

SAN GABRIEL RIVER WATERMASTER

FOR

CITY OF LONG BEACH, et al., vs. SAN GABRIEL VALLEY WATER CO., et al.

CASE No. 722647 — LOS ANGELES COUNTY

RECEIVED
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THOMAS M. STETSON

SIXTH ANNUAL REPORT OF

**SAN GABRIEL RIVER
WATERMASTER SERVICE**

1968-69

February 27, 1970

SAN GABRIEL RIVER WATERMASTER

FOR
CITY OF LONG BEACH ET AL VS SAN GABRIEL VALLEY WATER CO.
CASE NO. 722647—LOS ANGELES COUNTY

WATERMASTERS
MAX BOOKMAN
M. E. SALSBUURY
THOMAS M. STETSON

February 27, 1970

MAILING ADDRESS
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To: Clerk of Superior Court of Los Angeles County
and All Parties

Re: Watermaster Report for 1968-69 Water Year

Gentlemen:

We have the honor of submitting the sixth annual report of the San Gabriel River Watermaster, for water year 1968-69, in accordance with the Judgment in Case No. 722647, entered September 24, 1965.

The 1968-69 water year exceeded all prior years of recorded runoff through the Whittier Narrows. The seasonal rainfall, which averaged about 160 percent of normal in the San Gabriel Valley, has been exceeded only three times in the last 40 years. The rainfall in the San Gabriel Mountains, however, was about 230 percent of normal, or the greatest amount since 1884. The surface runoff through the Whittier Narrows was about six times the average annual amount.

The principal Watermaster findings for the water year 1968-69 are as follow:

	<u>Acre-feet</u>
Lower Area Annual Entitlement	84,000
Usable Water received by Lower Area	162,790
Accrued Credit of Upper Area as of September 30, 1969	78,790

A complete summary of findings is contained in Chapter VI of this report.

Clerk of Superior Court of
Los Angeles County and
All Parties

-2-

February 27, 1970

We again gratefully acknowledge the cooperation and
data furnished by the Los Angeles County Flood Control District
and others.

Very truly yours,

SAN GABRIEL RIVER WATERMASTER

By:

Max Bookman
Max Bookman

M. E. Salsbury
M. E. Salsbury

Thomas M. Stetson
Thomas M. Stetson

Encl.

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CHAPTER I. INTRODUCTION

The Judgment in the case of City of Long Beach, et al., v. San Gabriel Valley Water Co., et al, hereinafter referred to as the Long Beach Case, divided the water supply available to the ground water basins along the San Gabriel River between the San Gabriel Valley (called the Upper Area) located upstream of Whittier Narrows and the coastal plain (called the Lower Area) located downstream of Whittier Narrows. It was stipulated in that Judgment that the Lower Area was entitled to receive an average annual usable supply of 98,415 acre-feet, corresponding to an average rainfall in the Upper Area of 18.52 inches per year.

Since annual rainfall varies widely, the Judgment included, for operational purposes, a formula for determining the annual entitlement of the Lower Area to usable supply. Under this formula, the annual entitlement each year depends on the ratio of (1) the average annual rainfall in San Gabriel Valley during the ten years ending with the year for which the entitlement is calculated to (2) the long-term average annual rainfall of 18.52 inches. A table expressing this relationship, designated as Table A, is included in the Judgment.

The utilization of a ten-year moving average of rainfall instead of the actual rainfall occurring in the year under consideration is for the purposes of avoiding extreme variations in the annual entitlement to usable supply under the Judgment. The use of ten-year average rainfall can

introduce a time lag in the obligation of the Upper Area following a sustained series of dry or wet years, but over a long-term period of years it will result in the Lower Area receiving an average annual entitlement of 98,415 acre-feet. For example, during a series of dry years the obligation of the Upper Area decreases, but with the commencement of a series of wet years the full effect is not immediately felt because of the prior dry years being included in the ten-year average.

Thus, when the San Gabriel River Watermaster Service commenced operation in 1963-64, the ten-year average rainfall for San Gabriel Valley (1954-55 through 1963-64) amounted to only 14.4 inches. This reflected the general drought conditions which had prevailed. There did occur two above-normal years, 1957-58 and 1961-62, when rainfall was 30.2 inches and 22.4 inches, respectively. The driest year of record occurred in 1960-61, when only 5.9 inches of rainfall was received. In fact, the three consecutive years 1958-59, 1959-60, and 1960-61 represented the driest three-year period of recorded rainfall in this area.

Since 1963-64 the ten-year moving average rainfall has been gradually increasing. Above-normal rainfall occurred in 1965-66, 1966-67, and 1968-69, amounting to 19.6 inches, 25.0 inches and 30.5 inches, respectively. The moving average has increased from 14.4 inches during the ten years ending 1963-64 to 16.6 inches during the ten years ending 1968-69. Accordingly, the Lower Area Annual Entitlement increased from 67,200 acre-feet to 84,000 acre-feet between 1963-64 and 1968-69.

When the Usable Water received by the Lower Area is less than the Lower Area Annual Entitlement, the Upper Area must provide Make-up Water in accordance with the Judgment. One method by which the Upper Area can provide Make-up Water is by payment to the Central Basin Municipal Water District for Reclaimed Water previously purchased for replenishment. During the period 1963-64 through 1968-69 the Upper Area paid for 55,542 acre-feet of Reclaimed Water at a cost of \$844,467.83. Another method, which has been utilized by the Upper Area, is to purchase replenishment water and deliver it to the Lower Area. In water year 1965-66 a quantity of 6,489 acre-feet of replenishment water was delivered. In view of the above-normal supply received during 1968-69 the Upper Area, as determined herein, now has an Accrued Credit of 78,790 acre-feet.

History of Litigation

On May 12, 1959, a complaint was filed in the Superior Court in and for the County of Los Angeles, Case No. 722647, by the City of Long Beach, the Central Basin Municipal Water District, and the City of Compton. The purpose of the suit was to determine the rights of the parties to waters of the San Gabriel River System and to provide for protection against interference with the rights of the Lower Area Parties. The parties to the action are as follows:

PLAINTIFFS

Board of Water Commissioners of the City of Long Beach
Central Basin Municipal Water District
City of Compton

DEFENDANTS

San Gabriel Valley Water Company
Azusa Agricultural Water Company
Azusa Valley Water Company
California Cities Water Company
California Water and Telephone Company
(now California-American Water Company)
Covina Irrigating Company
Cross Water Company
East Pasadena Water Company, Ltd.
Glendora Irrigating Company
(now City of Glendora)
Southern California Water Company
Suburban Water Systems
Sunny Slope Water Company
Vallecito Water Company
City of Alhambra
City of Arcadia
City of Azusa
City of Covina
City of El Monte
City of Glendora
City of Monrovia
City of Monterey Park
City of South Pasadena
Baldwin Park County Water District
San Gabriel County Water District

INTERVENORS

Upper San Gabriel Valley Municipal Water District
California Domestic Water Company

In an effort to reach a physical solution, two negotiating committees of five members each were appointed, one to represent the plaintiffs and one to represent the defendants. Attorneys, engineers and geologists were utilized as advisors to the negotiating committees and on September 26, 1961, a "Statement of Principles for Settlement" was executed. There followed a period of study and negotiations in order to arrive at a fair and equitable physical solution to the problem.

