THESIS

PASADENA'S SEWAGE DISPOSAL BY THE ACTIVATED SLUDGE PROCESS

vs.

PROPOSED COUNTY OUTFALL TO THE OCEAN

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Pasadena, California

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GENERAL SUMMARY OF SEWAGE DISPOSAL IN LOS ANGELES AND ORANGE COUNTIES.

From careful studies which have been made of the topography of the City of Los Angeles adn the vicinity it has been found that the natural flow by gravity to the ocean is divided into two sections by an imaginary line, starting at about the boundary between Pasadena and Eagle Rock and extending in a southwesternly direction to a point just east of Vernon. Thence it runs southwestward to a point near El Segundo..All of the territory to the north and west of this line naturally drains to the western coast; and all the territory to the east and south drains to the southern coast with the exception of the beach cities between El Segundo and San Pedro. This fact alone eliminates from consideration any possibility of pasadena at any time finding an outlet to the ocean thru the great outfall sewer of Los Angeles, as Glendale has done.

Glendale has purchased a certain capacity of the Los Angeles outfall by building and paying for about ten miles of the trunk sewer which joins the San Fernando valley with the Los Angeles outfall. Vernon and Culver City also have contracts with the City of Los Angeles for the disposal of their sewage.

Burbank has just completed an internal sewer system discharging into an Imhoff tank disposal plant, located on a 40 acre sewer farm. The excess effluent is ultimately disposed of thru the L.A. outfall.

Santa Ana, Anaheim, Fullerton, Orange, Placentia, Garden Grove and La Habra have built a joint outfall sewer to the ocean under a mutual contract agreement.

Pasadena, South Pasadena, Alhambra and San Marino have built an Activated Sludge disposal plant on the Pasadena city farm, under a mutual contract agreement. The purified effluent is used on the city farm or discharged into the Rio Hondo. The sludge is for the most part disposed of as fertilizer on the city farm.

Monrovia has an internal sewer system discharging onto a 50 acre sewer farm equipt with a Cameron tank. Monrovia is now planning a more modern sewage disposal plant in conjunction with Arcadia and Sierra Madre. The city engineer Mr. Gerlic stated that they were not considering the County sewer plan very seriously because they feel that the expense would be out of the question at the present time.

Whittier has an internal sewer system discharging onto a 100 acre farm which is equipped with an Imhoff tank and sprinkling filter. The farm has an outlet to Coyote Creek. The board of directors of Whittier have adopted a resolution to take initial proceedings toward forming a County Sanitation District for the purpose of joining the County outfall sewer to the ocean.

Covina, Azuza, Glendora have no sewer system at present and have no definite plans for the future.

Pomona, Claremont and La Verne are now constructing an internal system which will discharge into a tri-city farm to the southwest of Pomona. A modified activated sludge plant, known as the Elrod System will be installed under a mutual contract agreement. The sludge will be used as a fertilizer and the effluent for irrigation.

Long Beach has an internal system discharging into the ocean at Alamitos Bay. The ocean currents, however, are such that it is

desirable to discontinue to discharge at that point and the City Council has passed a resolution in favor of disposing thru the proposed County Outfall Sewer to the ocean.

Long Beach and Signal Hill are in County Sanitation District #3 Practically all the territory in Los Angeles County to the south and east of the City of Los Angeles, with the exception of a few cities as mentioned above have no sewers at present and depend entirely on cess pools and septic tanks which may become a menace to the health of the country as it becomes more thickly set-tled. It is to relieve this situation that the County has proposed the joint outfall under the new act of the State Legislature, known as Chapter 250 of Bill 191, adopted May 29, 1923. This is an act authorizing the creation, government and maintenance of county sanitation districts, the issuance of bonds by such districts and the powers thereof.


MAP
SHOWING SEWAGE DISPOSAL
IN L.A. AND ORANGE COUNTIES
Temporary Outfall
North Outfall
Central Outfall
Hyperion
Tunnel
Orange County Outfall
Watts
Montebello
LOS ANGELES
SAN RAFAEL
SANTA ANITA
Pasadena
Glendale
Burbank
AZUSA
LA PUENTE
SAN JOSE
CUCAMONGA
Pomona
Ontario
SANTA ANA DEL CHINO
Whittier
LA HABRA
SANTA GERTRUDIS
Downey
Norwalk
SAN JUAN CAJON DE SANTA ANA
Fullerton
Anaheim
CANYON DE SANTA ANA
Corona
LA SIERRA
LOS COYOTES
LOS CERRITOS
LOS ALAMITOS
Long Beach
SAN PEDRO BAY
San Pedro
Point Fermin
LOS PALOS VERDES
Redondo
Inglewood
Santa Monica
LA BALLONA
Port Ballona
Wilmington
Westminster
LA BOLSA CHICA
LAS BOLSAS
SANTA ANA
Tustin
Orange
LOMAS DE SANTIAGO
SANTIAGO DE SANTA ANA
Newport Beach
SAN JOAQUIN
TRABUCO
CLEVELAND
PACIFIC OCEAN

A TRI-CITY OUTFALL.

The natural drainage of the three cities is down the Rio Hondo to the Los Angeles River, thence thru the Dominguez Ranch to the Long Beach Harbor. The San Gabriel River flows thru level land north of El Monte and while it sometimes flows down the Rio Hondo into the Long Beach Harbor, it usually flows thru another channel near Whittier and out thru Alimitos Bay.

The ocean shore between San Pedro and Alimitos Bay is well built up for the entire distance, and any attempt to establish an outfall sewer site and treatment plant along this stretch would be vigorously contested by the cities and property owners in this section.

The city of Los Angeles owns a strip a mile in length along the coast at their outfall site. Yet with this added protection the State Board of Health is constantly receiving complaints from the adjacent cities. There are two possible locations for an outfall--- one, at a point on the rock bound coast of the San Pedro Hills where there is no possibility of there ever being any bathing beaches. The ocean currents are such that they will tend to take the screened sewage outward into the ocean. The other location is east o f Alamitos Bay, and therefore in Orange County. To turn raw sewage or even screened sewage into the ocean at any point on the coast in this vicinity is nearly out of the question, unless it were taken as far as the mouth of the Santa Ana River. The Orange County outfall empties into the ocean at this point. An outfall of such length should be designed for a future of at least fifty(50) years and from a close study of past growth and an estimate as to probable future growth, a population of at least 300,000 may be expected to be served by such a sewer.

At present the population of the three cities--Pasadena, South Pasadena, and Alhambra, is close to II0,000 persons. Figuring I00 gal.per capita daily as a maximum and safe figure, the quantity to be carried by such a sewer at present and 50 years hence would be as follows:

Present Capacity Required

Having II0,000 population at I00 gal.per day per capita would be equal to II,000.000 gal per day. Figuring an I8 hour period in which this volume would be discharged(the remaining 6 hours of the 24 having negligible flow), this would equal a flow of 22.7 second feet, or with 50 miners inches to the sec. ft., I,I38 miners inches.

Future Capacity Required

In I955 having a population of 300,000 and I00 gal.per capita per day, there would be 30,000,000 gal per day. This is equal to 62 sec, ft, or 3,I00 miners inches.

Estimates of size for future population of 300,000

Grade	Size of Pipe	Vel.of Flow	Linear Feet of Pipe
.67%	45"	7.5'	29,040
.25%	54"	5.4'	39,600
.22%	54"	5.0'	34,320
.07%	66"	3.3'	34,320
			I37,280

The above table is based on the possibility of finding a suitable location, someplace in the neighborhood of Alamitos Bay.

It is impossible to give an accurate of the cost of an outfall to the sea, without extensive field work, but from the available maps an approxomate estimate can be made and approximate conclusions can be drawn.

