Los Angeles FCD

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QUESTIONS ASKED BY MR. SAGRAMOSA
OF MARICOPA COUNTY, ARIZONA

Flood Control History For L.A.

I. When did your organization evolve from sponsor of federally funded and constructed flood control measures to the current mission/functions? What was the rationale at each step in the evolution? Was there such an evolution? Was there special legislation that helped the transition?

Reponse: District History

1984

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B. Flood Control Facilities

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The electorate passed the following bond issues to finance storm drain systems:

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1958	$225,000,000
1964	$275,000,000
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D. Transfer Drains

Transfer charge? No. Must accept system. Main line system 24" min.

Local subdivision ordinances require elimination of the flood hazards before land developers may sell subdivided properties. Elimination of the flood hazard often requires construction of drainage facilities by the developer. It is usually to the developer's advantage to build the facilities to District standards and transfer them to the District for maintenance. The District also accepts drains constructed by other public agencies.

E. Operations and Maintenance

What computer system? Real time?

As a consequence of the extensive District flood control and water conservation facility construction and the transfer of numerous drains constructed by others, the District has acquired a widespread operation and maintenance responsibility. Thus, the District has implemented a computer-based management information system. The system produces a series of management reports that assist that division in work scheduling, cost tracking, budget analysis, productivity measurement, and equipment and personnel usage. The features of this system provide, on a daily basis, the cost of individual jobs as they are progressing, the ability to better schedule essential personnel and equipment on the jobs for which they are required, and information on the use of District and rented equipment to maximize efficiency. Operation and Maintenance Division has also defined its routine workload and structured it to optimize the use of manpower and equipment.

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The District's authority is derived primarily from the Los Angeles County Flood Control Act which was enacted by the State in 1915 and revised on several occasions.

Assignments such as flood plain management and advice to Regional Planning and County Engineer-Facilities, as well as fees for the various services provided, are by local ordinance.

II. What is the relationship between your District and municipally owned storm systems? Are you involved in storm sewer systems? If so, what is the usual level of protection provided? What is the least level of protection? Do you justify projects on an economic basis (B/C ratio)? What interest rate do you use?

Response

Since 1952, the voters of the District approved four major District-wide storm drain bond issues totaling $931 million. Projects were prioritized among the cities and the County on two bases: regional systems and local systems. Regional systems are those required to provide outfall capacity for local systems involving several communities. Local systems are the typical neighborhood drainage systems. The regional systems were financed on a District-wide basis through a coordinated planning system involving the participation of the cities and County. Local sytems were planned by each city on the basis of a funding allocation proportioned to population and assessed valuation. Local project priorities within each city were determined by the cities.

Drains constructed by subdividers, other agencies, and other departments may, upon application, if they have met District standards and procedures, be transferred to the District for operation and maintenance.

The District maintains more than 1,850 miles of channels and storm drains.

The following criteria are applicable to the level of protection provided:

a. In those situations where a proposed drain will be connected to an outlet of restricted capacity and where it is improbable that the upper terminus of the proposed drain will be extended in the future, the design Q shall be compatible with the outlet conditions.

b. For drains to be located in natural existing watercourses or which will serve as outlets for sump areas, a storm frequency based on 50-year rainfall shall apply.

c. For drains where the above criteria are not applicable, a storm frequency of not less than 10 years shall apply if the streets are capable of carrying the difference between the 10-year and 50-year Q's.

We use a form of benefit-cost analysis to justify projects, a statistical evaluation of urban drainage benefits, which we call "Beneval". We use the prevailing interest rate in accordance with the Corps of Engineers in our evaluations.

III. What is your flood plain management authority? Would you provide us with copies of appropriate regulations? What relationships do you have (formal and informal) with municipal flood plain administrators? If formal agreements are available, could we have a copy?

Response:

Our program of flood plain management, focusing on nonstructural flood protection, is accomplished under amendments to either the County Zoning Ordinances or the County Building Code. Under either of the ordinances, we map the area in a watershed that would be flooded in the event of our design storm. Then, we reserve in the area either a floodway under the Building Code or a flood protection area under the zoning ordinances. The reserved area is large enough to contain the design storm runoff without raising the water surface more than 1 foot above the level it would have been if the flow were allowed to cover the entire flood plain.

Under the Building Code, development can still take place in the reserved floodway if it is constructed free of flood hazard and does not in any way increase the flood hazard to adjoining properties. In a flood protection area established under zoning, no new construction is allowed. Copies of the ordinances are available.

We are urging the cities within the County to adopt Flood Plain Management Programs comparable to our own and are planning to offer incentives in the form of priorities for flood control projects in their cities and assistance to them in implementing the programs. We do not now have formal or informal agreements with the cities.

IV. Do you have any regulatory authority in drainage review for development? Would you provide us with copies of the appropriate regulations? What relationships do you have (formal and informal) with municipal planning and development departments to ensure compatible development in areas to be annexed?

Response:

In 1980, County ordinances were adopted which established that this District would act as a consultant to Regional Planning with respect to applications for a permit, variance, nonconforming use, structure review, zone change, or subdivision in the high flood hazard areas of the unincorporated areas within the District. At the same time, a similar ordinance was adopted establishing this District as a consultant to County Engineer-Facilities in building and grading permit matters in the same high flood hazard areas. Therefore, the District is very influential in development regulation in the unincorporated areas, but its authority is technically advisory rather than regulatory. Copies of the ordinances are available.

The District reviews any drainage facilities that are planned to be transferred upon completion to the District for operation and maintenance, and therefore, influences the extent and standards of such facilities in both the incorporated and unincorporated areas of the District.

We have no formal agreements with the cities with respect to drainage facilities in areas to be annexed; we handle each situation separately as it arises.

V. Are you involved in groundwater recharge? What are your design and construction criteria? Was there special legislation involved? What measures are taken to ensure quality of recharge water?

Response:

The Los Angeles County Flood Control District is extensively involved in groundwater recharge and is empowered to do so under the provisions of its act which provides for the control and conservation of the flood, storm, and other wastewaters of said District; to conserve such waters for beneficial and useful purposes by spreading, storing, retaining, or causing to percolate into the soil within said District; or to save or conserve in any manner, all or any of such waters. The District operates 29 spreading grounds and utilizes reaches of soft-bottom channels for the spreading of storm runoff, releases from upstream dams, and imported, reclaimed, and other waste waters. Some of the spreading grounds have a

number of shallow basins with allowed water depths of 4 to 6 feet; some are deep pits. They are located adjacent to major channels from which diversions of water can be made. Also, they are located where the soil is porous and there is communication with the underground water producing zones.

The District works closely with the local water agencies who purchase and provide the imported and reclaimed water spread. Coordination is also made regarding the spreading of water under water rights.

Regarding quality assurance, the District has a surface water monitoring program which includes a monthly sampling of flows tributary to its two largest spreading grounds; satisfactory results there are felt to be representative of all flows to the District's spreading areas. Under its annual sampling of the groundwater basins, the District is assured of satisfactory water quality from the recharge area. Where reclaimed water is spread, the sampling is more intensive being quarterly. Also, for reclaimed water, the District conducts continuous TDS surface monitoring but relies on the treatment plants to provide satisfactory water in all regards since they report and are responsible to the health and regulatory agencies to meet standards for the release of the effluent. Similarly, discharges of wastewaters tributary to spreading areas are required to meet standards set under permits issued by the Regional Water Quality Control Board.

VI. Do you have published design and construction standards for certain flood control measures? (Riprap, channel sections, levee, etc.) What criteria or design standards do you use for side drain inlets and floodwalls parallel to main drain channels? What frequency of storms do you handle in side drains?

Response:

The District has developed design manuals, both hydraulic and structural. Levee and riprap criteria are included in the Hydraulic Design Manual. Channel sections are included in the Structural Design Manual.

The criteria we use for side drains and the frequency of storms we handle in the side drains are the same criteria we use for our drainage facilities anywhere in the District if the channel into which the drains outlet has the required capacity. If not, the side drain capacity is scaled down accordingly. (District level of protection is covered under question II.)

VII. What criteria do you use to differentiate between flood control problems and local drainage? Watershed or basin size? Volume or runoff rates?

Response:

We consider facilities that handle the flow from 5 acres or less of tributary drainage area to be local drainage facilities unless they are also subject to debris hazard.

VIII. What criteria do you use and how do you make notification or certification for a dam for insurance purposes?

Response:

We have not been involved in the notification or certification of dams for insurance purposes.

IX. What are your design criteria and level of protection for levee/channel systems?

Response:

The level of protection that we provide in our channel and levee systems is our design storm which is based on 50-year rainfall. Structural criteria are covered in our design manuals.

X. What criteria do you use to justify flood control or drainage projects other than benefit/cost? Do you authorize projects with a B/C ratio less than one?

Response:

In addition to benefit-cost analysis, we use our "Beneval" analysis, community input, and obvious need to protect life and property. Some projects therefore have been authorized that have a benefit-cost ratio of less than one.

XI. What are your project financing mechanisms other than property taxes? How does your "Benefit Assessment" work? Have your ever built detention/ drainage facilities and charged the developer a proportionate share later?

Response:

Nonbond issue District projects are financed by property taxes and benefit assessment.

The benefit assessment is calculated for all property within the District based on runoff from each individual property or, in other words, use of the drainage system. The unit assessment is charged for an average-size single-family residential property. Other properties are assessed by comparative runoff calculated by a formula equating area and land use to that of the average-size single-family residential property. Government land is exempt from the assessment. Also, in areas where there are few or no flood control facilities, the assessment is reduced or zero.

We are investigating the feasibility of developing a major system of detention/retention facilities and extensive channels with the costs to be charged proportionately to developers, but we have not yet adopted that system of financing for any of our projects.

XII. If you manage flood plains, what are your design criteria for developer-built channels and levees? Do you allow the developer to reduce the floodway width if he provides adequate hydraulic conveyance?

Reponse:

We require developers to meet District standards in their construction of channels and levees, including level of protection.

We reduce the floodway width if a developer provides an adequate lesser width conveyance built to District standards with an inlet which is adequate to collect the flow.

XIII. Have you prepared master plans for structural development of streams by private interests? If so, how is it working?

Response:

No, we have not prepared master plans for structural development of streams by private interests. Our floodways are, in effect, master plans for nonstructural solutions.

XIV. There was recently an article in APWA magazine concerning a new maintenance management system you have implemented. Is a copy of your study and maintenance criteria available to us? Who would be the point of contact for further questions? When was the system implemented? Have you done an impact analysis to identify cost savings?

Response:

The Maintenance Management System is contained in several volumes. The study used a system analysis approach and included four phases. These were: first, an Analysis Report which is a description of the current system and identification of areas that need further review; second, a state of the art report which summarized how maintenance was done in other agencies which in some fashion resembled the District; third, a Requirements Report which defined criteria that had to be met for a new system; and fourth, a series of design reports which defined the new system. Copies of any of these reports can be made available. The maintenance criteria that were established as a part of this endeavor are also available. Mr. James Noyes is currently Division Engineer for Operation and Maintenance Division and can be reached at (213) 226-4301 if you have any further questions.

The major implementation of the system occurred in May of 1976. Additional implementation or refinements have been continuous since then. The EDP system was implemented on July 1, 1983. We have done various calculations to give us some insight as to potential cost savings. However, with three major storms since implementation and other external factors impacting the District, it is not possible to exactly pinpoint cost savings.

XV. Are there irrigation facilities in your area that you use to convey or dispose of storm water? How do you ensure quality?

Response:

No, we do not convey or dispose of storm water directly into any irrigation system.

XVI. What are your policy and criteria for development in reservoir areas at normally dry flood control dams?

Response:

The major, normally dry reservoirs in this area in which there has been extensive agricultural and recreational development are owned and operated by the Corps of Engineers. We have allowed recreational useof some of our facilities if such use is not in conflict with our flood control operations and the recreational activity is under the auspices of a responsible public agency that assumes liability. Minor agricultural uses such as bee hives have been allowed through the Distict's permit process where such use does not hinder District operations.

XVII. What are your policy and criteria for reimbursement for loss of business or profit as a result of and during the construction of flood control measures?

Response:

If the flood control project is in a public street, our contract will specify that access be maintained, and we do not compensate businesses along the street. If the project is on private property, compensation for the loss of business becomes part of the right of way negotiations and settlement.

XVIII. What are your policy and criteria for accepting operation and maintenance responsibility for flood control measures constructed by others? Are construction and design criteria published? What level of protection? For channels to be constructed by others, do you require a sediment transport analysis to prove channel stability? In a channel/levee system, what are your design criteria and how do you consider protection against catastrophic failure?

Response:

We accept for operation and maintenance drains constructed by developers, cities, and the County Road Department if such drains are constructed to District standards, have an adequate outlet, have had required District inspections and approvals, and the jurisdictional city or County agency warrants that adequate rights of way are also being transferred.

We have published hydraulic and structural design manuals, and we have nearly ready to publish a Transfer Drain Review Manual.

We do not refuse to accept transfer of a drain on the basis of level of protection.

We make sure that any drains that will be subjected to debris-laden flow have the size, slope, and configuration to transport the debris without deposition. We also require additional invert protection.

We, of course, rely heavily on proper design and inspection as a means of avoiding catastrophic failure. However, we maintain surveillance of our facilities during storms for early detection of any problem that should occur and maintain work crews to make emergency repairs should any become necessary. We have made studies of the areas that would be inundated in the event of a failure of one of our major dams or debris basins for reference by our Director of Emergency Operations in the remote event such a failure should occur. These maps are not made available to the public since the probability of such an occurrence is extremely small, and the maps, therefore, might unnecessarily affect property values.

XIX. As local sponsors for a local Corps of Engineers' flood control channel being constructed through an urban developed area in metropolitan Phoenix, we have acquired nearly 170 residential units that we now manage as rental properties until the land is required for construction. Have you had or do you have a similar circumstance? If so, how did you manage the properties, e.g., utilizing staff or by contract? How was the demolition accomplished, e.g., did you continue the rental program to the last minute and dozer demolish the houses or did you attempt to sell them for removal/salvage?

Response:

Over the years, our projects have required the removal of numerous houses, but few single projects have required the extensive removal you are experiencing. In the large projects we have experienced, the houses were demolished soon after purchase.

We have sold houses to house movers, sold contents of houses that no mover was interested in purchasing, and rented houses until it was necessary to sell or demolish them. We have, in all cases, handled the sale or rental ourselves and have not contracted for that service.

XX. Do you have a flood emergency warning system? What are the components of the system and how does it work? Who is responsible for implementation of warning notification procedures, you or Emergency Services (Civil Defense) organizations? What experience have you had?

Response:

ALERT (Automatic Local Evaluation in Real Time), alias, the Flood Warning System, was developed by the National Weather Service (NWS) to assist local agencies in alerting potential flood victims.

In the early 1970s, the NWS began development of a model using automatic rainfall gages strategically located in the field which could radio current (real time) rainfall amounts into a central computer. The computer could then correct the watershed model based on real conditions and make accurate predictions on peak flows or specific downstream locations.

The first installation of this model was made on the Big Sur River in Monterey County. The system has enabled the County to evacuate residents hours in advance of the flood waters on several occasions. Similar installations have been made in Santa Barbara, Ventura, Orange, and San Diego Counties, all of which can be monitored by our computer.

Our Flood Warning System will first model the Los Angeles River watershed. To date, 16 rainfall and 5 runoff gages have been installed throughout the Los Angeless basin, radioing data to a central computer at Alcazar. The

Risk Management — Flood Alert System vs. Flood Warning. Liability for not warning.

Program Management Div. 60 people
- Planning
- Programming
- Benefit Assessment
- Floodplain Delineation
- Drainage Review.

Press relations — have changed outlook from no contact to developing contacts and being active. Use head of personnel admin group as Information Officer (point of contact).

Flood fighting - plan to spend only 1/3 capital budget prior to flood season. Normal maintenance is budgeted. Excessive maint as aftermath of fires. Make sandbags available to individual property owners (25 or more only if advice of staff engineers) - Temporary debris basins may be constr. Emergency during and after storm to clean debris & repair to structures. Emergency contract authority for Chief Engineer — takes about two weeks to negotiate contract.
Have unlimited rental authority for equipment etc.

Property Management - They dispose of property as soon as it becomes excess. Developing land use plans for r/w. Consider the future use of all r/w for utilities, recreation, transportation corridor. Now using r/w mostly for bike/horse trails with agreements w/ Parks.

model, currently being fine tuned by the NWS, will be installed prior to the 1984-85 Storm Season. It will thus give a prediction of the timing and peak flows at five locations: Los Angeles River Basin below Sepulveda Dam, Big Tujunga Wash below Hansen Dam, Rio Hondo at Stewart and Gray, Los Angeles River at Firestone, and Los Angeles River at Wardlow. These will be adjusted by the computer every 10 minutes based on current data from the field gages.

Unlike other flood control systems using ALERT, the Los Angeles River is controlled by 8 flood control dams. Before the model can give accurate predictions, the effects of the dams will have to be incorporated into the model. In addition, the San Gabriel River system with its 11 dams greatly affects the lower Los Angeles River. Plans to incorporate both the San Gabriel watershed and all the dams are under way, and a complete model for both systems is expected in the 1987-88 Storm Season. It is hoped that by providing an early estimate of peak flows and their timing, the operations of the facilities can be run more efficiently.

No special warning notification procedures have been developed to date. As discussed, a workable model for both the Los Angeles and San Gabriel watersheds is not expected until the 1987-88 Storm Season. Until we have developed some experience and confidence with the systems, formal warnings will probably not be issued.

KDM:lp
8/9/84

Accept any system offered so long as it meets their criteria
Accept catch basin connections for short distances; but generally 24" min pipe size.

50 year rainfall event is three day storm on saturated watershed (Capital Storm) with most rainfall on third.

Do not always pay close attention to B/C. Use of bond issues as authority for projects. Have developed B/C system to recognize
* manual "Benavale".

Incorp. areas only. { Charge $2K for single residential unit
1K for multi residential unit
10K for comm acre } master plan being developed for regional facilities. Detention basins, channels etc to dry lake beds.

Dams store water to be used for recharge purposes, and conservation. They are heavily involved in recreation use of lands.

Development of an infrastructure package maybe a way to go. Water, sewer, roads, parks, flood control

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Floodplain management: no jurisdiction in incorp. areas. Cities generally do a poor job & come back later to ask for $ to correct.
LAFCD is putting poor administrators at tail end of priority list for new construction funds to correct problems. FCD is willing to spend funds to map floodplains. They do their own mapping to own standard, eg, fully developed with debris consideration whereas FEMA standard is only current condition.

Risk management: They are paying for diversion damages. They have no criteria for flowage easement downstream of spillways. Courts have ruled against roadways being used as conveyance for water course.

Water course ordinance in LA County requires landowner to keep water course open. No drainage easement authority/responsibility passes.

Maintenance: Maint Standard — high end after constr appearance
Acceptable Maintenance Condition — low end before.
Maint Routines - prescribed tasks at prescribed intervals;
IBM 9080 central. Automated system, will be developed based on performance
Work standards.
Contracting significant portions of maint effort, eg, catch basin maintenance (has spawned industry); after disaster repair work; weed spray both pre emergent & post emergent spray.

How do you treat undefined water courses below emerg. spillways? Flowage easements? What is your criteria for depth, velocity?

GDM if we visit Corps Office

I. D. Acceptance of new Subd. facilities - anticipate increased tax, pop added maintenance cost - Acceptance Chng

E. ?

E. Cost Control System

VI CC: Design + Constr standards

(cont) (E X F) = ~~24~~

6 X 48 ~~128~~

240

288

A X B =

B X C =

C (E X F) ½

XIV cc maint
reports study

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Bob

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BOK

Los Angeles FCD

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II. What is the relationship between your District and municipally owned storm systems? Are you involved in storm sewer systems? If so, what is the usual level of protection provided? What is the least level of protection? Do you justify projects on an economic basis (B/C ratio)? What interest rate do you use?

Response

Since 1952, the voters of the District approved four major District-wide storm drain bond issues totaling $931 million. Projects were prioritized among the cities and the County on two bases: regional systems and local systems. Regional systems are those required to provide outfall capacity for local systems involving several communities. Local systems are the typical neighborhood drainage systems. The regional systems were financed on a District-wide basis through a coordinated planning system involving the participation of the cities and County. Local sytems were planned by each city on the basis of a funding allocation proportioned to population and assessed valuation. Local project priorities within each city were determined by the cities.

Drains constructed by subdividers, other agencies, and other departments may, upon application, if they have met District standards and procedures, be transferred to the District for operation and maintenance.

The District maintains more than 1,850 miles of channels and storm drains.

The following criteria are applicable to the level of protection provided:

a. In those situations where a proposed drain will be connected to an outlet of restricted capacity and where it is improbable that the upper terminus of the proposed drain will be extended in the future, the design Q shall be compatible with the outlet conditions.

b. For drains to be located in natural existing watercourses or which will serve as outlets for sump areas, a storm frequency based on 50-year rainfall shall apply.

c. For drains where the above criteria are not applicable, a storm frequency of not less than 10 years shall apply if the streets are capable of carrying the difference between the 10-year and 50-year Q's.

We use a form of benefit-cost analysis to justify projects, a statistical evaluation of urban drainage benefits, which we call "Beneval". We use the prevailing interest rate in accordance with the Corps of Engineers in our evaluations.

III. What is your flood plain management authority? Would you provide us with copies of appropriate regulations? What relationships do you have (formal and informal) with municipal flood plain administrators? If formal agreements are available, could we have a copy?

Response:

Our program of flood plain management, focusing on nonstructural flood protection, is accomplished under amendments to either the County Zoning Ordinances or the County Building Code. Under either of the ordinances, we map the area in a watershed that would be flooded in the event of our design storm. Then, we reserve in the area either a floodway under the Building Code or a flood protection area under the zoning ordinances. The reserved area is large enough to contain the design storm runoff without raising the water surface more than 1 foot above the level it would have been if the flow were allowed to cover the entire flood plain.

Under the Building Code, development can still take place in the reserved floodway if it is constructed free of flood hazard and does not in any way increase the flood hazard to adjoining properties. In a flood protection area established under zoning, no new construction is allowed. Copies of the ordinances are available.