On August 24, 1964, the Upper San Gabriel Valley Municipal Water District intervened in the action to assume the responsibilities of the Upper Area under the terms of a judgment. In order to reimburse the District for its expenses in so doing, a Reimbursement Contract was entered into early in 1965 by the District and all of the defendants and certain other producers of water from the Upper Area.

A proposed Stipulation for Judgment and Judgment were approved by the negotiating committees on December 7, 1964, and thereafter were approved by all parties. On September 24, 1965, Judgment was entered by Judge Edmund Moor with an effective date of October 1, 1963.

The Judgment provided for the appointment of a three-man Watermaster, one to represent the Upper Area, one to represent the Lower Area, and the third to represent both areas. On November 12, 1965, the three-man Watermaster was appointed and certified by the Court. The Upper Area is represented by Thomas M. Stetson, the Lower Area by Max Bookman, and both areas by M. E. Salsbury.

The Watermaster issued his report for the first and second years, 1963-64 and 1964-65, on February 28, 1966. Subsequent annual reports of the Watermaster have been issued in February of each year.

CHAPTER II. ACTIVITIES OF WATERMASTER

The activities of the Watermaster include administration of operations under the Judgment; performance of field inspections; collection of data and maintenance of records; analyses of data; preparation of the annual report presenting the required determination and findings; and recording the transfer of water rights. All operations and reports are based on the "water year," which is from October 1 to September 30.

The Judgment requires that the Watermaster make the following determinations each year:

1. The number of inches of depth of average rainfall on San Gabriel Valley.
2. The average annual rainfall on San Gabriel Valley for the ten consecutive water years ending with the year of calculation.
3. The Lower Area Annual Entitlement and the entitlement for the Long-term Accounting Period.
4. The amount of Surface Flow through Whittier Narrows.
5. The amount of Subsurface Flow.
6. The amount of Export to Lower Area.
7. The amount of Lower Area Replenishment Water.

8. The amount and quality of Reclaimed Water reclaimed by or on behalf of Lower Area.
9. The total amount of Make-up Water delivered to Lower Area.
10. The surface outflow from Montebello Forebay in the channel of each of the Rio Hondo and San Gabriel River.
11. The amount of Usable Water received by the Lower Area.
12. The Accrued Debit of Upper Area, if any, or Accrued Credit of Upper Area, if any, as it exists at the end of each water year.
13. The amount, if any, of Make-up Water which Upper District is obligated to deliver during the following water year.

Administration

The official office and depository of records of the Watermaster is at 102 North Brand Boulevard, Glendale, California, and such records are available for inspection at the request of any party.

A tentative budget for the water year 1969-70 was transmitted to the parties on July 25, 1969. After fifteen days, there being no objections thereto, the tentative budget became the final budget and is set forth in Table 1.

An audit of expenditures of the Watermaster for the water year 1968-69 was obtained. This audit was performed by R. J. Galletly, CPA,

TABLE 1

WATERMASTER BUDGET
FOR THE WATER YEAR 1969-70

1.	Administrative fees of Watermaster and general operating expenses	\$ 3,000
2.	Collection of data, field inspection, and maintenance of records	3,500
3.	Calculations and preparation of Watermaster Report for Water Year 1968-69	3,000
4.	Printing and reproduction costs	500
5.	Measurement installations--vicinity of Whittier Narrows	3,500
6.	Contingencies	<u>500</u>
	TOTAL	\$14,000
	Less estimated carry-over from 1968-69	<u>- 5,500</u>
	Balance to be financed for 1969-70	\$ 8,500

Proration for Payment Purposes

Upper San Gabriel Valley Municipal Water District,	50%	\$ 4,250.00
Central Basin Municipal Water District,	41.2%	3,502.00
City of Long Beach,	7.125%	605.63
City of Compton,	1.675%	<u>142.37</u>
TOTAL		\$ 8,500.00

and a letter from the auditor dated January 28, 1970, presenting his findings and showing the income and expense is included in the appendix.

Data Collection

The Watermaster collects data on stream flow, rainfall, water quality, ground water levels, export of water, reclaimed water, replenishment water, and other information as required. The principal source of data is the Los Angeles County Flood Control District. Copies of records were obtained from the District, and many conferences were held between Flood Control District personnel and Watermaster personnel in order that the Watermaster would be fully informed on the facts necessary to the determinations required by the Judgment. Other data were obtained from The Metropolitan Water District of Southern California, the County Sanitation Districts, the Central and West Basin Water Replenishment District, the Upper San Gabriel Valley Municipal Water District, the U. S. Geological Survey and the U. S. Army Corps of Engineers.

Plate 1, entitled "Stream Gaging Stations, Rio Hondo-San Gabriel River System," shows the general vicinity of the Whittier Narrows area. Plate 2, entitled "Map of Whittier Narrows," shows in detail the channels and facilities in the Whittier Narrows area.

Field Inspection

During the water year 1968-69 a number of field inspections were made of stream gaging facilities in the Whittier Narrows area. In particular, observations were made of the functioning of the newly constructed facilities and stream gages along the San Gabriel River.

Preparation of Annual Report

One of the required functions of the Watermaster is the preparation of the annual report containing certain determinations required by the Judgment. The Judgment provides that a report be prepared and submitted within five months after the end of each water year, and copies of the report are furnished the Court, each of the parties, and others. The report for water year 1968-69 covers the sixth year of operation under the Judgment.

Delivery of Make-up Water

The Upper District was required during the 1968-69 water year to deliver to Lower Area a minimum of 1,866 acre-feet of Make-up Water because of an Accrued Debit of 5,597 acre-feet as of September 30, 1968. The Upper District elected to reimburse Central Municipal by payment in the amount of \$100,746.00 for 5,597 acre-feet of reclaimed

water, the entire amount of the Accrued Debit. This payment was made on September 26, 1969.

Stream Gaging Stations

The Watermaster maintained contact during the water year 1968-69 with the Los Angeles County Flood Control District and the U.S. Geological Survey regarding operation of stream gaging stations in the vicinity of Whittier Narrows.

Prior Watermaster reports have discussed problems experienced with adequacy of gaging at the Whittier Narrows Flood Channel, Station E337-R. This gage is subject to unusual conditions. With storage of water in Whittier Narrows Reservoir, the gage can be affected and become inoperative by back-water and flooding. Moreover, other factors affect this gage, including a dike which exists in the near vicinity of the gage and debris buildup on bridge piers at the station. For these reasons the Watermaster has developed an alternative method for determining the flow in the Flood Channel which may be used during such times as measurements appear questionable at Station E337-R. This method determines Usable Water in the Rio Hondo by adding the amount spread in Rio Hondo Spreading Grounds to the estimated amount of water infiltrated in the Rio Hondo portion of the Whittier Narrows Reservoir.

The fifth annual report of the Watermaster stated that the flow at Station E337-R for water year 1967-68 would be reviewed. The review indicated that change from the quantities presented in the previous report is not justified.

The location of gaging stations on the San Gabriel River below Whittier Narrows Reservoir was changed during the 1967-68 water year. A station at Parkway Bridge, as anticipated in the Judgment, was constructed by the U. S. Corps of Engineers as part of the flood control improvements of the channel. This station became operative in August 1968. Prior to August, data for this station were developed by Flood Control District personnel, based on periodic discharge measurements. The station at Beverly Boulevard is being continued by the County Flood Control District for the purpose of measurement of low flows only. Periodic measurements of stream flow are made at Beverly Boulevard so that an overlap of data at the new station at Parkway Bridge will be available.

