief Engineer

WRB:bm

Enc. 4

MEMORANDUM COVERING REVIEW OF REPORT ENTITLED "ENGINEERING REPORT ON WASTE DISPOSAL FOR PROPOSED POTATO PROCESSING PLANT AT BRUCE, WASHINGTON" DATED MARCH 1965 PREPARED BY CONSULTING ENGINEERS, GRAY & OSBORNE

The following are the comments on this report:

(1) The report is quite comprehensive for the four general categories for disposing of waste from a potato processing plant but does not cover or comment on all the items which must be considered for possible future operations.

(2) One item is the very large areas of presumably valuable industrial land which would be taken for disposal lagoons. The report mentions that conventional mechanical waste treatment is not proposed, since it is relatively more expensive than the lagoon arrangement, but does not imply that the cost or possible use of land was a consideration. The requirements for lagoons would be reduced if an activated sludge or other mechanical waste treatment plant were installed; and before final design is considered, a study should probably be made to develop the cost comparison on a facility of this type, especially if the use of industrial land for the lagoons is of major importance. The acquisition of other less important land for lagooning and disposal should also be considered.

(3) As covered in the report, the water demand for a 200-ton per day plant would be 700 gallons per minute; there is another potato washing plant at Bruce which requires approximately 200 gallons per minute when the plant is in operation, as well as other water users. The present pump in the Northern Pacific well, installed in 1962, is rated at 400 gallons per minute. Although we do have additional capacity in the existing 10" well, any plant such as covered in the report, as well as future demands, will probably require a new well and/or additional large water storage tank. Another consideration which was not covered in the report but should be a matter of study is the possibility of returning satisfactorily-treated effluent to the plant for reuse.

The report went as far as it could regarding treatment of waste from a potato processing plant and also mentioned the possibilities of some day having to treat other kinds of wastes. Before final design, some study and decision on the possible ultimate uses of the facilities will have to be made. This must include our best estimate of expansion of the entire Bruce Industrial Site.

It is recognized that the further studies recommended in the aforegoing will result in additional Engineering costs and possibly fees to Gray & Osborne, and perhaps nothing further should be done until the Bruce Development indicates that the matter should be reopened.

Office of Chief Engineer
Northern Pacific Railway Company
St. Paul, Minnesota
April 9, 1965

WRB:bm

WRB - your mailgram to Joe Stone. 4/9 ark

St. Paul, Minnesota
April 6, 1965

12762

Mr. R. A. Juba:

Please refer to "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington", dated March 1965.

The report has been reviewed by Messrs. Bjorklund, Goss, and Cayou, who offer the following general comments:

(1) The report is quite comprehensive for the four general categories for disposing of waste from a potato processing plant but does not cover or comment on all the items which must be considered for possible future operations.

(2) One item is the very large areas of presumably valuable industrial land which would be taken for disposal lagoons. The report mentions that conventional mechanical waste treatment is not proposed, since it is relatively more expensive than the lagoon arrangement, but does not imply that the cost or possible use of land was a consideration. The requirements for lagoons would be reduced if an activated sludge or other mechanical waste treatment plant were installed; and before final design is considered, a study should probably be made to develop the cost comparison on a facility of this type, especially if the use of industrial land for the lagoons is of major importance. The acquisition of other less important land for lagooning and disposal should also be considered.

(3) As covered in the report, the water demand for a 200 ton per day plant would be 700 gallons per minute; there is another potato washing plant at Bruce which requires approximately 200 gallons per minute when the plant is in operation, as well as other water users. The present pump in the Northern Pacific well, installed in 1962, is rated at 400 gallons per minute. Although we do have additional capacity in the existing 10" well, any plant such as covered in the report, as well as future demands, will probably require a new well and/or additional large water storage tank. Another consideration which was not covered in the report but should be a matter of study is the possibility of returning satisfactorily treated effluent to the plant for reuse.

The report went as far as it could regarding treatment of waste from a potato processing plant and also mentioned the possibilities of some day having to treat other kinds of wastes. Before final design, some study and decision on the possible ultimate uses of the facilities will have to be made. This must include our best estimate of expansion of the entire Bruce Industrial Site.

It is recognized that the further studies recommended in the aforegoing will result in additional Engineering costs and possibly fees to Gray and Osborne, and perhaps nothing further should be done until the Bruce Development indicates that the matter should be reopened.

ACC:cw

Chief Engineer

cc: Mr. J. E. Hoving

April 5, 1965

12762

Gray & Osborne
Consulting Engineers
228 So. Second Street
Yakima, Washington

Re: Engineering Report Industrial Waste
Treatment, Bruce, Washington.

Gentlemen:

Please be referred to our agreement dated February 16 covering an engineering report in connection with industrial waste treatment for a potential potato processing plant on the Railway Company's industrial area at Bruce, Washington.

The fee for the engineering report was to be $1,050 which I trust you have received by this time.

Fifty percent of the engineering report fee was to be credited on a design fee if and when you were directed by the Railway Company to proceed with the detail plans and specifications. We do not intend to proceed with the detail plans and specifications at this time, but will keep you advised if the project is activated at a later date.

Very truly yours,

D. H. SHOEMAKER

Chief Engineer

S:ds

bcc: Mr. J. E. Hoving
Mr. G. R. Powe
Mr. M. H. Nixon

D. H. SHOEMAKER
12762

MEMORANDUM FOR FILE:

I have reviewed the March 1965 Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington, as prepared by the Consulting Engineers' firm of Gray & Osborne. We have the following comments on this report:

Day flow rate of 1,000,000 gallons per day is estimated for the 200 ton per day plant. This would mean a raw water demand of 700 gallons per minute, if plant was operating on a 24-hour day. A new pump was installed in the NP well in 1962, having a capacity of 400 gallons per minute. There also is a potato washing facility at Bruce which requires approximately 200 gallons a minute when the plant is in operation. We do have additional capacity on this 10-inch well; however, a new well and/or an additional large water tank storage installation may be required.

No mention is made on land cost for the very extensive lagoon construction. It is mentioned in the report that conventional mechanical waste treatment will not be proposed, since it is relatively more expensive than the lagoon arrangement, although it is mentioned that an activated sludge plant would appear feasible if properly designed, and we assume this would be part of the mechnical waste treatment package. It would be interesting to see what the cost comparison would be on a facility of this type, especially if the acquisition of land for lagoons is of major importance.

To reduce the amount of effluent into the drainage areas from the Waste Disposal System and also to reduce the amount of makeup water to the plant, we believe consideration might be given to reuse of the waste disposal effluent for plant process demands.

If a large expenditure is made at Bruce for waste disposal, design criteria should allow for future expansion from both a water supply and waste disposal standpoint.

Per your request, we are returning Report No. 16.

Office of Engineer of Water Service,
Power and Heating Plants
Northern Pacific Railway Company
St. Paul, Minnesota
March 30, 1965

JLG:bm

March 30, 1965 Mar. 1965 V-2923

One thousand fifty and - - - - - - no/100 1,050.00

GRAY & OSBORNE CONSULTING ENGINEERS
1844 Westlake North
Seattle, Washington
98109

In payment for: Engineering Services furnished in connection with preparation of report in connection with industrial waste treatment for the Railway Company's industrial area at Bruce, Washington, as per letter agreement dated February 16, 1965 -

Fee for Engineering Report - - - -	$1,050.00
AMOUNT OF VOUCHER - - -	$1,050.00

JEH #26

Western District Accounts 1050.00
M W & S 201-10 1050.00

Consulting Engineers • DON E. GRAY • F. T. OSBORNE

1844 Westlake North • Seattle, Washington 98109 • ATwater 4-0860

228 South 2nd Street • Yakima, Washington 98901 • GLencourt 3-4833

March 24, 1965

Northern Pacific Railway Co.
919 Smith Tower
Seattle, Washington 98104

FOR: Engineering Services furnished in connection with Industrial Waste Treatment, Bruce, Washington - Engineering Report, as per letter agreement dated 2/16/65.

AMOUNT NOW DUE . . . . . $ 1,050.00

GRAY & [illegible]

Don E. Gray

DON E. GRAY

N. P. 1386 12-24

TELEGRAM—BE BRIEF

TIME FILED 12762 M.

MAILGRAM

St. Paul, Minnesota
March 31, 1965

JOINT
Mr. J. L. Goss:
Mr. A. C. Cayou:

Mr. Juba has now requested a statement from us as to our opinion of the report on proposed lagooning at Bruce, Washington, as covered by report of Gray & Osborne.

Accordingly will you both get together and write up a brief statement to Mr. Juba incorporating the various items brought out in our several memorandums following discussion of the report.

W. R. BJORKLUND

WRB:ds

12762

MEMORANDUM FOR FILE:

Regarding "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington", prepared by Consulting Firm of Gray & Osborne, Seattle and Yakima, Washington:

Aside from the relatively high cost of waste disposal for processing raw potatoes, which we will have to accept as per Engineer's report, the big problem appears to be the areas required for ultimate disposal of sludge and waste. Here we must also accept the Engineer's figures.

Suggest some thought be given to some other methods of ultimate disposal; for instance, electrical drying and incineration of solids and ultimate return of waters either to plant or ground. It would appear that three courses would then be open:

1. Effect disposal without lagoons and retain land within the industrial site for industrial purposes.
2. Release industrial land for lagoons.
3. Purchase additional land for disposal areas, presumably at a lower cost than the industrial site.

A penciled flow chart is attached to this memo.

A. L. Layou

3/31

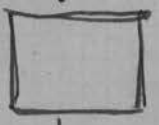
Office of Chief Engineer
N.P.Ry.Co.,St.Paul,Minn.
March 31, 1965

ACC:ds

12762

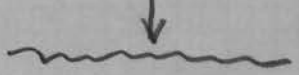
Wash

1,000,000 g/d



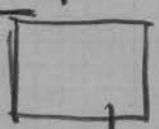
sump, 20,000 gpd/ft² - silt & dirt removal

→ silt & dirt



#40 screen → large solids removal - cake

1,000,000 gpd
14,000 # BOD
18,000 # solids



clarifier, 45'ϕ

vacuum filter, 6'ϕ x 7'

Overflow @ 600 gpd per ft²

7000# BOD

sludge
7000# BOD
1800# solids
96% moisture

→ cake

to yearly storage lagoon
1,742,400 cu.ft. sto./year
(420' □ @ 10' deep)

to lagoon

(Details per various proposals)

Waste Disposal - Bruce, Wn.
General Schematic per
Gray & Osborne Report
3/31/65

12762

MEMORANDUM FOR FILE:

Regarding "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington", prepared by Consulting Firm of Gray & Osborne, Seattle and Yakima, Washington:

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Suggest some thought be given to some other methods of ultimate disposal; for instance, electrical drying and incineration of solids and ultimate return of waters either to plant or ground. It would appear that three courses would then be open:

1. Effect disposal without lagoons and retain land within the industrial site for industrial purposes.
2. Release industrial land for lagoons.
3. Purchase additional land for disposal areas, presumably at a lower cost than the industrial site.