We are urging the cities within the County to adopt Flood Plain Management Programs comparable to our own and are planning to offer incentives in the form of priorities for flood control projects in their cities and assistance to them in implementing the programs. We do not now have formal or informal agreements with the cities.

IV. Do you have any regulatory authority in drainage review for development? Would you provide us with copies of the appropriate regulations? What relationships do you have (formal and informal) with municipal planning and development departments to ensure compatible development in areas to be annexed?

Response:

In 1980, County ordinances were adopted which established that this District would act as a consultant to Regional Planning with respect to applications for a permit, variance, nonconforming use, structure review, zone change, or subdivision in the high flood hazard areas of the unincorporated areas within the District. At the same time, a similar ordinance was adopted establishing this District as a consultant to County Engineer-Facilities in building and grading permit matters in the same high flood hazard areas. Therefore, the District is very influential in development regulation in the unincorporated areas, but its authority is technically advisory rather than regulatory. Copies of the ordinances are available.

The District reviews any drainage facilities that are planned to be transferred upon completion to the District for operation and maintenance, and therefore, influences the extent and standards of such facilities in both the incorporated and unincorporated areas of the District.

We have no formal agreements with the cities with respect to drainage facilities in areas to be annexed; we handle each situation separately as it arises.

V. Are you involved in groundwater recharge? What are your design and construction criteria? Was there special legislation involved? What measures are taken to ensure quality of recharge water?

Response:

The Los Angeles County Flood Control District is extensively involved in groundwater recharge and is empowered to do so under the provisions of its act which provides for the control and conservation of the flood, storm, and other wastewaters of said District; to conserve such waters for beneficial and useful purposes by spreading, storing, retaining, or causing to percolate into the soil within said District; or to save or conserve in any manner, all or any of such waters. The District operates 29 spreading grounds and utilizes reaches of soft-bottom channels for the spreading of storm runoff, releases from upstream dams, and imported, reclaimed, and other waste waters. Some of the spreading grounds have a

number of shallow basins with allowed water depths of 4 to 6 feet; some are deep pits. They are located adjacent to major channels from which diversions of water can be made. Also, they are located where the soil is porous and there is communication with the underground water producing zones.

The District works closely with the local water agencies who purchase and provide the imported and reclaimed water spread. Coordination is also made regarding the spreading of water under water rights.

Regarding quality assurance, the District has a surface water monitoring program which includes a monthly sampling of flows tributary to its two largest spreading grounds; satisfactory results there are felt to be representative of all flows to the District's spreading areas. Under its annual sampling of the groundwater basins, the District is assured of satisfactory water quality from the recharge area. Where reclaimed water is spread, the sampling is more intensive being quarterly. Also, for reclaimed water, the District conducts continuous TDS surface monitoring but relies on the treatment plants to provide satisfactory water in all regards since they report and are responsible to the health and regulatory agencies to meet standards for the release of the effluent. Similarly, discharges of wastewaters tributary to spreading areas are required to meet standards set under permits issued by the Regional Water Quality Control Board.

VI. Do you have published design and construction standards for certain flood control measures? (Riprap, channel sections, levee, etc.) What criteria or design standards do you use for side drain inlets and floodwalls parallel to main drain channels? What frequency of storms do you handle in side drains?

Response:

The District has developed design manuals, both hydraulic and structural. Levee and riprap criteria are included in the Hydraulic Design Manual. Channel sections are included in the Structural Design Manual.

The criteria we use for side drains and the frequency of storms we handle in the side drains are the same criteria we use for our drainage facilities anywhere in the District if the channel into which the drains outlet has the required capacity. If not, the side drain capacity is scaled down accordingly. (District level of protection is covered under question II.)

VII. What criteria do you use to differentiate between flood control problems and local drainage? Watershed or basin size? Volume or runoff rates?

Response:

We consider facilities that handle the flow from 5 acres or less of tributary drainage area to be local drainage facilities unless they are also subject to debris hazard.

VIII. What criteria do you use and how do you make notification or certification for a dam for insurance purposes?

Response:

We have not been involved in the notification or certification of dams for insurance purposes.

IX. What are your design criteria and level of protection for levee/channel systems?

Response:

The level of protection that we provide in our channel and levee systems is our design storm which is based on 50-year rainfall. Structural criteria are covered in our design manuals.

X. What criteria do you use to justify flood control or drainage projects other than benefit/cost? Do you authorize projects with a B/C ratio less than one?

Response:

In addition to benefit-cost analysis, we use our "Beneval" analysis, community input, and obvious need to protect life and property. Some projects therefore have been authorized that have a benefit-cost ratio of less than one.

XI. What are your project financing mechanisms other than property taxes? How does your "Benefit Assessment" work? Have your ever built detention/ drainage facilities and charged the developer a proportionate share later?

Response:

Nonbond issue District projects are financed by property taxes and benefit assessment.

The benefit assessment is calculated for all property within the District based on runoff from each individual property or, in other words, use of the drainage system. The unit assessment is charged for an average-size single-family residential property. Other properties are assessed by comparative runoff calculated by a formula equating area and land use to that of the average-size single-family residential property. Government land is exempt from the assessment. Also, in areas where there are few or no flood control facilities, the assessment is reduced or zero.

We are investigating the feasibility of developing a major system of detention/retention facilities and extensive channels with the costs to be charged proportionately to developers, but we have not yet adopted that system of financing for any of our projects.

XII. If you manage flood plains, what are your design criteria for developer-built channels and levees? Do you allow the developer to reduce the floodway width if he provides adequate hydraulic conveyance?

Reponse:

We require developers to meet District standards in their construction of channels and levees, including level of protection.

We reduce the floodway width if a developer provides an adequate lesser width conveyance built to District standards with an inlet which is adequate to collect the flow.

XIII. Have you prepared master plans for structural development of streams by private interests? If so, how is it working?

Response:

No, we have not prepared master plans for structural development of streams by private interests. Our floodways are, in effect, master plans for nonstructural solutions.

XIV. There was recently an article in APWA magazine concerning a new maintenance management system you have implemented. Is a copy of your study and maintenance criteria available to us? Who would be the point of contact for further questions? When was the system implemented? Have you done an impact analysis to identify cost savings?

Response:

The Maintenance Management System is contained in several volumes. The study used a system analysis approach and included four phases. These were: first, an Analysis Report which is a description of the current system and identification of areas that need further review; second, a state of the art report which summarized how maintenance was done in other agencies which in some fashion resembled the District; third, a Requirements Report which defined criteria that had to be met for a new system; and fourth, a series of design reports which defined the new system. Copies of any of these reports can be made available. The maintenance criteria that were established as a part of this endeavor are also available. Mr. James Noyes is currently Division Engineer for Operation and Maintenance Division and can be reached at (213) 226-4301 if you have any further questions.

The major implementation of the system occurred in May of 1976. Additional implementation or refinements have been continuous since then. The EDP system was implemented on July 1, 1983. We have done various calculations to give us some insight as to potential cost savings. However, with three major storms since implementation and other external factors impacting the District, it is not possible to exactly pinpoint cost savings.

XV. Are there irrigation facilities in your area that you use to convey or dispose of storm water? How do you ensure quality?

Response:

No, we do not convey or dispose of storm water directly into any irrigation system.

XVI. What are your policy and criteria for development in reservoir areas at normally dry flood control dams?

Response:

The major, normally dry reservoirs in this area in which there has been extensive agricultural and recreational development are owned and operated by the Corps of Engineers. We have allowed recreational useof some of our facilities if such use is not in conflict with our flood control operations and the recreational activity is under the auspices of a responsible public agency that assumes liability. Minor agricultural uses such as bee hives have been allowed through the Distict's permit process where such use does not hinder District operations.

XVII. What are your policy and criteria for reimbursement for loss of business or profit as a result of and during the construction of flood control measures?

Response:

If the flood control project is in a public street, our contract will specify that access be maintained, and we do not compensate businesses along the street. If the project is on private property, compensation for the loss of business becomes part of the right of way negotiations and settlement.

XVIII. What are your policy and criteria for accepting operation and maintenance responsibility for flood control measures constructed by others? Are construction and design criteria published? What level of protection? For channels to be constructed by others, do you require a sediment transport analysis to prove channel stability? In a channel/levee system, what are your design criteria and how do you consider protection against catastrophic failure?

Response:

We accept for operation and maintenance drains constructed by developers, cities, and the County Road Department if such drains are constructed to District standards, have an adequate outlet, have had required District inspections and approvals, and the jurisdictional city or County agency warrants that adequate rights of way are also being transferred.

We have published hydraulic and structural design manuals, and we have nearly ready to publish a Transfer Drain Review Manual.

We do not refuse to accept transfer of a drain on the basis of level of protection.

We make sure that any drains that will be subjected to debris-laden flow have the size, slope, and configuration to transport the debris without deposition. We also require additional invert protection.

We, of course, rely heavily on proper design and inspection as a means of avoiding catastrophic failure. However, we maintain surveillance of our facilities during storms for early detection of any problem that should occur and maintain work crews to make emergency repairs should any become necessary. We have made studies of the areas that would be inundated in the event of a failure of one of our major dams or debris basins for reference by our Director of Emergency Operations in the remote event such a failure should occur. These maps are not made available to the public since the probability of such an occurrence is extremely small, and the maps, therefore, might unnecessarily affect property values.

XIX. As local sponsors for a local Corps of Engineers' flood control channel being constructed through an urban developed area in metropolitan Phoenix, we have acquired nearly 170 residential units that we now manage as rental properties until the land is required for construction. Have you had or do you have a similar circumstance? If so, how did you manage the properties, e.g., utilizing staff or by contract? How was the demolition accomplished, e.g., did you continue the rental program to the last minute and dozer demolish the houses or did you attempt to sell them for removal/salvage?

Response:

Over the years, our projects have required the removal of numerous houses, but few single projects have required the extensive removal you are experiencing. In the large projects we have experienced, the houses were demolished soon after purchase.

We have sold houses to house movers, sold contents of houses that no mover was interested in purchasing, and rented houses until it was necessary to sell or demolish them. We have, in all cases, handled the sale or rental ourselves and have not contracted for that service.

XX. Do you have a flood emergency warning system? What are the components of the system and how does it work? Who is responsible for implementation of warning notification procedures, you or Emergency Services (Civil Defense) organizations? What experience have you had?

Response:

ALERT (Automatic Local Evaluation in Real Time), alias, the Flood Warning System, was developed by the National Weather Service (NWS) to assist local agencies in alerting potential flood victims.

In the early 1970s, the NWS began development of a model using automatic rainfall gages strategically located in the field which could radio current (real time) rainfall amounts into a central computer. The computer could then correct the watershed model based on real conditions and make accurate predictions on peak flows or specific downstream locations.

The first installation of this model was made on the Big Sur River in Monterey County. The system has enabled the County to evacuate residents hours in advance of the flood waters on several occasions. Similar installations have been made in Santa Barbara, Ventura, Orange, and San Diego Counties, all of which can be monitored by our computer.

Our Flood Warning System will first model the Los Angeles River watershed. To date, 16 rainfall and 5 runoff gages have been installed throughout the Los Angeless basin, radioing data to a central computer at Alcazar. The

model, currently being fine tuned by the NWS, will be installed prior to the 1984-85 Storm Season. It will thus give a prediction of the timing and peak flows at five locations: Los Angeles River Basin below Sepulveda Dam, Big Tujunga Wash below Hansen Dam, Rio Hondo at Stewart and Gray, Los Angeles River at Firestone, and Los Angeles River at Wardlow. These will be adjusted by the computer every 10 minutes based on current data from the field gages.

Unlike other flood control systems using ALERT, the Los Angeles River is controlled by 8 flood control dams. Before the model can give accurate predictions, the effects of the dams will have to be incorporated into the model. In addition, the San Gabriel River system with its 11 dams greatly affects the lower Los Angeles River. Plans to incorporate both the San Gabriel watershed and all the dams are under way, and a complete model for both systems is expected in the 1987-88 Storm Season. It is hoped that by providing an early estimate of peak flows and their timing, the operations of the facilities can be run more efficiently.

No special warning notification procedures have been developed to date. As discussed, a workable model for both the Los Angeles and San Gabriel watersheds is not expected until the 1987-88 Storm Season. Until we have developed some experience and confidence with the systems, formal warnings will probably not be issued.

KDM:lp
8/9/84

THE EVOLUTION OF A SUCCESSFUL MAINTENANCE SYSTEM

By

John M. Tettemer, Member[1]

ABSTRACT

The Los Angeles County Flood Control District found, as many public agencies have, that the available funds were not keeping pace with the financial demands of maintenance. A new approach had to be found to understand and control operation and maintenance expenditures.

The operation and maintenance organization at the District involved approximately 550 personnel spending $14 million annually throughout a 2,700-square-mile area in the County of Los Angeles. Facilities operated and maintained include many dams, debris basins, pump stations, spreading grounds, salt water intrusion barrier projects, and several thousand miles of channels and storm drains.

In analyzing its overall budget, the District found that a large portion of the funds once available for discretionary expenses, such as new projects, were now committed to maintenance and that current trends indicated that all of these funds would be committed to maintenance unless major increases in revenue were achieved or the costs of maintenance reduced. Added revenues would be difficult to find and should only be requested if operation and maintenance costs were clearly defined and close to minimum levels.

This paper gives a complete description of the steps taken which led to the establishment of a new maintenance system, the benefits, and the multimillion dollar cost savings incurred as a result of the system. While this study was developed specifically for the Flood Control District, the system is applicable to most major maintenance functions.

INTRODUCTION

Five years ago the Los Angeles County Flood Control District began implementing a comprehensive revision of its maintenance system. The subsequent years have been eventful ones including three of the wettest storm seasons in history and the passage of Proposition 13 with its sudden and substantial impact on the District's finances and personnel. Despite these "distractions" and the fact that the system is far from being perfect, it is estimated that the savings realized since the system began to be implemented exceed $10 million.

The Flood Control District maintains one of the largest and most complex flood control and water conservation systems in the world. Included are

[1]Acting Chief Deputy Engineer and Project Director, Maintenance Management Study.

14 major dams, 125 debris basins, pump stations, spreading grounds, salt water intrusion barrier projects, and several thousand miles of channels and storm drains throughout a 2,700 square-mile area in Los Angeles County. The estimated replacement cost of this system exceeds $10 billion.

Money is scarce, and the financial demands of maintenance continue to grow as the public works facilities throughout this nation age. The District found, as many public agencies have, that the available funds were not keeping pace with the financial demands of maintenance. A new approach had to be found to understand and control operation and maintenance expenditures.

During the 33 years preceding the implementation of the new maintenance system, the District had been heavily committed to one of the largest urban flood control construction programs in the world. During this period, its management had focused on the development of these new, high-priority facilities. During the same period, however, the maintenance organization was growing with increasing rapidity but without the same management attention that the construction programs enjoyed.

Prior to May 1976 when the new maintenance system began to be implemented, the District had 550 maintenance personnel and was spending $14 million annually for operation and maintenance of its facilities.

In analyzing its overall budget, the District found that a large portion of the funds once available for discretionary expenses, such as new projects, were being committed to maintenance and that trends indicated that all of these funds would be committed to maintenance unless major increases in revenue were achieved or the costs of maintenance reduced. Added revenues would be difficult to find and should only be requested if operation and maintenance costs were clearly defined and close to minimum levels.

THE PROBLEM

The administrative problems simply stated were--was the operation of the maintenance function as effective as possible in view of modern community requirements, limited funding, and governing regulations?--and how do we find out?

APPROACH TO FINDING A SOLUTION

Team Established

A "consulting team" from within the organization was established under close administrative direction. It was assigned to (1) analyze the present organization and (2) review large-scale, "state of the art", maintenance systems throughout the United States to determine what, if any, improvements could be made in the management of the existing maintenance system.

Initial Assessment

The results were quick in coming. The team found that the maintenance organization had grown to a point where management controls were

inadequate and new administrative direction was required. There was not an adequate understanding between line managers and the District's Administration on the levels of maintenance service that were desirable and practical in view of the limited funding available. Many problems were identified by the team and were corroborated by the management of the existing organization. Examples included excessive levels of field management, attempts to control the field organization through controlling dollars for specific maintenance projects, poor middle management morale, insufficiently defined preventive maintenance for major mechanical equipment, and inconsistent patterns of maintenance and employee use.

It appeared from these early studies that substantial improvement could be made, not only in general management but in specific definition of what was wanted from this major cost-consuming element of the District.

State-of-the-Art Search

The team was directed to review, on a national level, the effective maintenance systems that were up and operational. It was given some specific administrative guidance; namely, to find a system which is simple and direct, relatively inexpensive to operate, and if possible one which operates with a minimum amount of day-by-day management involvement.

Numerous organizations were visited and hundreds of telephone calls were made. From this "state-of-the-art" analysis, some basic concepts emerged that were found to be common to those relatively few successful large-scale maintenance organizations in the United States that had maintenance considerations similar to the District's. They are:

1. The majority of maintenance work can be preplanned, prescheduled, pre-engineered, prefinanced, and preapproved.

2. Delegation of day-by-day decision making can be made to relatively low levels because of the advance work done under No. 1.

3. Cost improvement of up to 30 per cent ($4 million for possible annual benefits by the District) can be expected through a well-defined, well-managed maintenance organization, when compared to a nonrigorous system.

4. Employee utilization decisions should be made as close to the work site as possible.

5. Control of maintenance organizations through dollars is far less effective than control through preapproved, clearly defined work.

6. Work site control of work as a management strategy is far less effective for routine work than a good post-audit, which shows any trends in the work development and approval process that need correcting.

The problem was clear, and the basic concepts for improvement were available. The team was directed to start looking at ways to apply the basic concepts to the Flood Control District.

The Consulting Team Approach

It was decided administratively that an internal consulting team would be used to develop a completely new maintenance system. The team included civil engineers with general management background and senior field maintenance personnel. The team was headed by an engineer under the general supervision of the District's Management Systems organization that was familiar with modern management practice and computer-based systems. The need for strong administrative direction was recognized, and an Assistant Chief Deputy Engineer was established as the Project Director. He was responsible directly to the Chief Engineer for development and execution of the study plan, and implementation of approved study findings. The in-house approach, utilizing an in-house consulting team, proved to have many advantages. Amongst them were:

1. The ability to understand in detail the personality aspects of the existing system and to separate them from the procedural, mechanical, policy, and other important ingredients.

2. Many team members who worked in the previous system were expected to be members of the new organization and therefore contributed toward their own future.

3. The Administration learned through the process of developing the many elements of the new system what could be expected, and these experiences were incorporated on an "as-you-go" basis under the general guidelines of the approved system study plan. This flexibility proved to be important.

THE NEW SYSTEM

Concepts

The District was not able to find any one existing maintenance system to adopt which was particularly applicable to the combination of geography, type of facility, community, financial structure, and other parameters under which the District operates in Los Angeles County. It was, however, able to glean many basic concepts from numerous organizations[2] and mold them into a maintenance system which is sufficiently general to be applicable to many maintenance organizations under varying sets of circumstances. The study team therefore benefited enormously by reviewing the highly specialized systems developed by others and then developing a unique generalized system which could be of use to many.

The new maintenance system was built around several very simple concepts. The adoption of these concepts required a major change in the District's traditional view of the operation and maintenance function. An initial design premise for the new system was the concept that 80 per cent of the operation and maintenance functions could be preplanned, pre-estimated,

[2]Major contributor was the Port Authority of New York and New Jersey.

and preapproved. The impact of this concept alone is quite significant to the District in that it changed the organization's management approach from one of centralized control of each maintenance activity to a decentralized preplanned approach. This approach required that the existing maintenance generating system, which was based on inspections and complaints, be replaced by one based on the concept of an "acceptable maintenance condition" for each part of each facility. The acceptable maintenance condition was defined as the level to which a facility can deteriorate physically, visually, and operationally before remedial maintenance activities are desired. Specific applications of maintenance resources to accomplish preplanned, pre-estimated, and preapproved remedial work were designed. These are called "routines". The execution of a "routine" brings the condition of the facility up to what has been defined as the "maintenance standard". The facility then deteriorates again from the maintenance standard to the acceptable maintenance condition, at which time the "routine" is repeated. This is shown in Figure 1.

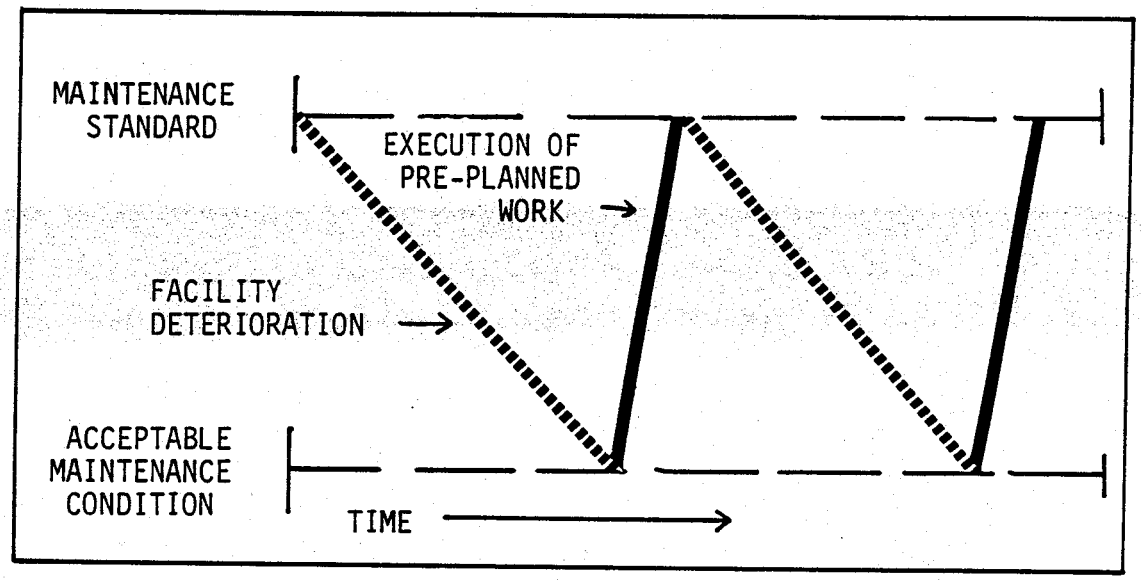


FIGURE 1

General management control can be exercised in three different ways:

1. By redefining the acceptable maintenance condition.
2. By redefining the maintenance standard.
3. By redesigning the "routine".