The new station at Parkway Bridge has some operational problems which have not yet been solved. Difficulty has been experienced in establishing a correct gage height-stage relationship because of : (1) lack of correlation between recorder equipment and outside staff gages; (2) possible sanding affecting recorder readings of bubbler gage; (3) waves in the channel above the bubbler outlet caused by the right wing wall at

the gage; and (4) protrusion in the upstream concrete stabilizing pad which causes the direction of flow in the approach to the gage to vary.

Transfer of Water Rights

In event of a change in ownership of the water rights of any of the Defendants in the case, the Judgment requires that the Watermaster shall be notified of such transfer in writing.

The Watermaster has not been advised of any transfers during the 1968-69 water year. Two previous transfers of water rights were reported in prior reports. These are the transfer of the Glendora Irrigating Company to the City of Glendora on April 28, 1965, and of the California Water and Telephone Company to the California-American Water Company in March 1966.

Change of Address

The Judgment provides that if any party or transferee of water rights shall desire to change its mailing address, it shall file a written notice of such change with the clerk of the Court and with the Watermaster. The Watermaster must then notify all parties of the change. The Upper San Gabriel Valley Municipal Water District filed a notice of change of address with the Court and the Watermaster under date of January 23, 1970.

A copy of the notice is included in the Appendix. No other notice of change of address of parties has been received by the Watermaster.

The water rights of producers in the Main San Gabriel Basin are currently being adjudicated and the Watermaster has kept informed regarding this action.

CHAPTER III. LOWER AREA ANNUAL ENTITLEMENT

The Lower Area Annual Entitlement for the water year 1968-69 is based on the average annual rainfall which occurred in the 10-year period ending with water year 1968-69 and the corresponding entitlement shown in Table A of the Judgment. Four precipitation stations in the San Gabriel Valley are utilized to determine the average annual precipitation for San Gabriel Valley. The four stations are located at San Dimas, Walnut, El Monte and Pasadena.

Precipitation during the 1968-69 water year at the four locations was as follows:

<u>Station number</u>	<u>Location</u>	<u>Depth of precipitation, in inches</u>
95	114 East First Street, San Dimas	32.55
102C	19711 East Valley Blvd., Walnut	28.78
108D	119 South Hoyt Avenue, El Monte	27.91
610B	City Hall, Pasadena	<u>32.76</u>
	Average rainfall	30.50

Shown in Table 2 is the calculation of the 10-year average rainfall in the San Gabriel Valley for the water years 1959-60 through 1968-69.

TABLE 2

AVERAGE ANNUAL RAINFALL
IN SAN GABRIEL VALLEY
1959-60 through 1968-69

<u>Water year</u>	<u>Rainfall, in inches</u>
1959-60	10.6
1960-61	5.9
1961-62	22.4
1962-63	12.3
1963-64	9.4
1964-65	15.2
1965-66	19.6
1966-67	25.0
1967-68	15.0
1968-69	<u>30.5</u>
Total	165.9
10-year average	16.6

Based on the 10-year average rainfall of 16.6 inches, the Lower Area Annual Entitlement for the water year 1968-69 is 84,000 acre-feet, determined from Table A of the Judgment.

CHAPTER IV. USABLE WATER

Presented in this chapter is the determination of the quantity of Usable Water received by the Lower Area during the water year 1968-69.

Surface Flow

The items to be included in Surface Flow through Whittier Narrows are set forth in Section III-A of Exhibit B of the Judgment. The measured flows, adjustments thereto as provided for in the Judgment, and estimated flows are described below.

Rio Hondo above Mission Bridge, Station F64-R

The measured flow at Station F64-R for the water year 1968-69 was 145,830 acre-feet.

Mission Creek at San Gabriel Boulevard, Station F83-R

The measured flow at Station F83-R for the water year 1968-69 was 5,530 acre-feet.

Rio Hondo Bypass Channel, Station F313-R

No water was diverted through the Rio Hondo Bypass Channel during the water year 1968-69.

Whittier Narrows Flood Channel, Station E337-R

The U. S. Geological Survey, which operated Station E337-R, reported a flow of 169,270 acre-feet for the water year 1968-69.

However, this value did not include the flow which occurred on January 25, 1969, because the gage was submerged and no determination was made. The Watermaster has tentatively estimated the flow on the 25th to be 14,000 cfs days or 27,770 acre-feet. This indicates a total flow at Station E337-R of 197,040 acre-feet for the 1968-69 water year. This value is subject to adjustment as discussed later.

Sycamore Canyon

The runoff from Sycamore Canyon which flows through Whittier Narrows is based on precipitation at Potrero Heights (Station 170F). Sycamore Canyon is located in the Merced Hills westerly of the Whittier Narrows and enters the Rio Hondo below Station F64-R, Rio Hondo above Mission Bridge. During the water year 1968-69, the precipitation at that station was 28.81 inches. Referring to Table 6 of Exhibit B, the runoff from Sycamore Canyon was determined to be 630 acre-feet.

San Gabriel River near Parkway Bridge

In August 1968 a new gage called San Gabriel River at Parkway Bridge, F263C-R, was installed. The installation of the gage was anticipated in the Judgment. This gage takes the place of the prior measurement of discharge at Beverly Boulevard on the San Gabriel River and eliminates the need of adjustment for the water which percolates between the point of maximum rising water and the Beverly Boulevard gage.

The flow measured by the Flood Control District at the San Gabriel River at Parkway Bridge, the point of maximum rising water, for the 1968-69 water year was 274,660 acre-feet.

Reclaimed Water Delivered to Rio Hondo below Station F64-R

Water from the Whittier Narrows Water Reclamation Plant is delivered to either the San Gabriel River or Rio Hondo. Of the total production of 17,124 acre-feet of Reclaimed Water during the 1968-69 water year, 9,352 acre-feet was delivered to Rio Hondo. Of the latter amount 1,425 acre-feet was measured as storm flow at Station E337-R. Thus, 7,927 acre-feet was delivered to the river below the F64-R gage and must therefore be added as Surface Flow.

The balance of the Reclaimed Water in the amount of 7,772 acre-feet was delivered to the San Gabriel River and measured at Parkway Bridge.

Adjustments to Surface Flow

The Surface Flow is, for the most part, based upon stream flow measurements made by the Los Angeles County Flood Control District. In essence, the method set forth in the Judgment is to measure the surface inflow to the Lower Area as it flows through Whittier Narrows and deduct the surface outflow that leaves the Montebello Forebay at its lower end. The difference in these measurements represents a determination of the quantity of Surface Flow which infiltrates in the Montebello Forebay and under normal operations this method gives reliable answers.

During the 1968-69 water year extremely unusual runoff conditions occurred as a result of above-normal rainfall. About twice the quantity of water passed through the Whittier Narrows as occurred during the

flood year of 1938. Not only were flows very large, but flows at relatively high rates persisted for some time. As a consequence, large quantities of water were lost to the ocean during the months of January through April. As the result of these very high flows, certain inconsistencies result from the inflow minus outflow calculation. While the stream gaging measurements may well be within the accuracy of normal stream gaging, the amount of Usable Surface Flow on some days is only a small portion of the total flow. Inaccuracy in the gaging of total flow will therefore greatly distort the determination of Usable Surface Flow.