Suppose it were possible to obtain a site suitable for a treatment plant in the vicinity of Alamitos Bay.The distance from the s southern boundary of Alhambra is approximately 26 miles.Such an outfall would be expensive to construct as well as to maintain, for it would be necessary to cross two very erratic rivers,which seemingly change their course at will sometimes flowing in one channel and sometimes in another. The country in the vicinity of A Alamitos Bay and for three or four miles inland is marshy and therefore level. Ground water would probably be encountered which would increase construction costs,and the flatness of the country for such distances would add difficulties in the way of proper gradients.

Conditions along the line of outfall

First 5.5 miles,drop in ft. I96---------gradient .67%

2nd. 7.5 " " " " I00 " .25%

3rd. 6.5 " " " " 75 " .22%

4th. 6.5 " " " " 25 " .07%

On Oct.23,I924 the City of Glendale received the following bids per ft.for their new I0 mile outfall to connect with the outfall of the City of Los Angeles.

Lowest Prices	45"semi-eliptical)	48" (s.e)	54"(s.e)
Laying and Material	$ I0.22	$ II.25	$I3.00
Excavating & Backfilling up to I5 ft.	7.86	7.86	7.86
Total up to I5 ft.	$ I8.08	$ I9.II	$20.86
Highest Prices			
Laying &Mat.	$ I6.00	$ I8.00	$20.00
Excavating & Backfilling 20-25 ft.deep	I4.I5	I4.I5	I4.I5
Total	$ 30.I5	$ 32.I5	$34.I5

Assuming costs of $ 15.00 to $ 20.00 per ft .for the pipe installed and a length of 26 miles or 137,280 ft. the following rough estimates were obtained.

	Pipe Cost Installed	
	$ 15.00/ft.	$ 20.00/ft.
137,280 ft. of pipe	$ 2,060,000	$ 2,750,000
Ocean Outfall	400,000	400,000
Screening Plant	70,000	70,000
Right of way 50 acres @ $8,000	400,000	400,000
	2,930,000	3,620,000
10% Engineering Costs	290,000	360,000
	$ 3,220,000	3,980,000
25% Contingencies	800,000	1,000,000
TOTAL ESTIMATED COST	$ 4,020,000	$ 4,980,000

The 25% for contingencies is to allow for the crossing of the two streams and a possible long inverted Cast Iron siphon(to insure permanent construction). This also takes into account the encountering of heavy soils and ground water near the ocean shore.

The trouble with this plan is that the cost is prohibitive. It would be out of the question for them to spend as much as this.

FUNDAMENTALS UPON WHICH ESTIMATES ARE BASED

MAXIMUM FLOW OF SEWAGE FOR DESIGNING COUNTY SEWER

80 gallons per capita daily.

AVERAGE FLOW OF SEWAGE FOR DESIGNING DISPOSAL PLANT

55 gallons per capita daily.

COST OF COUNTY SEWER

Used County Surveyors estimate.

COST OF ADDITIONS TO SEWAGE DISPOSAL PLANT

$ 60,000 per additional million gallons.

OPERATING COST OF ACTIVATED SLUDGE PLANT

Without drying sludge--$ 14.00/mil.gal.

Incinerating the sludge-$ 30.00/mil.gal.

ESTIMATED SALE VALUE OF FARM

$ 1,500,000

ESTIMATED TAXES ON CITY FARM

Shown in table of taxes.

BONDS

County Sewer Bonds--40 year--5.5%

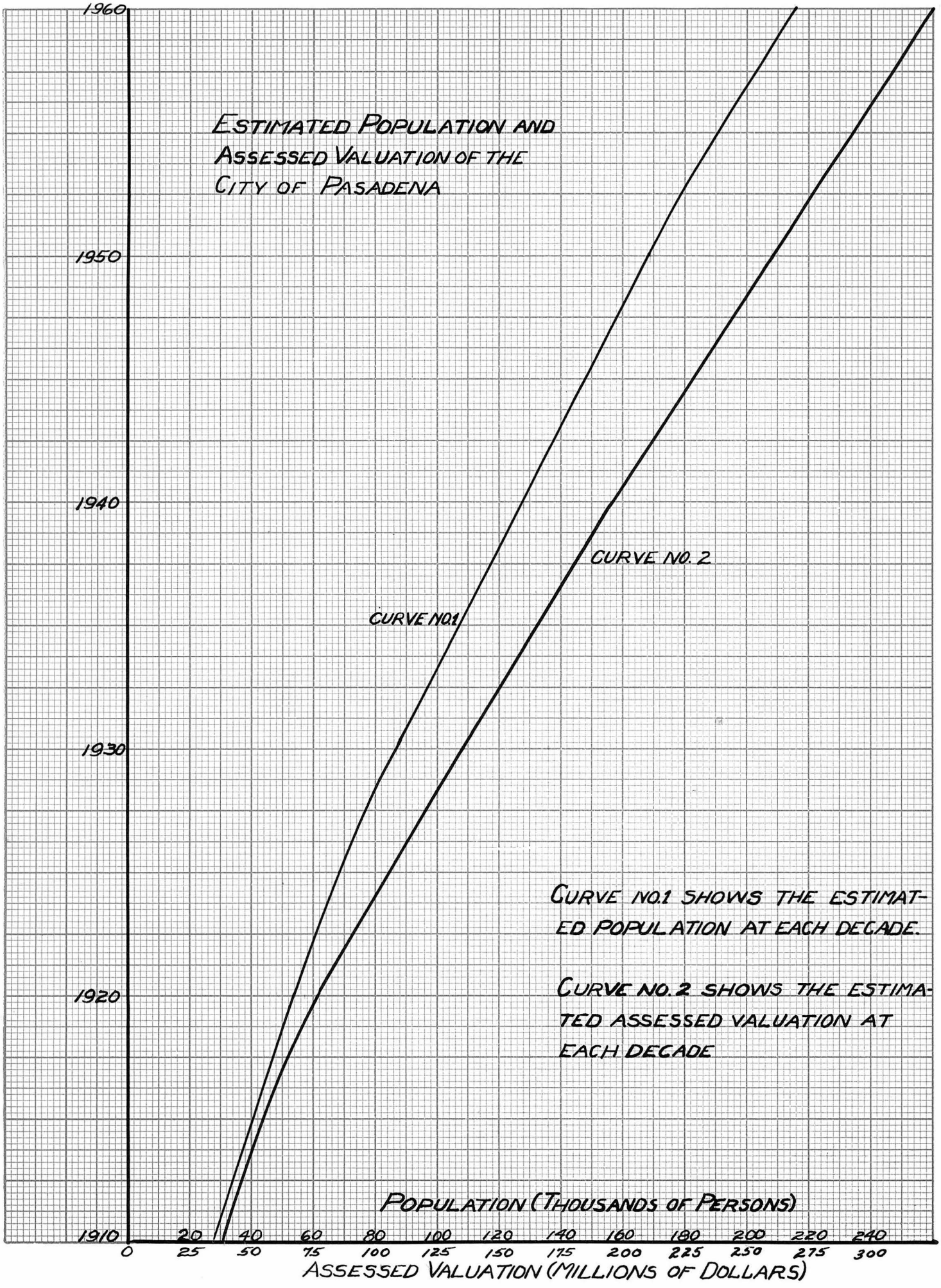
City Sewage Disposal Bonds--20 year--5%

BASIS OF DIVISION OF COST OF OPERATING PLANT

Pasadena--60%

Alhambra--29%

South Pasadena--11%



THE ACTIVATED SLUDGE PLANT

Operation Costs:

Without drying the sludge---$I4.00 per million gallons.

Incineratimg the sludge-----$30.00 " " "

Average flow of sewage------ 55 gallons per day, per capita.

Year	Pop. of Pas.	Mil. gal. per day	Per Year.	I4	Operation Cost
I9I0	28,000	I.54	562.0	"	$7860.0
I920	54,000	2.97	I085.0	"	I5200.0
I930	88,000	4.84	I768.0	"	24780.0
I940	I28,000	7.04	2570.0	"	36000.0
I950	I78,000	9.35	3420.0	"	47900.0
I960	2I5,000	II.85	4320.0	"	60600.0

Taxes

The present taxes and the estimated taxes are shown on the table that follows.(See the next page)

Additions to the present plant

If the City of Pasadena should decide to continue with the present activated sludge plant then in a few years (about I930) they will have to make additions in order to take care of the increased population.