A penciled flow chart is attached to this memo.

Office of Chief Engineer
N.P.Ry.Co.,St.Paul,Minn.
March 31, 1965

ACC:ds

St. Paul, Minnesota
March 30, 1965

12762

Mr. J. L. Goss:
Mr. A. C. Cayou:

In line with our discussion today, will you please prepare and place in the file a memorandum covering your thoughts about the "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington" as covered by report of Consulting Firm of Gray & Osborne Company.

At this writing, I am informed by Mr. Juba that nothing is planned for the area; this is merely a study for the purpose of determining what might be involved in the event a large potato or food processing plant were installed in the Bruce area.

Assistant Chief Engineer

WRB:ds

MEMORANDUM FOR FILE: 12762

I have reviewed the March 1965 Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington, as prepared by the Consulting Engineers' firm of Gray & Osborne. We have the following comments on this report:

Day flow rate of 1,000,000 gallons per day is estimated for the 200 ton per day plant. This would mean a raw water demand of 700 gallons per minute, if plant was operating on a 24-hour day. A new pump was installed in the NP well in 1962, having a capacity of 400 gallons per minute. There also is a potato washing facility at Bruce which requires approximately 200 gallons a minute when the plant is in operation. We do have additional capacity on this 10-inch well; however, a new well and/or an additional large water tank storage installation may be required.

No mention is made on land cost for the very extensive lagoon construction. It is mentioned in the report that conventional mechanical waste treatment will not be proposed, since it is relatively more expensive than the lagoon arrangement, although it is mentioned that an activated sludge plant would appear feasible if properly designed, and we assume this would be part of the mechnical waste treatment package. It would be interesting to see what the cost comparison would be on a facility of this type, especially if the acquisition of land for lagoons is of major importance.

To reduce the amount of effluent into the drainage areas from the Waste Disposal System and also to reduce the amount of makeup water to the plant, we believe consideration might be given to reuse of the waste disposal effluent for plant process demands.

If a large expenditure is made at Bruce for waste disposal, design criteria should allow for future expansion from both a water supply and waste disposal standpoint.

Per your request, we are returning Report No. 16.

Office of Engineer of Water Service,
Power and Heating Plants
Northern Pacific Railway Company
St. Paul, Minnesota
March 30, 1965

JLG:bm

MEMORANDUM FOR FILE:

Bruce Industrial Site on Connell Northern Branch

This is a memorandum placed in the file for the purpose of commenting on the "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington", dated March, 1965, referred to by Consulting Engineers, Gray & Osborne, as Job No. 65006 as specifically relating to Report No. 14. The industrial tract at Bruce is located in Section 33, T.16 N., R.30 E. of the Willamette Merridian.

There is currently being utilized on the westerly side of the Connell Northern Branch a block of land by the Yoshino Company, food handlers. Immediately to the north, there has been proposed a potato processing plant of a capacity to handle from one hundred to two hundred tons of potatoes daily resulting in an effluent which must be processed and treated before discharge or must be retained and allowed to seep into the ground or evaporate.

The Consulting Engineers make four general categories for disposing of this waste:

1. Clarification and lagooning with discharge;
2. Clarification and lagooning without discharge;
3. Clarification, aeration and lagooning with discharge; and
4. Sludge accumulation of the lagoon and lagooning without discharge.

It appears that from an annual cost basis, the proper type of treatment to follow is the first; namely, clarification and lagooning with discharge.

There are certain items which should be reviewed before the actual design is undertaken which are to look into the possibility of taking the effluent off of the last settling basin and returning it to the plant for reuse. It would be assumed that this effluent would be in a reasonably good condition and should be satisfactory for reuse. This would not only eliminate any possibility of objectionable material getting into the discharge channels in the area, but it would also reduce the makeup water load at the plant.

Another item which should be given some consideration is the possibility for installing the sewage lagoon at a more remote location or someplace which does not have the potential for industrial development, such as the area shown on the Exhibits 3 to 7, inclusive. It is possible that maybe there is some land that does not have the potential that the industrial site has and this land could possibly be worked into a system of sewage lagoons at a lesser price. This is particularly desirable because there is some 80 or more acres involved in the lagoons proper. It would be a shame to utilize good industrial land for such lagooning.

As a possible further alternate, a completely mechanical system for sewage treatment should be considered.

W. R. BJORKLUND

Office of Chief Engineer
N.P.Ry.Co.,St.Paul,Minn.
March 30, 1965
WRB:ds

MEMORANDUM FOR FILE:

Bruce Industrial Site on Connell Northern Branch

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As a possible further alternate, a completely mechanical system for sewage treatment should be considered.

W. R. BJORKLUND

Office of Chief Engineer
N.P.Ry.Co.,St.Paul,Minn.
March 30, 1965
WRB:ds

MEMORANDUM FOR FILE: 12762

I have reviewed the March 1965 Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington, as prepared by the Consulting Engineers' firm of Gray & Osborne. We have the following comments on this report:

Day flow rate of 1,000,000 gallons per day is estimated for the 200 ton per day plant. This would mean a raw water demand of 700 gallons per minute, if plant was operating on a 24-hour day. A new pump was installed in the NP well in 1962, having a capacity of 400 gallons per minute. There also is a potato washing facility at Bruce which requires approximately 200 gallons a minute when the plant is in operation. We do have additional capacity on this 10-inch well; however, a new well and/or an additional large water tank storage installation may be required.

No mention is made on land cost for the very extensive lagoon construction. It is mentioned in the report that conventional mechanical waste treatment will not be proposed, since it is relatively more expensive than the lagoon arrangement, although it is mentioned that an activated sludge plant would appear feasible if properly designed, and we assume this would be part of the mechnical waste treatment package. It would be interesting to see what the cost comparison would be on a facility of this type, especially if the acquisition of land for lagoons is of major importance.

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If a large expenditure is made at Bruce for waste disposal, design criteria should allow for future expansion from both a water supply and waste disposal standpoint.

Per your request, we are returning Report No. 16.

Office of Engineer of Water Service,
Power and Heating Plants
Northern Pacific Railway Company
St. Paul, Minnesota
March 30, 1965

JLG:bm

St. Paul, Minnesota
March 30, 1965

12762

Mr. J. L. Goss:
Mr. A. C. Cayou:

In line with our discussion today, will you please prepare and place in the file a memorandum covering your thoughts about the "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington" as covered by report of Consulting Firm of Gray & Osborne Company.

At this writing, I am informed by Mr. Juba that nothing is planned for the area; this is merely a study for the purpose of determining what might be involved in the event a large potato or food processing plant were installed in the Bruce area.

W. R. BJORKLUND

Assistant Chief Engineer

WRB:ds

12762

Docket No. 25112
St. Paul, Minnesota
March 22, 1965

Mr. F. L. Steinbright, Vice President, Operations
Mr. N. M. Lorentzsen, General Manager
Mr. E. L. Ordell, Comptroller (3)
Mr. L. C. Wise, District Accountant
Mr. Robert A. Juba, Manager, Industrial Development
Mr. M. H. Nixon, Western Manager, Industrial Development
Mr. W. J. Luchsinger, Vice President, Traffic
Mr. E. M. Stevenson, Assistant Vice President, Traffic
Mr. O. A. Kobs, Western Freight Traffic Manager
Mr. D. H. King, Superintendent, Spokane
Mr. D. H. Shoemaker, Chief Engineer (3)
Mr. J. E. Hoving, Assistant Chief Engineer

Attached is copy of Letter Agreement dated February 16, 1965, between Gray & Osborne, Consulting Engineers, and Northern Pacific Railway Company covering vegetable dehydrating plant at Bruce, Washington (to be constructed by Yoshino Brothers) and engineering study of industrial waste treatment and disposal.

Distribution of this instrument is limited to the list shown hereon. It must not be copied and distributed to other departments or subordinate officers without the approval of the Secretary.

R. H. DICK

attach

NORTHERN PACIFIC RAILWAY COMPANY

ENGINEERING DEPARTMENT
ST. PAUL 1, MINN.

D. H. SHOEMAKER
Chief Engineer

February 16, 1965

GRAY & OSBORNE
REC'D YAKIMA
FEB 20 1965
DEG ✓ FTO
CJJ OWL
EDR DWT
JCP
RRJ

Gray & Osborne
Consulting Engineers
228 South 2nd Street
Yakima, Washington 98901

RE: Engineering Report, Industrial Waste Treatment, Bruce, Washington

Gentlemen:

It is desired to employ your firm to prepare an engineering report in connection with industrial waste treatment for the Railway Company's industrial area at Bruce, Washington. It is requested that you investigate the problem and present an engineering report in various alternates of handling the existing and potential waste at Bruce, Washington. The report is to include construction cost estimates, estimated cost of operation and maintenance, together with your recommendations. It is understood that you will consult with the Washington State Health Department and the Washington State Pollution Control Commission and obtain their approvals on the recommendations presented, all to be completed within 30 days hereof.

The fee for the engineering report will be . . . . . $1,050.00. Fifty percent (50%) of the engineering report fee will be credited on the design fee, if and when you are directed by the Railway Company to proceed with the detailed plans and specifications.

This letter agreement is submitted in duplicate. If you are in accord with the above stipulated terms, will you please indicate your acceptance by placing your signature in the space provided below and return the original to me. The duplicate original is to be retained by you.

Yours very truly,

FOR NORTHERN PACIFIC RAILWAY COMPANY

By D. H. Shoemaker
D. H. Shoemaker, Chief Engineer

ACCEPTED:

GRAY & OSBORNE

By Don E. Gray
Don E. Gray

St. Paul, Minnesota
March 24, 1965

12762

Mr. A. C. Cayou:
Mr. J. L. Goss :

We entered into a letter agreement with Gray and Osborne, Consulting Engineers, at Yakima, Washington, under date of February 16 to employ that firm to prepare an Engineering Report in connection with Industrial Waste Treatment for the Railway Company's Industrial Area at Bruce, Washington.

I am now sending to Mr. Cayou Report No. 15 and to Mr. Goss Report No. 16, furnished by the Consulting Firm and would be pleased to have you review these as promptly as possible and give me your views not later than March 30 with return of the reports.

D. H. SHOEMAKER

WRB:bm

Chief Engineer

Enc.

FILE
NOTE: Mr. W. R. Bjorklund has Report No. 14, which he is reviewing, and Reports No. 17, 18, 19, and 20 are attached to the file.