Accordingly, the Watermaster after evaluating the available data determined that for certain periods of time adjustments should be made in the Surface Flow as derived from the measurements. An alternative method of determining Surface Flow for the Rio Hondo was outlined in the Fifth Annual Report of the Watermaster. In this method an adjustment is made by first determining the amount spread in Rio Hondo Spreading Grounds and adding thereto the estimated amount of water infiltrated in the Rio Hondo portion of the Whittier Narrows Reservoir. This is compared to the measured inflow minus the outflow and a determination is made as to which of the methods is to be utilized.

Changes in measurements can be made under the terms of the Judgment. Reference is made to Exhibit B, Article III, Section A entitled, Surface Water Measurements and Calculations, which reads in part:

"In the event that any of the aforementioned gaging stations are inoperative for any reason and for any period of time the Watermaster shall estimate the quantity that would have been measured at the station had it been operative. The estimate shall be based on correlation to nearby operative measuring stations or on other reasonable engineering methods."

The Watermaster considers that stations are inoperative for the purpose of this Judgment when the results obtained are not of sufficient accuracy to produce reasonable results. For the water year 1968-69 the Watermaster decided to apply the alternative method during certain periods of time to both the Rio Hondo and San Gabriel River flows.

Rio Hondo Adjustment

Presented in Table 3 is an adjustment to Rio Hondo inflow. This table presents a summary of the calculations utilizing the alternative method. Analysis of the daily inflow and outflow data indicated that the alternative method should be applied during the 44-day period January 17 through March 1, 1969, when flood waters were being stored in Whittier Narrows Reservoir.

The unadjusted inflow in the Rio Hondo as set forth in Table 3 was 285,168 acre-feet during the 44-day critical period. The outflow during the same period (calculated on a daily basis from stream gaging measurements as provided in the Judgment) was 289,749 acre-feet. (This latter

TABLE 3
ADJUSTMENT TO RIO HONDO INFLOW
(Values in acre-feet)

<u>Item</u>	<u>Amounts in acre-feet for period from January 17 through March 1</u>
Outflow at Stewart and Gray Road	289,749
Infiltration by alternative method	
Spreading grounds infiltration	14,644
Reservoir area infiltration	<u>3,656</u>
Total infiltration	18,300
Adjusted inflow	308,049
Unadjusted inflow	
Rio Hondo above Mission Bridge F64-R	86,180
Mission Creek at San Gabriel Blvd. F83-R	1,473
Whittier Narrows Flood Channel E337-R	196,809
Sycamore Canyon	504
Ungaged Reclaimed Water	<u>202</u>
Total unadjusted inflow	285,168
Adjustment to Rio Hondo inflow	+22,881

value is water from San Gabriel Valley since local inflow below Whittier Narrows has been deducted.) Since the outflow exceeds the inflow by 4,581 acre-feet there is an obvious discrepancy requiring an adjustment. In making the adjustment the outflow figure was accepted because it involves only one measuring station and the record for this station was deemed to be less subject to gaging problems.

The infiltration in Montebello Forebay during the 44-day period was calculated to be 18,300 acre-feet. This included the amount delivered to the spreading grounds (measured by wiers or flumes) and the water infiltrated in the Whittier Narrows Reservoir westerly of Rosemead Boulevard. The inflow is therefore adjusted by adding the quantity of infiltration (18,300 acre-feet) to the outflow (289,749 acre-feet) to determine the adjusted inflow in the amount of 308,049 acre-feet.

San Gabriel River Adjustment

Presented in Table 4 is an adjustment to San Gabriel River inflow. The data shown are for 15 days during January, February and March 1969. For those 15 days the record indicated an infiltration in the river far in excess of rates previously experienced. Major discrepancies in data occurred on 11 days and minor discrepancies on four days. The total inflow to the Montebello Forebay reach of the San Gabriel River (Parkway Bridge to Florence Avenue) was 150,735 acre-feet during the 15 days. The outflow during these same days was 126,305 acre-feet and diversion to the spreading grounds was 1,293 acre-feet, indicating an infiltration in the

TABLE 4
ADJUSTMENT TO SAN GABRIEL RIVER INFLOW
(Values in acre-feet)

<u>Item</u>	<u>Amounts in acre-feet for 15 days of adjustment</u>
Inflow to river	
San Gabriel River at Parkway Bridge F263C-R	147,990
Unmeasured local inflow	2,741
Inflow from spreading grounds	<u>4</u>
Total unadjusted inflow	150,735
Outflow from river	
San Gabriel River above Florence Avenue F262-R	126,305
Diversion to spreading grounds	<u>1,293</u>
Total outflow	127,598
Inflow minus outflow	23,137
Calculated infiltration in river	<u>6,545</u>
Adjustment to inflow	-16,592

river of 23,137 acre-feet. The maximum amount of infiltration which could be considered to occur on those 15 days is 6,545 acre-feet indicating that an adjustment of 16,592 acre-feet should be made.

Summary of Adjustments

As determined above the adjustment to the Rio Hondo inflow is an increase of 22,881 acre-feet and to the San Gabriel River inflow a decrease of 16,592 acre-feet. Therefore, the net adjustment to Surface Flow for water year 1968-69 is an increase of 6,289 acre-feet.

Summary of Surface Flow

A total of 637,906 acre-feet of surface water flowed through Whittier Narrows during the water year 1968-69. Table 5 shows the components and the total Surface Flow.

TABLE 5

SUMMARY OF SURFACE FLOW THROUGH WHITTIER NARROWS FOR WATER YEAR 1968-69

	<u>Amount in acre-feet</u>
Rio Hondo above Mission Bridge, Station F64-R	145,830 ✓
Mission Creek at San Gabriel River, Station F83-R	5,530 ✓
Rio Hondo By-pass Channel, Station F313-R	0 ✓
Whittier Narrows Flood Channel, Station E337-R	197,040 ✓
Sycamore Canyon	630
San Gabriel River at Parkway Bridge, Station 263C-R	274,660 ✓ <i>less reclaimed</i>
Reclaimed Water delivered to Rio Hondo Channel below Station F64-R	7,927 ✓
Adjustment to Surface Flow	<u>6,289</u>
Total Surface Flow	637,906

Subsurface Flow

The method utilized to determine Subsurface Flow through Whittier Narrows is set forth in Exhibit B of the Judgment. The data used for computing Subsurface Flow are the spring and fall ground water levels in Whittier Narrows.

The Subsurface Flow for any year is the average of the six spring and fall computations of Subsurface Flow for the three years ending with the year of calculation. Shown in the following tabulation is the result of the calculations of Subsurface Flow for the water year 1968-69, which amounted to 24,400 acre-feet.

<u>Time</u>	<u>Subsurface Flow in acre-feet</u>	
Spring 1967	20,900	20900
Fall 1967	25,200	25200
Spring 1968	25,000	46100
Fall 1968	23,800	23800
Spring 1969	25,600	25600
Fall 1969	25,900	41700
		24800
Subsurface Flow 1968-69	24,400	

Export to Lower Area

The Watermaster is required to determine the amount of water which is pumped from ground water or diverted from surface streams in the Upper Area and transported in conduits through Whittier Narrows.