The present proposed County Outfall will ,it is estimated, reach its capacity in I944. Then a new sewer will be built.

The City of Pasadena could therefore continue with their present plant until I944 and then plan to join with that outfall. Or they can,if they deem it best, plan to continue indefinitely the activated sludge plant.

The estimated cost for both of these plans has been calculated and is shown on the graph which follows.

CALCULATIONS FOR ESTIMATED TAXES ON CITY FARM

Year	Estimated Population of City of Alhambra	Increase over Year 1924	Assessed Valuation of Alhambra 1924	Increase in Assessed Valuation Over 1924	Estimated Assessed Valuation Alhambra	Per Cent of 1924 Assessed Valuation	Total Taxes on City Farm 1924	Estimated Total Taxes on City Farm
1924	21,000		$ 24,000,000		$ 24,000,000		$ 13,000	$ 13,000
				4,000,000				
1929	29,000	8,000			28,000,000	117%		15,000
				8,000,000				
1934	37,000	16,000			32,000,000	133%		17,000
				13,000,000				
1939	47,000	26,000			37,000,000	154%		20,000
				18,000,000				
1944	57,000	36,000			42,000,000	175%		23,000
				23,500,000				
1949	68,000	47,000			47,000,000	198%		26,000
				29,000,000				
1954	79,000	58,000			53,000,000	220%		29,000
				34,500,000				
1959	90,000	69,000			58,500,000	224%		32,000
				40,000,000				
1964	101,000	80,000			64,000,000	268%		35,000

Note:- Actual Assessed Valuation of Alhambra in 1924 = $23,090,075

Assumed $500,000 increase in assessed valuation per 1000 increase in population.

A very conservative estimate of the maximum average capacity of the present activated sludge plant 8,000,000 gallons per day, Pasadena is entitled to 60% Of this or 4,800,000 gal.per day. On a basis of 55 gal,per capita per day this capacity will be sufficient to last until the population is 87,000 persons. This population will be reached in 1930. Thus at the end of 1929 or the beginning of 1930 it will be necessary to have ready for operation an additional unit to the present plant.

The additions will be made in increments sufficient to last for an estimated period of ten years. At the end of this ten year period the addition will not be obsolete and it will be still serviceable for some time. The bonds therefore will be twenty (20) year bonds. These bonds will be retired in the 20 years being paid off in 20 equal annual payments.

I have computed tabulated and plotted a graph of the estimated cost of these additions.

The estimated population of Pasadena at the various years was taken from the curves of population,

The computations are based on an estimated average flow of sew sewage of 55 gal.per capita per day.

The cost of additions was taken as $60,000 per million gallons added.

COSTS

The Present Bond Issue

Im I924 there was $ 392,000 due on the present bond issue This is to be paid off in I9 equal annual installments. The bonds pay an interest of 4.5%.

Year	Amount Due	Interest	Reduction plus Interest
I924	$ 392,000	$ I7,620	$ 38,252
I925	37I,368	I6,700	37,332
I926	350,736	I5,800	36,432
I927	330,I04	I4,850	35,482
I928	309,472	I3,900	34,532
I929	288,840	I3,000	33,632
I930	268,208	I2,I00	32,732
I93I	247,576	II,I00	3I,732
I932	226,944	I0,200	30,832
I933	206,3I2	9,280	29,9I2
I934	I85,680	8,350	28,982
I935	I65,048	7,420	28,052
I936	I44,4I6	6,500	27,I32
I937	I23,784	5,570	26,202
I938	I03,I52	4,640	25,272
I939	82,520	3,720	24,352
I940	6[illegible],880	2,780	23,4I2
I94I	4I,25 6	I,860	22,492
I942	20,420	920	2I,522
I943	-------	-----	------

COSTS OF THE ACTIVATED SLUDGE PLANT

There are three plans for additions to the activated sludge plant which I have investigated. They are shown on the graph of costs.

Plan No.I.

This plan calls for additions of ten years, the addition to be paid for by twenty (20) year bonds. The additions start in I930 the work of construction being started in I929 and the first payment being made at the end of I929. Plan no.I is shown in black on the curve. The main objection to this plan is that it does not distribute the costs evenly over the period.

Plan No.2.

This plan is very similar to plan no.I except that it calls for an initial expenditure to cover thirteen years. The corresponding bond issue is for twenty years. After the first thirteen year issue the issues are for ten years. The object of this is to give a more uniform cost over the period of operation. If at the end of the life of this improvement, which will be in I943 it is decided that the best policy will be to join the next County Outfall then small additions can be made to carry until the outfall.is ready. This would mean, however that the city would be paying for the addition for seven years after it is obsolete.

Plan No.3

This plan anticipates that Pasadena will join with the next outfall in I944. Thus the addition is until then and the bonds are only for these fourteen years.

PLAN NO.I.

Additions

Population I940-population I930= increase to be provided for.

I28,000 - 87,000 4I,000

4I,000 times 55 gives the gal per day to be provided for, this is 2,260,000 gal/day.

2.26 times $ 60,000 gives the total cost of the addition, this is $ I35,000. This is to be paid off in 20 equal, annual indrements.

The increase in population between I940 and I950 is the same as the increase between I930 and I940 so that the following table holds good for both additons.

Year		Amt. Due	Interest 5%	Reduction plus Interest
I929	I939	$ I35,000	$ 6,750	$ I3,500
I930	I940	I28,250	6,400	I3,I50
I93I	I94I	I2I,500	6,050	I2,800
I932	I942	II4,750	5,700	I2,450
I933	I943	I08,000	5,400	I2,I50
I934	I944	I0I,250	5,050	II,800
I935	I945	94,500	4,720	II,470
I936	I946	87,750	4,380	II,I30
I937	I947	8I,000	4,050	I0,800
I938	I948	74,250	3,7I0	I0,460
I939	I949	67,500	3,380	I0,I30
I940	I950	60,750	3,035	9,785
I94I	I95I	54,000	2,700	9,450
I942	I952	47,250	2,350	9,I00
I943	I953	40,500	2,020	8,770
I944	I954	33,750	I,685	8,435
I945	I955	27,000	I,350	8,I00
I946	I956	20,250	I,0I0	7,760
I947	I957	I3,500	675	7,425
I948	I958	6,750	337	7,087

PLAN NO.I(cont)

Additions

Population I960- population I950= increase to be provided for.

215.000 I69,000 46,000

46,000 times 55 gives 2,520.000 gal/day.

2.52times $ 60.000 gives $ I52,000

Year	Amt.Due	Interest 5%	Reduction plus Interest
I949	$ I52,000	$ 7,600	$ I5,200
I950	I44,400	7,200	I4,800
I95I	I36,000	6,840	I4,440
I952	I29,200	6,450	I4,050
I953	I2I,600	6,090	I3,690
I954	II4,000	5,700	I3,300
I955	I06,$00	5,320	I2,920
I956	98,800	4,930	I2,520
I957	9I,200	4,650	I2,I60
I958	83,600	4,I80	II,780
I959	76,000	3,800	II,400
I960	68,400	3,400	II·000
I96I	60,800	3,040	I0,640
I962	53,200	2,660	I0,260
I963	45,600	2,280	9,880
I964	38,000	I,900	9,500
I965	30,400	I,520	9,I20
I966	22,800	I,I40	8,740
I967	I5,200	760	8,360
I968	7,600	380	7,980
I969	------	---	-----