Great benefits are obtained by using these three controls to establish and adjust service levels, thereby controlling the use of available maintenance dollars. Administration found that based on current community demands and available funds, many of its facilities were overmaintained and some were undermaintained.

Contract With Management

From an administrative standpoint, the most significant adjustment in the new system is embodied in the concept of preapproved work. The District's system will have approximately 7,000 items of preapproved work. Each of these "routines" has related to it the schedule, personnel, equipment, and material requirements for its completion. It is set in the framework of the acceptable maintenance conditions and the maintenance standards for that specific facility. For example, there are routines for landscaping maintenance. The watering, pruning, fertilizing, and general maintenance for each facility's landscaping have been defined, the procedures for work execution have been established. The contract between management and the staff is that management will define its objectives through routines, acceptable maintenance conditions, and maintenance standards, and the field personnel will execute the work effectively. The administrative responsibility is to preapprove each of these routines and thereby establish its specific commitment to budget for personnel, material, and equipment expenditures.

Risk Management

The need for direct administrative involvement in the design of "routines" was established when it was learned that the operation and maintenance organization tended to request the amount of personnel, equipment, and material sufficient for a "no risk" approach to maintenance. Few organizations can afford to eliminate all risk from their operations. To accept some risk, however, requires that the level of risk be defined. This is a management responsibility, and it was accomplished by establishing specific desired results in terms of schedules, equipment, and personnel requirements for each routine, based upon the Administration's judgment of acceptable levels of risk. As an example, some risk in the maintenance of security fencing in lightly populated areas might be worth taking, though the field organization would not be free to make that decision. Alternatively, the effective operation of valves in the major dams must be at a no-risk level. Experience has indicated that this high level of involvement is important in planning the "routine" activities which will consume approximately 80 per cent of the ultimate maintenance dollars spent.

THE FIRST FIVE YEARS

The most important activities that preceded and continued during the first year of implementation were training. One of the system's strong points and the key to its present and future success is that the philosophy, expectations, procedures, and specific duties of all management and supervisory personnel within the system are written. The initial training included not only review of these documents but extensive discussions using visual aids to emphasize the most important aspects of the new system.

Acceptance of the new system, particularly by field maintenance personnel, did not occur quickly. The field management personnel had enjoyed considerable autonomy in a wide range of decision making. Many of these day-to-day decisions were no longer necessary once the District's management had established maintenance standards, acceptable maintenance

conditions, and rosters of routine maintenance. The system also provided a rigorous system of identifying, prioritizing, and approving nonroutine work which allowed less discretion to maintenance supervisors than the previous system had. The field was not at all sure that these changes were for the better. Training, although essential, certainly did not overcome everyone's objections to the new system. Major attitude adjustments have required several years for some individuals. Attrition and replacement by promotion has been a carefully used and effective management tool to strengthen the system. Field supervisory personnel now have a better understanding and appreciation of the fact that by not having to worry about "what am I going to do today?" allows them to concentrate their efforts on the efficient and effective use of resources to perform high quality work, ongoing training, personnel development, identification of maintenance deficiencies, and full participation in the planning of future work.

There have been several external events during the past five years that have had a substantial effect on the maintenance management system and specifically on the rate at which it has been implemented:

1. In June 1978, the California electorate passed Proposition 13 which limited property tax. This immediately reduced the District's 1978-79 budget by approximately 60 per cent. Even though the initial layoff of personnel due to Proposition 13 was small, the uncertainty concerning the District's future during the following year and a half resulted in many excellent, experienced personnel resigning or retiring. This large turnover in personnel caused some delay in the implementation of the new maintenance program. The new system provided accurate information that was essential to decisions to reduce and/or change maintenance standards that were necessary as a result of the sudden loss of revenue. These decisions were able to be made quickly and with assurance that available funds would be spent most effectively to maintain the most vital elements of the District's flood control and water conservation system.

2. When the new maintenance system was introduced, there was widespread skepticism that Operation and Maintenance Division's reduced staff size (560 reduced to 420) would have adequate emergency response capability. These fears proved to be unfounded. In 1978 and again in 1980, Los Angeles County was lashed by storms that resulted in Federal disaster declarations. The District's facilities and its ability to respond adequately to a major emergency were severely tested. The routinizing of storm patrols provided better communication and better quality information concerning conditions at key locations during those storm emergencies. The new system facilitated the orderly prioritization of emergency and routine work, which had to be changed often during the series of storms that occurred in both of those years. The shifting of resources from one geographical area to another took place smoothly. The District's top management was kept continuously apprised of the condition of District facilities and the status of emergency work. The large number of nonroutine storm damage repair items did result in the backlogging of considerable routine maintenance work. Coping with these problems necessarily slowed the implementation of the system.

It is expected, however, that by the fall of 1981, all of the storm damage repair work and the backlogged routine work will have been accomplished.

3. In November 1979, the District's electorate passed Proposition A which restored a substantial portion of the funds lost to Proposition 13. The incomplete restoration has meant, however, that the District's capital outlay program is now restricted almost exclusively to maintenance and repair items. This has accentuated the importance of an efficient maintenance system.

In addition to the interesting influences that are discussed above, there have also been some problems with the system that present opportunities for future improvement. Specifically, the management reports that were "borrowed" from the Port Authority of New York and New Jersey proved only partially adaptable to the District's needs. New computer systems and reports are being developed.

SUMMARY

The five years that have passed since we began to implement the new maintenance system have been turbulent. The new system has not only survived but has made an important contribution to the District's ability to survive these troubled times and to respond successfully to major emergencies.

The benefits accruing to the District from the new maintenance system are numerous. For the first time, the District's Administration directly participates through approval of routines in the risk management aspects of one of the largest and fastest growing areas of nondiscretionary expenditures. Other specific benefits include:

- Shortened chain of command
- Reduced levels of supervision
- Improved planning information for staffing and budgeting
- Greatly increased productivity
- Reduced crew travel
- Greater accountability
- Job enrichment
- Rejuvenated policies and procedures
- Reduced staff support overhead
- Improved opportunities for productive competitiveness
- Quicker and better coordinated response to emergencies

In these days of tight money with no let-up in sight, this type of approach is absolutely mandatory in that it brings to the administrative offices the ability to balance new work, maintenance responsibilities, etc., in one budget at the highest level of organizational management.

The predicted cost savings are being exceeded and the managers and staff are enthusiastic and committed. The public is being better served, at a lower cost.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
SUMMARY OF 1984-85 TABLE OF ORGANIZATION

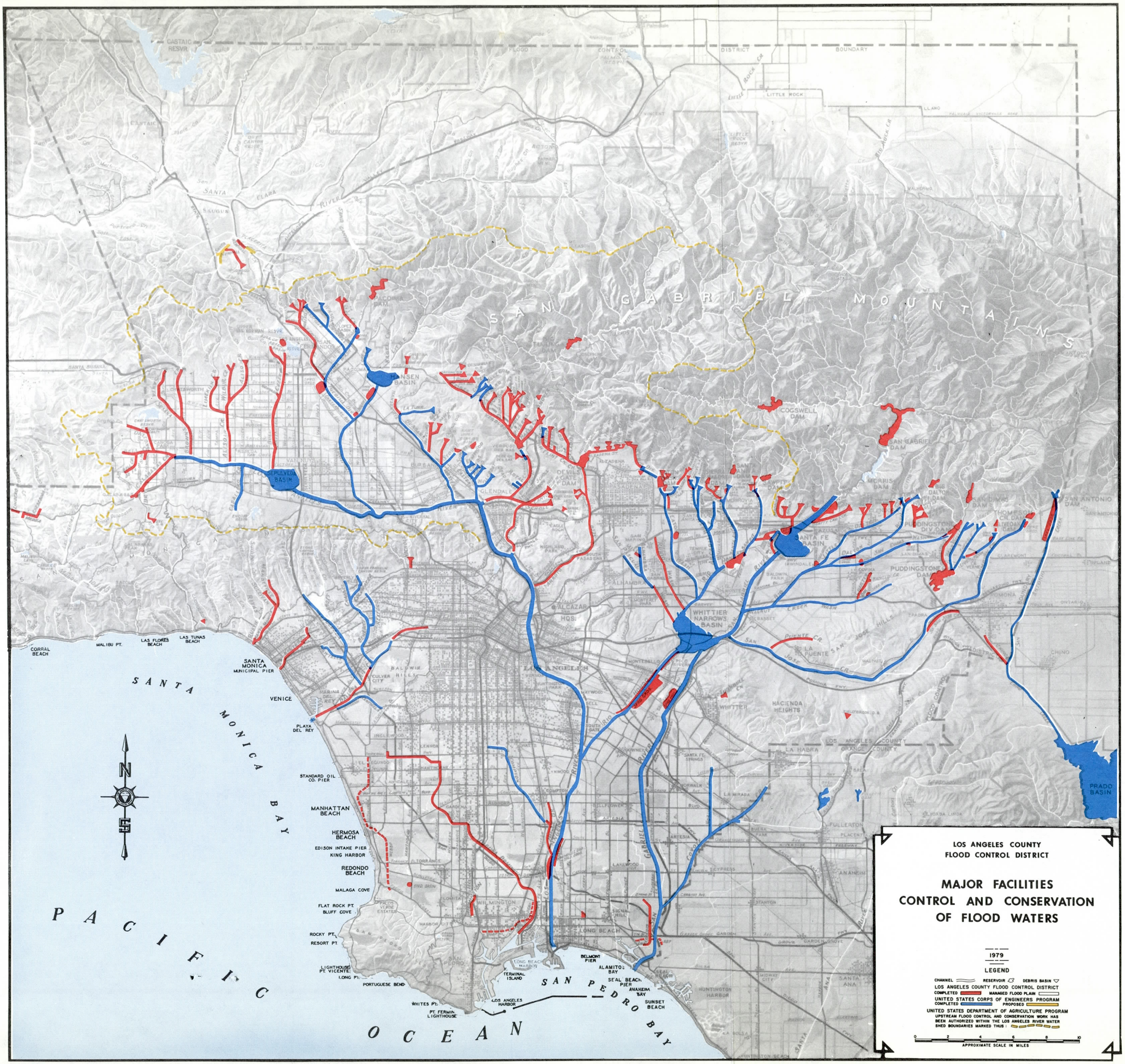
Division	Ordinance Positions	Budgeted Positions
Administration	25	25
Administrative Services	123	116
Business and Fiscal	43	42
Communications and Electrical	36	36
Contract Administration	198	176
Design	93	92
Hydraulic	67	67
Operation and Maintenance	426	391
Program Management	73	66
Property Management	76	61
Water Conservation	69	66
District Total, Permanent Positions	1,229	1,138
As-Needed Positions	581	-
Volunteer Positions	50	
Grand Total - District	1,860	1,138

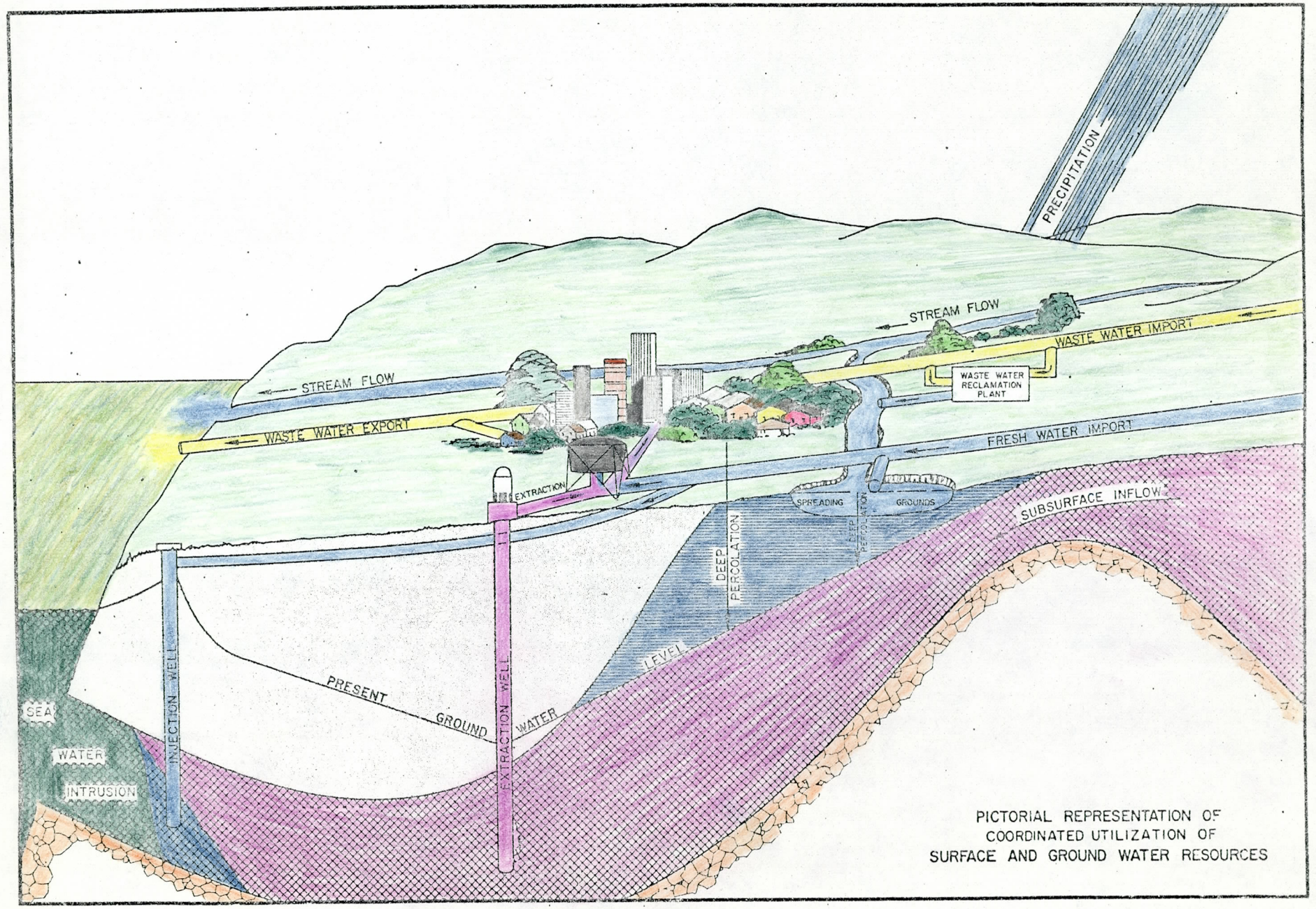
PETER M. WOOD

GROUND-WATER RECHARGE SECTION
WATER CONSERVATION DIVISION
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

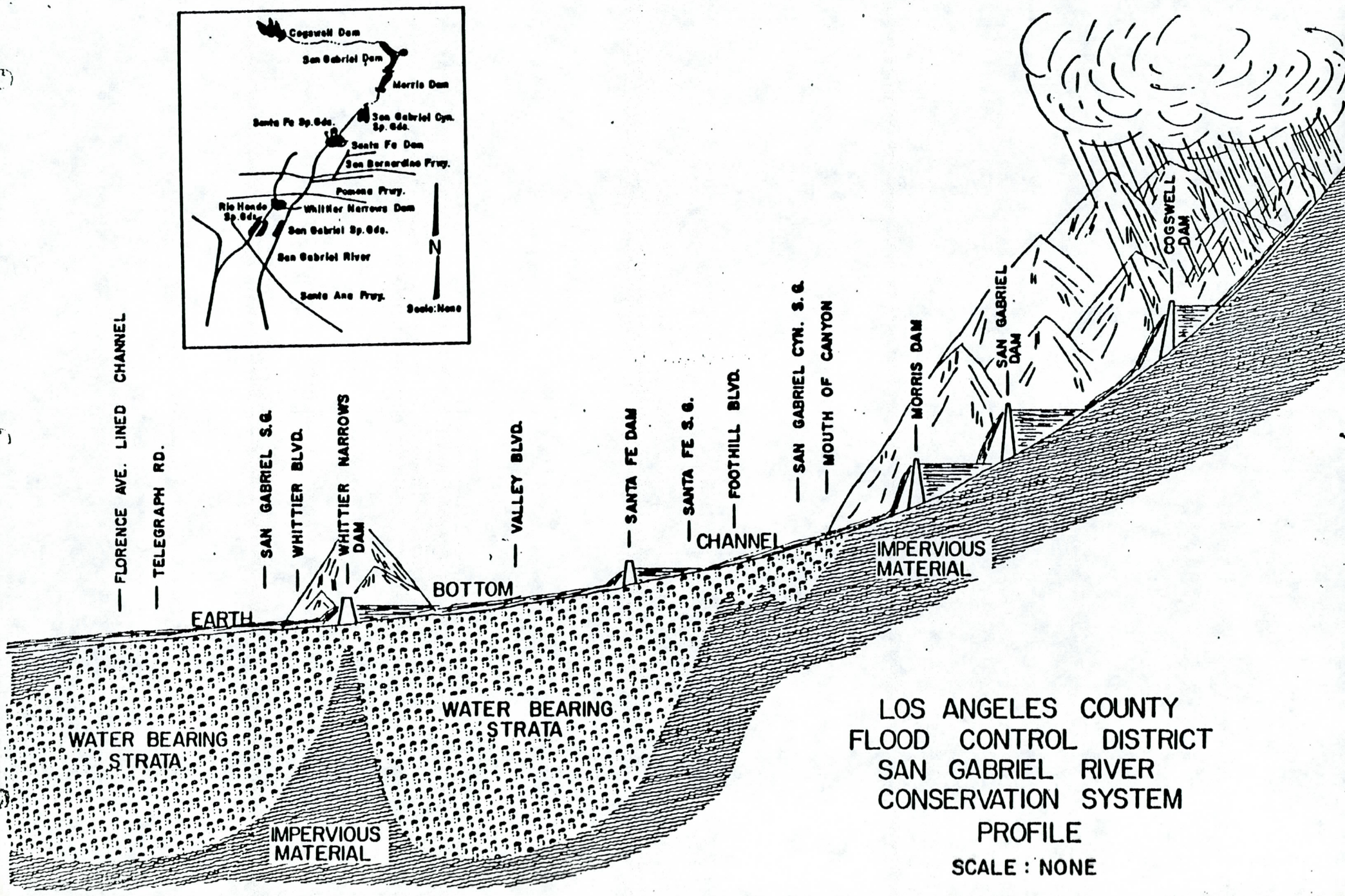
2250 ALCAZAR STREET
LOS ANGELES, CA 90033

TELEPHONE
(213) 226-4384


LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT
MAJOR FACILITIES
CONTROL AND CONSERVATION
OF FLOOD WATERS
1979
LEGEND
CHANNEL
RESERVOIR
DEBRIS BASIN
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
COMPLETED
MANAGED FLOOD PLAIN
UNITED STATES CORPS OF ENGINEERS PROGRAM
COMPLETED
PROPOSED
UNITED STATES DEPARTMENT OF AGRICULTURE PROGRAM
UPSTREAM FLOOD CONTROL AND CONSERVATION WORK HAS BEEN AUTHORIZED WITHIN THE LOS ANGELES RIVER WATER SHED BOUNDARIES MARKED THUS :
0 2 4 6 8 10
APPROXIMATE SCALE IN MILES
SAN GABRIEL MOUNTAINS
PACIFIC OCEAN
SANTA MONICA BAY
SAN PEDRO BAY
SEPULVEDA BASIN
HANSEN BASIN
SANTA FE BASIN
WHITTIER NARROWS BASIN
PRADO BASIN
COGSWELL DAM
SAN GABRIEL DAM
MORRIS DAM
PUDDINGSTONE DAM
SAN ANTONIO DAM
DEVILS GATE DAM
LACOMA DAM
CASTAIC RESVR
CHATSWORTH RESVR
LITTLE ROCK
LITTLE ROCK RESVR
LA PUENTE
HACIENDA HEIGHTS
LA HABRA
LOS ANGELES COUNTY
ORANGE COUNTY
CORRAL BEACH
MALIBU PT.
LAS FLORES BEACH
LAS TUNAS BEACH
SANTA MONICA MUNICIPAL PIER
VENICE
PLAYA DEL REY
STANDARD OIL CO. PIER
MANHATTAN BEACH
HERMOSA BEACH
EDISON INTAKE PIER
KING HARBOR
REDONDO BEACH
MALAGA COVE
FLAT ROCK PT.
BLUFF COVE
ROCKY PT.
RESORT PT.
LIGHTHOUSE
PT. VICENTE
LONG PT.
PORTUGUESE BEND
WHITES PT.
PT. FERMIN LIGHTHOUSE
LOS ANGELES HARBOR
TERMINAL ISLAND
LONG BEACH HARBOR
BELMONT PIER
ALAMITOS BAY
SEAL BEACH PIER
ANAHEIM BAY
SUNSET BEACH
HUNTINGTON HARBOR
LOS ANGELES
WILMINGTON
LONG BEACH
GLENDALE
PASADENA
ALHAMBRA
BURBANK
CULVER CITY
WHITTIER
FULLERTON
ANAHEIM
SANTA ANA
CHINO
ONTARIO
POMONA
CLAREMONT
LA MIRADA
CERRITOS
LAKEWOOD
TORRANCE
GARDENA
COMPTON
NORWALK
SANTA FE SPRINGS
BALDWIN HILLS
HIGHLAND PARK
EAGLE ROCK
ALCAZAR HQS.
SAN MARINO
MONROVIA
AZUSA
COVINA
WALNUT
BALDWIN PARK
IRWINDALE
MIDWAY CITY
LA BOLSA
HUNTINGTON BEACH
N



PICTORIAL REPRESENTATION OF
COORDINATED UTILIZATION OF
SURFACE AND GROUND WATER RESOURCES


Cogswell Dam
San Gabriel Dam
Morris Dam
Santa Fe Sp.Gds.
San Gabriel Cyn. Sp. Gds.
Santa Fe Dam
San Bernardino Fwy.
Pomona Fwy.
Rio Hondo Sp.Gds.
Whittier Narrows Dam
San Gabriel Sp.Gds.
San Gabriel River
Santa Ana Fwy.
N
Scale: None
FLORENCE AVE. LINED CHANNEL
TELEGRAPH RD.
SAN GABRIEL S.G.
WHITTIER BLVD.
WHITTIER NARROWS DAM
VALLEY BLVD.
SANTA FE DAM
SANTA FE S.G.
FOOTHILL BLVD.
SAN GABRIEL CYN. S.G.
MOUTH OF CANYON
MORRIS DAM
SAN GABRIEL DAM
COGSWELL DAM
EARTH
BOTTOM
CHANNEL
IMPERVIOUS MATERIAL
WATER BEARING STRATA
WATER BEARING STRATA
IMPERVIOUS MATERIAL
LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT
SAN GABRIEL RIVER
CONSERVATION SYSTEM
PROFILE
SCALE : NONE

THE LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

FLOODS...AN OLD STORY

Floods in Los Angeles County have been recorded as far back as the days of the Mission Padres. For centuries waters have swept out of the San Gabriel Mountains causing extensive property damage and taking a great toll of lives.