The Lower Area purchases replenishment water from the Metropolitan Water District of Southern California. Deliveries were made during water year 1968-69 at four connections: (1) San Gabriel River north of the San Bernardino Freeway (M335-R), (2) Alhambra Wash (M340-R), (3) Live Oak Wash (F311-R) and (4) a new connection on the

Lower Area Replenishment Water

The Judgment provides that commencing in the water year 1966-67, the maximum allowance for export in the determination of Usable Water shall not exceed 23,395 acre-feet. The quantity credited herein as Export to Lower Area for 1968-69 is therefore 23,395 acre-feet.

<u>Exporter</u>	<u>in acre-feet</u>
California Domestic Water Company	11,889
Suburban Water Systems	13,155
City of Whittier	<u>11,112</u>
Total	36,156
Export to Lower Area	<u>23,395</u>

During water year 1968-69 there were three entities which transported water by pipelines through Whittier Narrows. They are the California Domestic Water Company, Suburban Water Systems and the City of Whittier. The total export for each of the exporters in water year 1968-69 as shown by reports filed with the Upper San Gabriel Valley Municipal Water District is shown below.

Foothill Feeder at San Dimas Wash (M382-R). All connections are metered and delivered amounts are recorded by the Metropolitan Water District. During water year 1968-69 the amount of imported water purchased for replenishment by or on behalf of the Lower Area Parties was 12,529 acre-feet at Alhambra Wash, 1,470 acre-feet at the San Gabriel River, 3,371 acre-feet at Live Oak Wash, and 411 acre-feet at San Dimas Wash, for a total of 17,781 acre-feet.

Provision is made in the Judgment for the deduction of evaporation losses upstream from Whittier Narrows from the metered releases of replenishment water. The calculated amounts of evaporation were four acre-feet for Alhambra Wash releases, two acre-feet for San Gabriel River releases, 24 acre-feet for the Live Oak Wash releases, and three acre-feet for the San Dimas Wash releases, for a total of 33 acre-feet.

The net amount of Lower Area Replenishment Water after deducting evaporation amounted to 17,748 acre-feet.

Reclaimed Water

The total amount of reclaimed water produced at the Whittier Narrows Water Reclamation Plant during 1968-69 was 17,124 acre-feet. During storm periods and the ensuing periods of dam releases 3,247 acre-feet of the reclaimed water was delivered to the Rio Hondo and was included in the outflow from the Montebello Forebay. The total amount of reclaimed

water purchased in the water year 1968-69 from the Whittier Narrows Water Reclamation Plant by or on behalf of the Lower Area Parties was therefore 13,877 acre-feet. A chemical analysis of the reclaimed water is included in the appendix to this report.

County Sanitation District No. 21 owns and operates a sewage treatment and water renovation plant near the City of Pomona. The majority of the effluent from this plant is delivered to either San Jose Wash near Spadra or into the San Jose Creek at the treatment plant. Minor quantities of the reclaimed sewage are sold for agricultural use. During the 1968-69 water year, a substantial quantity of reclaimed water from this plant reached the Whittier Narrows. The discharge of effluent from this plant, changes in plant facilities, and method of determining the amount of discharge generated within the San Gabriel River System and reaching the Whittier Narrows were described in the fifth annual report.

The total production at the Pomona Water Renovation Plant during 1968-69 water year was 7,840 acre-feet. The total sales were 266 acre-feet resulting in 7,574 acre-feet of reclaimed water delivered to San Jose Wash. It is estimated that of this latter amount 1,659 acre-feet wasted to the ocean, leaving 5,915 acre-feet as the net amount. The portion of this reclaimed water which was generated inside the watershed of the San Gabriel River system was calculated to be 3,253 acre-feet.

The total amount of Reclaimed Water which should be deducted from the inflow is 17,130 acre-feet for the 1968-69 water year. This is comprised of the 13,877 acre-feet from the Whittier Narrows Water Reclamation Plant and the 3,253 acre-feet of reclaimed water generated inside the watershed originating from the Pomona Plant.

Make-up Water by Surface Flow Delivery

During the water year 1968-69 the Upper Area purchased no Metropolitan Water District water for surface flow delivery to the Lower Area as Make-up Water. All Make-up Water requirements were fulfilled by payment for Reclaimed Water previously purchased by Lower Area Parties.

Recirculation of Measured Water

During the water year 1968-69 there was no recirculation of measured water as defined in Paragraph 3(1)(6) of the Judgment.

Unusable Surface Flow

The water from San Gabriel Valley which flows past Montebello Forebay is called Unusable Surface Flow and is determined in accordance

with Exhibit B of the Judgment. Surface outflow from the Montebello Forebay is accounted for on the Rio Hondo at Stewart and Gray Road, Station F45D-R, and on the San Gabriel River at Florence Avenue, Station F262-R. This surface outflow may be comprised of water from the San Gabriel Valley and of local storm water which enters the channel southwesterly of Whittier Narrows.

During water year 1968-69, measured surface outflow from the Montebello Forebay in the Rio Hondo at Station F45D-R was 307,100 acre-feet. This included water from San Gabriel Valley and local inflow originating below Whittier Narrows. The daily inflow from tributary channels below Whittier Narrows was estimated by correlating the drainage areas of the unmeasured storm drains with the Montebello storm drain, which is equipped with a stream flow recorder. The total amount of local storm inflow was calculated to be 12,523 acre-feet. By an analysis of daily flows, it was possible to segregate the flow at Stewart and Gray Road into local storm outflow and unusable surface flow. It was determined that the local storm outflow was 11,991 acre-feet and the unusable surface flow in the Rio Hondo was 295,109 acre-feet.

The total flow of the San Gabriel River at Florence Avenue Station F262-R was measured to be 197,600 acre-feet. This flow consisted of local storm inflow through storm drains located in the Montebello Forebay and of discharge from San Gabriel Valley. Analysis of daily flows in accordance with provisions in the Judgment indicated a total outflow from

the Montebello Forebay of San Gabriel Valley Water of 192,924 acre-feet in the San Gabriel River.

There is provision in the Judgment that any Surface Flow which has been caused to flow out of Montebello Forebay as surface runoff because of spreading of water in Montebello Forebay by or on behalf of Lower Area Parties shall be a part of Usable Water. Although there was a considerable quantity of surplus flow out of Montebello Forebay during water year 1968-69, it was not due to spreading of water in the Forebay.

The total Unusable Surface Flow passing through the Montebello Forebay in the Rio Hondo and San Gabriel River in water year 1968-69 was 488,033 acre-feet.

Determination of Usable Water

Usable Water under terms of the Judgment is defined as the sum of Surface Flow, Subsurface Flow and Export to Lower Area less Lower Area Replenishment Water, Reclaimed Water, Make-up Water by Surface Flow Delivery, Recirculation of Measured Water and Unusable Surface Flow. Shown in Table 6 is the determination of Usable Water for water year 1968-69.

TABLE 6

USABLE WATER FOR WATER YEAR 1968-69

<u>Item</u>	<u>Amount, in acre-feet</u>
Surface Flow	637,906
Subsurface Flow	24,400
Export to Lower Area	<u>23,395</u>
Subtotal	685,701
Less:	
Lower Area Replenishment Water	17,748
Reclaimed Water	17,130
Make-up Water by Surface Flow Delivery	0
Recirculation of Measured Water	0
Unusable Surface Flow	<u>488,033</u>
Subtotal	<u>522,911</u>
Usable Water	162,790

CHAPTER V. ACCRUED DEBIT OR CREDIT, MAKE-UP WATER AND LONG-TERM ACCOUNTING

Under terms of the Judgment, the Watermaster is required to annually determine the Accrued Debit or Credit of the Upper Area and the obligation, if any, of the Upper District to deliver Make-up Water during the ensuing water year. A long-term accounting is required each 15 to 25 years. There is presented herein a summary of operations under the Judgment which include Usable Water received, Annual Entitlement, Accrued Debit or Credit and Make-up Water deliveries.