PLAN NO.2

Population I943---I40,000

Population I930--- 87,000

Difference ------- 53,000

Cost of addition---$ I75,000

Year	Amt Due	Interest 5%	Reduction plus Interest
I929	$ I75,000	$ 8,750	$ I7,500
I930	I66,250	8,320	I7,070
I93I	I57,500	7,880	I6,630
I932	I48,750	7,440	I6,I90
I933	I40,000	7,000	I5,750
I934	I3I,250	6,550	I5,300
I935	I22,500	6,I20	I4,870
I936	II3,750	5,660	I4,400
I937	I05,000	5,250	I4,000
I938	96,250	4,8I0	I3,560
I939	87,500	4,370	I3,I20
I940	78,750	3,940	I2,690
I94I	70,000	3,500	I2,250
I942	6I,250	3,060	II,8I0
I943	52,500	2,620	II,370
I944	43,750	2,200	I0,950
I945	35,000	I,750	I0,500
I946	26,250	I,3I0	I0,060
I947	I7,500	875	9,625
I948	8,750	437	9,I80

PLAN NO.2 (cont)

Population-1953---183,000

Population 1943---140,000

Difference-------- 43,000

Cost of addition---$ 142,000

Year	Amt. Due	Interest 5%	Reduction plus Interest
1942	$ 142,000	$ 7,100	$ 14,200
1943	134,000	6,740	13,840
1944	127,000	6,440	13,540
1945	120,700	6,030	13,130
1946	113,000	5,660	12,760
1947	106,500	5,320	12,420
1948	99,400	4,970	12,070
1948	92,300	4,600	11,700
1950	85,200	4,250	11,250
1951	78,000	3,900	11,000
1952	71,000	3,550	10,650
1953	63,900	3,200	10,300
1954	56,800	2,840	9,940
1955	49,700	2,490	9,590
1956	42,600	2,150	9,250
1957	35,500	1,770	8,870
1958	28,400	1,420	8,520
1959	21,300	1,065	8,165
1960	14,200	710	7,810
1961	7,100	355	7,455

PLAN NO.3

Additions untill I944

If at present it should be decided that the best policy to follow would be to make additions which would last untill I944 then the costs would be somewhat as shown by the following table. In this I have assumed that it would be possible to make additions in I930 which would just be sufficient to last until I944. Then in I944 Pasadena would join with the next County Outfall. As the plant would not be used after this time I have figured the bonds to be retired at that time. By doing it this way the people of Pasadena will not be paying for the plant after they have quit using it.
The estimated population of Pasadena in I944 is I44,000
The present population is (from the graph) 67,000.
Thus an increase of 77,000 persons must be provided for.
77,000 times 55= 4,235,000 gal/day.
4,235 times $ 60,000= $254,000

Assuming that the sewer was completed and ready for use in I930, then the bonds would have to be sold and the work carried on in I929.

The $254,000 will be paid off in I4 equal annual installments.

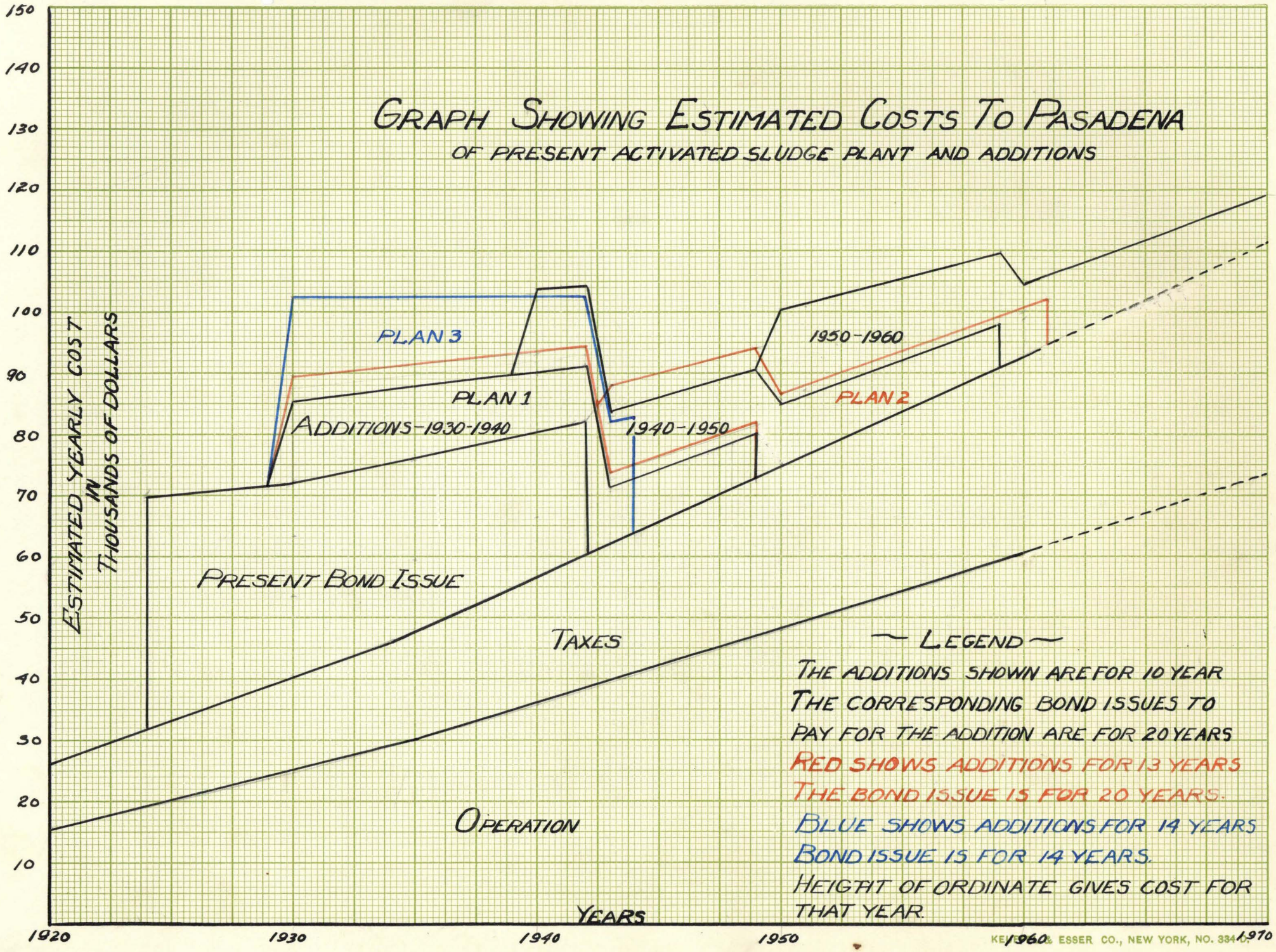
PLAN NO.3 (cont)

Years	Amt.Due	Interest 5%	Reduction plus Interesty
I930	$ 254,000	$ I2,700	$ 30,850
I93I	253,850	II,750	29,900
I932	217,700	I0,850	29,000
I933	I99,550	9,770	27,920
I934	I8I,400	9,070	27,220
I935	I63,250	8,I60	26,3I0
I936	I45,I00	7,260	25,4I0
I937	I26,950	6,350	24,500
I938	I08,800	5,430	23,580
I939	90,650	4,540	22,690
I940	72,500	3,630	2I,780
I94I	54,350	2,720	20,870
I942	36,200	I,8I0	I9,960
I943	I8,050	903	I9,052

It is very unlikely that this plan would be used ,first because of the uncertainty and secondly because it would be rather expensive due to the short term of the bonds. Nevertheless it is a possibility and will be considered.

GRAPH SHOWING ESTIMATED COSTS TO PASADENA

OF PRESENT ACTIVATED SLUDGE PLANT AND ADDITIONS



CHARGES AGAINST AND PROFIT ON THE ACTIVATED SLUDGE PLANT

The farm on which the activated sludge plant is located is the property of the City of Pasadena. All of the profit derived from the plant would go to Pasadena. I have two estimates of the value of the farm and a fair figure seems to be $ 1,200,000 If the farm were sold it is reasonable to suppose that the money received from the sale could be put out on interest. A fair rate of interest is 6%. Therefore I have figured this lost interest as a charge against the plant. In other words if the City of Pasadena did join the County Outfall Sewer to the ocean then they could sell the farm and receive an interest on the money which they would receive.