Such a flood occurred in 1914 causing over $10 million in property damage and taking many lives. As a result, the State legislature passed an act creating the Los Angeles County Flood Control District.

The District was assigned two tasks... control the floods and conserve the water.

Santa Anita Dam

CONTROLLING THE WATERS

Successful early bond issues financed construction of the 14 dams which the District built high in the San Gabriel Mountains to impound storm waters until they could be released in an orderly fashion. Debris basins were constructed to trap eroded materials which had caused terrible damage in the past. Flood channel improvements were undertaken to confine the waters.

District engineers prepared a Comprehensive Plan in the early 1930's which provided for the control of flooding and the saving of as much of the water as practicable. With minor modifications, it is still the plan today.

Federal legislation in 1936 brought the United States Army Corps of Engineers into the local flood control picture. Since that time, the two agencies have been jointly prosecuting construction of the Comprehensive Plan which is now nearing completion. The District also cooperates with the United States Soil Conservation Service and Forestry Service in erosion control and debris reduction programs.

CONSERVING THE WATERS

In addition to its flood control program, the District has the equally important task of conserving as much of the storm and other waste waters as practicable. The use of water conservation facilities adjacent to river channels and their tributaries permits water to be percolated into ground reservoirs for later pumping by consumers. These water conservation facilities are located in areas where the underlying soils are composed of porous sands and gravel formations resembling rice paddies, while others are deep basins which were once gravel pits.

The importance of this activity is apparent when it is realized that about 35 to 45 per cent of the water used in the County is pumped from ground supplies. The growth of the County, combined with periodic droughts, seriously depleted these supplies on numerous occasions down through the years.

Other major conservation efforts by the District include combatting the serious intrusion by salt water of fresh well supplies along the Pacific Ocean and the utilization of reclaimed sewage waters in spreading operations.

District Headquarters

ORGANIZED TO DO THE JOB

Day to day administration of District affairs is vested in the Chief Engineer who is appointed by and responsible to the Los Angeles County Board of Supervisors. The dual mission of the agency is recognized in its organization. Although a large part of the District's activities involve the construction of flood control and water conservation facilities, the operation and maintenance of dams, debris basins, spreading grounds, channels, and storm drains are also of great importance.

Some 1,600 civil service employees serve the District, and through it the general public in a variety of tasks. Many have storm assignments which place them on call 24 hours a day throughout the winter season.

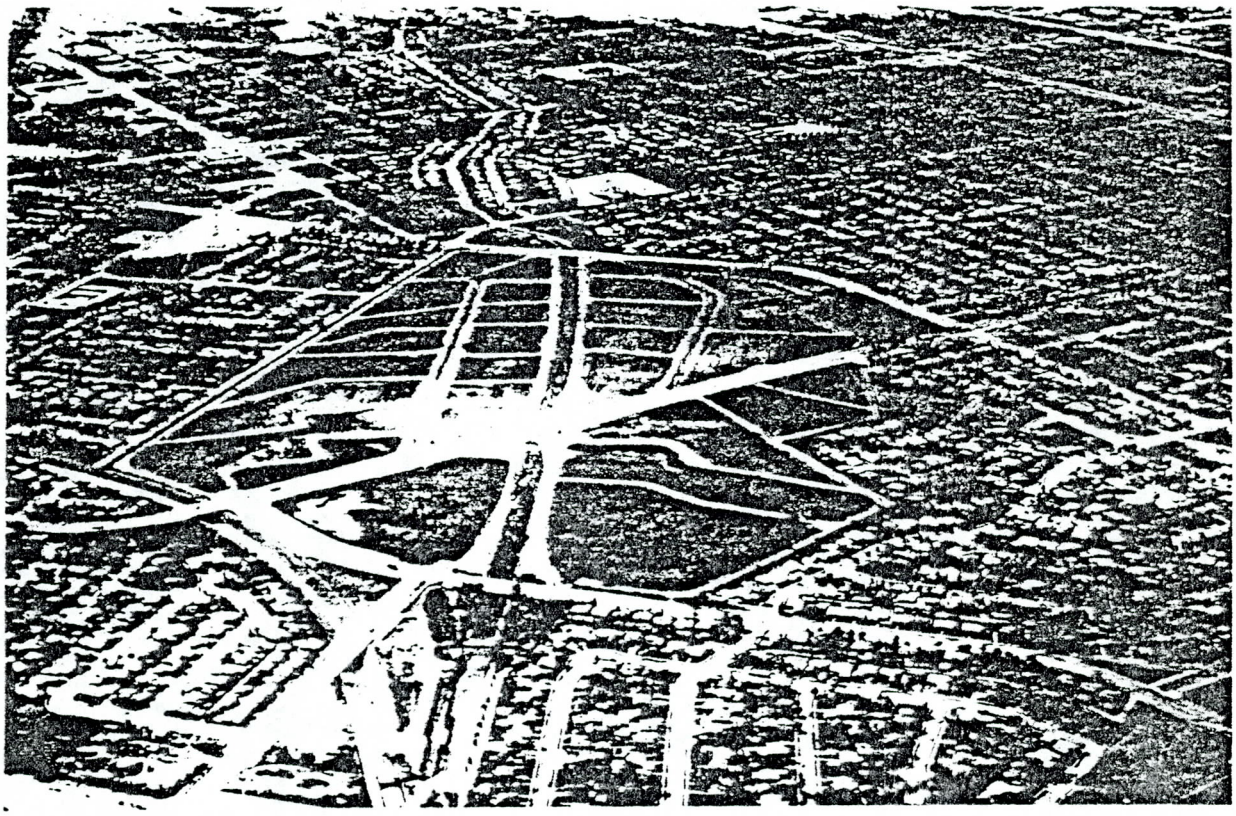
WATER CONSERVATION

FOREWORD

Information presented in this section includes amounts of local, imported, and reclaimed water conserved in spreading grounds, spreading basins, reservoirs, and unlined channels. Also, information on the sea-water barrier projects which prevent salt-water intrusion in the coastal area and information on the District's water quality monitoring programs of surface and ground water are included. Pertinent data are presented regarding the locations and descriptions of District conservation facilities, as well as facilities owned by others. Also included are groundwater maps delineating elevations recorded during the report period, hydrographs of selected key wells, and maps indicating the District's water quality monitoring programs.

The various types of water conserved, namely local, imported, and reclaimed, are construed to have the following meanings in this section: Local water is derived from runoff due to rainfall on the mountain and valley watersheds within or tributary to the District. Imported water is water derived outside the District which is transported and delivered within the District. Reclaimed water is the effluent produced by the Whittier Narrows Water Reclamation Plant and the San Jose Creek Water Renovation Plant, both operated by the Los Angeles County Sanitation Districts.

The rainfall amounts during the water years 1975-76 and 1976-77 were approximately 51 and 78 per cent of normal, and the local water conserved during these periods were over 59,700 and 50,500 acre-feet, respectively.



Pacoima Spreading Grounds

SPREADING GROUNDS

The total gross acreage of spreading grounds owned and operated by the District during this annual report period amounted to 2,201 acres. The District also assisted in the operation and maintenance of 679 acres of spreading grounds owned by others. An additional 246 acres of spreading grounds are controlled, maintained, and oprerated by other agencies. The total gross acreage of spreading grounds in the County is 3,126 acres, with a combined infiltration capacity of more than 2,400 cfs.

IMPORTED WATER

During this annual period, imported Colorado River water and State Project water for spreading was obtained from The Metropolitan Water District. This water was purchased with funds provided by the Central and West Basin Water Replenishment District and the Upper San Gabriel Valley Municipal Water District. Funds were also provided by the Water Conservation Zone I, prior to its termination on June 30, 1972. The Zone was established by the Board of Supervisors in January 1952 to finance the acquisition and conservation of untreated Colorado River Water in the Coastal Plain. The funds were provided by taxation at a rate of $.05 per $100 assessed value. The Zone had a life of five years with provisions for renewal by the Board of Supervisors. Zone I was renewed three times before its termination in 1972.

Imported water for the Coastal Plain, purchased with funds from the Central and West Basin Water Replenishment District, was spread in the District's facilities in the Rio Hondo and San Gabriel River systems south of Whittier Narrows Dam.

Imported water for the San Gabriel Valley groundwater basin, purchased by the Upper San Gabriel Valley Municipal Water District, was spread in Santa Fe Spreading Grounds and in the San Gabriel River between Morris Dam and the spreading grounds.

The San Gabriel Valley Municipal Water District made the first delivery of replacement water through its Devil Canyon-Azusa pipeline to the San Gabriel River on November 18, 1974. They also used the pipeline for the delivery of water for cyclic storage, as per agreement with the Watermaster.

RECLAIMED WATER

The County Sanitation Districts' Whittier Narrows Water Reclamation Plant, in operation since 1962, produced from 12 to 18 mgd of high quality effluent during the annual period. The effluent is purchased by the Central and West Basin Water Replenishment District and transported to the Rio Hondo and San Gabriel River systems for groundwater replenishment.

The County Sanitation Districts' San Jose Creek Water Reclamation Plant, activated in May 1972, made its first delivery of effluent in November 1972.

This effluent is also purchased by the Central and West Basin Water Replenishment District and is transported by pipeline to the San Gabriel River system for ground-water replenishment.

Reclaimed water comprised about 25 per cent of the total purchased water spread in the Montebello Forebay between October 1, 1975 and September 30, 1977.

BARRIER PROJECTS

The West coast Basin Barrier Project, just inland of the Santa Monica Bay coastline, prevents the intrusion of ocean water into the fresh-water aquifers by the injection of fresh water to form a pressure barrier.

During December 1975 and January 1976, 11 newly constructed injection wells (Unit 6A) were put into operation. Ten of these wells inject into the lower San Pedro aquifer and the remaining one injects into the Silverado aquifer. Also, two observation wells were constructed, one in the Silverado aquifer and the other in the 200 Foot Sand aquifer, during the report period.

During the two year period, 69,480 acre-feet of fresh water was injected, at an average rate of 48 cfs.

The Dominguez Gap Barrier Project was designed to prevent sea-water intrusion from the San Pedro Bay into the West Coast Basin through the Dominguez Gap area.

Seven observation wells were constructed at three sites during the report period. Also, modification of 11 of the Unit 1A injection wells to dual wells were completed in October 1976. Five additional piezometers were also constructed.

A leak in the supply line resulted in the shutdown of all injection wells on March 30, 1976. Injection was resumed on April 9, 1976 following completion of repair work. During the report period, 14,216 acre-feet of water was injected, at an average rate of about 10 cfs.

The existing operational facilities of the Alamitos Barrier Project consist of 20 injection wells and 4 extraction wells. The project facilities are designed to protect the groundwater supplies of the Central Basin of Los Angeles County and the Eastern Coastal Plain Basin of Orange County from intrusion of sea water through the Alamitos Gap area.

Construction of Units 9A and 9B, consisting of a dual-injection well and 12 observation wells, was begun in March 1977 and was completed in early 1978. During the two year-period, 10,429 acre-feet of fresh water was injected, at an average rate of about 7 cfs, and 2,720 acre-feet of saline water was extracted.

EXPLORATION AND OBSERVATION WELLS

During this biennial report period, nine wells were drilled for monitoring ground-water levels and obtaining geologic data. These wells were constructed to replace important observation wells that have been destroyed.

SEASONAL DATA AND MAPS

During this biennial report period several thousand observations of ground water levels of over 3,000 wells were made and processed, monthly or semiannually. Those wells were scattered over the groundwater basins in the County. Hydrographs of selected key wells are included in this report.

GROUNDWATER BASINS

The natural ground water reservoirs underlying Los Angeles County consist of groundwater basins which are grouped under five local watersheds. These watersheds are identified as San Fernando Valley, San Gabriel Valley, Coastal Plain, Santa Clarita Valley, and Antelope Valley.

The following paragraphs relate the change in ground-water levels as taken from wells considered representative of average basin conditions. The change is measured as the difference in groundwater level occurring on September 30, 1977, as compared to the level on October 1, 1975.

SAN FERNANDO VALLEY

The San Fernando Valley watershed overlies the San Fernando Main Basin and five subbasins. The subbasins are named Sylmar, Pacoima, Tujunga, Glenoaks, and Verdugo. The ground-water level was stable in the western portion of the San Fernando Valley, but historic lows occurred in other portions of the Valley.

SAN GABRIEL VALLEY

Eighteen ground-water basins exist under the San Gabriel Valley watershed. Ground-water levels decreased throughout most of these basins.

COASTAL PLAIN

Ground-water level changes in the Coastal Plain varied throughout the basin.

SANTA CLARITA VALLEY

Ground-water levels in the main portion of the basin for this period had decreased. The water level records as obtained from Well 7048A indicate that the water table in the Saugus area had declined about 6 feet during this report period.

ANTELOPE VALLEY

The Lancaster ground-water level, as determined from measurements from Well 9974 (Well 9926D was previously used), has continued to decline. The decline for this report period has reached a record low. Available records show this declining trend continuing from 1921 at the approximate rate of 5 feet per year.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

WATER CONSERVATION DIVISION

RESERVOIR AND CHANNEL ABSORPTION

EXCLUSIVE OF SPREADING GROUNDS

WATER YEARS 1975-77

Stream	Reach of Stream Where Absorption Occurred	Year	Total Release To Reach A.F.	Absorption in Channels, Reservoirs and Diversions A.F.	Excess of Release Over Absorption A.F.
Pacoima	Dam to Lined Channel	1975-76	486	486	0
		1976-77	508	508	0
Tujunga	Mouth to Lined Channel	1975-76	7,631	1,857 (1)(2)	5,774
		1976-77	7,896	3,588 (1)(2)	4,308
Arroyo Seco	Devil's Gate Reservoir	1975-76	0	967 (1)	0
		1976-77	0	N.A. (1)	0
Eaton Wash	Eaton Wash Dam	1975-76	0	496 (1)	0
		1976-77	0	290 (1)	0
Santa Anita	Dam to Lined Channel	1975-76	1,470	280	1,190
		1976-77	1,207	142	1,065
Santa Fe Diversion	Santa Fe Dam to Sawpit Wash	1975-76	0	0	0
		1976-77	N.A.	N.A.	N.A.
San Gabriel	Mouth to Foothill Boulevard	1975-76	34,050	13,590	20,460
		1976-77	27,834	9,340	18,503
San Gabriel	Foothill Boulevard to Santa Fe Dam	1975-76	20,160	2,380 (1)	17,780
		1976-77	18,139	4,414 (1)	13,725
San Dimas	Dam to Lined Channel	1975-76	928	587 (1)	341
		1976-77	1,150	581 (1)	569
Walnut	Puddingstone Dam to Lined Channel	1975-76	0	0	0
		1976-77	159	-16 (3)	175
Thompson	Thompson Creek Reservoir	1975-76	0	0	0
		1976-77	0	0	0

NOTES: (1) Includes percolation and evaporation losses in reservoirs.

(2) Includes water diverted for municipal water supply.

(3) Indicates rising water.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF DATA ON SPREADING FACILITIES
OWNED AND OPERATED BY THE DISTRICT
UPDATED THROUGH SEPTEMBER 1977

GROUNDS	TYPE	SEASON FIRST USED	AREA IN ACRES		CAPACITIES				LOCATION	SOURCE OF WATER	REMARKS
			GROSS	WETTED	CHANNEL** CFS	INTAKE CFS	STORAGE A.F.	PERC.* CFS			
LOPEZ	SHALLOW BASINS	1956-57	18	13	-	25	25	7	SOUTHEASTERLY SIDE OF PACOIMA WASH, NORTHEASTERLY OF FOOTHILL BOULEVARD	CONTROLLED FLOW FROM PACOIMA DAM AND LOPEZ FLOOD CONTROL BASIN.	THE FLOW IS DIVERTED FROM LOPEZ FLOOD CONTROL BASIN VIA CANAL TO THE SPREADING GROUNDS.
PACOIMA	SHALLOW BASINS	1932-33	169	116	17,000	400	299	100	BOTH SIDES OF OLD PACOIMA WASH CHANNEL FROM ARLETA STREET SOUTHWESTERLY TO WOODMAN AVENUE.	CONTROLLED FLOW FROM PACOIMA DAM. PARTIALLY CONTROLLED FLOW FROM LOPEZ FLOOD CONTROL BASIN, UNCONTROLLED FLOW FROM EAST CANYON AND PACOIMA WASH.	DIVERSION LEVEE ADDED TO BASIN 1 IN 1976.
HANSEN	SHALLOW BASIN	1944-45	156	110	22,000	450	230	185	NORTHWESTERLY SIDE OF TUJUNGA WASH FROM ABOVE GLENOAKS BOULEVARD SOUTHWESTERLY TO SAN FERNANDO ROAD.	CONTROLLED FLOW FROM HANSEN DAM AND BIG TUJUNGA DAM.	GENERALLY WATER IS AVAILABLE FOR SPREADING ONLY DURING YEARS OF NORMAL OR ABOVE NORMAL RAINFALL.
BRANFORD	DEEP BASIN	1956-57	12	8	1,540	1,540	179	1	SOUTHWESTERLY OF ARLETA STREET ABOVE CONFLUENCE OF TUJUNGA CHANNEL AND PACOIMA DIVERSION CHANNEL	UNCONTROLLED FLOWS FROM BRANFORD STREET DRAIN.	BASIN DEVELOPMENT 85 PER CENT COMPLETE. OUTLET CAPACITY 1540 CFS TO PACOIMA DIVERSION CHANNEL.
ARROYO SECO	SHALLOW BASINS	1948-49	24	13	-	100	30	15	EASTERLY SIDE OF ARROYO SECO, LOWER END 0.5 MILE ABOVE DEVIL'S GATE DAM.	UNCONTROLLED FLOW FROM ARROYO SECO AND THE ALTADENA STORM DRAIN, CONTROLLED FLOW FROM CITY OF PASADENA.	SPREADING GROUNDS ARE HELD UNDER EASEMENT FROM THE CITY OF PASADENA.
EATON WASH	DEEP AND SHALLOW BASINS	1947-48	28	24	6,600	100	525	20	EASTERLY SIDE OF EATON WASH FROM BELOW EATON DAM TO FOOTHILL BLVD.	CONTROLLED FLOW FROM EATON WASH DAM AND SIERRA MADRE VILLA CHANNEL.	THREE DEEP BASINS COMPRISE 15 ACRES. THE SHALLOW STRIP BASINS TOTAL 13 ACRES.
SANTA ANITA	SHALLOW BASINS	1944-45	20	8	-	20	25	7	WESTERLY SIDE OF SANTA ANITA WASH 1.25 MILES ABOVE FOOTHILL BOULEVARD.	CONTROLLED FLOW FROM SANTA ANITA DAM AND SANTA ANITA DEBRIS DAM.	THE HEADWORKS LOCATED UPSTREAM OF THE DEBRIS DAM DIVERTS WATER TO SANTA ANITA SPREADING GROUNDS AND CITY OF SIERRA MADRE SPREADING GROUNDS.
SAWPIT	SHALLOW BASINS	1946-47	12	4	-	30	13	12	WESTERLY SIDE OF SAWPIT WASH BELOW MOUTH OF CANYON AT HEAD OF NORUMBEGA STREET, MONROVIA.	CONTROLLED FLOWS FROM SAWPIT DAM AND SAWPIT DEBRIS DAM.	
SAN GABRIEL CANYON	DITCHES AND CHECKS	ABOUT 1917	165	-	-	-	-	35	EASTERLY SIDE OF SAN GABRIEL RIVER. BELOW MOUTH OF CANYON. NORTH OF THE CITY OF AZUSA.	SAN GABRIEL RIVER CONTROLLED RELEASES FROM COGSWELL DAM, SAN GABRIEL DAM, AND MORRIS DAM.	THE DISTRICT TOOK OVER OPERATION OF THIS FACILITY IN NOVEMBER 1969. RECEIVES SURPLUS WATER FROM THE WATER RIGHTS OF THE COMMITTEE OF NINE.
LITTLE DALTON	SHALLOW BASINS, DITCHES, AND CHECKS	1931-32	14	4.7	-	20	5	10	WESTERLY OF GLENDORA MT. ROAD, FROM LITTLE DALTON DEBRIS DAM SOUTH TO EAST PALM DRIVE.	CONTROLLED FLOW FROM LITTLE DALTON DEBRIS DAM.	
BIG DALTON	SHALLOW BASINS, DITCHES, AND CHECKS	1930-31	24	13	-	45	25	15	WESTERLY SIDE OF BIG DALTON WASH. INTAKE ONE HALF MILE ABOVE SIERRA MADRE AVENUE.	CONTROLLED FLOWS FROM BIG DALTON DAM AND BIG DALTON DEBRIS DAM.	
LIVE OAK	SHALLOW BASINS	1961-62	5	2	-	15	2	5	WESTERLY SIDE OF LIVE OAK WASH, NORTH OF BASE LINE ROAD (PROJECTED).	CONTROLLED FLOW FROM LIVE OAK DAM AND LIVE OAK DEBRIS DAM.	
LAGUNA	SHALLOW BASINS	1962-63	6	3	-	-	5	1	EAST SIDE LONG BEACH FREEWAY, ONE HALF MILE NORTH OF BROOKLYN AVENUE.	LOCAL RUNOFF FROM ALHAMBRA AND EL SERENO VIA DORCHESTER DRAIN.	THE PIT IN WHICH BASINS ARE LOCATED WAS DESIGNED AS A RETENTION BASIN FOR THE DORCHESTER STORM DRAIN.
EATON BASIN	DEEP BASIN	1956-57	16	10.6	9,600	400	280	10	EAST SIDE OF EATON CHANNEL NORTH OF DUARTE ROAD, 0.6 MILE SOUTH OF HUNTINGTON DRIVE.	CONTROLLED FLOW FROM EATON WASH DAM AND UNCONTROLLED FLOWS BETWEEN DAM AND SPREADING BASIN.	
PECK ROAD	DEEP BASIN	1959-60	157	85	30,100	30,100	3,347	17	CONFLUENCE OF SAWPIT AND SANTA ANITA WASHES.	ALL FLOWS IN SAWPIT AND SANTA ANITA WASHES.	
BUENA VISTA	DEEP BASIN	1954-55	10	6	2,900	2,900	194	8	1.0± MILE EASTERLY OF SAWPIT WASH. 0.5± MILE NORTHERLY OF ARROW HIGHWAY, BETWEEN MERIDIAN STREET AND BUENA VISTA CHANNEL.	CONTROLLED FLOW FROM SANTA FE DAM AND UNCONTROLLED FLOW FROM BUENA VISTA CHANNEL.	NO OUTFLOW EXPECTED EXCEPT CAPITAL STORM, BUT A SMALL OUTLET STRUCTURE OF 150 CFS PROVIDED. INLET CAPACITY OF SANTA FE DIVERSION 120 CFS.