DHS

12762

OFFICE OF
CHIEF ENGINEER

MAR 24 1965

NORTHERN PACIFIC RY. CO.
ST. PAUL, MINN.

Seattle, Washington
March 22, 1965

Bruce - 11

Mr. D. H. Shoemaker:

Please refer to your letter of February 27, your file 12762, relative to an engineering report to be prepared by Gray and Osborne relative to handling the industrial waste at Bruce, Washington in connection with a proposed dehydrating plant being planned by Yoshino Bros. at that location. I am furnishing seven copies of Engineering Report dated March 1965 as prepared by Gray and Osborne, entitled "Engineering Report on Waste Disposal for Proposed Potato Processing Plant at Bruce, Washington." This report has been prepared in connection with letter agreement which you executed with Gray and Osborne.

J E Hoving
Assistant Chief Engineer

JEH:dj
Attmts.

cc: N. M. Lorentzsen (1)
R. G. Brohaugh (1)

Wmbwell, ACE, #1C6
for mine

3/24

St. Paul, March 15, 1965

12762

Mr. F. L. Steinbright:

Please refer to my letter of February 17 in regard to proposed vegetable dehydrating plant at Bruce, Washington, to be constructed by Yoshino Brothers, and proposed letter-agreement with Gray & Osborne for engineering study of industrial waste treatment and disposal.

For filing with the Secretary, I am attaching fully executed letter-agreement dated February 16, 1965, with Gray & Osborne.

D. H. SHOEMAKER

attachment

12762

Serving Municipalities
Gray & Osborne Consulting Engineers • DON E. GRAY • F. T. OSBORNE
1844 Westlake North • Seattle, Washington 98109 • ATwater 4-0860
228 South 2nd Street • Yakima, Washington 98901 • GLencourt 3-4833
* REPLY TO YAKIMA OFFICE

February 22, 1965

D. H. Shoemaker
Chief Engineer
Northern Pacific Railway Co.
Engineering Department
St. Paul 1, Minnesota

Re: Engineering Report, Industrial Waste Treatment,
Bruce, Washington

Dear Mr. Shoemaker:

We are returning herewith the signed original letter agreement in connection with the above referenced project. The duplicate copy submitted was not signed; however, we have made a Verifax copy of the original for our record and file.

Yours very truly,

GRAY & OSBORNE

Don E. Gray

DEG:er
enclosure

PTL
Files Bruce with JEH
for record. Thanks
Courtesy JEH.

At Seattle, February 27, 1965

12762

Mr. J. E. Hoving:

In reference to my letters of February 12 and February 17 about employment of Gray & Osborne to prepare a study and recommendations for handling the industrial waste at Bruce for the vegetable dehydrating plant being planned by Yoshino Brothers.

We now have an executed copy of the agreement which you prepared and submitted to me for my handling.

DHS/jwm

D. H. SHOEMAKER

NORTHERN PACIFIC RAILWAY COMPANY

ENGINEERING DEPARTMENT
ST. PAUL 1, MINN.

D. H. SHOEMAKER
Chief Engineer

February 16, 1965

GRAY & OSBORNE
REC'D YAKIMA
FEB 20 1965
DEG ✓ FTO
CJJ OWL
EDR DWT
JCP
RRJ

Gray & Osborne
Consulting Engineers
228 South 2nd Street
Yakima, Washington 98901

RE: Engineering Report, Industrial Waste Treatment, Bruce, Washington

Gentlemen:

It is desired to employ your firm to prepare an engineering report in connection with industrial waste treatment for the Railway Company's industrial area at Bruce, Washington. It is requested that you investigate the problem and present an engineering report in various alternates of handling the existing and potential waste at Bruce, Washington. The report is to include construction cost estimates, estimated cost of operation and maintenance, together with your recommendations. It is understood that you will consult with the Washington State Health Department and the Washington State Pollution Control Commission and obtain their approvals on the recommendations presented, all to be completed within 30 days hereof.

The fee for the engineering report will be . . . . . $1,050.00. Fifty percent (50%) of the engineering report fee will be credited on the design fee, if and when you are directed by the Railway Company to proceed with the detailed plans and specifications.

This letter agreement is submitted in duplicate. If you are in accord with the above stipulated terms, will you please indicate your acceptance by placing your signature in the space provided below and return the original to me. The duplicate original is to be retained by you.

Yours very truly,

FOR NORTHERN PACIFIC RAILWAY COMPANY

By D. H. Shoemaker
D. H. Shoemaker, Chief Engineer

ACCEPTED:

GRAY & OSBORNE

By Don E. Gray
Don E. Gray

NORTHERN PACIFIC RAILWAY COMPANY

ENGINEERING DEPARTMENT
ST. PAUL 1, MINN.

D. H. SHOEMAKER
Chief Engineer

February 16, 1965

GRAY & OSBORNE
REC'D YAKIMA
FEB 20 1965
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Gray & Osborne
Consulting Engineers
228 South 2nd Street
Yakima, Washington 98901

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This letter agreement is submitted in duplicate. If you are in accord with the above stipulated terms, will you please indicate your acceptance by placing your signature in the space provided below and return the original to me. The duplicate original is to be retained by you.

Yours very truly,

FOR NORTHERN PACIFIC RAILWAY COMPANY

By D. H. Shoemaker
D. H. Shoemaker, Chief Engineer

ACCEPTED:

GRAY & OSBORNE

By Don E. Gray
Don E. Gray

St. Paul, February 17, 1965

~~11777~~

Mr. F. L. Steinbright:

The Industrial Department has been trying to locate a vegetable dehydrating plant at Bruce, and Yoshino Brothers are very much interested in what we have to offer. If we can handle their industrial wastes at Bruce, they would plan to commence construction in the early spring of 1965.

Our industrial people have discussed this matter with Mr. Yoshino, and he suggested that we contact Gray & Osborne at Yakima who have prepared plans for handling wastes at several of the other communities in the Columbia Basin.

Mr. Stanton asked me to negotiate an agreement with this concern for a study of our problem and recommendations for the type of plant necessary to take care of the industrial wastes. I have done so, and Mr. Stanton has approved the $1,050 fee for this study. I have written Gray & Osborne under date of February 16, accepting this proposition, copy of which is attached.

We have also received a letter from Gray & Osborne that they will credit half of this fee toward the cost of the design if and when they are directed to proceed with detail plans and specifications. We have a written proposal from them which we may or may not accept in the future to complete final design, prepare plans and specifications on the method chosen by our office, including sending out plans and specifications to prospective bidders, conduct bid opening and present recommendations relative to awarding the contract at a fee of 6-1/2%. They also propose a fee of 4-1/2% for field supervision. We, of course, would not use their forces for field supervision and would propose re-negotiating the planning phase of the work as we will want to issue the proposals and take the bids.

DHS/jwm
attachment

D. H. SHOEMAKER

B/C Mr. J. E. Hoving

Seattle, Washington
February 16, 1965

Bruce

Mr. J. E. Hoving:

With reference to the retention of the consulting firm of Gray & Osborne at Yakima for a study of the handling of industrial wastes at Bruce:

In the fourth paragraph of Mr. Shoemaker's letter of February 12th, 1965 to you he suggests that Mr. Nixon and I meet with Mr. Gray to discuss the matter. As a matter of information, the proposal has been discussed on the telephone with Mr. Nixon and with Mr. Gray and Mr. Gray advises that he has all data at hand for preparation of the study but if anything further is needed to assist him in his study he will get in touch with us.

I informed him that the letter agreement would be forwarded to him in the next few days.

R. G. BROHAUGH

RGB/rt

District Engineer

cc: Mr. D. H. Shoemaker
Mr. M. H. Nixon

NORTHERN PACIFIC RAILWAY COMPANY

ENGINEERING DEPARTMENT

ST. PAUL 1, MINN.

February 16, 1965

D. H. SHOEMAKER
Chief Engineer

Gray & Osborne
Consulting Engineers
228 South 2nd Street
Yakima, Washington 98901

RE Engineering Report, Industrial Waste Treatment, Bruce, Washington

Gentlemen:

It is desired to employ your firm to prepare an engineering report in connection with industrial waste treatment for the Railway Company's industrial area at Bruce, Washington. It is requested that you investigate the problem and present an engineering report in various alternates of handling the existing and potential waste at Bruce, Washington. The report is to include construction cost estimates, estimated cost of operation and maintenance, together with your recommendations. It is understood that you will consult with the Washington State Health Department and the Washington State Pollution Control Commission and obtain their approvals on the recommendations presented, all to be completed within 30 days hereof.

The fee for the engineering report will be . . . . . $1,050.00. Fifty percent (50%) of the engineering report fee will be credited on the design fee, if and when you are directed by the Railway Company to proceed with the detailed plans and specifications.

This letter agreement is submitted in duplicate. If you are in accord with the above stipulated terms, will you please indicate your acceptance by placing your signature in the space provided below and return the original to me. The duplicate original is to be retained by you.

Yours very truly,

FOR NORTHERN PACIFIC RAILWAY COMPANY

By_____
D. H. Shoemaker, Chief Engineer

ACCEPTED:

GRAY & OSBORNE

bcc: D. H. Shoemaker (AIR MAIL) - w/att.
M. H. Nixon

By_____
Don E. Gray

NORTHERN PACIFIC RAILWAY COMPANY

ENGINEERING DEPARTMENT

ST. PAUL 1, MINN.

D. H. SHOEMAKER
Chief Engineer

February 16, 1965

Gray & Osborne
Consulting Engineers
228 South 2nd Street
Yakima, Washington 98901

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Gentlemen:

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The fee for the engineering report will be . . . . . $1,050.00. Fifty percent (50%) of the engineering report fee will be credited on the design fee, if and when you are directed by the Railway Company to proceed with the detailed plans and specifications.

This letter agreement is submitted in duplicate. If you are in accord with the above stipulated terms, will you please indicate your acceptance by placing your signature in the space provided below and return the original to me. The duplicate original is to be retained by you.

Yours very truly,

FOR NORTHERN PACIFIC RAILWAY COMPANY

By D. H. Shoemaker
D. H. Shoemaker, Chief Engineer

ACCEPTED:

GRAY & OSBORNE

By_____
Don E. Gray

St. Paul, February 12, 1965

11777

Mr. J. E. Hoving:

In reference to our discussion today about hiring Gray & Osborne, Consulting Engineers at Yakima, to furnish a feasibility study to handle industrial wastes at Bruce, Washington.

Mr. Stanton has approved the initial expenditure of $1050 for this study. Will you please handle with Gray & Osborne for the completion of the report and study, keeping Mr. Nixon advised.

For your information in preparation of letter, I hand you a copy of Gray & Osborne's letter of January 27 and Mr. Nixon's letter of the same date about the matter.