The farm at present is not making a profit. It is entirely possible that when the plant has been in operation for a while they will be able to pay a profit. I have received an estimate of the probable profit and will give it in the following table.

Classification	Acres	Est. yearly profit per acre.	Total Profit
Oranges	75	$ 100	$ 7,500
Beans	295	150	44,200
Roads and Bldgs.	25		
Eucalyptus	15		
Grain Land	25		
Walnuts	60		
	495		
Sewage Disposal	40		
Total Acres	535		$ 51,700

RESUME OF COSTS OF ACTIVATED SLUDGE PLANT AND ADDITIONS

Year	Assessed Valuation	Plan No.I Total Cost	6% Interest on $ I,5 mil	Final Total	Cost per $ I00
I925	$ I05 mil	$ 70,000	$ 90,000	$ I60,000	$ .I5
I930	I35 "	85,000	"	I75,000	.I3
I935	I65 "	88,000	"	I78,000	.II
I940	I96 "	I04,000	"	I94,000	.I0
I945	227 "	86,000	"	I76,000	.077
I950	260 "	I00,000	"	I90,000	.073
I955	296 "	I05,000	"	I95,000	.066
I960	325 "	,05,000	"	I95,999	.060

Year	Assessed Valuation	Plan No.2 Total Cost	6% Interest on Farm	Final Total	Cost per $ I00
I925	$ I05 mil	$ 70,000	$ 90,000	$ I60,000	$ .I5
I930	I35 "	90,000	"	I80,000	.I32
I935	I65 "	92,000	"	I82,000	.II
I940	I96 "	94,000	"	I84,000	.094
I945	227 "	90,000	"	I80,000	.080
I950	260 "	87,000	"	I77,000	.068
I955	296 "	94,000	"	I84,000	.062
I960	325 "	I00,000	"	I90,000	.059

Year	Assessed Valuation	Plan No.3 Total Cost	6% Interest on Farm	Final Total	Cost per $ I00
I925	$ I05 mil	$ 70,000	$ 90,000	$ I60,000	$ .I50
I930	I35 "	I02,000	"	I92,000	.I42
I935	I65 "	I03,000	"	I93,000	.II7
I940	I96 "	I03,000	"	I93,000	.099
I943	215 "	83,000	"	I73,000	.080

TTT

COMPARISON OF COSTS: INCINERATING THE SLUDGE AND THEREBY MAKING THE FARM UNNECESSARY

Operation Costs

Incinerating the sludge---$ 30.00 per million gallons

Year	Millions Gal/Yr.	Cost/mil.gal	Operating Cost
1910	562.0	$ 30.00	$ 16,850.0
1920	1085.0	"	32,600.0
1930	1768.0	"	53,000.0
1940	2570.0	"	77,000.0
1950	3420.0	"	103,000.0
1960	4320.0	"	130,000.0

Taxes

The taxes would be greatly reduced by doing away with the farm and retaining only that which is taken by the plant proper.

Taxes in 1924---$ 975

Taxes in 1964--- 2,620

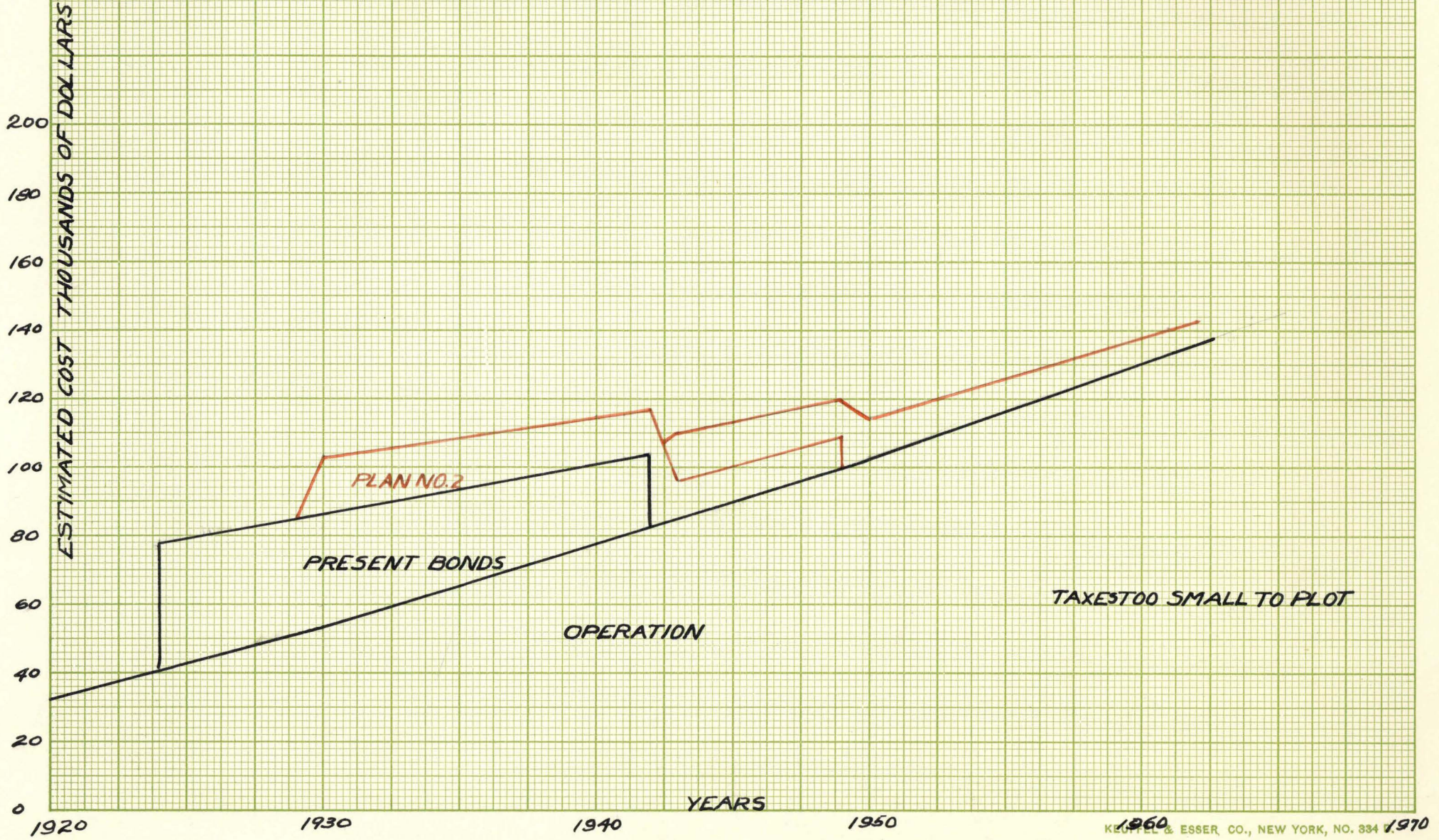
Additions

The additions will be made according to Plan No.2.

Year	Assessed Valuation	Incinerating the Sludge	Cost per $ 100
1925	$ 105 mil	$ 78,000	$ .075
1930	135 "	103,000	.076
1935	165 "	108,000	.066
1940	196 "	115,000	.059
1945	227 "	113,000	.050
1950	260 "	114,000	.044
1955	296 "	126,000	.043
1960	325 "	138,000	.043

GRAPH SHOWING ESTIMATED COST TO PASADENA

OF ADDITION TO ACTIVATED SLUDGE PLANT UNDER PLAN NO. 2 BUT INCINERATING THE SLUDGE THUS DOING AWAY WITH THE FARM.