*THE CAPACITIES LISTED ARE BASED ON INFILTRATION RATES WHICH MAY BE EXPECTED TO PERSIST FOR AT LEAST FIVE DAYS BUT ARE NOT VALID FOR SUSTAINED SPREADING OPERATIONS.

**DESIGN CAPACITY OF MAIN CONCRETE CHANNEL.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF DATA ON SPREADING FACILITIES OWNED AND OPERATED BY THE DISTRICT
UPDATED THROUGH SEPTEMBER 1977

GROUNDS	TYPE	SEASON FIRST USED	AREA IN ACRES GROSS	AREA IN ACRES WETTED	CAPACITIES CHANNEL** CFS	CAPACITIES INTAKE CFS	CAPACITIES STORAGE A.F.	CAPACITIES PERC.* CFS	LOCATION	SOURCE OF WATER	REMARKS
SANTA FE***	SHALLOW BASINS	1953-54	260	230	-	600	370	350	WITHIN SANTA FE DAM RESERVOIR AND SPILLWAY AREAS.	CONTROLLED FLOWS FROM SAN GABRIEL CANYON AND UNCONTROLLED FLOWS FROM BRADBURY CHANNEL AND SAN GABRIEL RIVER BELOW MORRIS RESERVOIR.	RIGHT OF WAY, HELD UNDER LICENSE FROM THE FEDERAL GOVERNMENT INCLUDES 30± ACRES IN SAN GABRIEL RIVER BED FOR EARTH DIVERSION LEVEE. CONSTRUCTION OF THE 605 FREEWAY REDUCED THE SPREADING AREA IN THE RESERVOIR AND A SUBSTITUTE AREA WILL BE PROVIDED DOWNSTREAM OF THE SPILLWAY. FLOCCULANT FACILITY ADDED IN 1976.
IRWINDALE	DEEP BASIN	1958-59	17	14	20,000	450	403.3	40	NORTHEASTERLY OF INTERSECTION OF BIG DALTON CHANNEL AND IRWINDALE AVENUE; CONTINUES 1,300 FEET EAST OF IRWINDALE AVENUE.	BIG DALTON CHANNEL CONTROLLED FLOWS FROM BIG AND LITTLE DALTON DEBRIS DAMS AND PUDDINGSTONE DIVERSION DAM; UNCONTROLLED FLOWS.	
CITRUS	SHALLOW BASIN	1960-61	19	15	-	25	20	28	SOUTH SIDE OF BIG DALTON WASH BETWEEN CITRUS AND CERRITOS AVENUES.		AZUSA IRRIGATION COMPANY ABANDONED PIPELINE IN 1967; NO SPREADING OPERATIONS AFTER THAT DATE.
BEN LOMOND	SHALLOW BASIN	1958-59	24	17	-	25	25	34	BOTH NORTH AND SOUTH SIDES OF SAN DIMAS WASH CHANNEL AT SOUTHWESTERLY CORNER OF INTERSECTION OF ARROW HIGHWAY AND BEN LOMOND AVENUE.	CONTROLLED RELEASES FROM COVINA IRRIGATING COMPANY PIPELINE	SPREADING GROUNDS UTILIZED TO CONSERVE EXCESS SURFACE SAN GABRIEL CANYON WATER RELEASES TO THE COVINA IRRIGATING COMPANY PIPELINE.
WALNUT CREEK SPREADING BASIN	DEEP BASIN	1962-63	16	8	8,000	150	166	5	WEST SIDE OF WALNUT WASH CHANNEL, NORTH OF SAN BERNARDINO FREEWAY.	CONTROLLED FLOW FROM PUDDINGSTONE DAM AND UNCONTROLLED FLOW FROM WALNUT WASH CHANNEL; EXCESS WATER FROM COVINA IRRIGATING COMPANY.	
SAN DIMAS CANYON SPREADING GROUNDS	SHALLOW BASIN	1965-66	22	11	-	25	22	12	SOUTHEAST SIDE OF SAN DIMAS WASH BETWEEN PUDDING STONE DIVERSION AND SAN DIMAS CANYON ROAD.	CONTROLLED RELEASES FROM PUDDINGSTONE DIVERSION DAM; UNCONTROLLED FLOW FROM SAN DIMAS CHANNEL.	
FORBES SPREADING BASIN	DEEP BASIN	1964-65	21	9.6	-	50	45	10	SOUTH SIDE OF SAN DIMAS WASH BETWEEN LONE HILL AVENUE AND VALLEY CENTER AVENUE.	CONTROLLED RELEASES FROM PUDDINGSTONE DIVERSION DAM AND LOCAL STORM RUNOFF FROM SAN DIMAS WASH	
SAN GABRIEL COASTAL	SHALLOW BASIN	1938-39	128	91	-	300	316	80	WESTERLY SIDE OF SAN GABRIEL RIVER, SOUTHERLY FROM WHITTIER BOULEVARD TO WASHINGTON BOULEVARD.	CONTROLLED FLOW FROM DAMS IN SAN GABRIEL CANYON AND SANTA FE DAM, AND UNCONTROLLED VALLEY RUNOFF BELOW SANTA FE DAM VIA SAN GABRIEL RIVER; ALSO IMPORTED AND RECLAIMED WATER.	
SAN GABRIEL RIVER UPPER	TEMPORARY CHECK LEVEES	1965-66	196±	196±	-	-	-	180	SAN GABRIEL RIVER FROM SANTA FE DAM TO RISING WATER.	CONTROLLED FLOW FROM DAMS IN SAN GABRIEL CANYON AND SANTA FE DAM AND UNCONTROLLED VALLEY RUNOFF BELOW SANTA FE DAM, ALSO IMPORTED WATER.	CHECK LEVEES DEVELOPED IN RIVER TO SPREAD WATER.
SAN GABRIEL RIVER LOWER	TEMPORARY CHECK LEVEES	1954-55	133	133	-	-	-	100	SAN GABRIEL RIVER FROM WHITTIER NARROWS DAM TO FLORENCE AVENUE.	SAME AS UPPER PORTION. ALSO RECLAIMED WATER.	SAME AS UPPER PORTION. SEE SAN GABRIEL COASTAL REMARKS.
RIO HONDO COASTAL	SHALLOW BASIN	1937-38	570	455	40,000	900	1,875	450	EASTERLY SIDE OF RIO HONDO SOUTHERLY FROM U.P.R.R. (SOUTH OF WHITTIER BOULEVARD) TO SLAUSON AVENUE, WEST SIDE OF RIO HONDO CHANNEL FROM 0.2± MILE ABOVE WHITTIER BOULEVARD SOUTH TO FOSTER BRIDGE BOULEVARD.	CONTROLLED RELEASES FROM SAN GABRIEL CANYON DAMS AND SANTA FE DAM, AND CONTROLLED RELEASES OUT OF WHITTIER NARROWS DAM FROM VALLEY RUNOFF VIA RIO HONDO; ALSO IMPORTED AND RECLAIMED WATER.	IN COOPERATION WITH THE CORPS OF ENGINEERS, THE DISTRICT OPERATES 4000-ACRE-FOOT POOL AT WHITTIER NARROWS DAM FOR RETENTION OF STORM WATERS. FLOCCULENT FACILITY ADDED AT WHITTIER NARROWS DAM IN 1967.
DOMINGUEZ GAP	DEEP BASIN	1957-58	54	31	-	20	254	3	CONTINUES 1.0 MILE SOUTH FROM DEL AMO BOULEVARD, AND BORDERS THE EASTERN AND WESTERN SIDES OF THE LOS ANGELES RIVER.	CONTROLLED FLOW FROM LOS ANGELES RIVER LOW FLOW CHANNEL AND UNCONTROLLED FLOWS FROM STORM DRAINS.	EAST SIDE BASIN USED FOR FLOOD REGULATION WITH SOME CONSERVATION STORAGE. INTAKE OF 20 CFS IS THE FIGURE FOR LOW FLOW DIVERSION FROM THE LOS ANGELES RIVER. THE WEST SIDE BASIN IS FED BY A 42-INCH CONCRETE PIPE FROM THE EAST SIDE BASIN.
WALTERIA SPREADING BASIN	DEEP BASIN	1962-63	26	-	-	-	85	6	WEST SIDE OF HAWTHORNE AVENUE AT 236TH STREET.	LOCAL STORM DRAINS.	BASIN USED FOR FLOOD REGULATIONS WITH SOME CONSERVATION STORAGE.
TOTALS			2,201	1,515.9			8,688.3	1,611			

*THE CAPACITIES LISTED ARE BASED ON INFILTRATION RATES WHICH MAY BE EXPECTED TO PERSIST FOR AT LEAST FIVE DAYS BUT ARE NOT VALID FOR SUSTAINED SPREADING OPERATIONS.

**DESIGN CAPACITY OF MAIN CONCRETE CHANNEL.

***DOES NOT INCLUDE AREA DOWNSTREAM FROM SANTA FE DAM SPILLWAY WHICH IS BEING TESTED TO DETERMINE AREA NECESSARY TO COMPENSATE FOR CAPACITY LOSS DUE TO FREEWAY CONSTRUCTED ACROSS THE SPREADING GROUNDS PROPER.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF WATER SPREAD AT GROUNDS OWNED AND OPERATED BY THE DISTRICT
UPDATED THROUGH SEPTEMBER 1977

RECORD OF LOCAL WATER SPREAD
ACRE - FEET

	SAN FERNANDO VALLEY					SAN GABRIEL VALLEY – FOOTHILLS								
SEASON	LOPEZ	PACOIMA	HANSEN	BRANFORD	ARROYO SECO	EATON S.G.	SANTA ANITA	SAWPIT	SAN GABRIEL CANYON*	LITTLE DALTON	BIG DALTON	LIVE OAK	SUBTOTAL	SEASON
1930-31											10		10	1930-31
32										160	394		554	32
33		26								0	0		26	33
34		230								0	100		330	34
35		1,200								0	131		1,331	35
36		2,000								0	0		2,000	36
37		4,680								275	866		5,821	37
38		3,844								287	397		4,528	38
39		363								12	49		424	39
40		907								0	0		907	40
41		9,775								1,166	1,528		12,469	41
42		37								0	0		37	42
43		3,744								1,084	1,191		6,019	43
44		7,223								469	543		8,235	44
45		1,467	7,651				337			290	64		9,809	45
46		514	2,268				0			73	47		2,902	46
47		3,763	8,725				141	39		89	174		12,981	47
48		0	0			1	0	0		0	0		1	48
49		0	0		108	0	0	8		0	88		204	49
50		245	0		283	61	0	0		28	66		683	50
51		0	0		19	0	0	19		0	0		38	51
52		6,121	16,780		986	1,196	448	517		563	856		27,447	52
53		1,651	1,271		216	0	58	56		9	3		3,264	53
54		1,891	1,014		455	190	265	0		161	370		4,346	54
55		205	0		197	0	145	0		0	0		547	55
56	0	566	2	0	301	181	161	180		30	180		1,601	56
57	28	475	0	38	397	0	2	38		11	15		1,005	57
58	1,030	10,922	18,407	20	2,088	861	1,576	978		658	2,380		38,920	58
59	0	352	1,023	-	352	130	185	199		22	145		2,408	59
60	0	379	0	6	0	0	810	28		0	0		1,233	60
61	0	78	0	183	0	0	304	29		0	27	0	621	61
62	673	5,635	12,570	402	1,103	1,021	664	547		394	1,212	38	24,259	62
63	52	643	0	415	249	7	449	126		43	77	-	2,061	63
64	212	1,206	0	376	317	24	327	135		18	165	0	2,780	64
65	0	1,199	0	563	744	324	575	161		100	193	0	3,859	65
66	1,020	11,701	19,806	391	1,036	2,000	1,641	1,367		987	2,063	89	42,101	66
67	1,472	22,800	31,383	623	1,828	1,450	1,563	2,458		1,846	3,766	330	69,519	67
68	1,938	1,819	9,836	339	855	305	638	790		187	348	0	17,555	68
69	393	14,262	32,464	461	609	3,249	494	321		335	2,074	803	55,965	69
70	0	1,577	11,927	724	195	483	1,415	769	19,583	220	562	45	37,500	70
71	727	4,049	11,657	507	544	583	334	529	14,037	226	888	0	34,181	71
72	0	1,113	1,932	191	173	0	31	216	6,481	23	44	0	10,204	72
73	0	6,343	11,755	430	1,214	1,689	732	1,396	13,428	484	1,253	88	38,812	73
74	946	2,378	6,287	285	1,478	1,581	427	1,043	14,233	136	1,130	0	29,924	74
75	915	2,476	5,423	667	664	337	59	808	15,225	46	237	13	26,870	75
76	562	1,307	3,128	468	344	295	36	561	9,904	19	390	3	17,037	76
77	63	1,944	2,856	378	374	218	0	487	7,140	0	0	9	13,269	77
TOTALS	10,531	143,110	217,965	7,467	17,229	16,186	13,817	13,885	100,031	10,451	24,527	1,418	576,617	TOTALS

* The District took over operation of this facility in November of 1969

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF WATER SPREAD AT GROUNDS OWNED AND OPERATED BY THE DISTRICT
UPDATED THROUGH SEPTEMBER 1977

RECORD OF LOCAL WATER SPREAD
ACRE - FEET

	MAIN SAN GABRIEL VALLEY										COASTAL PLAIN							
SEASON	EATON S.B.	PECK ROAD S.B.	BUENA VISTA S.B.	SANTA FE S.G.	IRWINDALE S.B. (A)	CITRUS S.G.	BEN LOMOND S.G.	WALNUT S.B.	SAN DIMAS CANYON S.G. (B)	FORBES S.B. SAN DIMAS S.D. (C)	SAN GABRIEL SYSTEM UPPER (D)	SAN GABRIEL SYSTEM LOWER (E)	RIO HONDO SYSTEMS (F)	LAGUNA S.B.	WALTERIA S.B.	DOMINGUEZ S.B.	TOTAL	SEASON
1930-31																	10	1930-31
32																	554	32
33																	26	33
34																	330	34
35																	1,331	35
36																	2,000	36
37																	5,821	37
38													3,660				8,188	38
39												2,603	0				3,027	39
40												0	1,702				2,609	40
41												4,684	9,830				26,983	41
42												0	2,170				2,207	42
43												0	0				6,019	43
44												0	0				8,235	44
45												0	0				9,809	45
46												0	9,548				12,450	46
47												384	4,842				18,207	47
48												0	3,760				3,761	48
49												0	0				204	49
50												0	0				683	50
51												0	0				38	51
52												5,412	400				33,279	52
53												4,023	3,368				10,655	53
54				3,500								4,859	4,621				17,326	54
55			10	0								9,518	0				10,075	55
56	0		227	0								5,869	1,924				9,621	56
57	260		817	0								7,789	7,486				17,357	57
58	1,236		2,730	12,752								46,474	30,407			107	132,626	58
59	441		1,097	181	242 (A)		1,431					16,009	5,464			87	27,350	59
60	501	986	1,234	59	934 (A)		1,055					7,669	7,266			80	21,017	60
61	165	478	700	30	256	1,133	732					4,874	2,960			360	12,309	61
62	902	8,876	869	11,818	1,817	2,194	2,857	292	50			19,932	17,120	0		2,414	93,400	62
63	532	1,895	273	121	593	1,292	2,428	367	286			5,405	4,464	+	289	1,406	21,412	63
64	869	1,841	195	120	1,126	906	1,008	502	62	5		3,979	5,531	+	135	544	19,603	64
65	1,007	2,490	945	6,287	2,121	1,287	1,435	0	3	331		4,481	7,975	+	244	1,248	33,713	65
66	783	13,018	834	23,502	3,317	4,010	3,799	1,412	2,413	0	45,730	14,437	24,325	+	537	803	181,041	66
67	1,046	17,914	2,192	73,910	6,792	1,064	6,444	2,147	2,099	1,199	51,160	22,392	28,854	+	436	273	287,541	67
68	605	2,616	262	17,501	4,603	0	5,096	1,201	2,180	0	1,784	11,875	25,166	+	468	274	91,186	68
69	1,104	7,543	2,231	42,523	7,339	0	3,447	2,016	4,836	0	55,585	50,340	69,056	+	525	375	302,985	69
70	333	4,044	299	8,396	490	0	5,912	1,120	2,604	0	18,368	28,247	24,671	+	152	187	132,323	70
71	0	3,954	387	14,016	313	0	3,018	532	1,490	0	9,275	20,389	24,368	+	272	1,521	113,716	71
72	359	1,555	195	4,443	879	0	1,414	233	484	0	3,990	6,726	10,964	+	165	1,109	42,720	72
73	1,158	6,460	502	43,943	2,796	0	5,109	669	1,318	0	22,327	12,016	33,061	+	435	1,074	169,680	73
74	1,096	5,395	386	18,737	1,624	0	3,936	547	1,052	0	7,379	9,169	20,627	+	206	610	100,888	74
75	527	2,476	184	4,151	1,310	0	1,286	612	786	686	5,781	10,360	19,305	+	577	1,130	76,041	75
76	716	2,023	864	970	1,118	0	1,267	310	333	16	9,904	9,298	15,536	+	58	326	59,776	76
77	666	3,425	456	3,851	1,207	0	1,535	410	289	243	135	8,121	16,412	+	N/A	673	50,672	77
TOTALS	14,306	86,989	17,879	290,811	38,877	11,886	53,209	12,370	20,285	2,480	231,418	357,334	446,843		4,499	14,701	2,180,504	TOTALS

(A) Includes Metropolitan Water District water purchased under contract with San Gabriel Valley Labor Association.

(B) San Dimas Canyon water spread prior 1965-66 in temporary development below Puddingstone Diversion.

(C) San Dimas Spreading development inoperative after 1968-69 water year.

(D) San Gabriel River from Santa Fe Dam to rising water. Hook levees developed in river, 1965.

(E) San Gabriel River from Whittier Narrows Dam to Florence Avenue; (Hook levees developed in river, 1954) and the San Gabriel Coastal Spreading Grounds.