Gray & Osborne have been furnished maps of our Bruce property, and I suggest the first step in this proposal will be to have Mr. Brohaugh and Mr. Nixon meet with Mr. Gray to discuss the matter further.

As has been our past practice, I will sign the letter-agreement which should incorporate the language in Gray & Osborne's letter of January 27, the second and third paragraphs.

DHS/jwm
attachments

D. H. SHOEMAKER

cc: Mr. R. G. Brohaugh

11777

OFFICE OF
CHIEF ENGINEER

FEB 12 1965

NORTHERN PACIFIC RY. CO
ST. PAUL, MINN.

St. Paul, Minn., February 12, 1965

C.F. 24512

Mr. D. H. Shoemaker
Chief Engineer

Attached are copies of Mr. Nixon's letters of January 27 and January 29 to Mr. Powe together with copy of proposal dated January 27 from Gray & Osborne to perform an industrial waste treatment study pertaining to our property at Bruce.

Mr. Stanton has approved hiring Gray & Osborne to make the initial feasibility study for a fee of $1,050. As discussed with you in his office yesterday, will you please handle with Gray & Osborne for their completion of the study and report. I advised Mr. Nixon by telephone of approval of the expenditure, and he, in turn, was to discuss the matter briefly with Gray & Osborne. However, it is understood the study will be under the supervision of the Engineering Department as suggested by Mr. Stanton.

Manager, Industrial Development

RAJ md
Atts. (3)

cc - Mr. J. E. Hoving, Asst. Chf. Engr., Seattle)
Mr. R. G. Brohaugh, Dist. Engr., Seattle)

Attached for your information and file are copies of Mr. Nixon's letters of Jan. 27 and 29 and Gray & Osborne's proposal of Jan. 27.

R. A. J.

cc - Mr. M. H. Nixon, WMID, Seattle

Seattle, Washington
January 29, 1965

Mr. George R. Powe, General Manager
Properties & Industrial Development
St. Paul, Minnesota

Supplementing my letter of January 27 in regard to proposed vegetable dehydrating plant to be constructed by Yoshino brothers in the Columbia Basin, we are attaching copy of letter dated January 27, 1965, from Mr. Don Gray, of Gray & Osborne, quoting a fee of $1,050 for an engineering study in regard to various alternates of handling waste at Bruce.

Since the location of any processing plants on our property depend on waste disposal, it is my recommendation that we be authorized to employ Gray & Osborne to make this study for us.

Will you please advise if we may do so?

W. T. Nixon
Western Manager
Industrial Development

FRE:glb
attachment

O.K. to hire Gray & Osborne for $1050 for study only, but E.D.S. says to handle through Engr. Dept. 2/11/65

Serving Municipalities
Gray & Osborne Consulting Engineers • DON E. GRAY • F. T. OSBORNE
1946 Westlake North • Seattle, Washington 98109 • ATwater 4-0960
220 South 2nd Street • Yakima, Washington 98901 • VAncourt 3-4833

January 27, 1965

Mr. M. H. Nixon
Western Manager
Industrial Development
Northern Pacific Railway Co.
919 Smith Tower
Seattle, Washington 98104

COPY

Re: Engineering Fee, Industrial Waste Treatment, Bruce, Washington

Dear Mr. Nixon:

We are pleased to offer our engineering services in connection with industrial waste treatment for your industrial area at Bruce, Washington.

We will investigate the problem and present an engineering report in various alternates of handling the existing and potential waste at Bruce, Washington. The report to include construction cost estimates, estimated cost of operation and maintenance, and our recommendations. We will consult with the Washington State Health Department and the Washington State Pollution Control Commission and obtain their approvals on the recommendations presented.

The fee for the Engineering Report will be . . . . . $ 1,050.00
Fifty percent (50%) of the Engineering Report fee will be credited on the design fee if, and when, we are directed to proceed with the detail plans and specifications.

We will complete final design, prepare plans and specifications on the method chosen by your office, we will issue plans and specifications to prospective bidders, conduct the bid opening and present recommendations relative to awarding contract(s).

The fee for this phase of the work will be 6.5%
of contract(s) awarded, or Engineer's estimate if no contracts are awarded.

January 27, 1965

Mr. M. H. Nixon

Re: Engineering Fee, Industrial Waste Treatment, Bruce, Washington

Page two

We will supervise and inspect the construction and will have a qualified engineer on the project during all major construction. We will prepare monthly progress pay estimates for the contractor and will prepare the Excise Tax Division and Department of Labor & Industries reports relative to construction contracts. We will make final inspection and make recommendations as to acceptance of the work.

The fee for this phase will be . . . . . 4.5% of the amounts paid the contractor(s).

Yours very truly,

GRAY & OSBORNE

Don E. Gray

ACCEPTED BY:

NORTHERN PACIFIC RAILWAY COMPANY
this ____ day of _____, 1965

_____
Title

ATTEST:

_____
Title

DEG:er
in triplicate

Seattle, Washington
January 27, 1965

Mr. George R. Powe, General Manager
Properties & Industrial Development
St. Paul, Minnesota

For quite some time, Yoshino brothers have been proposing a vegetable dehydration plant for the Columbia Basin.

The planning of this plant has been handled by Mr. George Yoshino, who operates Yoshino Western, Inc. at Quincy, Washington. His planning has been mostly in a Quincy location. This matter was reported to Mr. Edgell in our letter of May 24, 1963, and since that time we have been keeping in very close contact with the Yosino brothers in regard to this proposed plant. When Yoshino determined that the Quincy Port could not do anything for them, we were able to get them to take a closer look at the Bruce area, and they have been giving our location considerable study. A few months ago, Yoshino employed Mr. Arthur Van Fleet, who was formerly plant manager of the dehydrating division at their El Centro, California plant.

Mr. George Yoshino feels that they will commence construction on this plant during the early spring of 1965, and are going to make their site location some time in early February. Although the Town of Quincy has told him that they will spend 3/4 of a million dollars to enlarge their sewer system to handle the waste, and the Great Northern has told them that they will provide financing for the buildings, he has not completely eliminated a location on the Northern Pacific property at Bruce. His two largest concerns on the Bruce location are adequate labor and sewage disposal. He has suggested that the Northern Pacific make a study of what can be done on a sewage disposal method at our location, and if we can come up with some workable plan, he will give serious consideration to locating on the Northern Pacific. He suggests that we contact Mr. Don Gray, of Gray & Osborne at Yakima, who is consulting engineer for most of the cities in the Basin area and is probably the most familiar with sewage disposal problems to see what they suggest. We have had a brief telephone conversation with Mr. Gray and have furnished him maps of our Bruce property, and will have a meeting with him soon to discuss the matter further. We will make a further report to you after our meeting with Mr. Gray.

For your information, we are attaching a prospectus on the dehydrating plant. Mr. Yoshino advises that the building plans have been enlarged since this prospectus was made and that the building cost is now up to an estimated $142,000. If it is decided that they will locate at Bruce, they will be asking for financial assistance from the Northern Pacific on the building construction.

Western Manager
Industrial Development

FRE:glb

12762

Northern Pacific Railway Company
WESTERN DIVISION

Seattle, Washington

Engineering Report
on
Waste Disposal
For
Proposed Potato Processing Plant
at
Bruce, Washington

March 1965

JOB NO. 65006

Gray & Osborne
CONSULTING ENGINEERS
Seattle - Yakima
Washington

ARTICLE NO. INDEX PAGE

FIGURE NO. PLATES PAGE

FORWARD

The Northern Pacific Railway Company, D. H. Shoemaker, Chief Engineer has commissioned this engineering firm to make a study of waste disposal requirements for a proposed potato processing operation at its Bruce, Washington industrial development site.

WASTE DISPOSAL FOR PROPOSED POTATO PROCESSING PLANT
at
BRUCE, WASHINGTON

1. STATEMENT OF PROBLEM: The construction of Grand Coulee Dam pumping plants and storage and distribution facilities of the Columbia Basin Project in Washington has brought many acres of previously arid and semi-arid land under the influence of irrigation. These United States Bureau of Reclamation constructed facilities have made possible the production of agricultural crops of a large variety where only some grains, dry-land hay and pasture once were the only crops. The high yields and quality of food crops grown in this area are bringing in related industries to prepare the products for the retail consumer market.

Due to the increasing affluence of our society, a demand has developed for foodstuffs in advanced stages of preparation. New industries have developed to fulfull this demand for products in a more nearly "table ready" condition.

At Bruce, Washington approximately five miles east of Othello, and nine miles south of Warden, in the heart of the Columbia Basin Project, (Fig. 1) there are already several industries which are intimately connected with the surrounding agricultural lands. These industries handle the food products in the fresh form and consequently there is very little waste emmission from the area. It is anticipated however, that a food processing plant will locate here with its accompanying large and relatively potent waste. Early indications point this industry out to be a dehydrating facility for the production of potato flakes and other vegetables, such as carrots, cabbage and asparagus, in the dehydrated form.