THE METROPOLITAN OUTFALL SEWER TO THE OCEAN

The Los Angeles County Sanitation District was formed under the County Sanitation Act which passed the State Legislature in May 1923 The said act provides that,"Said district as created may include either unincorporated territory or both incorporated and unincorporated territory. The incorporated territory included in any such sanitation district may include the whole or part of one or more incorporated cities;porvided however,that less than the whole of any incorporated city shall not be included in such district except by the unanimous consent of the governing body of such city;provided,further,that such district formed shall not include the whole or part of any other district formed for similar purpose."

"The resolution calling the election shall be published once a week for three successive weeks in such newspaper having general circulation in the district as the board of directors may designate No other notice need be given."

"If at such election two thirds of the votes cast are in favor of incurring the bonded indebtedness as proposed,then bonds of the district for the amount stated in the resolution calling the election shall be sold."

For any further information with regard to this bill see Assembly Bill No.191.

The Sanitation District was formed for the purpose of collecting and disposing of the sewage from its entire area. The area taken in is shown on the following map.

The plan is to collect all the sewage,originating within the District,by means of trunk lines constructed to all centers of population.These trunk sewers carry the sewage to the OutfallSewer at the southerly boundary of the district.It is a part of the plan

to join the County Sanitation District No.2 with the County Sanitation Districts Nos.I,3 and 5.Also to this will undoubtedly be added Whittier and possibly a Pasadena District. These districts will then all cooperate in the construction of a common outfall to the ocean,for the disposal of all the sewage originatigg with in the district.

Sanitation District No.I includes all the territory between the shoe string strip of the City of Los Angeles and the Los Angeles River,from the City of Vernon to the City of Long Beach.

Sanitation District No.2 includes the territory extending from the San Gabriel River on the East to the Los Angeles River and the City of Los Angeles on the West,and form the southerly boundary of the City of Alhambra on the North to and including the community of Hynes and Bellflower on the South.

Sanitation District No.3 includes all of Long Beach,Signal Hill and Virginia City.

Sanitation District No.5 includes all the territory west of the shoe string strip of the City of Los Angeles,east of the west coast beach cities and includes Inglewood on the North to the ocean on the south.

The Whittier District,includes Whittier and the surrounding vicinity.This is sometimes referred to as District No.6.

The Pasadena District includes the City of Pasadena and the surrounding vicinity. If Pasadena does not join with the present outfall,then a district will probably be formed in this vicinity which leaves out the City Of Pasadena.

The beach cities, Redondo, Hermosa, and Manhattan are not included in this plan because they have already voted bonds and propose to join the Los Angeles City outfall.

The most adaptable place in Los Angeles County has been selected for ocean disposal. It is located on the rock bound coast of the San Pedro hills where there is no possibility of there ever being any bathing beaches. The ocean currents are such that they will tent to carry the screened sewage outward into the ocean. As the sewage mixes with the waters of the ocean, it becomes very much diluted and the free oxygen in the water will gradually change all organic matter and bacteria to stable matter and will eliminate any possible chance of polution (so says the County).

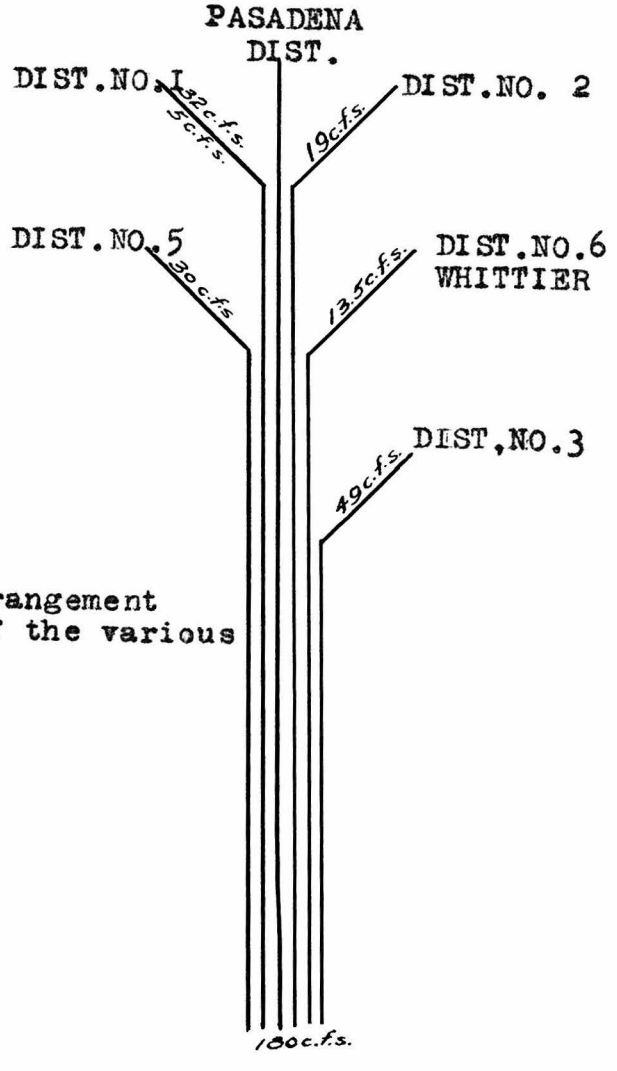
It is proposed to pass all the sewage thru fine screens, to take out all the solid matter before final disposal.

This plan of sewage disposal will eliminate all local disposal within the districts and it is estimated that it will be more economical.

It is estimated that the system will be completed and ready for operation in two years, from the date that the bonds are voted.

There is only one plan which need interest Pasadena and that is Plan No.I. This plan is the one which includes Pasadena and Whittier. Pasadena is especially lucky in that she would not have to construct any internal trunk lines, everything would join on at the present activated sludge plant.

SHOWING THE PROPOSED PLAN NO.I WHICH INCLUDES PASADENA CITY.



This shows the arrangement and the discharge of the various districts.

TO THE OCEAN

The following is the estimated cost of Plan No.I to the various districts.

Plan No.I

District.	Estimated cost of outfall
I	$ I,216,000
2	I,291,000
3	I,371,500
5	636,000
Pasadena	2,630,000
Whittier(6)	I,066,000
Total	$ 8,021,000

The estimated cost of operation is very low,most of it is for screening and it increases as the flow of sewage increases.

Cost of Operation

I926	$ 7,000	This is assumed to be a straight line in-
I964	9,500	crease.

Total cost of outfall to Pasadena District is $ 2,630,000

Assessed valuation of the entire Pasadena District $ I46,I67,000

Assessed valuation of the City of Pasadena $ 68,788,555

$\frac{68,788,555}{I46,I67,885} \times 2,630,000 =$ $ I,250,000 This the estimated cost to the property owners of the City of Pasadena to participate in the Proposed County Outfall. The money is to be raised by voting a bond issue. These bonds will be paid off in forty(40) equal annual payments. These bonds will bear an interest rate of 5.5% on the unpaid remainder.

The next sheet shows the costs at the end of every five years.