(F) Spreading grounds only up through 1967-68 water year, thereafter figures include Whittier Narrows Dam (Rio Hondo side) percolation.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF DATA ON SPREADING FACILITIES NOT OWNED BY THE DISTRICT
UPDATED THROUGH SEPTEMBER 1977*

GROUNDS	TYPE	SEASON FIRST USED	AREA IN ACRES GROSS	AREA IN ACRES WETTED	CAPACITIES CHANNEL** CFS	CAPACITIES INTAKE CFS	CAPACITIES STORAGE A.F.	CAPACITIES PERC.* CFS	LOCATION	SOURCE OF WATER	REMARKS
GROUNDS IN WHICH DISTRICT DOES CONSTRUCTION, MAINTENANCE, AND SOME OPERATIONS:											
SIERRA MADRE	SHALLOW BASINS	ABOUT 1933	22	9	-	25	47	18	CITY OF SIERRA MADRE, SOUTH SIDE OF GRANDVIEW AVENUE, ONE HALF MILE WEST OF SANTA ANITA AVENUE.	LITTLE SANTA ANITA CREEK AND STREET RUNOFF ONLY PRIOR TO 1951-52. STARTING IN 1951-52 ALSO CONTROLLED FLOWS FROM SANTA ANITA DAM.	NO RECORDS OF WATER SPREAD PRIOR TO 1951-52. GROUNDS REBUILT IN 1951. ULTIMATE CAPACITY ESTIMATED 25 CFS. THREE BASINS ADDED IN SUMMER OF 1959.
FISH CREEK	SHALLOW BASINS	ABOUT 1917	6±	4	-	-	-	7	WESTERLY SIDE OF SAN GABRIEL RIVER BELOW MOUTH OF FISH CANYON AND NORTH OF THE CITY OF AZUSA.	SAN GABRIEL RIVER, CONTROLLED RELEASES FROM COGSWELL DAM, SAN GABRIEL DAM, AND MORRIS DAM, VIA DUARTE DITCH.	DISTRICT DELIVERS WATER, DOES HYDROGRAPHIC WORK AND SOME CONSTRUCTION. SOME WATER ALSO PERCOLATES IN SAN GABRIEL RIVER IN VICINITY OF SPREADING GROUNDS AND IN BRUSH LAND WHERE IRRIGATION WASTE LINES DISCHARGE. NO SEPARATE RECORDS KEPT PRIOR TO 1926-27.
THOMPSON CREEK	DITCHES CHECKS AND DEEP BASIN	ABOUT 1928	53	37	-	70	-	37	SOUTHERLY FROM, AND ADJACENT TO THOMPSON CREEK DAM, EAST SIDE OF CREEK.	COBAL, WILLIAMS, PALMER, AND PADUA CREEKS, ALSO THOMPSON CREEK, WHEN RESERVOIR ABOVE ELEV. 1625.	HELD UNDER EASEMENT BY THE DISTRICT, OPERATED BY POMONA VALLEY PROTECTIVE ASSOCIATION. IN ADDITION TO THE 53 ACRES, SOME AREA WITHIN THOMPSON CREEK RESERVOIR IS USED TO SPREAD STORM FLOWS. WATER SPREAD IN AREA SINCE ABOUT 1918.
SAN ANTONIO	DITCHES CHECKS AND SHALLOW BASINS	1921-22	598	300	8,000	900	-	300	BOTH SIDES OF SAN ANTONIO CREEK. FROM TWO AND ONE HALF MILES ABOVE BASE LINE SOUTHWESTERLY TO BASE LINE.	CONTROLLED RELEASES FROM THE SAN ANTONIO FLOOD CONTROL DAM.	HELD UNDER EASEMENT BY THE DISTRICT, OPERATED BY POMONA VALLEY PROTECTIVE ASSOCIATION. WEST SIDE OF CHANNEL 500 ACRES. EAST SIDE OF CHANNEL 98 ACRES. IN ADDITION THERE ARE 207 ACRES EAST OF CHANNEL IN SAN BERNARDINO COUNTY; WATER SPREAD IN VICINITY ON AND OFF AS EARLY AS ABOUT 1896.
TOTALS			679		-	-	-	362			
GROUNDS CONTROLLED BY OTHERS. THE DISTRICT COOPERATING:											
CITY OF POMONA	DITCHES CHECKS AND SHALLOW BASINS	(SEE REMARKS)	10	8	-	-	-	-	NORTH OF CLAREMONT, ONE HALF MILE NORTH OF FOOTHILL BOULEVARD AND 1.5 MILE WEST OF MILLS AVENUE.	SAN ANTONIO CREEK WATER DELIVERED THROUGH LOOP MERSERVE CANYON WATER CO'S. PIPE LINE. ALSO SOME LOCAL RUNOFF.	WATER SPREAD IN VICINITY ON AND OFF SINCE ABOUT 1897. GROUND ACQUIRED BY CITY OF POMONA, OCTOBER 1926. NO RECORD OF WATER SPREAD PRIOR TO 1949-50. DEEP BASIN COMPLETED IN 1957.
L.A. CITY DEPT. OF WATER & POWER TUJUNGA	SHALLOW BASINS	1931-32	188	130	22,000	400		300	SAN FERNANDO VALLEY, EAST SIDE OF TUJUNGA WASH AT ROSCOE BOULEVARD.	LOS ANGELES CITY'S OWENS VALLEY ACQUEDUCT AND CONTROLLED RELEASES FROM HANSEN DAM.	PRIOR TO 1938 FLOOD, USED 80 ACRES NET. TUJUNGA CHANNEL ON WESTERLY SIDE OF GROUNDS PAVED IN 1950.
HEADWORKS	SHALLOW BASINS	1938-39	48	28	57,000	-	40	40	SAN FERNANDO VALLEY SOUTH OF LOS ANGELES RIVER, ABOVE MARIPOSA STREET.	LOS ANGELES RIVER, PARTIALLY CONTROLLED BY VARIOUS DAMS. RELEASE OF OWENS VALLEY WATER FROM CHATSWORTH RESERVOIR. GROUND WATER FROM WELLS IN THE WEST END OF SAN FERNANDO VALLEY.	CRYSTAL SPRINGS INFILTRATION AREA, NOT REGULAR SPREADING GROUNDS. WATER PUMPED OUT FROM COLLECTING GALLERIES UNDER AREA. IN OCTOBER 1958 A 130-FOOT COLLAPSIBLE RUBBER DAM WAS INSTALLED ACROSS LOS ANGELES RIVER.
TOTALS			246	166	-	-	-	-			

*THE CAPACITIES LISTED ARE BASED ON INFILTRATION RATES WHICH MAY BE EXPECTED TO PERSIST FOR AT LEAST FIVE DAYS BUT ARE NOT VALID FOR SUSTAINED SPREADING OPERATIONS.

**DESIGN CAPACITY OF MAIN CONCRETE CHANNEL

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF WATER SPREAD IN GROUNDS NOT OWNED BY THE DISTRICT THROUGH SEPTEMBER 1977

RECORD OF WATER SPREAD
ACRE-FEET

	GROUNDS IN WHICH DISTRICT DOES CONSTRUCTION, MAINTENANCE, AND SOME OPERATIONS						GROUNDS CONTROLLED BY OTHERS, THE DISTRICT COOPERATING					
	CITY OF SIERRA MADRE		CALIFORNIA AMERICAN	SAN GABRIEL SPREADING CORPORATION					LOS ANGELES CITY DEPT. OF WATER AND POWER			
SEASON	SANTA ANITA WATER	LOCAL WATER	FISH CANYON (G)	CANYON BASIN (F)	MAIN BASIN	THOMPSON CREEK (B)	SAN ANTONIO (B)	CITY OF POMONA	TUJUNGA	HEADWORKS	TOTAL	SEASON
1919-20				7,974							7,974	1919-20
21				10,082							10,082	21
22				6,132			(C)				6,132	22
23				12,408			(C)				12,408	23
24				5,069			(C)				5,069	24
25				2,878			(C)				2,878	25
26				8,443			(C)				8,443	26
27				18,560	2,707		8,090	(C)			29,357	27
28				17,537	3,270	(C)	(C)	(C)			20,807	28
29				15,615	3,501	(C)	(C)	(C)			19,116	29
30				16,607	5,898	(C)	(C)	(C)			22,505	30
31				8,360	5,827	(C)	201	(C)			14,388	31
32				25,328	12,106	(C)	7,801	(C)	20,338		65,573	32
33				13,386	6,620	(C)	111	(C)	26,873		46,990	33
34		(C)		12,401	4,506	(C)	630	(C)	20,795		38,332	34
35		(C)		34,315	17,692	(C)	6,834	(C)	24,775		83,616	35
36		(C)		17,997	6,975	(C)	1,652	(C)	19,310		45,934	36
37		(C)		33,814	20,297	(C)	22,552	(C)	8,736		85,399	37
38		(C)		31,627	13,134	(C)	15,000	(C)	5,732		65,493	38
39		(C)		17,815	6,194	(C)	1,433	(C)	12,258	(D)	37,700	39
40		(C)		19,304	8,544	0	2,670	(C)	3,024	(D)	33,542	40
41		(C)		45,618	13,298	563	28,093	(C)	3,446	(D)	91,018	41
42		(C)		21,392	8,241	0	83	(C)	11,290	(D)	41,006	42
43		(C)		24,502	7,702	505	26,000	(C)	12,134	(D)	70,843	43
44		(C)		31,130	9,820	37	10,270	(C)	3,192	(D)	54,449	44
45		(C)		34,681	14,467	18	4,957	(C)	0	17,518	71,641	45
46		(C)		23,351	12,745	5	3,271	(C)	0	21,141	60,513	46
47		(C)		23,716	8,936	0	5,801	(C)	1,686	18,738	58,877	47
48		(C)		4,796	2,218	0	6	(C)	0	19,016	26,036	48
49		(C)		2,874	1,343	0	0	(C)	0	6,451	10,668	49
50		(C)		9,125	2,590	0	55	450±	762	7,691	20,673	50
51		(C)		1,378	622	0	3	0	2,255	4,917	9,275	51
52	1,547	384		27,847	8,361	163	10,467	952	7,269	1,524	58,514	52
53	257	5		15,765	5,705	0	1,011	257	0	7,424	30,524	53
54	470	113		18,021	4,960	0	2,150	916	0	6,648	34,278	54
55	288	50		20,328	6,096	0	0	838	0	10,867	38,467	55
56	349	80		19,135	8,406	0	927	660	0	6,553	36,110	56
57	295	34		16,225	6,199	0	0	1,341	0	4,784	28,880	57
58	3,897	313		47,419	7,616	164	12,881	3,026	0	6,278	81,594	58
59	343	14		24,558	6,176 (A)	0	0	2,820	0	9,045	42,956	59
60	43	2		6,111	(E)	0	0	963	0	8,040	15,159	60
61	41	2		2,534		0	0	12	0	6,121	8,710	61
62	1,313	219		34,008		27	2,525	234	6,894	10,642	55,862	62
63	874	21		25,345		0	0	73	0	10,279	36,592	63
64	427	54		12,785		0	0	70	0	11,312	24,648	64
65	905	99		17,463		0	-	71	0	12,881	31,419	65
66	4,075	386		22,981		0	13,056	508	4,537	11,783	57,326	66
67	4,236	767		34,415		45	10,727	856	8,231	8,870	68,247	67
68	1,723	107		26,955		21	549	407	0	11,860	41,622	68
69	1,871	2,024		17,733		850	29,960	340	16,728	6,698	76,204	69
70	521	67	7,635	1,697 (H)		0	365	242	2,380	11,021	23,928	70
71	1,299	118	10,968			0	26	251	399	6,804	19,865	71
72	857	17	5,303			0	45 (J)	127	0	7,389	13,738	72
73	3,017	376	7,619			0	6,725 (J)	851	2,274	5,182	26,044	73
74	2,786	114	9,170			0	330 (J)	297	0	6,205	18,902	74
75	2,179	115	7,405			21	9	263	9,224	4,070	23,284	75
76	1,150	16	5,990			0	153	338	5,500	3,837	16,984	76
77	919	41	5,297			10	273	197	16	3,137	9,890	77
TOTALS	35,682	5,540	59,385	949,540	252,772	2,429	238,692	17,460	240,258	294,726	2,096,484	TOTALS

(A) Beginning in 1958-59, this excludes canyon water spread at Ben Lomond.

(B) Operated by Pomona Valley Protective Association

(C) Water spread, no records kept

(D) Daily measurements made. Total volume not computed

(E) East Side Water Committee discontinued keeping records as of 1959-60 season. The San Gabriel Spreading Corporation was dissolved in the Spring of 1965. The Canyon Basin Spreading Grounds were then operated by the Committee of Nine until November 1969, at which time the Flood Control District took over operations.

(F) Water Spread, records not available

(G) Previously to 1969-70 Fish Canyon Spreading Grounds records were incorporation into San Gabriel Canyon Spreading Grounds.

(H) The District took over operation of this facility in November 1969.

(J) Record supplied by Pomona Valley Protective Association

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
DISTRIBUTION OF PURCHASED WATER
THROUGH SEPTEMBER 1977

IMPORTED WATER (ACRE-FEET)

	WATER FOR UPPER SAN GABRIEL VALLEY				WATER FOR COASTAL PLAIN					
SEASON	SANTA FE SPREADING GROUNDS (F)	SAN GABRIEL RIVER CANYON (A)	SAN GABRIEL SYSTEM UPPER	SUBTOTAL	MAIN SAN GABRIEL BASIN (B)	SAN GABRIEL SYSTEM LOWER	RIO HONDO SYSTEM (D)	SUBTOTAL	TOTAL IMPORTED	SEASON
1953-54					15,610	7,760	7,230	30,600	30,600	1953-54
55					8,750	4,770	9,730	23,250	23,250	55
56					18,820	16,920	14,990	50,730	50,730	56
57					15,220	18,120	20,400	53,740	53,740	57
58					13,557	26,644	64,911	105,112	105,112	58
59					6,013	24,338	24,069	54,420	54,420	59
60					10,969	32,227	37,450	80,636	80,636	60
61					25,740	51,090	70,166	146,996	146,996	61
62					28,164	77,183	102,781	208,128	208,128	62
63					12,418	36,798	29,411	80,627	80,627	63
64					18,830	40,150	45,917	104,897	104,897	64
65			12,400	12,400	29,700	69,995	66,510	166,205	178,605	65
66			12,600	12,600	21,140	38,625 (c)	62,735	122,500	135,100	66
67			23,871	23,871	17,105	20,813	46,322	84,240	114,111	67
68			22,170	22,170	16,487	12,402	66,501	95,390	117,560	68
69			18,567	18,567	443	4,896	12,442	17,780	36,347	69
70			0	0	7,901	35,164	25,800	68,865	68,865	70
71			0	0	9,133	21,211	41,802	72,146	72,146	71
72	2,312	604	0	2,916	4,546	14,491	15,413	34,450	37,366	72
73	5,477	1,611	0	7,088	11,285	32,823	47,712	91,820	98,908	73
74	12,376	5,370	0	17,746	12,482	33,771	45,848	92,071	109,817	74
75	17,966	9,439	0	27,324	3,383	32,974	34,234	70,761	98,085	75
76	16,436	13,461 E	0	29,899	12,371	19,611	18,202	50,184	80,648	76
77	8,068	11,834	0	19,902	6,339	5,462	18,767	30,568	50,470	77

(A) San Gabriel River from Morris Dam to Santa Fe Spreading Grounds.

(B) Includes unidentifiable minor losses.

(C) 6,500 Acre-Feet make-up water purchased by the Upper San Gabriel Valley Municipal Water District and spread in the lower San Gabriel System.

(D) Rio Hondo Spreading Grounds and Whittier Narrows Reservoir.

(E) Approximately 15,948 Acre-Feet State Project Water held in temporary Cyclic Storage in the Upper San Gabriel System.

(F) Water Conserved to include area From Foothill Blvd, Finger Levees And Reservoir.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
DISTRIBUTION OF PURCHASED WATER
THROUGH SEPTEMBER 1977

	RECLAIMED WATER (ACRE-FEET)					DISTRIBUTED WATER (a)	FINANCED BY				
	WHITTIER NARROWS PLANT			SAN JOSE PLANT							
SEASON	SAN GABRIEL SYSTEM LOWER	RIO HONDO SYSTEM (b)	SUBTOTAL	SAN GABRIEL SYSTEM LOWER	TOTAL RECLAIMED (c)	TOTAL	ZONE 1	CBWBWRD	USGVMWD	SGVMWD	SEASON
1953-54						30,600	30,032				1953-54
55						23,250	24,764				55
56						50,730	54,539				56
57						53,740	50,030				57
58						105,112	105,112				58
59						54,420	54,420				59
60						80,636	80,926				60
61						146,996	80,807	66,374			61
62	0	1,178	1,178		1,178	209,306	39,492	169,814			62
63	0	12,405	12,405		12,405	93,032	4,780	88,252			63
64	4,145	9,115	13,260		13,260	118,157	0	118,157			64
65	4,866	9,662	14,528		14,528	193,133	75,456	99,196	12,400		65
66	3,130	11,926	15,056		15,056	150,156	67,813	68,903	19,100(d)		66
67	2,105	14,119	16,224		16,224	130,335	74,060	26,404	29,871		67
68	1,975	16,300	18,275		18,275	135,835	66,591	47,074	22,170		68
69	7,772	6,105	13,877		13,877	50,224	12,529	19,128	18,567		69
70	3,683	13,474	17,157		17,157	86,022	25,792	60,230	0		70
71	8,367	11,128	19,495		19,495	91,641	46,726	44,915	0		71
72	4,959	12,584	17,543		17,543	54,909	0	51,993	2,916		72
73	1,440	12,238	13,678	8,327	22,005	120,913	0	113,825	7,088		73
74	2,560	10,877	13,437	7,956	21,393	131,210	0	113,464	17,421		74
75	877	13,799	14,676	7,207	21,883	119,968	0	92,844	24,611	2,713	75
76	1,235	11,169	12,404	9,062	21,466	87,757	0	72,249	7,692	7,816	76
77	3,002	7,155	10,157	12,705	22,862	72,867	0	53,312	10,448	9,107	77
TOTALS	50,116	173,219	223,335	45,257	268,609	2,389,849	903,869	1,305,934	172,284	19,636	TOTALS

(a) Differences between water distributed and water financed by due to the following:
1. Water temporarily held in storage at Puddingstone Reservoir from one water year to the next.
2. Losses in Puddingstone Reservoir
3. District records are based on 12 midnight readings, amounts shown under Financing Column are based on meter readings taken during normal working hours
4. Includes unidentifiable minor losses

(b) Rio Hondo Spreading Grounds and Whittier Narrows Reservoir

(c) All reclaimed water purchased by Central and West Basin Water Replenishment District.

(d) 6,500 Acre-Feet make-up water purchased by the Upper San Gabriel Valley Municipal Water District and spread in the lower San Gabriel System.

(e) Approximately 15,948 Acre-Feet State Project Water held in temporary Cyclic Storage in the Upper San Gabriel System.

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
WATER CONSERVATION DIVISION
SUMMARY OF WATER INJECTED AT BARRIER PROJECTS
UPDATED THROUGH SEPTEMBER 1977

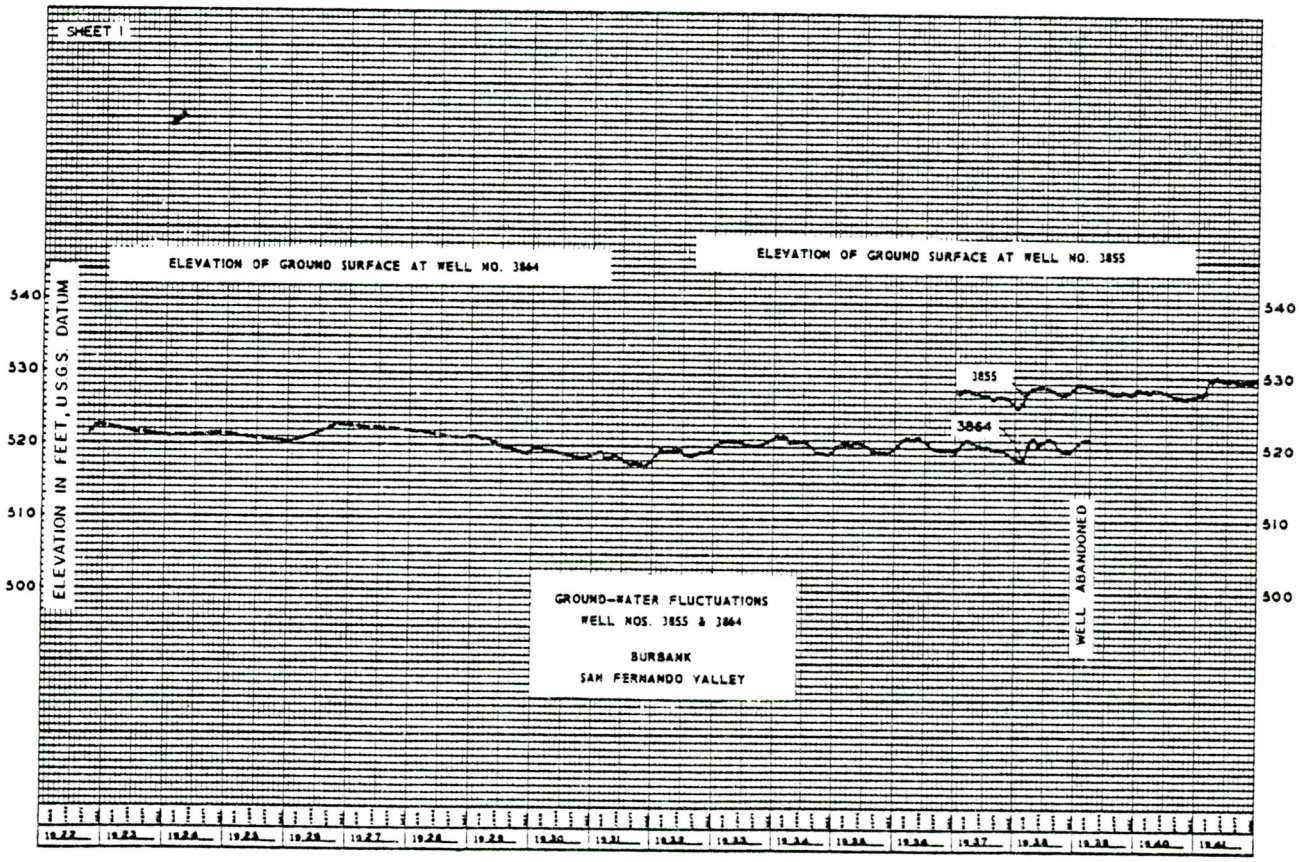
		WEST COAST BASIN BARRIER PROJECT				ALAMITOS BARRIER PROJECT			DOMINGUEZ GAP BARRIER PROJECT			
WATER YEAR	STATE APPROPRIATION	C & WSWRD	WSWA	ZONE II	TOTAL WCBBP	C & WSWRD	OCWD	TOTAL A&P	C & WSWRD	ZONE II	TOTAL DGBP	TOTAL ALL PROJECTS
1952-53	1,141*				1,141							1,141
54	761*		1,673	856	3,290							3,290
55				2,744	2,744							2,744
56				2,840	2,840							2,840
57				3,592	3,592							3,592
58				4,331	4,331							4,331
59				3,695	3,695							3,695
60				3,804	3,804							3,804
61		2,944		1,532	4,476							4,476
62		4,512			4,512							4,512
63		4,194			4,194							4,194
64		10,450			10,450							10,450
65		33,015			33,015	2,758	198	2,956				35,971
66		44,388			44,388	3,368	347	3,715				48,103
67		32,658		10,402	43,060	3,395	485	3,880				46,940
68		6,127		33,456	39,583	4,214	735	4,949				44,532
69		3,981		32,435	36,416	4,310	945	5,255				41,671
70		6,627		22,834	29,461	3,757	724	4,481				33,942
71		16,519		13,348	29,867	3,309	823	4,132	852	1,346	2,198	36,197
72		28,484			28,484	4,061	933	4,994	9,551		9,551	41,036
73		28,148			28,148	4,299	881	5,180	8,468		8,468	41,796
74		27,541			27,541	6,138	1,149	7,287	7,829		7,829	42,657
75		26,434			26,434	4,443	716	5,159	5,161		5,161	36,754
76		35,219			35,219	4,088	566	4,654	4,938		4,938	44,811
77		34,261			34,261	4,891	884	5,775	9,278		9,278	49,314
TOTALS	1,902	343,509	1,673	135,869	482,953	53,031	9,386	62,417	46,077	1,346	47,423	592,793