Prior Year Determinations

In previous Watermaster reports minor changes have been made in findings published in prior reports. These changes have usually resulted from finalizing of preliminary data available at time of preparation of the report. The U.S. Geological Survey has not yet published its water supply paper for the 1967-68 water year. The Los Angeles County Flood Control District is scheduled to publish its "Biennial Report on Hydrologic Data Seasons of 1967-68 and 1968-69" in September 1970. When these documents are published they will be reviewed and any changes considered warranted for prior Watermaster reports will be made.

Delivery of Make-up Water

By letter dated October 2, 1968, the Upper San Gabriel Valley Municipal Water District requested of Central Basin Municipal Water District a statement of the total number of acre-feet of Reclaimed Water purchased and the cost per acre-foot thereof for the 1967-68 water year. By letter dated October 21, 1968, Central Municipal advised Upper District that it had purchased 18,275.3 acre-feet. The cost of this water was \$18.00 per acre-foot.

The Upper District elected to pay Central Municipal for the cost of Reclaimed Water to the full extent of the Accrued Debit as of September 30, 1968. Accordingly, prior to October 1, 1969, the Upper District made a payment to Central Municipal in the amount of \$100,746.00 for 5,597 acre-feet.

Adjusted Accrued Debit

Shown in the following tabulation is the determination of the Adjusted Accrued Debit as of September 30, 1968. The Adjusted Accrued Debit as of September 30, 1968 is defined herein as the "Accrued Debit as of September 30, 1968, adjusted for the Make-up Water delivered in 1968-69 water year."

		<u>Quantity, in acre-feet</u>
Accrued Debit of Upper Area as of September 30, 1968		5,597
Make-up Water Deliveries		
Reclaimed Water Credit	5,597	
Surface Flow Delivery	<u>0</u>	
Subtotal		<u>5,597</u>
Adjusted Accrued Debit of Upper Area as of September 30, 1968		0

Accrued Credit for 1968-69

The Lower Area Annual Entitlement as heretofore determined for 1968-69 is 84,000 acre-feet. The Usable Water received was 162,790 acre-feet, which results in a credit for the water year 1968-69 of 78,790 acre-feet. The Accrued Credit as of September 30, 1969 is equal to the 1968-69 credit of 78,790 acre-feet since the Accrued Debit of September 30, 1968 was reduced to zero by the payment for Reclaimed Water during the water year 1968-69. Since there is an Accrued Credit for 1968-69 the Upper Area is under no obligation to furnish Make-up Water to the Lower Area during 1969-70. This Accrued Credit will be carried forward until it is used up by future Debits.

Summary of Operations under Judgment

Table 7 is a summary of operations under the Judgment showing Lower Area Annual Entitlement, Usable Water and Make-up Water received by Lower Area and the Accrued Debit or Credit of Upper Area for each year of operation since the effective date of the Judgment.

TABLE 7
SUMMARY OF OPERATION UNDER JUDGMENT
(Values in acre-feet)

<u>Water Year</u>	<u>Lower Area Annual Entitlement</u>	<u>Water received by Lower Area*</u>			<u>Accrued Credit(+) or Debit(-)</u>
		<u>Usable</u>	<u>Make-up</u>	<u>Total</u>	
1963-64	67,200	40,975	0	40,975	-26,225
1964-65	68,000	34,741	13,257	47,998	-46,227
1965-66	70,300	71,272	21,017	92,289	-24,238
1966-67	78,700	80,653	14,735	95,388	- 7,550
1967-68	67,200	61,728	7,425	69,153	- 5,597
1968-69	<u>84,000</u>	162,790	5,597	<u>168,387</u>	<u>+78,790</u>
Six-year total	435,400			514,190	+78,790

*Includes only Upper Area obligation under the Judgment

Long-term Accounting Data

The Watermaster is required from time to time, but not sooner than 15 years nor later than 25 years after September 30, 1963, to make a Long-term Accounting of the aggregate amount of Usable Water and Make-up Water received by the Lower Area. The amount of such water received during the Long-term Accounting period is compared to a theoretical amount comprised of the base period annual entitlement multiplied by the number of years in the period and then adjusted by the ratio of the average annual rainfall for the period to 18.52 inches. A summary of items which will in the future be needed for Long-term Accounting is presented in Table 8.

TABLE 8
DATA FOR LONG-TERM ACCOUNTING

<u>Water year</u>	<u>Rainfall, in inches</u>		<u>Water received by Lower Area, in acre-feet</u>			
	<u>Annual amount</u>	<u>Accumu- lated average annual amount</u>	<u>Usable</u>	<u>Make-up</u>	<u>Total</u>	<u>Accumu- lated total</u>
1963-64	9.45	9.45	40,975	0	40,975	40,975
1964-65	15.24	12.34	34,741	13,257	47,998	88,973
1965-66	19.61	14.77	71,272	21,017	92,289	181,262
1966-67	25.03	17.33	80,653	14,735	95,388	276,650
1967-68	15.03	16.87	61,728	7,425	69,153	345,803
1968-69	30.50	19.14	162,790	5,597	168,387	514,190

1969-70

Thus far under the Watermaster operation the rainfall has averaged 19.14 inches for the six year period. The Lower Area has received under the Judgment 514,190 acre-feet which is an average for the six year period of 85,698 acre-feet.