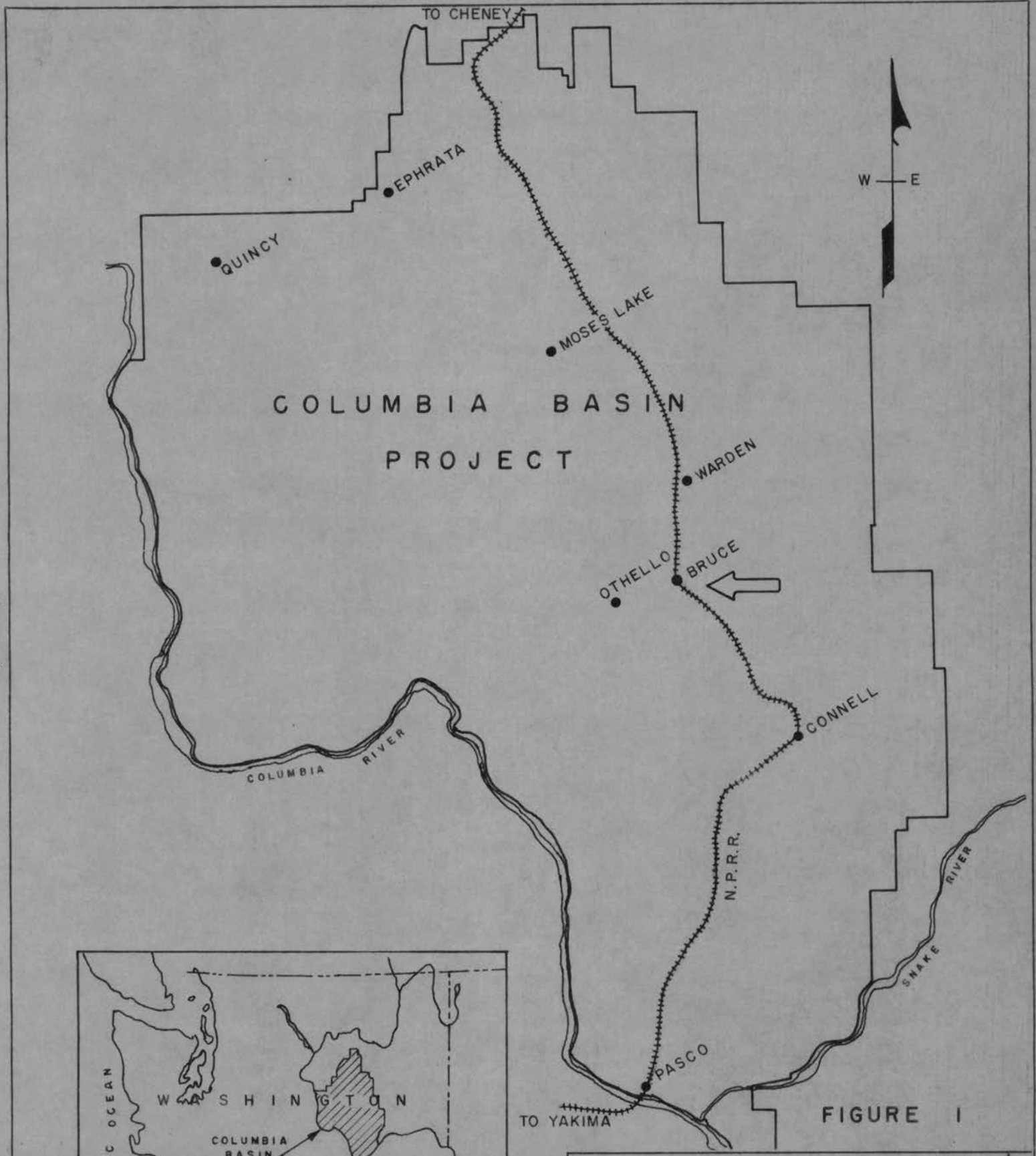

FIGURE 1

COLUMBIA BASIN PROJECT

POTATO WASTE DISPOSAL

BRUCE — WASHINGTON

DATE: MAR. 65	Gray + Osborne	SCALE:
DRAWN: JRA	CONSULTING ENGINEERS	SHEET
CHKD: LAE	SEATTLE & YAKIMA	OF
APPD:	WASHINGTON	

CN 807

2. INDUSTRY TO BE SERVED: The industry expected to locate on the industrial tract owned by the Northern Pacific Railway is a potato processing plant with possible vegetable products also. The plant is expected to concentrate primarily on potato processing however and it is for the waste from this activity that the waste handling facilities to be proposed will be designed. Since the size of this plant is also unestablished, a range of plant sizes will be assumed for consideration.

Assumed for the purpose of this report will be a potato flake plant to be located in the northern part of the industrial tract owned by the Northern Pacific Railway at Bruce (Fig. 2). The plant will be assumed as one capable of handling 100, 150 or 200 tons per day of raw potatoes during normal operation.

3. EXPECTED WASTE: The main considerations in wastes from any source are the effect they would have if allowed to enter the environment and the amount of treatment required to make them suitable for introduction to the environment if they are not already so. Two constituents of potato processing wastes that make it unfit to enter streams or water courses without prior treatment are a high biochemical oxygen demand and a high suspended solids content. Another objectionable waste characteristic is a high pH from the lye peel process.

All meaningful publication on waste contributors of this sort relate contribution of flow, biochemical oxygen demand(B.O.D.),and suspended solids on a quantity or weight per unit product or raw material basis. In the case of potato processing the waste loads are commonly expressed as gallons of waste flow, or pounds of B.O.D. or suspended solids, per ton of raw potatoes

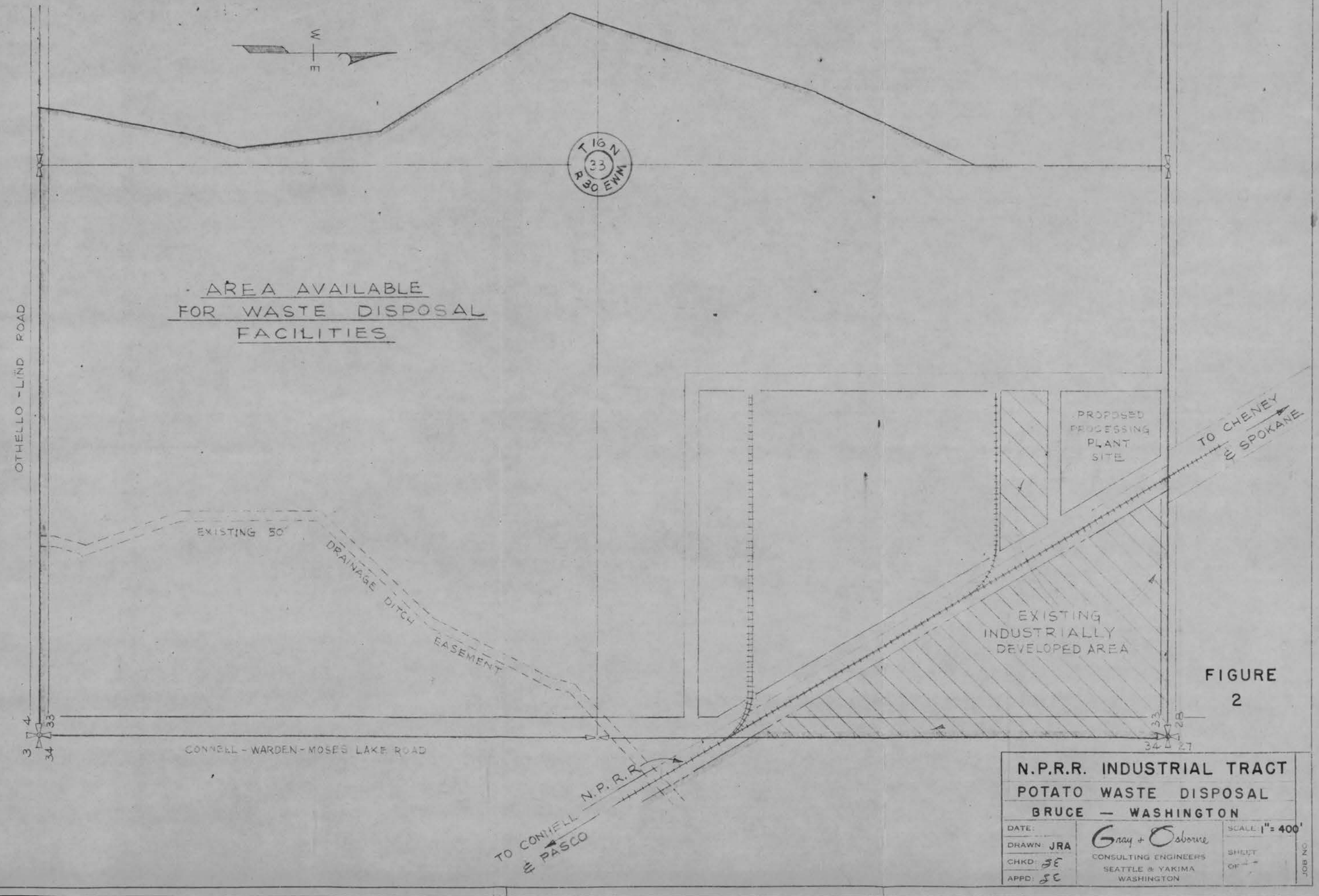

FIGURE
2

N.P.R.R. INDUSTRIAL TRACT		
POTATO WASTE DISPOSAL		
BRUCE — WASHINGTON		
DATE:	Gray & Osborne	SCALE: 1" = 400'
DRAWN: JRA	CONSULTING ENGINEERS	SHEET
CHKD: JE	SEATTLE & YAKIMA	OF
APPD: JE	WASHINGTON	JOB NO.

processed.

Literatature sources have given waste ranges for Potato Flake plants in other areas of the country. (1, 2, & 3.) (See Bibliography)

Based on this literature and other data available, the following waste characteristics were estimated for the proposed processing plant for Bruce, Washington:

Flow= 5000 gallons per ton of raw potatoes processed.

B.O.D.= 70 pounds per ton of raw potatoes processed.

Suspended Solids= 90 pounds per ton of raw potatoes processed.

For a flake plant of the three assumed sizes this would give wastes as follows:

100 Tons per day of raw potatoes processed

Flow = 500,000 gallons per day

B.O.D. = 7,000 pounds per day

Suspended Solids = 9,000 pounds per day

150 Tons per day of raw potatoes processed

Flow = 750,000 gallons per day

B.O.D. = 10,500 pounds per day

Suspended Solids = 13,500 pounds per day

200 Tons per day of raw potatoes processed

Flow = 1,000,000 gallons per day

B.O.D. = 14,000 pounds per day

Suspended Solids = 18,000 pounds per day

The waste strength would be 1680 milligrams per liter (mg/l) and 2160 mg/l for the B.O.D. and suspended solids respectively in the estimated waste for all three sizes. As can be seen this is a very strong waste. In addition

to the high B.O.D. and suspended solids contents to the waste may be highly alkaline (high pH) from lye wastes entering the system from peeler operations. Also the waste is traditionally low in the inorganic nutrients nitrogen and phosphorus. These elements are essential to the living organism and therefor must be added to the waste in proper amounts to assure proper biological action in a treatment process.

In the event that a potato processing plant locates here that processes to frozen products other than flakes, the waste will be slightly different from what is estimated above. The flow may be approximately the same but B.O.D. and suspended solids loadings would probably be slightly lower per ton of raw potatoes processed than for a flake plant.

4. WASTE REQUIREMENTS The Northern Pacific Railway siding of Bruce has waterways that are naturally intermittant but which likely maintain year -round flows due to the influence of the Columbia Basin Project irrigation waters. The flows will still be small however and provide only a small amount of dilution to any wastes that may enter them.

Wastes, if released to these drains, will have to be of a high quality to keep the streams from becoming public nuisances or health hazards. This would require nearly complete removal of B.O.D. and suspended solids from the potato processing waste before release, or else containment of all waste flows and not permitting any of it from reaching these surface waters. Release of these wastes after B.O.D. and suspended solids removal could be made without disinfection by chlorine if all human wastes were not permitted to enter the system. No health hazard would result since there would be no source of pathogenic organisms into the waste.

5. TREATMENT OPERATIONS AND PROCESSES The treatment facilities for the proposed plants waste must either remove the suspended solids and B.O.D. loads from the waste water before releasing it to the adjacent watercourse or prevent the waste from entering the watercourse. Four methods of obtaining these objectives will be proposed for the assumed waste loads. Each of the methods will consist of two stage treatment or handling of the wastewater.