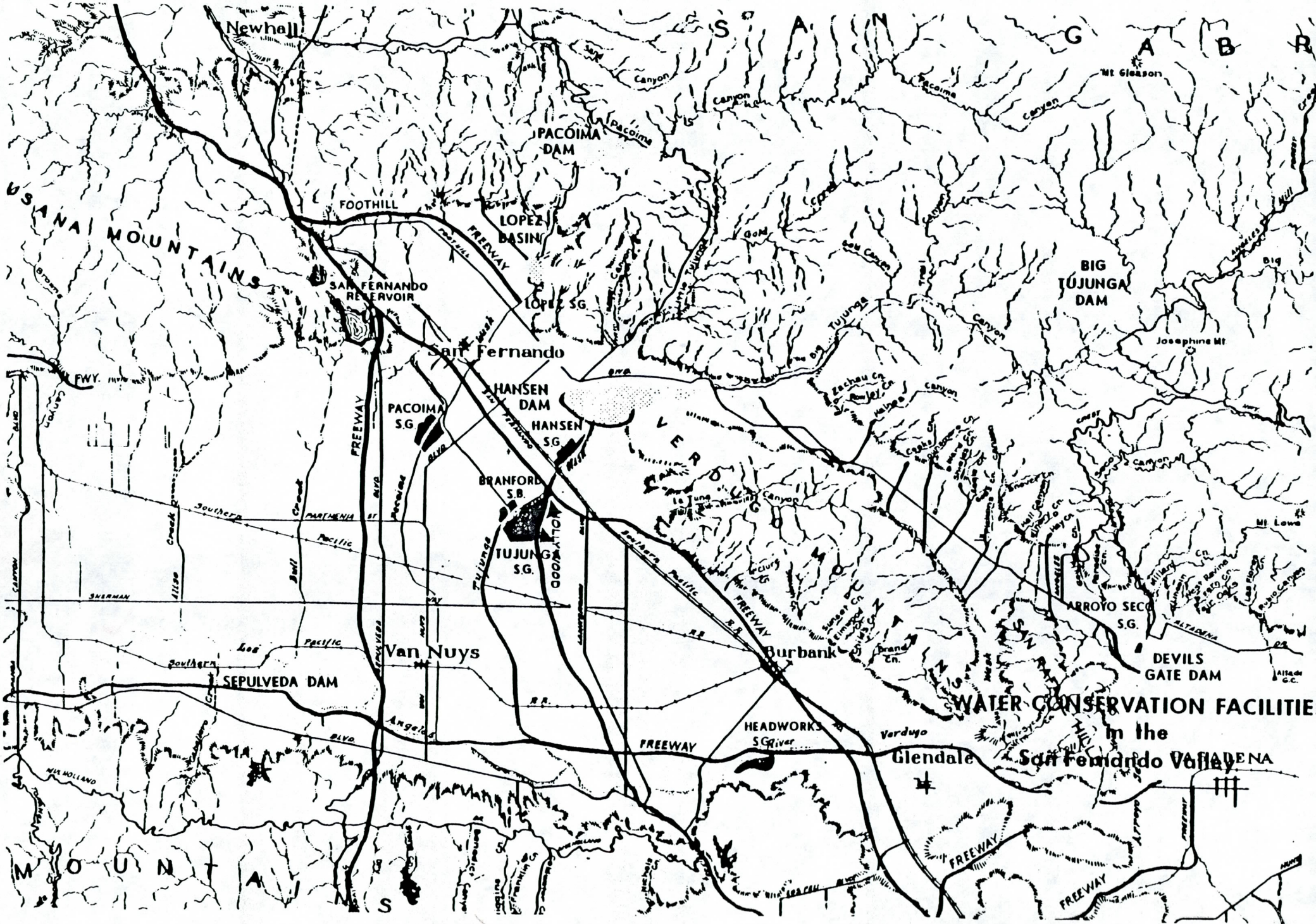
*FUNDS PROVIDED FOR WEST COAST BASIN EXPERIMENT PROJECT BY STATE WATER RESOURCES BOARD.

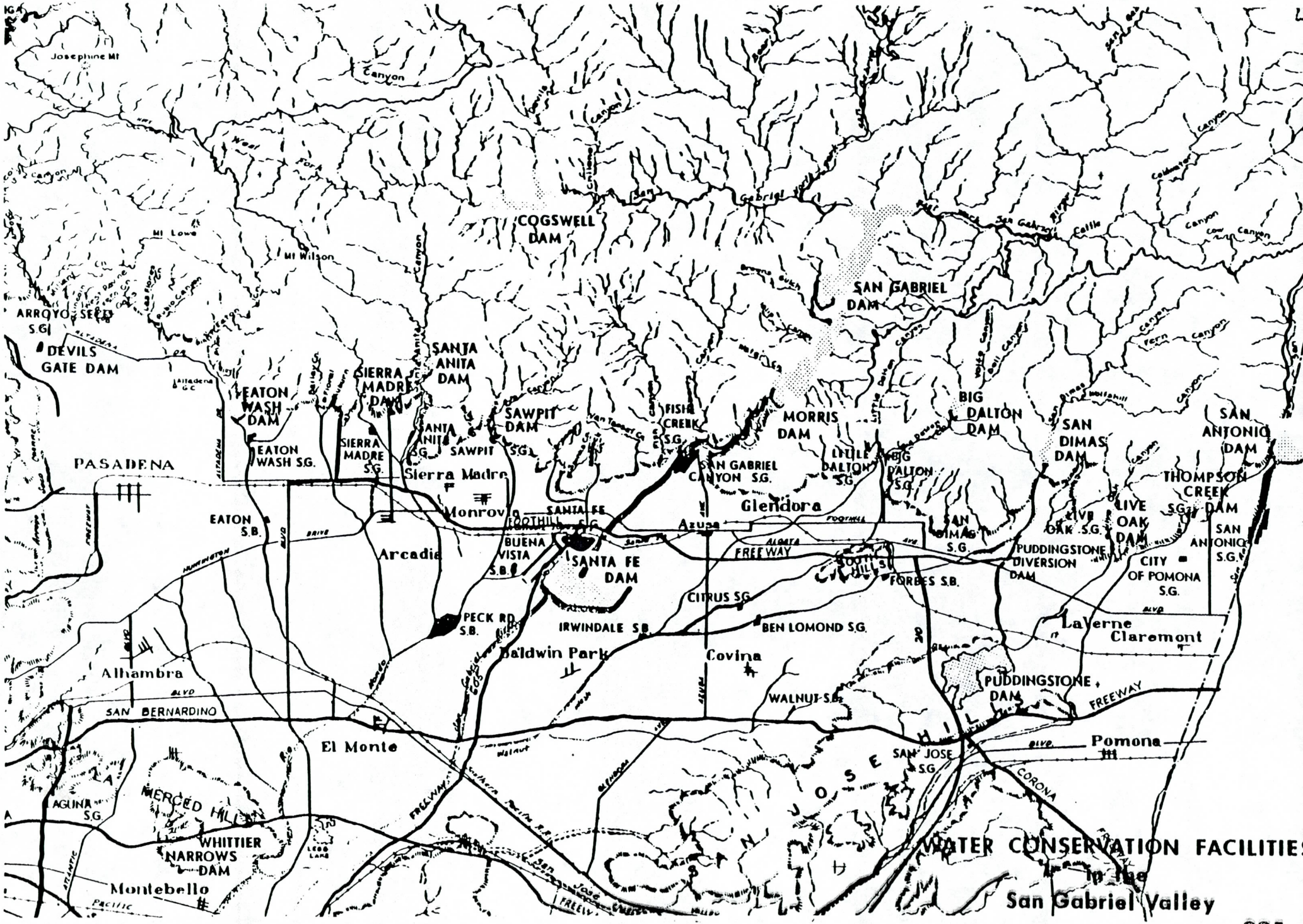
WELL HYDROGRAPHS INCLUDED IN THIS REPORT

WELL NO.*	GROUND-WATER BASIN	APPROXIMATE LOCATION	PAGE NO.
3872H	MAIN SAN FERNANDO BASIN	CLARK AVENUE AND GRIFFITH PARK DRIVE, BURBANK	319
4709	MAIN SAN FERNANDO BASIN	SHERMAN WAY AND DEERING AVENUE, CANOGA PARK	321
4057H	RAYMOND BASIN	LOS ROBLES AND GLENARM STREETS, PASADENA	322
2955X	MAIN SAN GABRIEL	TYLER AVENUE AND CENTRAL AVENUE, SOUTH EL MONTE	324
3030F	MAIN SAN GABRIEL	600 FEET NORTHWEST OF THE INTERSECTION OF LOS ANGELES STREET AND MAINE AVENUE, BALDWIN PARK	325
4284A	UPPER SAN GABRIEL CANYON	3600 FEET NORTHWEST OF THE INTERSECTION OF SIERRA MADRE AVENUE AND SAN GABRIEL CYN. RD., AZUSA	327
4508B	UPPER CLAREMONT HEIGHTS	800 FEET SOUTHEAST OF THE INTERSECTION OF BASE LINE RD. AND PADUA AVENUE, CLAREMONT	329
3251E	POMONA BASIN	2,200 FEET NORTH OF THE INTERSECTION OF SAN BERNARDINO FREEWAY AND TOWNE AVENUE, POMONA	330
1601T	CENTRAL BASIN	1,000 FEET SOUTH OF THE INTERSECTION OF WASHINGTON BOULEVARD AND ROSEMEAD BOULEVARD, MONTEBELLO	332
906D	CENTRAL BASIN	1,300 FEET NORTHWEST OF THE INTERSECTION OF LONG BEACH BOULEVARD AND SAN ANTONIO DRIVE, LONG BEACH	333
460K	CENTRAL BASIN	2,600 FEET NORTHEAST OF THE INTERSECTION OF LAKEWOOD BOULEVARD AND PACIFIC COAST HIGHWAY, LONG BEACH	335
760C	WEST BASIN	99 FEET SOUTHWEST OF THE INTERSECTION OF COMPTON BLVD. AND DOTY AVENUE, LAWNDALE	336
7048A	SANTA CLARITA VALLEY	SOUTHEAST OF THE INTERSECTION OF NEWHALL AVENUE AND MAGIC MT. PKWY., SAUGUS	338
9962D	LANCASTER	1,500 FEET NORTHWEST OF THE INTERSECTION OF SIERRA HIGHWAY AND AVENUE K, LANCASTER	339

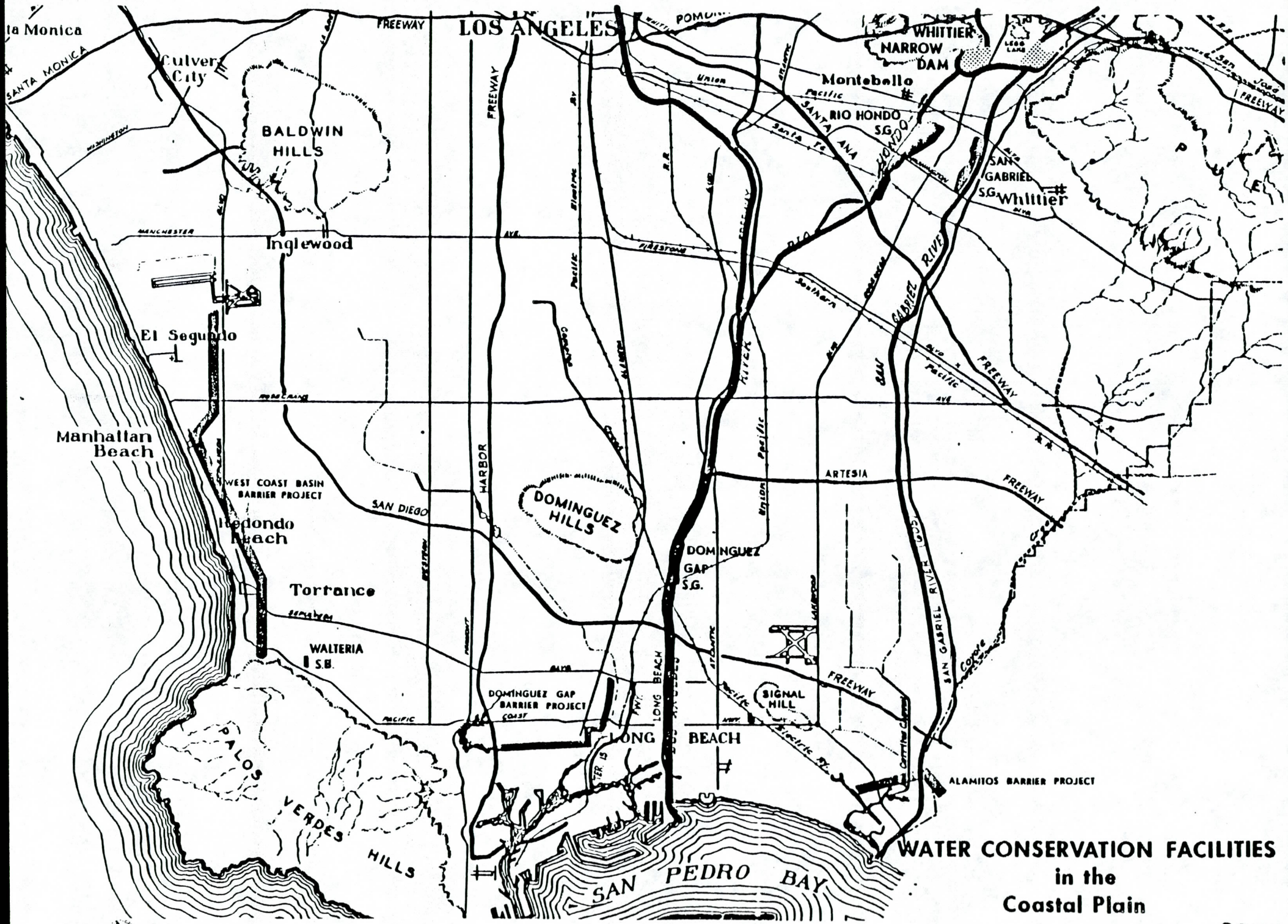
* WELL LISTED IS THAT WELL CURRENTLY BEING MEASURED AT THE LOCATION DESCRIBED.




Newhall
S A N G A B R
Mt Gleason
PACOIMA DAM
FOOTHILL
LOPEZ BASIN
FREEWAY
SAN FERNANDO RESERVOIR
LOPEZ S.G.
San Fernando
BIG TUJUNGA DAM
Josephine Mt
HANSEN DAM
HANSEN S.G.
PACOIMA S.G.
BRANFORD S.B.
TUJUNGA S.G.
Van Nuys
Burbank
ARROYO SECO S.G.
DEVILS GATE DAM
SEPULVEDA DAM
HEADWORKS S.G.
Glendale
PASADENA
WATER CONSERVATION FACILITIE
in the
San Fernando Valley
M O U N T A I N S

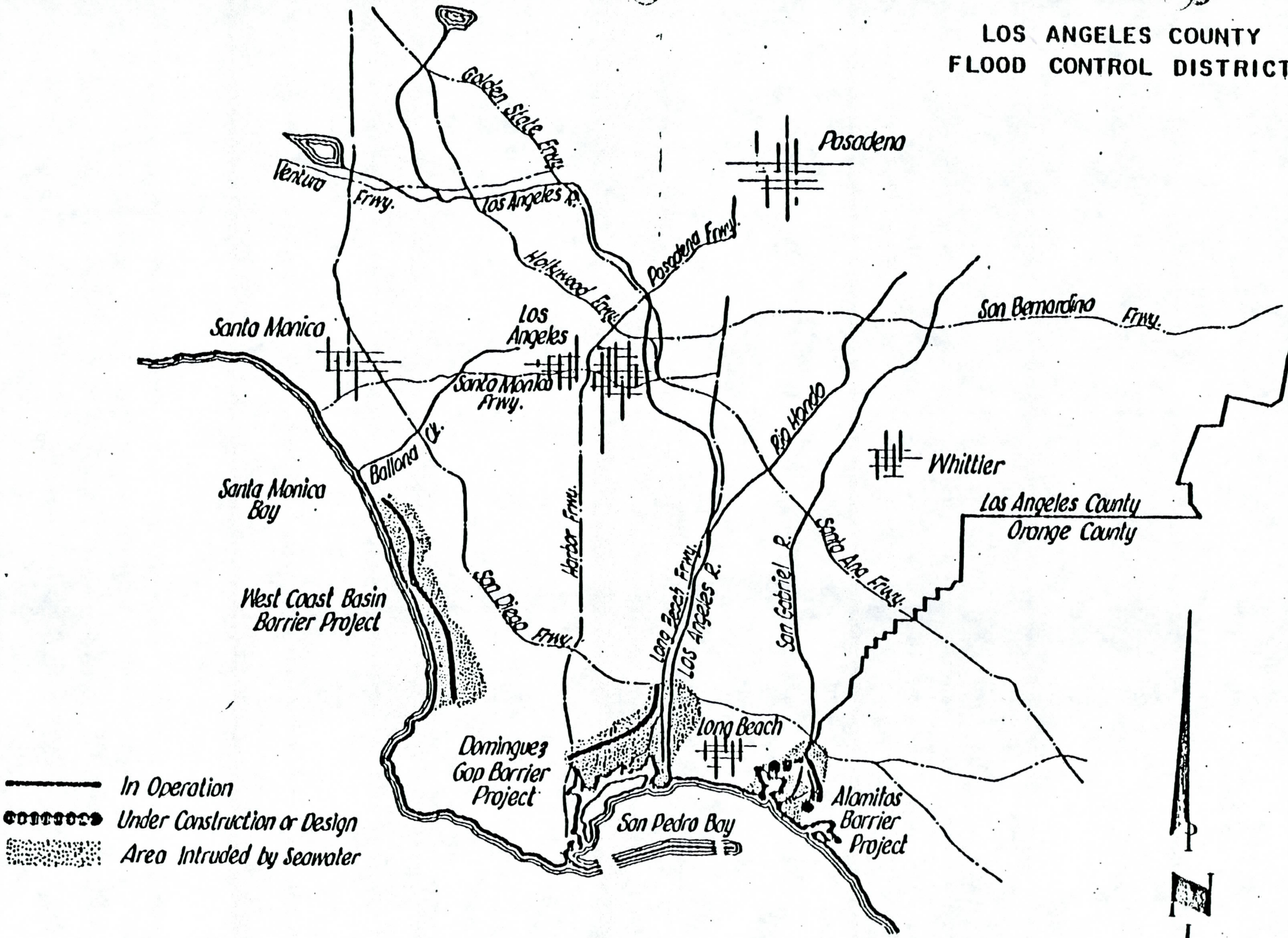


WATER CONSERVATION FACILITIES in the San Gabriel Valley

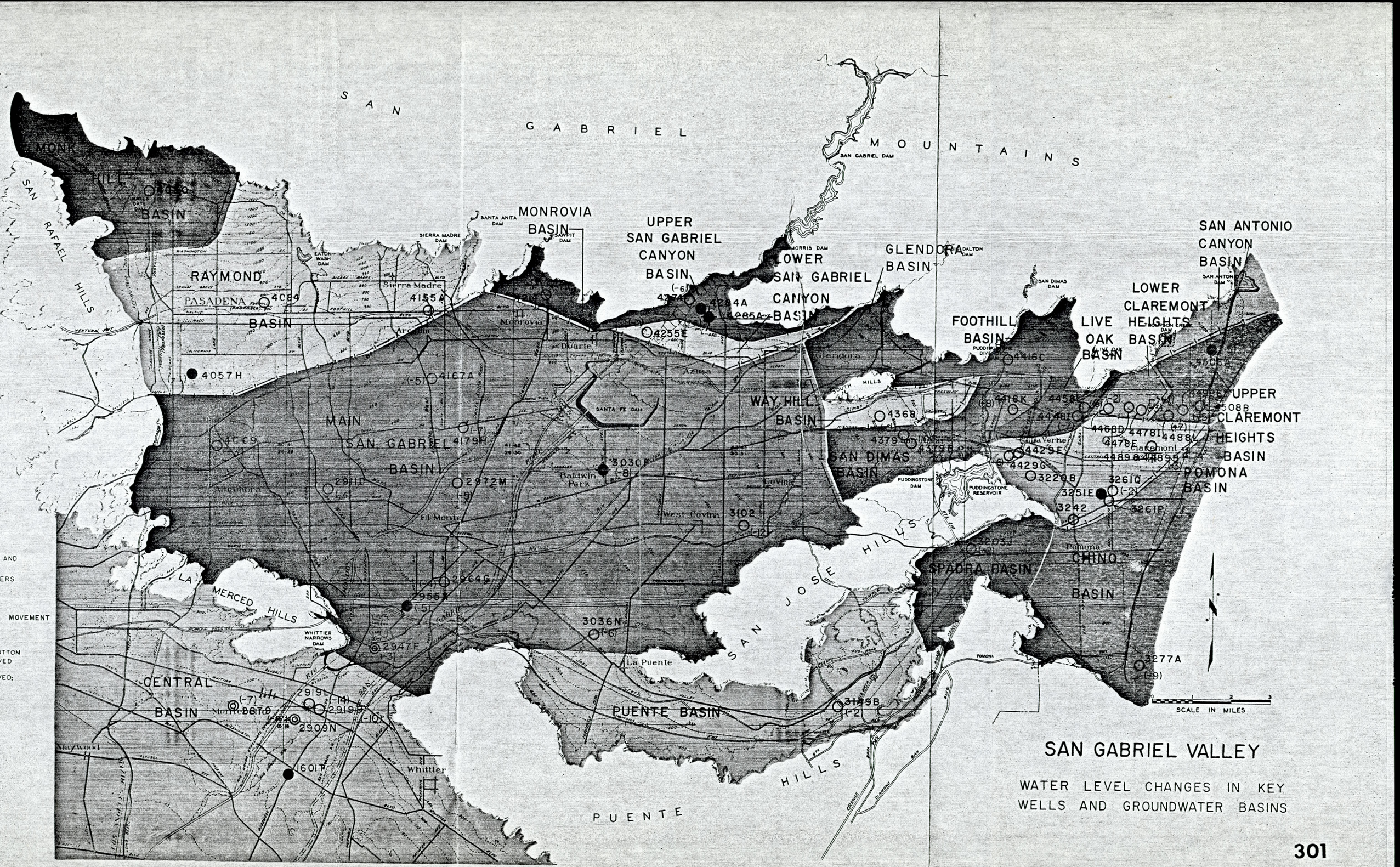


WATER CONSERVATION FACILITIES in the Coastal Plain

LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT



EXTENT OF SEAWATER INTRUSION ALONG OUR COASTLINE



SAN GABRIEL VALLEY

WATER LEVEL CHANGES IN KEY WELLS AND GROUNDWATER BASINS

SEAWATER THREAT

Freshwater production wells along the coast in Los Angeles County have been destroyed by seawater intrusion as a result of heavy pumping inland, which has lowered ground-water levels far below sea level.