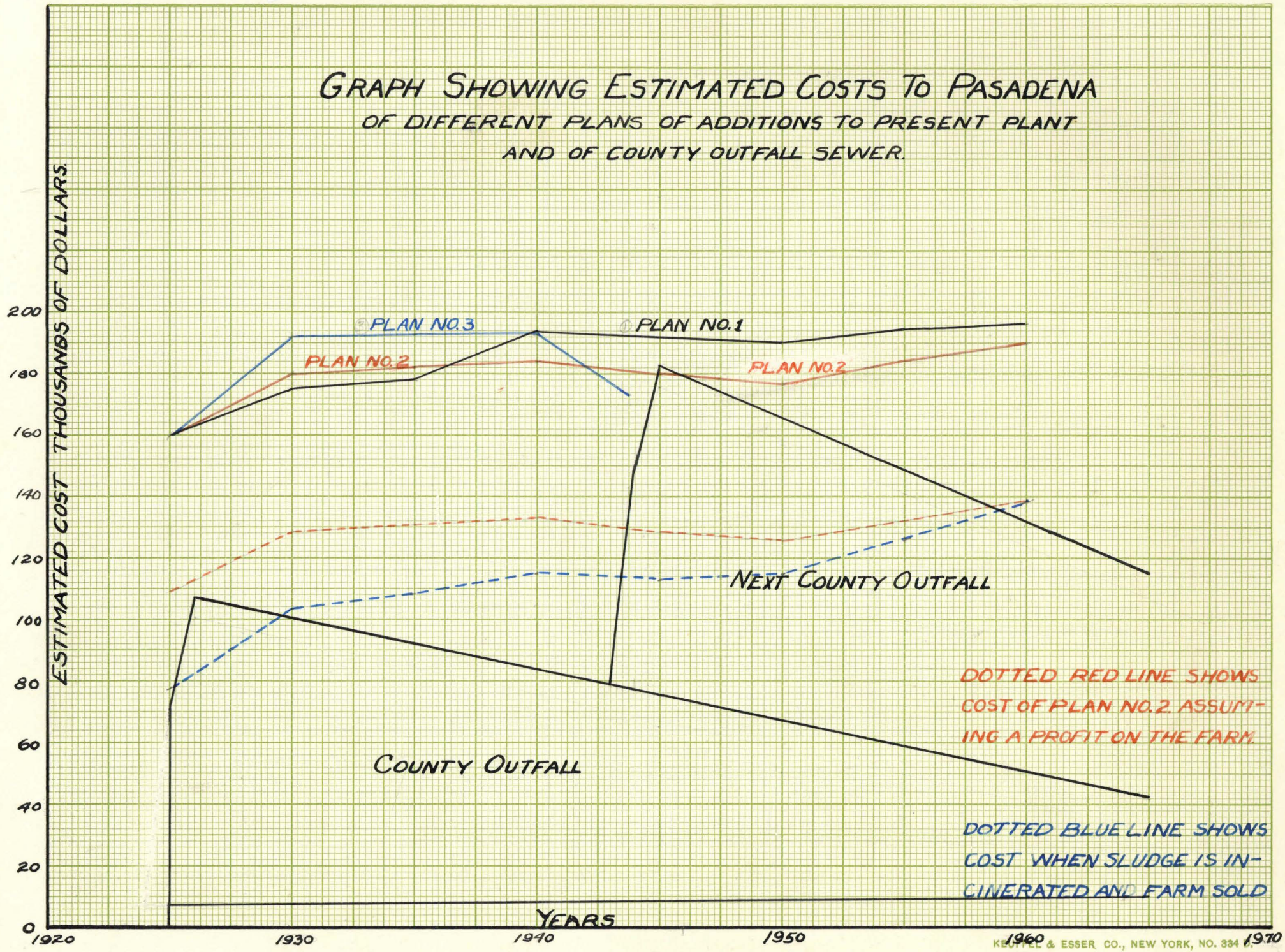
Costs of Metropolitan Outfall

It is planned to sell half the bonds the first year and the other havf the second yaar. There will be no retirement of bonds the first year.

Year	Amount Due	Interest 5.5%	Reduction plus Interest
I925	$ 625,000	$ 34,400	$ 65,650
I926	I,250,000	68,800	I00,050
I927	I,2I8,000	67,000	98,250
I928	I,I87,000	65,400	96,550
I929	I,I25,000	63,600	94,850
I930	I,093,000	6I,200	92,450
I935	968,000	53,300	84,550
I940	8I3,000	44,700	75,950
I945	6I5,000	33,800	65,050
I950	500,000	27,500	58,750
I955	344,000	I8,900	50,I50
I960	I87,000	I0,300	4I,550
I965	3I,200	I,720	32,970

GRAPH SHOWING ESTIMATED COSTS TO PASADENA

OF DIFFERENT PLANS OF ADDITIONS TO PRESENT PLANT AND OF COUNTY OUTFALL SEWER.



COST CONCLUSIONS

From the preceeding graph it appears evident that the cost of operating the present plant is excessive. The value of the farm which at present is bringing no return on the investment is the factor which runs up the cost. But it is true that the farm has not been in operation very long and it is almost impossible to tell in so short a time whether or not it is going to yield a profit.

If the farm should yield a profit then it would probably be best to keep it and use it for sludge disposal. If however it is not going to yield a profit then it will be cheaper to adopt some other plan, that is either sell the farm and incinerate the sludge or join the County Outfall.

The cheapest method of disposal by using the activated sludge plant is to sell the farm and incinerate the sludge.

From the graph it can be seen that the present County Outfall would be cheaper than any of the plans proposed for the activated sludge plant. But if Pasadena will wait until about 1944 when the next outfall will be built, then she will be in a better position to make a decision. At that time they will know whether or not the farm is going to pay a profit. They will then know better whether the disposal of sewage into the ocean is going ot meet with public approval. Also they will know whether there are apt to be any complaints against the present plant and there methods of disposal. It is entirely possible that at some time in the near future the effluent from the present plant may become objectionable. If this does happen it may be necessary for Pasadena to provide some closed conduit to carry the effluent to the ocean.

CONSERVATION OF WATER

With the present development of the country, where large tracts of land are still available sufficiently remote from built up sections, where water is such a vital consideration to such land and worth anything from (I) to(5) cents per inch per hour for irrigation purposes, and when the problem is becoming more vital with each years growth, to waste sewage water when it is possible to purify it for irrigation purposes in such a manner as to cause no nuisance from odors or endanger public health is a willful waste and should not be tolerated.

Inthe City of Alhambra, a city of 3,800 acres and largely an orahard city, water sells for $.50 per I000 cu.ft. Thisis equivalent to a rate of $.036 per inch per hour. With a population of 60,000 and a normal sewage flow of 50 gallons per capita per day the daily discharge is 3,000,000 gallons or 3I0 inches. Consider that no storage is provided and that it is possible to sell water only (I2) hours per day and (200) days per year and that such water is worth, for irrigation purposes 3 cents per inch per hour.

3I0 inches per at 3@=$ 9.30 per hour

I2 hours at $ 9.30=$ III.60

200 days at III.60= $22,320.00

This is equivalent to an investment of $ 446,400 @ 5% .

The only thing against this is that it may be hard to dispose of the efflient, or waste water.

Another plan for the conservation of the effluent is to pump it up back of Devils Gate Dam and let sink into the natural reservoir. This plan might well be feasible from a financial standpoint and it seems to meet the approval of the State Board of Hea Health, for in his letter states that he sees no objection to it.

It has been said that a municipality should not allow commercialism to enter into its affairs. In some cases this may be true, but I see no reason why we should waste so valuable an asset when such asset can be utilized without interfeering with the rights of others.

OCEAN BEACHES AND THEIR PROTECTION

The discharge of the Los Angeles sewer into the ocean at Hyperion caused a nuisance before the present sewer was constructed. This was chiefly due to to the sewage litter which is noticeable along the beach and in the adjacent water for a mile or more in either direction, particularly to the south. The effect of such pollution varied with the wind and tide both as to extent to which it was noticeable at any one place, and the distance from the Hyperion pier to which the sewage was carried. For some distance from the Hyperion Pier there was a sewage field, varying in extent within which the sewage was insufficiently mixed with sea water to prevent detection as to its prigin. Some times the odors were of an oily nature but in hot weather the odors were very offensive and suggestive of sewage.

Bacteria analysis of the surf water showed that bathing at Hyperion would be attended with some risk if the bathers should have swallowed some of the water. The same is said to be true of a number of other places along the beach far removed from the Hyperion outfall. This shows the necessity, in the interest of clean safe conditions for bathers, of materially improving the sewage disposal arrangements, not only at Hyperion but at numerous other ~~xxxx~~ places along the coast where local outfalls discharge.

It is true that patrons of the beaches are annoyed be black, oily masses which are not however the result of sewage disposal but are washed ashore from submerged oil and asphaltum deposits, such as are shown on the U.S. Coast Survey chart opposite Redondo. There are also some oily substances discharged into the ocean from the oil works at El Segundo.