A. Solids Removal:

The first stage of the treatment process will consist of removal of suspended (or insoluble) solids from the waste. This is essential since one-half of the total B.O.D. load can be removed from the waste by this step, as well as reduction of suspended solids to a level at which they will not seriously impair the further treatment process.

a. Silt Removal: The solids removal process would start with silt removal from potato or vegetable wash water. This would consist of passing the wash water through a sump or holding pond before permitting it to enter the main waste stream. This would remove dirt and silt, thereby preventing it from fouling subsequent processes. This sump or holding pond for wash water must contain a minimum of two hours liquid detention time if solids are to be stored therein or a maximum surface loading rate of 20,000 gallons per day per square foot for sumps with solids withdrawal provision. Since this facility is highly variable in construction but is fairly common among plants of this type, it will be assumed to be part of the processing stream and constructed in conjunction with the processing plant. An estimate of cost of this facility will not be here included.

b. Screening:

The removal of large solids through the use of a screening device is commonly employed in the treatment of food wastes. This is essential to remove articles that may cause plugging of sewer pipes, restriction of or damage to mechanical devices which may follow (including pumps) or that would impair subsequent treatment processes. The screen size recommended for potato waste is forty mesh per inch. The vibrating type screen is normally used to attain most efficient use of screen area. The screens are usually mounted on an elevated hopper which stores the screenings for later hauling by truck to an area where they are utilized as livestock feed. This elevated screen then necessitates pumping of the waste to the proper elevation. The pumping and screening facilities or just the pumping facilities may be built in conjunction with the processing plant.

c. Suspended Solids Removal:

Suspended solids not removed by screening are those referred to earlier and presented as pounds per day for each of the three sizes of processing plant. It has been established that about ninety percent of these solids and at the same time about fifty percent of the B.O.D. load can be removed through sedimentation. This sedimentation can take place in specially designed clarifier of concrete or steel with sludge removal mechanism on the bottom or simply in a lagoon where sludge is allowed to accumulate on the bottom.

Data acquired in pilot scale and full scale facilities in Idaho indicate that to achieve efficient solids removal the clarifier must be designed at an overflow velocity of 600 gallons per day per square foot or less. This design figure would give required clarifier sizes of 35 foot, 40 foot and 45 foot diameters for the 100,150 and 200 ton per day plants respectively.

This clarifier would be of adequate side water depth to allow for proper sludge handling. The solids removed from the waste in this operation are suitable for livestock feed. They come from the clarifier as a rather dilute sludge however (about 96 percent moisture) and hard to handle. The operation of vacuum filtration has been successfully applied to this sludge and effectively reduces the moisture content to about 84 to 89 percent leaving a fairly workable filter cake. Approximately two-thirds of the water in the sludge is removed in the operation. Approximate vacuum filter sizes required for the three previously assumed processing plant sizes would be four foot diameter by six foot long, six foot diameter by six foot long and six foot diameter by seven foot long for 100,150 and 200 tons per day respectively. It has been observed in previous installations of this type that the sludge filters satisfactorily without the addition of conditioning chemicals.

A sludge accumulation type solids removal lagoon would be designed at a volume to accommodate the solids of at least one operating season. Since these solids are very difficult to dewater after standing, the lagoon would be abandoned and additional space provided for waste handling the following season. Perhaps after several years of standing idle the sludge would attain a consistancy amenable to mechanical handling and the lagoon could be cleaned for reuse.

Assuming nine month per year operation of the 100,150 or 200 ton raw potatoes per day processing plant, the yearly volume required for sludge storage would be approximately twenty, thirty, or forty acre feet per year respectively at an assumed four percent solids sludge accumulation.

B. Secondary Waste Handling:

Handling of the waste following removal of the undissolved solids could follow several means. The processes proposed in this report are considered to be the most practical considering the location and nature of the waste. The processes, all involving lagooning, make use of the land available within the industrial tract, but may need additional land, should insufficient land presently exist in the tract.

Conventional mechanical waste treatment will not be proposed here since it is relatively more expensive than the proposed methods herein given. Irrigation with the waste will be ruled out because of the winter operating season of the proposed potato processing plant. Also, continued irrigation with this type of waste tends to render the ground impervious so the waste will eventually run off in a largely untreated condition and enter adjacent water courses.

a. Lagooning with Discharge:

Treatment by a series of lagoons to achieve a progressive B.O.D. decrease through each cell, and subsequent discharge to a watercourse appears to be a feasible method of disposal. To utilize this process the waste must have the solids removed in a clarifier. This is essential to cut the B.O.D. load by fifty percent. Solids removal by lagoon will not be acceptable since potato solids removed and stored in this manner tend to become quite acid and disolve into the supernatant giving a much higher, highly variable unpredictable B.O.D. load to the effluent. Treatment by a series of lagoons for subsequent release to a watercourse depends upon a predictable B.O.D. loading.

In addition to suspended solids removal by clarification, inorganic nutrients must be added to the waste to achieve proper biological action for

adequate B.O.D. removal. The nutrients nitrogen and phosphorus must exist in a certain ratio to the B.O.D. load being treated to get proper biological growth. Acceptable values of this ratio are considered to be one pound nitrogen for each twenty pounds of B.O.D. (1:20) and one pound phorsphorus for each one hundred pounds of B.O.D. (1:100). A Washington State University publication by Hindin and Dunstan (4) indicates these ratios are about 1:42 and 1:500 respectively in potato processing waste. At present prices approximately $4.40 would be required to provide the supplemental nutrients in commercial fertilizer form for one thousand pounds of B.O.D. in the clarified waste.

The proposed series of lagoons would consist of two anaerobic lagoons followed by two facultative (commonly called aerobic) lagoons in series. The waste, following clarification and nutrient addition would enter the first anaerobic lagoon with a residence time of about 10 days. This would give a lagoon loading of approximately 5.2 pounds per day per thousand cubic feet. Effluent from this lagoon would enter anaerobic lagoon number two after receiving a minimum of fifty percent B.O.D. removal. In a similarly sized lagoon (Residence Time = 10 days) the maximum loading would be about 2.6 pounds per day per thousand cubic feet. Assuming similar fifty percent removals from each of the two lagoons, their effluent to the following facultative lagoons would equal only one fourth of the entering B.O.D. load. These lagoons if designed and constructed to an adequate depth should create no odor problems since an active digestion process will take place which will emit carbon dioxide and methane gases, both odorless. Hydrogen sulfide gas emission should be virtually non-existant since the potato processing plant will not add sulfates to the low-sulfate water supply typically found in the Columbia Basin region.

The volume of these two lagoons would each be 15.4 acre feet for the 100 ton per day plant, 23 acre feet for the 150 ton per day plant and 31 acre feet for the 200 ton of raw potatoes processed per day plant.

The first facultative lagoon will be designed at 50 lbs.of B.O.D. per day per acre for the waste containing one=fourth its clarified B.O.D. load. This lagoon would contain sufficient depth (6 ft.) to maintain facultative action year -round. Areas required for the three sizes of plants waste would be 17.5 acres, 27 acres and 35 acres for this first facultative lagoon in series.

The second facultative lagoon in series would be designed on a basis of twenty pounds per day per acre for a waste containing only thirty per cent of the B.O.D. load entering the first facultative lagoon. Lagoon sizes would be 13 acres, 20 acres and 26 acres in this final cell for the 100, 150 and 200 ton per day processing plants respectively.

Disinfection of this effluent would be unnecessary since no wastes of human origin would be allowed to enter the disposal system.

b. Lagooning Without Discharge:

The construction of holding facilities or lagoons to contain all of the waste volume received is a widely used method of handling hard-to-treat wastes in a manner to prevent their pollution of surface waters in the area. As is implied, these lagoons are constructed to consist of an adequate area to permit evaporation and ground percolation consumption of the entire waste flow. A serious drawback to this method is the much larger areas required to handle the large waste flows from an industry such as potato processing.

Annual net evaporation rates (annual evaporation minus annual precipitation) in the Columbia Basin have averaged slightly over forty inches per year or

0.11 inches per day over the last sixteen years (1948 through 1963). This figure will be applied in the design of these non-overflow lagoons.

Percolation from lagoons is variable from one area to another and hard to predict under prolonged lagoon bottom conditions. The percolation rate decreases with time under continuous loading due to soil chemical changes. The added biological action as would prevail in a lagoon bottom might tend to cut the percolation rate even further. In a lagoon of this type it is essential to remove the solids from the waste since the starchy and voluminous solids found in potato processing wastewater would surely seal a lagoon bottom almost entirely in a short period of time, thus preventing any further percolation.

Allowable percolation rate from a lagoon in the State of Washington is one-fourth inch per day over the lagoon area. This figure and the known net evaporation rate for the area will be used as design parameters for this proposed potato processing waste. However the design of these lagoona will be based on the maximum flows that have been reported for this type of plant to provide a small safety factor. If the percolation rate on this site should be less than assumed after prolonged lagooning, additional area may be needed over what will be proposed.

The maximum reported flows for this type plant would give estimates of of 700,000 gallons per day from the 100 ton per day plant, 1,050,000 gallons per day from the 150 ton per day plant and 1,400,000 gallons per day from the 200 tons of raw potatoes processed per day plant

The total lagoon area required for these three size plants would be 72 acres, 108 acres and 144 acres. These lagoons at six feet deep would provide volume for about 200 days flow at the assumed maximum or 280 days flow at the previously estimated flows.

c. Aeration and Lagooning With Discharge:

Aeration of potato processing wastes has been attempted previously, but with inconclusive or poor results (5 & 6). However, based on the preliminary results of a pilot activated sludge plant operated on potato processing waste in Prosser, Washington, an aerated basin without sludge return appears feasible if properly designed. This design would be on the basis of activated sludge principles, taking into account the relatively low mixed liquor suspended solids concentration and high sludge wasting rate. The following facultative lagoon would be designed to accept the volatile suspended matter wasted from the aerated basin plus the dissolved B.O.D. remaining in the supernatant. The first facultative lagoon would be designed at fifty pounds per day of dissolved B.O.D. plus volatile suspended matter per acre. The second and final facultative lagoon would be designed on the basis of twenty pounds per day of B.O.D. per acre assuming that thirty percent of the B.O.D. and volatile suspended matter entering the first facultative lagoon is discharged into the second as B.O.D.

Here, as in the case of the series of anaerobic and facultative lagoons, suspended solids removal must be through clarification to get predictable B.O.D. loadings. Also nutrient chemical addition must precede this treatment to obtain satisfactory biological action. Once again, no disinfection of the effluent from this facility would be required since human wastes would be excluded.