THE PROBLEM

The movement of seawater into pumping fields was causing production wells to be abandoned. Inasmuch as the area of Los Angeles County subject to seawater intrusion depends upon underground supplies for a significant portion of its water, any reduction of the supplies is critical. Imported water is presently the only feasible replacement for ground-water supplies, but is unavailable to meet the entire peak and heavy summer demands.

THE SOLUTION

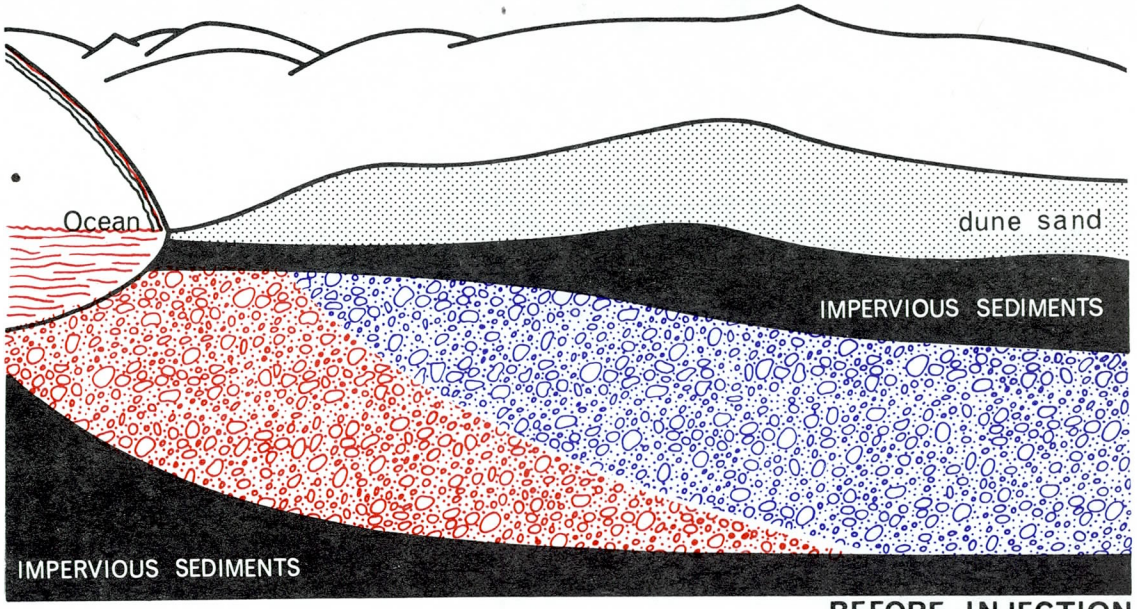
A barrier is created by injecting fresh water under pressure into the underground water-producing zones. Through continuous injection, the fresh water blocks further seawater intrusion and also moves inland, raising ground-water levels and supplying production wells. Three such barrier projects in Los Angeles County, the West Coast Basin, the Alamitos and the Dominguez Gap Barrier Projects, are presently in operation. Imported water is presently the only available supply for barrier operations.

EFFECTIVENESS OF THE SOLUTION

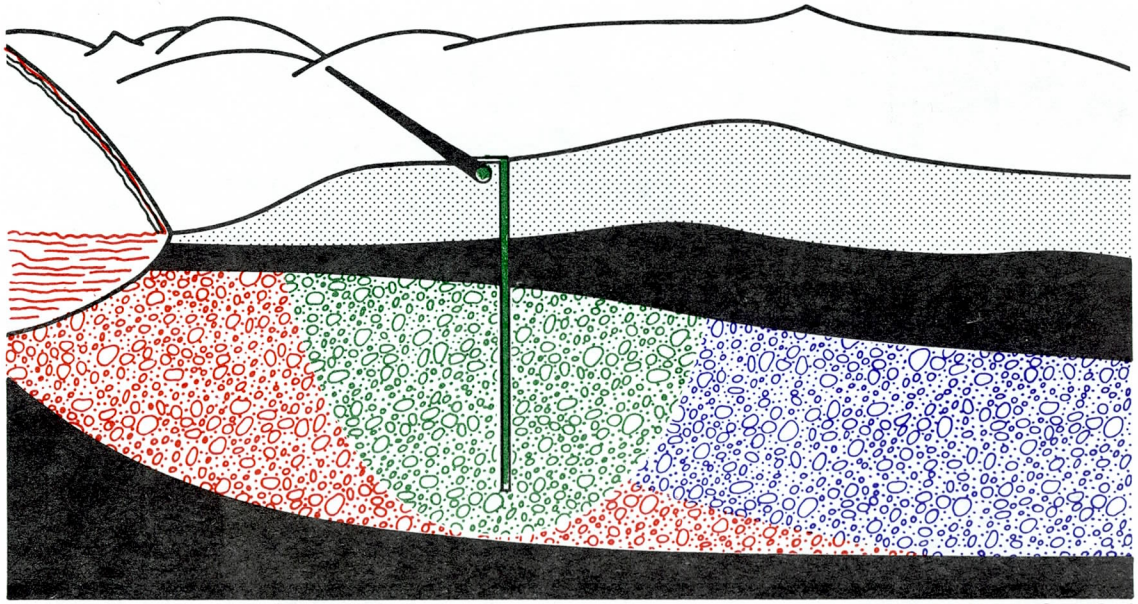
As illustrated, the different waters do not materially intermingle in their movement through the underground reservoir but essentially retain separate identities. Cut off by the artificially created freshwater barrier, the remaining heavier seawater moves inland beneath most water wells.

SUMMING UP

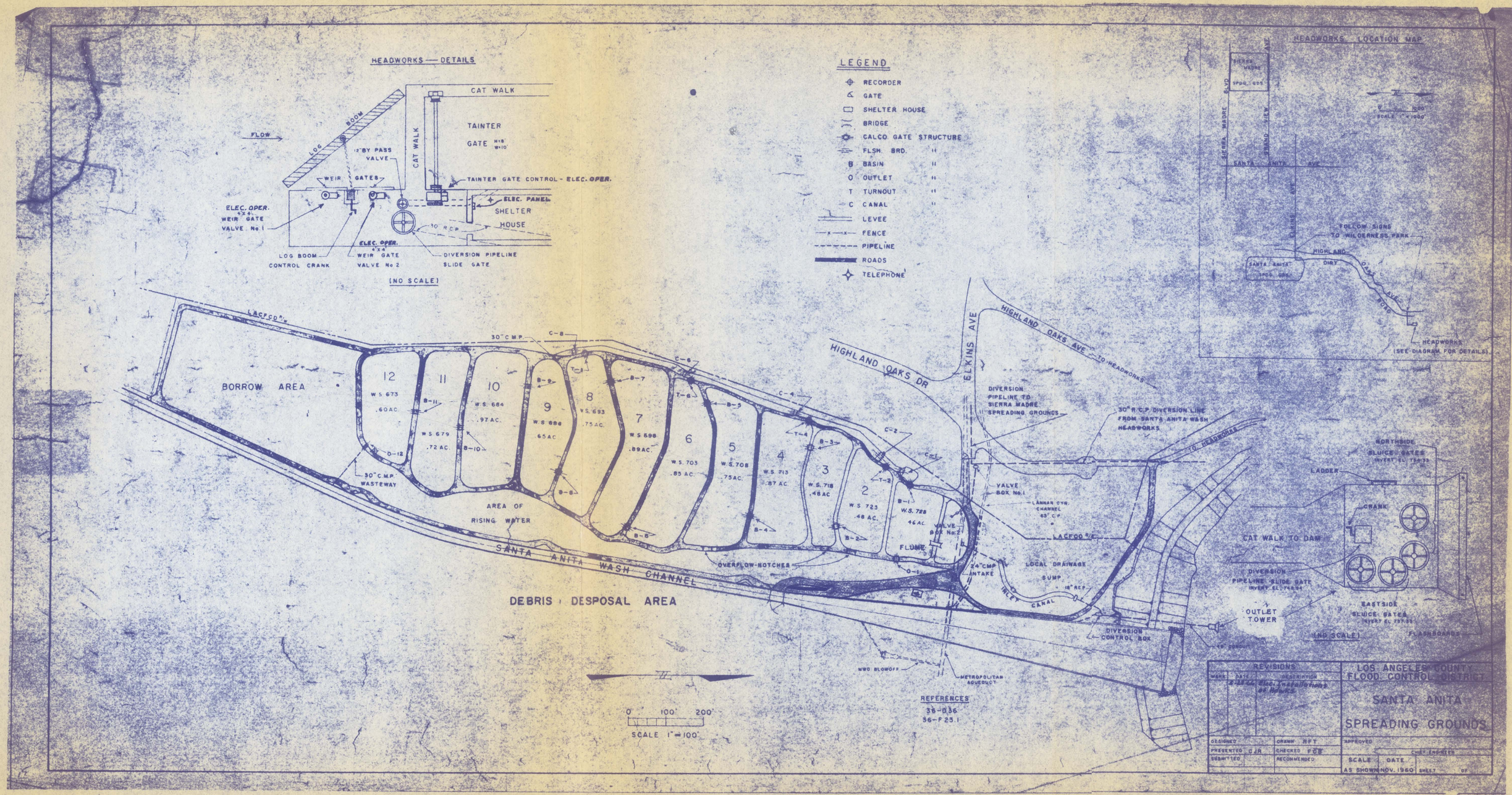
Intruding seawater has been effectively halted in the major portion of three areas in Los Angeles County.



BEFORE INJECTION



AFTER INJECTION


HEADWORKS — DETAILS
CAT WALK
TAINTER GATE H=8' W=10'
FLOW
LOG BOOM
12" BY PASS VALVE
CAT WALK
WEIR
GATES
TAINTER GATE CONTROL - ELEC. OPER.
ELEC. PANEL
SHELTER HOUSE
ELEC. OPER. 4'x4' WEIR GATE VALVE No. 1
10" R.C.P.
ELEC. OPER. 4'x4' WEIR GATE VALVE No. 2
LOG BOOM CONTROL CRANK
DIVERSION PIPELINE SLIDE GATE
(NO SCALE)
LEGEND
RECORDER
GATE
SHELTER HOUSE
BRIDGE
CALCO GATE STRUCTURE
FLSH. BRD. "
B BASIN "
O OUTLET "
T TURNOUT "
C CANAL "
LEVEE
FENCE
PIPELINE
ROADS
TELEPHONE
HEADWORKS LOCATION MAP
SIERRA MADRE BLVD
SIERRA MADRE
SPDG. GDS.
GRAND VIEW AVE
SANTA ANITA AVE
NORTH SCALE 1"=1000'
FOLLOW SIGNS TO WILDERNESS PARK
HIGHLAND
DIRT
OAKS AVE
ROAD
SANTA ANITA SPDG. GDS.
HEADWORKS (SEE DIAGRAM FOR DETAILS)
LACFCD R/W
BORROW AREA
30" C.M.P.
C-8
12 W.S. 673 .60 AC.
11 W.S. 679 .72 AC.
10 W.S. 684 .97 AC.
9 W.S. 686 .65 AC.
8 W.S. 693 .75 AC.
7 W.S. 698 .89 AC.
6 W.S. 703 .85 AC.
5 W.S. 708 .75 AC.
4 W.S. 713 .87 AC.
3 W.S. 718 .48 AC.
2 W.S. 723 .48 AC.
W.S. 728 .46 AC.
30" C.M.P. WASTEWAY
AREA OF RISING WATER
SANTA ANITA WASH CHANNEL
OVERFLOW-NOTCHES
FLUME
DEBRIS DESPOSAL AREA
HIGHLAND OAKS DR
ELKINS AVE
HIGHLAND OAKS AVE
TO HEADWORKS
DIVERSION PIPELINE TO SIERRA MADRE SPREADING GROUNDS
30" R.C.P. DIVERSION LINE FROM SANTA ANITA WASH HEADWORKS
VALVE BOX No. 1
LANNAR CVD. CHANNEL 63" C.P.
VALVE BOX No. 2
LACFCD R/W
24" CMP INTAKE
LOCAL DRAINAGE SUMP
18" R.C.P.
INLET CANAL
DIVERSION CONTROL BOX
MWD BLOWOFF
METROPOLITAN AQUEDUCT
NORTHSIDE SLUICE GATES
LADDER
CRANK
CAT WALK TO DAM
DIVERSION PIPELINE SLIDE GATE
OUTLET TOWER
EASTSIDE SLUICE GATES
(NO SCALE)
FLASHBOARDS
REFERENCES
38-036
56-F 23.1
0 100' 200'
SCALE 1"=100'
REVISIONS
MARK DATE DESCRIPTION
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
SANTA ANITA SPREADING GROUNDS
DESIGNED
DRAWN RFT
PRESENTED GJR
CHECKED FCB
SUBMITTED
RECOMMENDED
APPROVED
CHIEF ENGINEER
SCALE AS SHOWN
DATE NOV. 1960
SHEET OF

60" R.C.P. DRAIN — 3-21" DRAIN PIPES (TWO HAVE FLAP GATES)
3-24" DRAIN PIPES
SANTA FE SPRINGS DISPOSAL LINE
PARAMOUNT BLVD.
CITY OF DOWNEY PRODUCTION WELL
BASIN 37
BASIN 31
INLET BASIN
ARROYO DITCH
VALVE
FLOW
48" DIA. R.C.P. (FLOW FROM D-3)
DETAIL A
NO SCALE
DRAIN FROM PARK
VAN NORMAN ROAD
LOCH LOMOND STREET
DIVERSION
FLOCCULATION TANK
CHEMICAL STORAGE
EAST FLUME
RISING WATER CHANNEL FROM DAM TO SYPHON. BOTTOM AREA 8.8 ACRES.
54" R.C.P. GATED RISING WATER SYPHON.
IVY STREET DRAIN. 42" CMP.
HEADWORKS
RIO HONDO CHANNEL
STORM DRAIN
WEST FLUME
RECORDER
TEST BASINS
C. OF E. GAGING STA.
WHITTIER BLVD.
BLUFF ROAD
U.P.R.R.
TEST BASIN
CANAL NO.
FISH BASINS
BRIDGE
L.A.C.F.C.D. R/W
WASHINGTON BLVD.
4" DRAIN PIPE
40" CMP DRAIN
TUNNEL
BIKE ENT.
S.P.R.R.
LAWSON
BIKE BRIDGE
SANTA ANA FREEWAY
P.E.R.Y.
FOSTER BRIDGE BLVD.
40" C.M.P. INLET
FILLED
SILVA

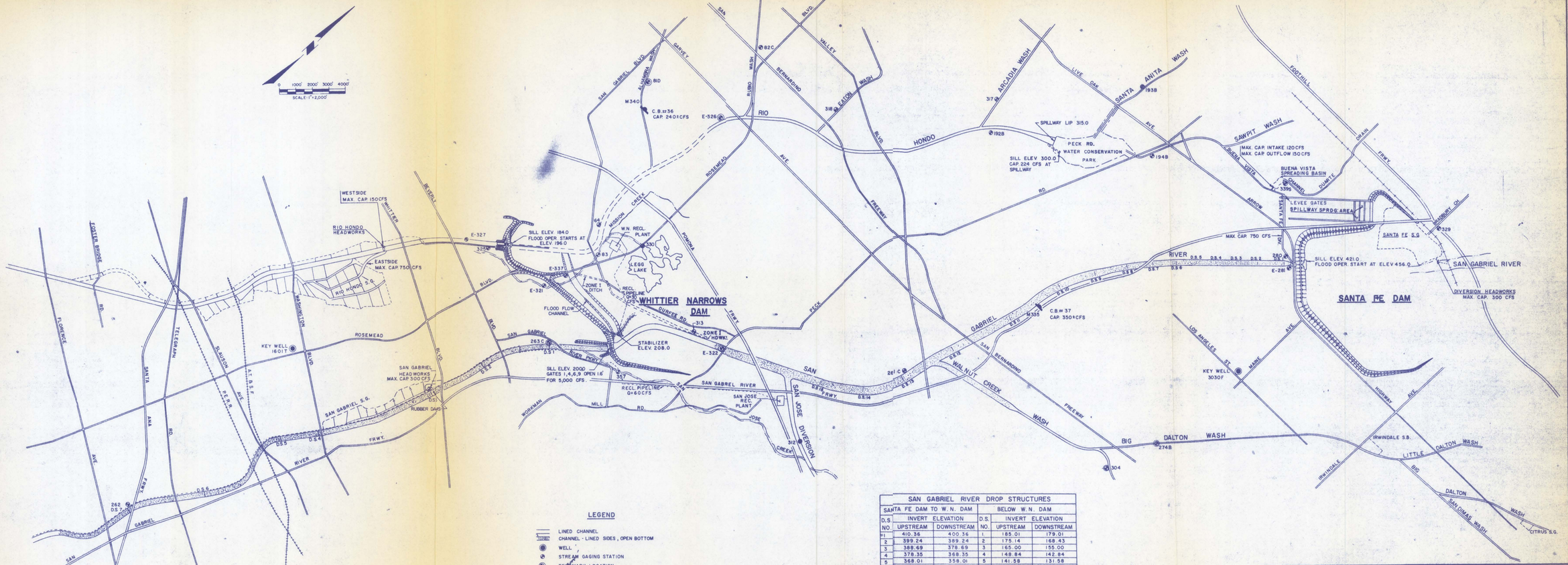
LEGEND

- SPREADING GROUNDS ROADS
- O WELL
- WELL W/ RECORDER
- FLOW RECORER
- B BASIN OUTLET STRUTURE
- T TURNOUT STRUCTURE
- S SYPHON
- C CANAL STRUCTURE
- L.A.C.F.C.D RIGHT OF WAY
- TD TOE DRAIN
- △ COUNTY TELEPHONE
- (B) O-1 (DRAINS INTO TEST BASIN & FISH BASINS BY WAY OF 12" C.M.P.)
- ● BIKE TRAIL

REVISIONS:
12-15-69 Combine basins 17&20, 21&22, 23&24. Relocate B-22
7-23-74 Revised

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
RIO HONDO COASTAL BASIN SPREADING GROUNDS
OPERATING MAP

J.S.C. | SCALE: 1" = 400' | DATE: 6-21-68



LEGEND

- LINED CHANNEL
- CHANNEL - LINED SIDES, OPEN BOTTOM
- WELL
- STREAM GAGING STATION
- SCALE MARK LOCATION
- METROPOLITAN WATER DISTRICT OUTLET
- STREAM GAGING STATION WITH TELEMARK (INFORMATION RELAYED TO RIO HONDO HDWKS. ONLY)
- D.S. DROP STRUCTURE

SAN GABRIEL RIVER DROP STRUCTURES

SANTA FE DAM TO W. N. DAM			BELOW W. N. DAM		
D.S. NO.	INVERT ELEVATION UPSTREAM	INVERT ELEVATION DOWNSTREAM	D.S. NO.	INVERT ELEVATION UPSTREAM	INVERT ELEVATION DOWNSTREAM
P1	410.36	400.36	1	185.01	179.01
2	399.24	389.24	2	175.14	168.43
3	389.69	378.69	3	165.00	155.00
4	378.35	368.35	4	149.84	142.84
5	368.01	358.01	5	141.58	131.58
6	357.67	347.67	6	127.77	117.77
7	346.68	336.68	7	114.80	104.80
8	335.78	325.78			
9	324.05	314.05			
10	312.24	302.24			
11	298.29	288.29			
12	283.50	273.50			
13	268.12	258.12			
14	257.33	247.33			
15	246.53	236.53			

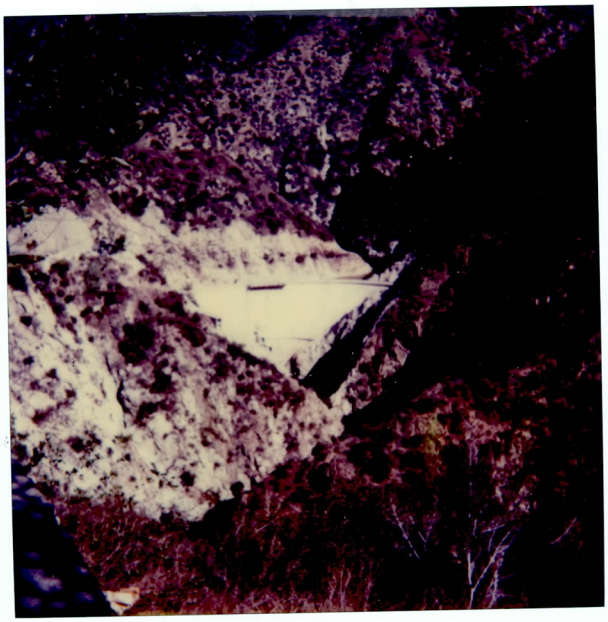
REVISIONS	
DATE	DESCRIPTION
May '75	Changed Peck Rd. Sprd'g Basin to Peck Rd. Water Conservation Park

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

RIO HONDO-SAN GABRIEL DRAINAGE

SANTA FE DAM TO FLORENCE AVE.

DRAWN BY	CHECKED BY	SCALE	DATE
H.C.	F.R.S.	A.S.	OCT., 1968



Santa Anita Dam 1927
11 sq mile drainage area. Conserv pool 11/20/84

Santa Anita Debris Basin & spreading grounds 11/20/84

San Gabriel channel 14,000 cfs use to spread 100 cfs in chan divert 300 cfs. 11/20/84

Rio Hondo channel 40,000 cfs cap. 11/20/84

San Gabriel Rubber Dam, 99'x8' water infla. initial cost 68 @ $250k 11/20/84

Rio Hondo eastside inlet to spreading basins 750cfs 11/20/84

Rio Hondo Headworks, radial gates. 11/20/84