CHAPTER VI. SUMMARY OF FINDINGS
FOR WATER YEAR 1968-69

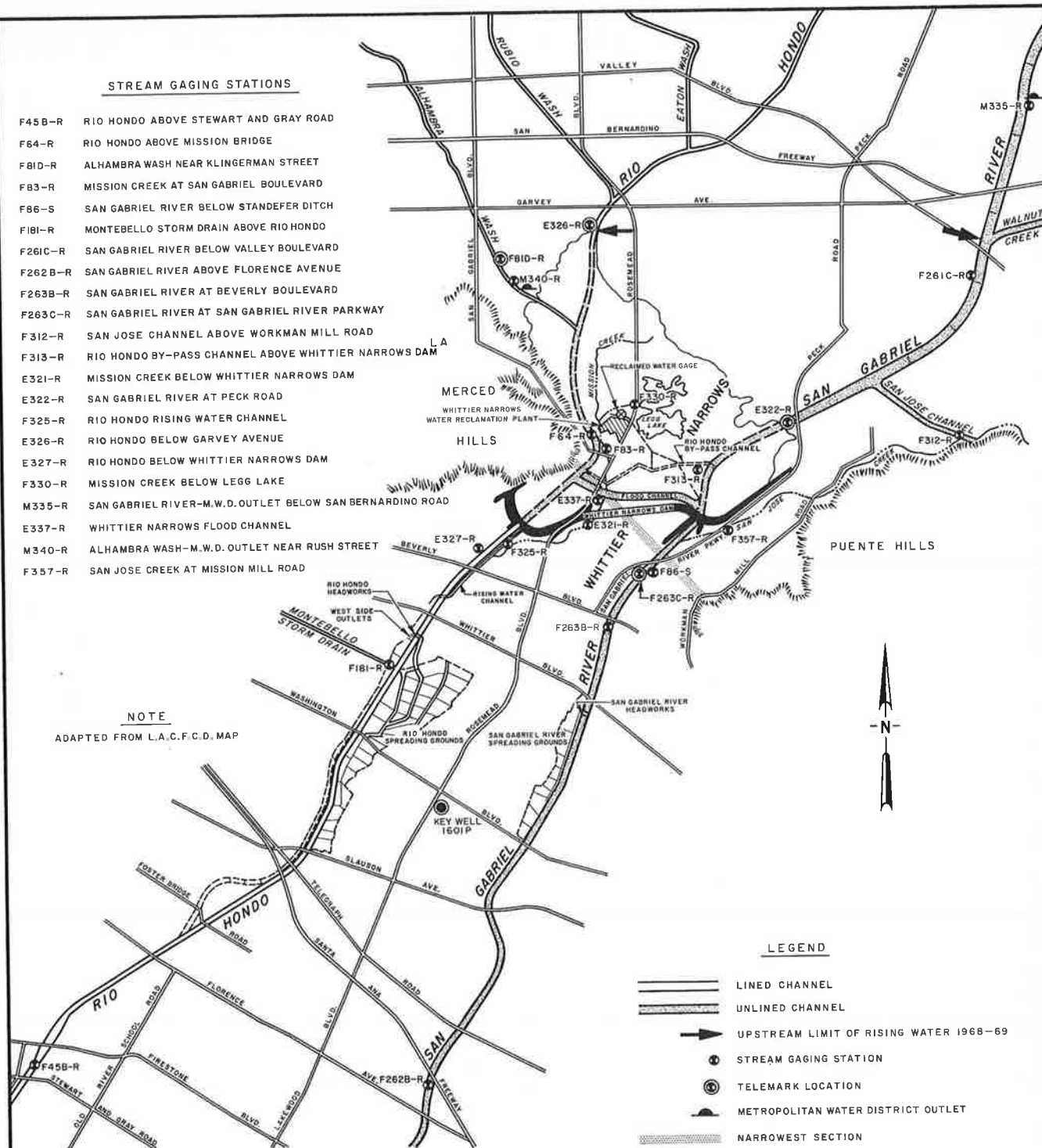
The findings of the Watermaster for water year 1968-69 are as follows:

	<u>Quantities in acre-feet</u>
1. Rainfall 1968-69, 30.50 inches	
2. 10-year average rainfall, 16.6 inches	
3. Lower Area Annual Entitlement	84,000
4. Surface Flow through Whittier Narrows	637,906
5. Subsurface Flow through Whittier Narrows	24,400
6. Water exported through Whittier Narrows	23,395
7. Total flow through Whittier Narrows	685,701
8. Lower Area Replenishment Water	17,748
9. Reclaimed Water	17,130
10. Make-up Water (Surface Flow delivery)	0
11. Recirculation of Measured Water	0
12. Unusable Surface Flow	488,033
13. Usable Water received by Lower Area	162,790
14. Credit for water year 1968-69	78,790
15. Accrued Debit of Upper Area as of September 30, 1968	5,597
16. Amount of Make-up Water delivered during water year 1968-69	
Payment for Reclaimed Water	5,597
Surface Flow Delivery	<u>0</u>
Total	5,597
17. Adjusted Accrued Debit of Upper Area as of September 30, 1968	0
18. Accrued Credit of Upper Area as of September 30, 1969	78,790

STREAM GAGING STATIONS

- F45B-R RIO HONDO ABOVE STEWART AND GRAY ROAD
- F64-R RIO HONDO ABOVE MISSION BRIDGE
- F81D-R ALHAMBRA WASH NEAR KLINGERMANN STREET
- F83-R MISSION CREEK AT SAN GABRIEL BOULEVARD
- F86-S SAN GABRIEL RIVER BELOW STANDEFER DITCH
- F101-R MONTEBELLO STORM DRAIN ABOVE RIO HONDO
- F261C-R SAN GABRIEL RIVER BELOW VALLEY BOULEVARD
- F262B-R SAN GABRIEL RIVER ABOVE FLORENCE AVENUE
- F263B-R SAN GABRIEL RIVER AT BEVERLY BOULEVARD
- F263C-R SAN GABRIEL RIVER AT SAN GABRIEL RIVER PARKWAY
- F312-R SAN JOSE CHANNEL ABOVE WORKMAN MILL ROAD
- F313-R RIO HONDO BY-PASS CHANNEL ABOVE WHITTIER NARROWS DAM
- E321-R MISSION CREEK BELOW WHITTIER NARROWS DAM
- E322-R SAN GABRIEL RIVER AT PECK ROAD
- F325-R RIO HONDO RISING WATER CHANNEL
- E326-R RIO HONDO BELOW GARVEY AVENUE
- E327-R RIO HONDO BELOW WHITTIER NARROWS DAM
- F330-R MISSION CREEK BELOW LEGG LAKE
- M335-R SAN GABRIEL RIVER-M.W.D. OUTLET BELOW SAN BERNARDINO ROAD
- E337-R WHITTIER NARROWS FLOOD CHANNEL
- M340-R ALHAMBRA WASH-M.W.D. OUTLET NEAR RUSH STREET
- F357-R SAN JOSE CREEK AT MISSION MILL ROAD

NOTE
ADAPTED FROM L.A.C.F.C.D. MAP



LEGEND

- ==== LINED CHANNEL
- ===== UNLINED CHANNEL
- ➔ UPSTREAM LIMIT OF RISING WATER 1968-69
- ⊗ STREAM GAGING STATION
- ⊙ TELEMARK LOCATION
- ◐ METROPOLITAN WATER DISTRICT OUTLET
- ▨ NARROWEST SECTION