To eliminate fluctuations in waste flow and characteristics that might damage an active aerobic culture such as would exist in the aerated basin, there would be provided a holding lagoon of two days detention time ahead of such a facility. This would level out pH and other fluctuations as well as providing a short anaerobic pre-conditioning treatment.

Aeration of this proposed basin would be provided by surface type aerators mounted on platforms supported by columns from the basin bottom. The aerator sizes are dictated by mixing requirements rather than oxygen transfer capacity due to the size of the basin involved.

Volume of the aeration basin for the three assumed sizes of potato processing plants would be respectively for the 100,150 or 200 ton size, 340,000 cubic feet, 460,000 cubic feet or 670,000 cubic feet. This would be preceded by 3.1, 4.6, or 6.1 acre foot holding lagoon. Aeration basin effluent B.O.D. would be only slightly over 30 milligrams per liter (mg/l) however the volatile suspended matter concentration would be about 260 mg/l. This would give a load of the combined constituents to the first facultative lagoon of 290 mg/l or1200 pounds per day, 1800 pounds per day or 2400 pounds per day depending on processing plant size (100,150 or 200 tons per day). Required facultative lagoon area would be 24, 36 or 48 acres for the three plant sizes assumed. Surface area of the second facultative lagoon would be 18, 27 or 36 acres.

Assuming 80 percent B.O.D. removal in the final facultative cell, the effluent strength of this treatment process will be approximately 17 mg/l of B.O.D.

6. PROPOSED TREATMENT FACILITIES: Four combinations of the above discussed suspended solids removal operations and secondary treatment processes will be proposed as facilities for handling the waste to be emitted from the proposed potato processing plant at Bruce, Washington. It is here pre-supposed that the wash water silt removal and waste screening operations will be performed, regardless of which following facility is utilized. The cost of these two operations will

not be included in the estimates presented, but acceptance of the waste at an elevated location as it would be from a vibrating screen is assumed, thereby, eliminating need for subsequent lift pumps and pumping station. Cost of land acquisition or land usage is not included in any of the following estimates.

A. Clarification and Lagooning with Discharge:

Treatment of the waste by primary removal of suspended solids, followed by inorganic nutrient addition prior to passage through the series of lagoons and effluent to a drainage ditch. The proposed layout for this installation is shown on Fig. 3.

Total estimated cost for this treatment facility for the three sizes of potato processing plants is:

100 ton/day	$162,000
150 ton/day	$174,000
200 ton/day	$194,000

Operation and maintenance costs are estimated to be:

100 ton/day	$970.00 /month
150 ton/day	$1135.00 / month
200 ton/day	$1275.00 /month

B. Clarification and Lagooning without Discharge:

Primary suspended solids removal followed by waste disposal via non-overflow lagoons is illustrated on Fig. 4. Estimated cost of this installation would be as follows:

100 ton/day	$194,000
150 ton/day	$218,000
200 ton/day	242,000

LEGEND

PROPOSED CONSTRUCTION

100 TON OF RAW POTATOES

150 TON OF RAW POTATOES

200 TON OF RAW POTATOES

ANAEROBIC CELL #2

ANAEROBIC CELL #1

OVERFLOW

CLARIFIER

VACUUME FILTER STATION

PROPOSED PROCESSING PLANT SITE

NORTHERN PACIFIC RAILWAY

FACULTATIVE LAGOON CELLS 1&2

EXISTING 50'

DRAINAGE DITCH

RELOCATE R.O.W.

EASEMENT

EXISTING INDUSTRIALLY DEVELOPED AREA

OTHELLO - LIND ROAD

CONNELL - WARDEN - MOSES LAKE ROAD

FIGURE 3

CLARIFICATION & LAGOON WITH DISCHARGE

POTATO WASTE DISPOSAL

BRUCE — WASHINGTON

DATE:

DRAWN: PSC

CHKD: SE

APPD: SE

Gray + Osborne

CONSULTING ENGINEERS

SEATTLE & YAKIMA

WASHINGTON

SCALE: 1" = 400'

SHEET

OF

JOB NO.

PROPOSED CONSTRUCTION

LEGEND:

- 100 TON OF RAW POTATOES
- 150 TON OF RAW POTATOES
- 200 TON OF RAW POTATOES

N
W E
S

NON - OVERFLOW LAGOON CELL #4

NON - OVERFLOW LAGOON CELL #3

NON - OVERFLOW LAGOON CELL #2

NON - OVERFLOW LAGOON CELL #1

VACUUM FILTRATION

CLARIFIER

PROPOSED PROCESSING PLANT SITE

NORTHERN PACIFIC RAILWAY

OTHELLO - LIND ROAD

EXISTING 50'

EMERGENCY OVERFLOW

RELOCATED R.O.W.

DRAINAGE DITCH EASEMENT

EXISTING INDUSTRIALLY DEVELOPED AREA

CONNELL - WARDEN - MOSES LAKE ROAD

3 4 33 34 33 28 34 27

SEC. 33 T16 N. R 30 E.W.M.

CLARIFICATION AND LAGOONS WITHOUT DISCHARGE

FIGURE 4

POTATO WASTE DISPOSAL
BRUCE — WASHINGTON

DATE:	Gray + Osborne	SCALE: 1" = 400'
DRAWN: JRA	CONSULTING ENGINEERS	SHEET
CHKD: S E	SEATTLE & YAKIMA	OF
APPD: S E	WASHINGTON	JOB NO.

LEGEND

PROPOSED CONSTRUCTION

- 100 TON OF RAW POTATOES
- 150 TON OF RAW POTATOES
- 200 TON OF RAW POTATOES

N

FACULATIVE LAGOONS

AERATION BASIN

ANAEROBIC HOLDING LAGOON

VACUUME FILTRATION

CLARIFIER

PROPOSED PROCESSING PLANT SITE

NORTHERN PACIFIC RAILWAY

EXISTING INDUSTRIALLY DEVELOPED AREA

OTHELLO - LIND ROAD

EXISTING 50'

OVERFLOW

DRAINAGE DITCH EASEMENT

CONNELL - WARDEN - MOSES LAKE ROAD

3 4 33 34

33 28 34 27

FIGURE 5

CLARIFICATION, AERATION & LAGOONING WITH DISCHARGE

POTATO WASTE DISPOSAL
BRUCE — WASHINGTON

DATE:
DRAWN: PSC
CHKD: SE
APPD: SE

Gray + Osborne
CONSULTING ENGINEERS
SEATTLE & YAKIMA
WASHINGTON

SCALE: 1" = 400'
SHEET
OF
JOB NO.

LEGEND

PROPOSED CONSTRUCTION

100 TON OF RAW POTATOES

150 TON OF RAW POTATOES

200 TON OF RAW POTATOES

N

W E

S

NON-OVERFLOW LAGOON CELL #2

NON-OVERFLOW LAGOON CELL #1

FUTURE SOLIDS ACCUMULATION AREA AVAILABLE FOR APPROX. TEN YEARS EXPANSION.

SOLIDS ACCUMULATION LAGOON

PROPOSED PROCESSING PLANT SITE

OTHELLO - LIND ROAD

EXISTING 50' DRAINAGE DITCH EASEMENT

RELOCATED R.O.W.

EMERGENCY OVERFLOW

NORTHERN PACIFIC RAILWAY

EXISTING INDUSTRIALLY DEVELOPED AREA

CONNELL - WARDEN - MOSES LAKE ROAD

3 4 33 34

33 28 34 27

FIGURE 6

NOTE: NON-OVERFLOW LAGOON AREA SHOWN IS SUFFICIENT FOR 100 TON PER DAY LOADING.
THE ADDITION OF A THIRD CELL, OF THE SAME SIZE AS CELL #1, WOULD BE REQUIRED FOR 150 TON PER DAY LOADING AND A FOURTH CELL FOR A 200 TON PER DAY LOADING.

SOLIDS REMOVAL LAGOONS & LAGOONS WITHOUT DISCHARE

POTATO WASTE DISPOSAL
BRUCE — WASHINGTON

DATE:	Graw + Osborne	SCALE: 1" = 400'
DRAWN: PSC	CONSULTING ENGINEERS	SHEET
CHKD: SE	SEATTLE & YAKIMA	OF
APPD: SE	WASHINGTON	JOB NO.

Cost of operation and maintenance of this installation is estimated to be:

100 ton/day	$750 /month
150 ton/day	$785 /month
200 ton/day	$815 /month

C. Clarification, Aeration and Lagooning With Discharge:

Primary suspended solids removal followed by nutrient addition, aeration and overflow lagoons would be layed out approximately as shown on Fig 5. The estimated cost for this installation would be:

100 ton/day	$220,000
150 ton/day	$276,000
200 ton/day	$316,000

Operation and maintenance costs for this facility would be about as follows:

100 ton/day	$1180 /month
150 ton/day	$1440 /month
200 ton/day	$1670 /month

D. Solids Removal Lagoon and Lagooning without Discharge:

Removal of suspended solids by lagoon with sludge allowed to accumulate untilremoval of the lagoon from service and abandonment followed by non-overflow lagooning is depicted on Fig. 6. Initial solids removal lagoon size will be adequate for one seasons use, after which a new lagoon must be constructed. This annual construction is figured as part of the operation and maintenance costs and spread over a hypothetical nine month operating season. Initial cost of this installation would be as follows:

100 ton/day	$128,000.00
150 ton/day	$146,000.00
200 ton/day	$162,000.00

As can be seen from Fig. 6, this installation would require additional land that is not figured in the estimate. There appears to be land of a suitable nature for expansion of these facilities to the south of the land considered This however would require further investigation as to price and feasibiltiy

Estimated cost of operation and maintenance of this facility would be as follows:

100 ton/day	$1560.00 /month
150 ton/day	$1860.00 /month
200 ton/day	$2050.00 /month

7. OTHER FOOD PROCESSING WASTES: Since a food processing plant other than potato processing might conceivably locate in this industrial tract. Design criteria would have to be altered but the costs as estimated would probably not be altered materially for wastes of comparable volume and strength. The waste from some vegetable processing plants such as pea canneries may have higher soluble B.O.D. contents so the reduction by settling could not be obtained that was herein assumed. For this type waste, expansion of secondary or lagooning facilities may be necessary in overflow type alternatives.

Although it has not been considered in the treatment or economic analysis, the liquid, non-human wastes, with silt and large solids removed, from the existing industries on the industrial site could be introduced into any of the proposed facilities. Little additional cost other than waste transport would be involved due to the low water usage of these industries, but their inclusion must be accounted for in final design to prevent the overload of facilities.

8. SUMMARY AND RECOMMENDATIONS: Comparison of the various alternatives is very difficult financially due to the different initial and operation and maintenance costs. Therefore for reason of comparison the annual operation and maintenance cost (nine month operating season assumed) as given in the previous section was added to the ammortized initial project cost, at a hypothetical six percent interest rate. This total annual cost has been computed for ten and twenty year periods and is in table I.