CALIFORNIA STATE BOARD OF HEALTH

Sacramento

Bureau of Sanitary Engineering.

C. G. GILLESPIE, Director

Berkeley, California,
October 27, 1924.

Mr. Wm. C. Rowse,
City Hall,
Pasadena, Calif.

Dear Sir:

I shall attempt to answer the questions you have asked with respect to your activated sludge plant, as fully as I am able.

Question (1). "In your opinion would it be entirely satisfactory from a standpoint of health and public nuisance, to continue to discharge effluent from our present activated sludge plant into the Rio Hondo, provided said effluent was of a quality satisfactory to the State Board of Health".

The State Board of Health would not endorse or allow the emptying of sewage effluent into the Rio Hondo if it menaced health or created a nuisance. In my opinion it is easily feasible to satisfy these requirements by treatment using the activated sludge method, followed by sand filtration or chlorination. I would expect your present plant to be capable of this performance. I would at this point make a generalization applicable to most of the opinions you are seeking, that I regard the activated sludge process as a very efficient one for producing a clear, stable (i.e., odorless) effluent of relatively low bacterial content, but that it requires the programing of construction to keep ahead of the needs, the use of a certain degree of skill, easily attainable, in operation, the avoidance of penny-wise

policies in operation and, where an effluent of the safety of drinking water is required, it requires chlorination or sand filtration of the effluent. Also, that it requires a certain isolation to protect against plant nuisance and where area for wet sludge disposal is a difficult item, it requires sludge dehydrating and drying devices. Experience as to isolation is to be sought whenever possible. Our observations at Lodi and Folsom show the very modest isolation of 500 feet to be sufficient there. Your best guide is your own experience.

Question (2). "Is our present activated sludge plant capable of purifying the effluent to a quality satisfactory to the State Board of Health?"

I would anticipate that you are probably producing an effluent satisfactory to us, but have no tests upon which to base this opinion.

Question (3). "Do you believe that there is any probability that a sewer will have to be constructed to carry said effluent to the ocean?"

I can anticipate no requirements from this Board, or any from the standpoint of health and decency, which need compel your carrying this effluent to the ocean. In my opinion all reasonable requirements can be easily met by proper design and operation of the treatment works themselves.

Question (4). "Would you approve of the practice, from a health standpoint, of pumping this effluent back of Devil's Gate Dam, allowing it to drain into the underground basins from which Pasadena pumps its water supply for domestic use?"

Without regard to prejudice and sentiment, and considered from the standpoint of no unwholesome or unhealthful effect on your water supply, I see no objection to this disposal, but would expect it would be prudent to first pass the effluent through a sand filter. Well water supplies are

being preserved in Germany by the similar expedient of spreading storm drain water upon areas to be saturated for well water supply purposes.

(See later letter of October 30, 1924)

Question (5). "Would you approve of the practice of using said effluent for irrigation of either parks or crops?"

The effluent of your plant is well suited to irrigation, without nuisance. I should consider it advisable to chlorinate it prior to use on lawns, but not on shrubs, and on table vegetables.

Question (6). "Is "wet sludge" free from harmful bacteria?"

In my opinion wet sludge is to be looked upon as highly dangerous unless stored for three or four weeks.

Question (7). "Is 'dry sludge' free from harmful bacteria? What percentage of water in dry sludge? If not, does said sludge become harmful when wet again?"

I believe dry sludge is reasonably free of disease germs and will remain so.

Question (8). "Should the present practice of spreading "wet sludge" on the Pasadena Sewer Farm be continued or discontinued?"

I cannot answer this question since I do not know the crops upon which it is used or nearness to residences.

Question (9). "If the sludge were properly dried could it be disposed of anywhere, either selling as fertilizer or dumping as a fill for low ground? In other words, could the activated sludge plant be operated without the farm?"

Such dry sludge could, in my opinion, be handled with impunity. I would regard it as necessary to retain enough land around the works to keep

you free of odor complaints from high grade residences, assuming that the surplus land were disposed of for that purpose. See Question (1).

Question (10). "What are your views as to catering to public sentiment?"

I believe that sanitary engineering should be availed of whenever economy results, that health should be protected and that nuisance and property damage should be avoided. Beyond that, the expenditure of sums simply to satisfy sentiment is one which I believe can only be settled by the people who pay the bills, with a full and fair understanding of all the facts and the realization that what they are paying for is satisfaction to sentiment.

Question (11). "From your information, what figures should be used in calculating the following: -

(a) Average flow of sewage in gallons per capita per day.
(I used 55)

(b) Maximum flow of sewage in gallons per capita per day.
(I used Mr. Warren's figure of 80)

(c) Cost of operation of activated sludge plant in dollars per million gallons, without drying sludge.
(I used $14.00)

(d) Cost of operation of activated sludge plant in dollars per million gallons, including drying the sludge.
(I used $30.00)

(e) Cost of additions in dollars per million gallons per day.
(I used $60,000)

(a) This figure seems low, as judged by measurements of sewage flow elsewhere, but should of course be predicated on local measurements or analysis of local factors.

(b) This figure seems low but appears consistent as compared with the figure in Question (a).

(c) This figure looks reasonable.

(d) This figure looks reasonable.

(e) This figure looks reasonable.

Very truly yours,

C. G. GILLESPIE

DIRECTOR

CGG T

CALIFORNIA STATE BOARD OF HEALTH

SACRAMENTO

Bureau of Sanitary Engineering

C.G. GILLESPIE, DIRECTOR

Berkeley, California.
October 30, 1924.

Mr. Wm. C. Rowse,
City Hall,
Pasadena, Calif.

Dear Sir:

I sent to Mr. Goudey a copy of my letter to you and he corrects me in two particulars.

It seems I misunderstood the portent of Question (4). I understood the plan was to dispose of the effluent upon the sand deposits above Devil's Gate reservoir. Mr. Goudey understands the inquiry to refer to emptying the sewage directly into the reservoir and calls attention to at least one objection, namely, the setting up of algae growths in the reservoir if that is done; also that the indicatioms are that this water passes rapidly from the reservoir into the filter gallery.

I therefore wish to correct any misimpression I have given and reiterate that I would have no objection to running the effluent from the activated sludge plant through a sand filter and then upon the sand deposits above the reservoir, such that the sewage would finally gravitate into the underground waters.

In further comment on Question (11), Mr. Goudey calls attention to the fact that the figures for the main outfalls should allow for considerable infiltration and in all probability the maximum rate should be higher than quoted.

Very truly yours,
C. G. GILLESPIE--DIRECTOR

CGC T

THE HUMAN ELEMENT IN OPERATION

In the practical operation of a sewage system such as an activated sludge plant it is as a general rule very difficult to get men of high order as superintendents. The salarys of such a position are generally not very high and one with training or experience is hard to get and hold.

This means that at some time the operator is apt to let go an effluent which is very putricible and offensive. Such a practice as this is bound to lead to trouble sooner or later for the people below the plant are going to complain. I do not know whether this has happned at Pasademas plant yet or not but it is liable to happen and is one of the objections to such a system.

POPULAR SENTIMENT

Popular sentiment at the present time seems to be opposed to disposal into the ocean, because of the nuisance to beaches. This opinion has been created, no doubt, by the condition of the former Los Angeles outfall. This condition has been remedied now and it remains to be seen whether or not public sentiment will change.

GENERAL CONCLUSIONS

In general conclusions I would say that the best plan would be to wait until 1930 when additions will have to be made and then to decide whether or not to keep the farm. At that time the City of Pasadena can either make addititon until 1944 or they can make longer ones. At that time they will know beeter the possibilities of the plants paying an income. They will also know the efficiency of activated sludge disposal and the popular sentiment with regard to disposal in the ocean.

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Harold E.Babbitt.

Mr.A.K.Warren

County Sanitation Engineer