SAN GABRIEL RIVER WATERMASTER

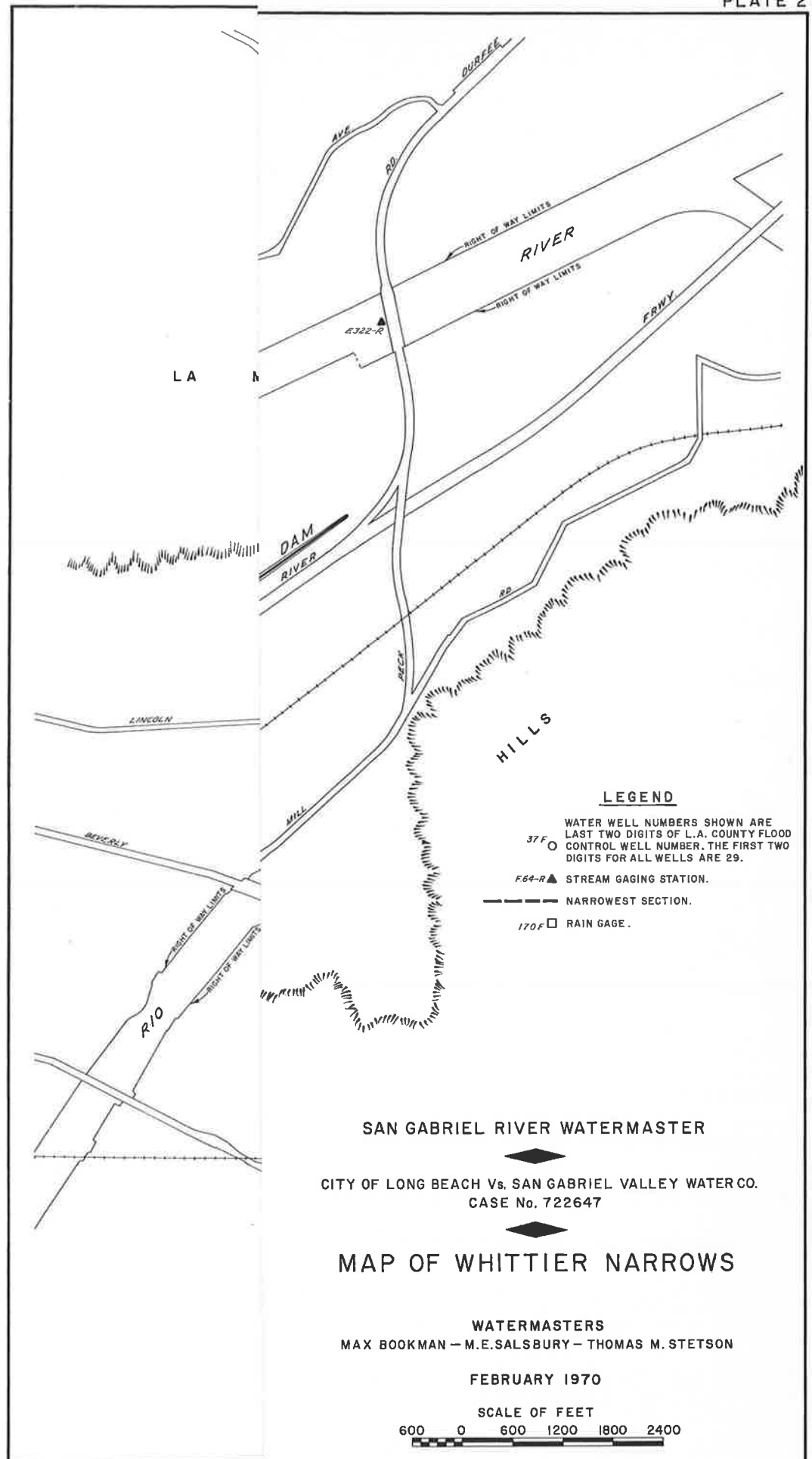
CITY OF LONG BEACH Vs. SAN GABRIEL VALLEY WATER CO.
CASE No. 722647

STREAM GAGING STATIONS
RIO HONDO - SAN GABRIEL RIVER SYSTEM

WATERMASTERS
MAX BOOKMAN-M.E.SALSBURY-THOMAS M.STETSON

FEBRUARY 1970

SCALE OF FEET
4000 0 4000 8000



APPENDIX

SAN GABRIEL RIVER WATERMASTER
Statement of Income and Expenditures
For the Water Year 1968 - 1969

Carried forward from year 1967 - 1968		\$ 7,471.53
Income		<u>7,500.00</u>
		14,971.53
Expenditures		
Administrative fees and general operating expenses	\$ 3,105.59	
Field inspections	32.60	
Collection of data and maintenance of records	3,051.06	
Calculations and preparation of Watermaster Reports for water years 1968 - 1969	2,809.41	
Printing and reproduction costs	<u>463.75</u>	
Total expenditures		<u>9,462.41</u>
Balance		\$ <u><u>5,509.12</u></u>

R. J. GALLETTY CERTIFIED PUBLIC ACCOUNTANT

1 HELM & BUDINGER
2 4063 RADford Avenue
3 Studio City, California 91604
4 877-1526

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JAN 27 1970

COUNTY CLERK

5 Attorneys for Upper San Gabriel
6 Valley Municipal Water District,
7 Defendant.

8 SUPERIOR COURT OF THE STATE OF CALIFORNIA

9 FOR THE COUNTY OF LOS ANGELES

10 BOARD OF WATER COMMISSIONERS)
11 OF THE CITY OF LONG BEACH,)
12 a Municipal Corporation;)
13 CENTRAL BASIN MUNICIPAL WATER)
DISTRICT, a Municipal Water District;)
and CITY OF COMPTON, a Municipal)
Corporation,)

14 Plaintiffs,

15 vs.

16 SAN GABRIEL VALLEY WATER COMPANY,
17 a corporation; et al,

18 Defendants.

NO. 722647

NOTICE OF CHANGE OF
ADDRESS

19 Pursuant to Paragraph XVII of the Judgment in this matter
20 notice is hereby given that the mailing address of Upper San
21 Gabriel Valley Municipal Water District has been changed to:
22 11310 East Valley Boulevard, El Monte, California 91734.

23 Dated: January 23, 1970.

24 UPPER SAN GABRIEL VALLEY MUNICIPAL
25 WATER DISTRICT, Defendant

26 By Ralph B. Helm
27 Ralph B. Helm, Attorney

WATER QUALITY ANALYSIS OF RECLAIMED WATER
FROM THE WHITTIER NARROWS WATER RECLAMATION PLANT

Composite: 8:00 A.M. September 3 to 8:00 A.M. September 4, 1969

<u>Constituent</u>	<u>Raw Sewage</u>	<u>Final Effluent</u>	<u>Maximum Limits</u>
pH	7.50	8.00	
Solids, Suspended, mg/l	167	16	
Solids, Dissolved, mg/l	603	698	1,000
Solids, Total, mg/l	770	714	
Conductivity, EC x 10 ⁶	977	1,162	
Hardness, Total, mg/l as Ca CO ₃	207	170	
Alkalinity, Total, mg/l as Ca CO ₃	242	262	
Chloride, mg/l Cl	109	146	250
Sulfate, mg/l SO ₄	102	111	
Sulfate + Chloride mg/l	211	257	500
Phosphate, Total, mg/l P	7.05	9.40	
Fluoride, mg/l F	0.72	1.16	1.5
Nitrate, mg/l N	-	2.5	
Nitrite, mg/l N	-	0.49	
Ammonia, mg/l N	20.4	17.1	
Organic Nitrogen, mg/l N	12.3	3.5	
Carbon, Total, mg/l C	-	-	
COD, Total, mg/l O	283	53	
COD, Soluble, mg/l O	-	38	
BOD, mg/l O, 5 days, 20° C	159	8	
Phenols, mg/l as C ₆ H ₅ OH	0.023	0.000	
MBAS, mg/l as ABS	2.7	1.3	2.0
Hexane Extractables, mg/l	-	0.5	
Arsenic, mg/l As	0.00	0.00	0.05
Boron, mg/l B	0.42	0.72	2.0
Cadmium, mg/l Cd	-	0.001	
Chromium, Hexavalent, mg/l Cr	0.10	0.01	0.05
Copper, mg/l Cu	0.22	0.04	3.0
Iron, mg/l Fe	1.18	0.11	
Lead, mg/l Pb	0.070	0.017	0.1
Manganese, mg/l Mn	0.0	0.0	
Iron + Manganese, mg/l	1.18	0.11	0.3
Potassium, mg/l K	14	18	
Sodium, mg/l Na	111	153	
Sodium, Equivalent Ratio. % Na	51.8	63.2	60.0
Zinc, mg/l Zn	0.46	0.23	15
Calcium, mg/l CaCO ₃	146	131	
Lithium, mg/l Li	0.07	0.06	
Sodium Adsorption Ratio	3.36	5.09	