These figures are plotted on Fig. 7 & 8. As can be seen from these figures the clarification and lagooning with discharge is the most economical alternative considered.

From analysis of the cost and characteristics of the facility, it is recommended that the proposed "Clarification and Lagooning with Discharge" alternative be accepted. In addition to being the most advantageous from an economic standpoint as presented herein, this alternative would require the least amount of area for construction, leaving a larger portion of the industrial site for future development or expansion of waste treatment facilities.

ANNUAL COST OF TREATMENT FACILITIES AMORTIZED OVER 10 YEARS AT 6 % PLUS ANNUAL OPERATION & MAINTENANCE COST VS. SIZE OF PROCESSING PLANT

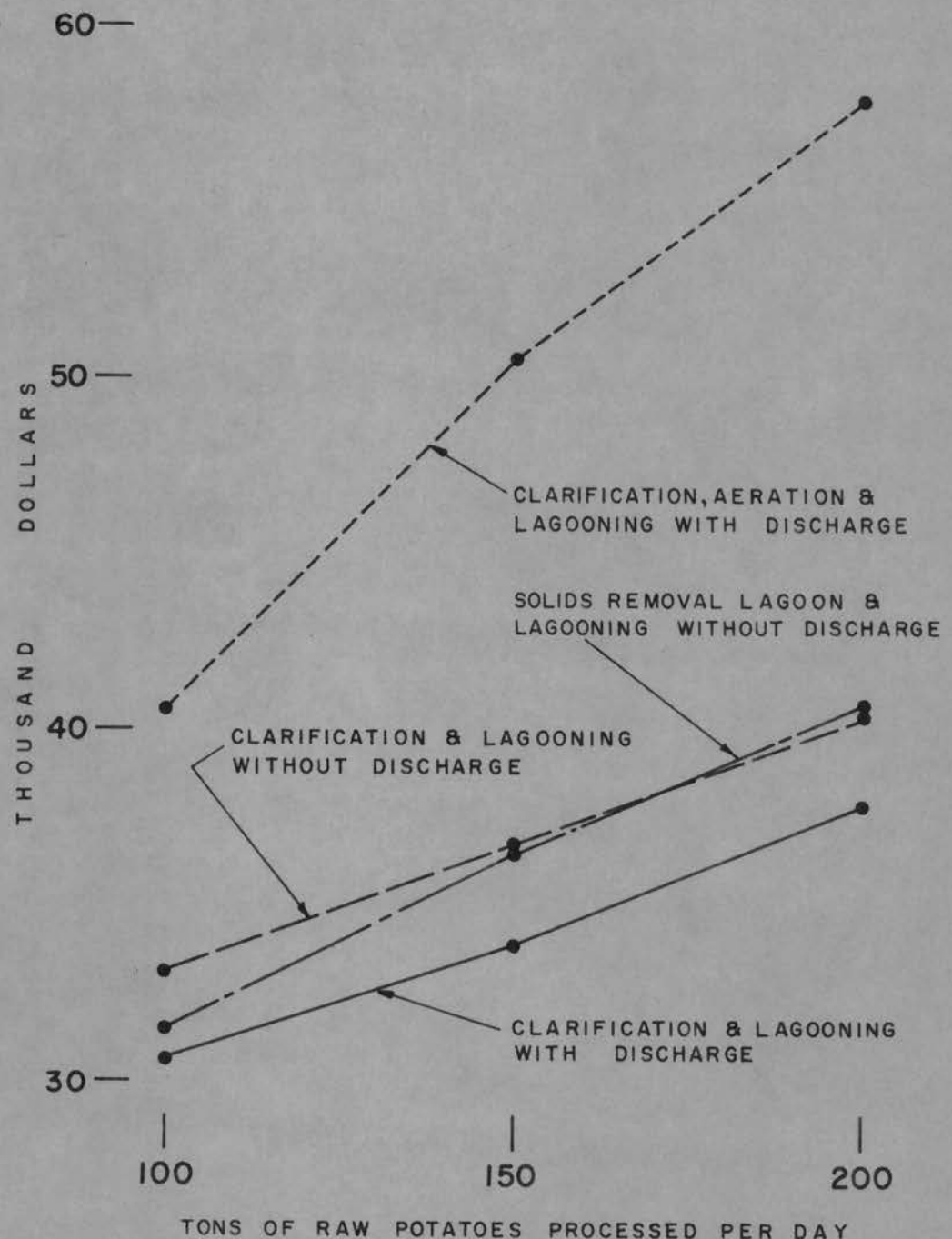

FIGURE 7

POTATO WASTE DISPOSAL BRUCE, WASHINGTON		
DATE: 3-12-65 DRAWN: PSC. CHKD: LAE. APPD: PSC	Gray + Osborne CONSULTING ENGINEERS SEATTLE & YAKIMA WASHINGTON	SCALE: NONE SHEET OF JOB NO.

ANNUAL COST OF TREATMENT FACILITIES AMORTIZED OVER 20 YEARS AT 6 % PLUS ANNUAL OPERATION & MAINTENANCE COST VS. SIZE OF PROCESSING PLANT

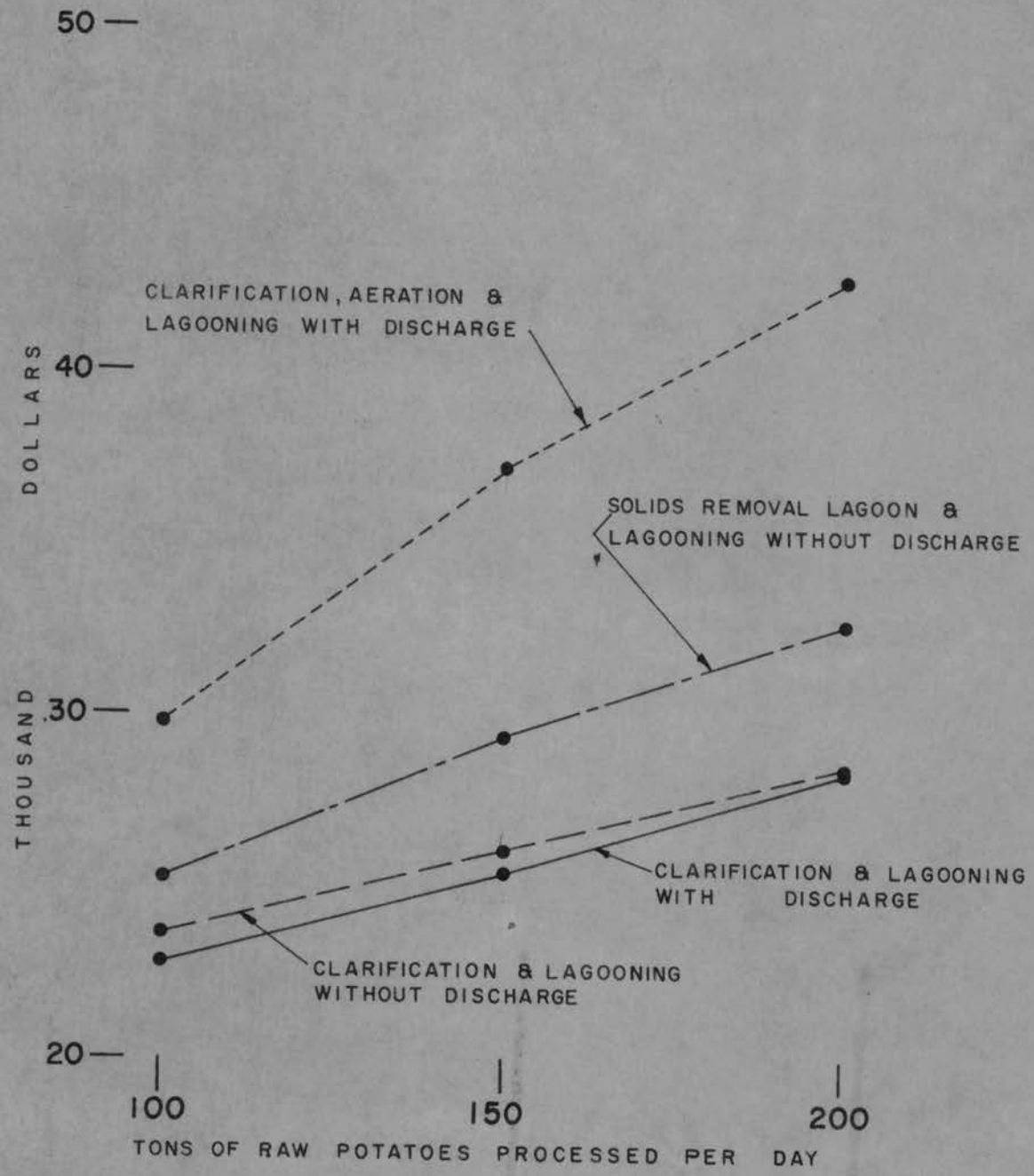

FIGURE 8

POTATO WASTE DISPOSAL		
BRUCE, WASHINGTON		
DATE: 3-12-65	Gray + Osborne	SCALE: NONE
DRAWN: PSC.	CONSULTING ENGINEERS	SHEET
CHKD: L.A.E.	SEATTLE & YAKIMA	OF
APPD: DEG	WASHINGTON	JOB NO.

TABLE I

Potato Processing Plant Capacity Tons/day	Annual O & M* Cost At 9 Mo/Yr Operation	Initial Cost	Annual Cost Over 10 yrs at 6%	Total Annual Cost	Annual Cost Over 20 yrs at 6%	Total Annual Cost
CLARIFICATION AND LAGOONING WITH DISCHARGE						
100	$8,700	$162,000	$22,000	$30,700	$14,100	$22,800
150	10,200	174,000	23,600	33,800	15,200	25,400
200	11,500	194,000	26,300	37,800	16,900	28,400
CLARIFICATION AND LAGOONING WITHOUT DISCHARGE						
100	6,800	194,000	26,300	33,100	16,900	23,700
150	7,100	218,000	29,600	36,700	19,000	26,100
200	7,400	242,000	32,900	40,300	21,100	28,500
CLARIFICATION, AERATION AND LAGOONING WITH DISCHARGE						
100	10,600	220,000	29,900	40,500	19,200	29,800
150	13,000	276,000	37,500	50,500	24,100	37,100
200	15,000	316,000	42,900	57,900	27,600	42,600
SLUDGE ACCUMULATION LAGOON AND LAGOONING WITHOUT DISCHARGE						
100	14,100	128,000	17,400	31,500	11,200	25,300
150	16,700	146,000	19,800	36,500	12,700	29,400
200	18,500	162,000	22,000	40,500	14,100	32,600

* Operation and Maintenance

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