COMPREHENSIVE STORM DRAIN PLAN #3 PROJECT 3-5 AREA DRAINAGE PLAN

City of Colton, City of Rialto,
City of San Bernardino and San Bernardino County
Department of Transportation/Flood Control
Public Works Group

MARCH 1991

TABLE OF CONTENTS

ORDINANCE NO. 3436

AN ORDINANCE OF THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ESTABLISHING THE COMPREHENSIVE STORM DRAIN PLAN #3, PROJECT 3-5, ADDING SUBSECTION 16.0212(j)(4) TO CHAPTER 2 OF DIVISION 6 OF TITLE 1 TO THE SAN BERNARDINO COUNTY CODE RELATING TO DRAINAGE FEES TO ASSIST THE FINANCING AND CONSTRUCTION OF DRAINAGE FACILITIES, AND PROVIDING FOR THE COLLECTION OF SAID FEES IN THE UNINCORPORATED TERRITORY INCLUDED WITHIN THE BOUNDARIES OF THE AREA DRAINAGE PLAN FOR COMPREHENSIVE STORM DRAIN PLAN #3, PROJECT 3-5.

The Board of Supervisors of the County of San Bernardino, State of California, ordains as follows:

SECTION 1. The Board of Supervisors of the County of San Bernardino finds:

1. The Local Area Drainage Plan (hereinafter "Plan") for Comprehensive Storm Drain Plan #3, Project 3-5, has been prepared in accordance with the requirements of law and is on file with the Clerk of this Board.

2. The Comprehensive Storm Drain Plan #3, Project 3-5, drainage area will experience growth which will increase the need for flood control facilities to protect against the increased potential flood hazards caused by such growth. This financing mechanism is necessary to achieve an equitable method of payment to complete the construction of flood control facilities required to accommodate new development or redevelopment and to prevent potential flood hazards to existing and proposed development.

3. The drainage fees will be used to build and improve the flood control facilities identified in the Plan. The need for such flood control facilities is related to new development because such new development will contribute to the flood waters and drainage in the Plan Area which will cause an increased potential for flood hazards in the Plan Area.

4. There is a reasonable relationship between the amount of the fees and the cost of the flood control facilities attributable to the developments on which the fees are imposed because the fees have been calculated based upon the estimated

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costs of the facilities that will be required to mitigate the flood hazards created by new development. The estimated total costs of the flood control facilities necessary to accommodate new development in the Plan Area has been apportioned uniformly over the acreage, capable of being developed, contributing to the need for the new facilities.

5. Prior to implementation, accounts will be established for the fees specified herein, and the funds from each account will be appropriated for the flood control facilities identified in the Plan. The proposed construction schedule is set forth in the Plan.

6. Failure to mitigate the growth impact on flood control facilities within the Plan Area and the new development therein will place occupants of the Plan Area in conditions perilous to their health, safety and welfare.

7. Flood control facilities contained in the Plans are, in addition to, or reconstruction of, existing flood control facilities serving the Plan Area.

SECTION 2. The Board of Supervisors hereby establishes a Local Area Drainage Plan to be known as the Comprehensive Storm Drain Plan #3, Project 3-5 pursuant to the authority of Chapter 1 of Division 11 of Title 8 of the San Bernardino County Code. The legal description of the boundaries of said plan is set forth in Attachment A.

SECTION 3. The drainage fee for the Plan Area shall be subject to periodic adjustments for project revisions and inflation. The time and method of payment, fee account, credits, reimbursement agreements and exemptions are specified by Chapter 1 of Division 11 of Title 8 of the San Bernardino County Code.

The drainage facilities to be financed, their location, and an estimate of the total cost of construction of the drainage facility are as set forth in the Plan. In that the Plan is based upon schematic engineering maps, the drainage facilities eligible for funding or reimbursement and the phasing of said facilities

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shall be subject to possible revisions to the systems as they become evident during the design phase. All descriptions, figures, maps and provisions and standards contained in the Plan or any amendment to the Plan shall be followed in the financing and construction of the drainage facilities.

SECTION 4. Any property within the boundary of the Plan Area which, after being developed, does not drain into or derive protection from the Plan Area shall be exempt from payment of the applicable drainage fees. The decision as to whether developed property drains into or derives protection from the Plan Area rests solely with the County. If it is found that a particular parcel of property does not drain into or derive protection from the Plan Area, then it shall not be a part of said Plan Area but will be included in any other Local Area Drainage Plan into which it drains or derives protection, if any, and shall pay the applicable fee.

SECTION 5. Subsection 16.0212(j)(4) is added to Chapter 2 of Division 6 of Title 1 of the San Bernardino County Code, as follows:

16.0212 Flood Control

. . .

(j) Area Drainage Plan Fees.

(1) . . .

(2) . . .

(3) . . .

(4) Comprehensive Storm Drain Plan #3, Project 3-5.....$7,159/acre

SECTION 6. This ordinance shall take effect sixty (60) days from the date of adoption.

Larry Walker

LARRY WALKER, Chairman
Board of Supervisors

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SIGNED AND CERTIFIED THAT A COPY OF THIS DOCUMENT HAS BEEN DELIVERED TO THE CHAIRMAN OF THE BOARD

EARLENE SPROAT
Clerk of the Board of Supervisors
of the County of San Bernardino

Earlene Sproat

STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN BERNARDINO)

I, EARLENE SPROAT, Clerk of the Board of Supervisors of the County of San Bernardino, State of California, hereby certify that at a regular meeting of the Board of Supervisors of said County and State, held on the 25th day of March, 1991, at which meeting were present Supervisors: Marsha Turoci, Jon D. Mikels, Barbara Cram Riordan, Robert L. Hammock, Larry Walker and the Clerk, the foregoing ordinance was passed and adopted by the following vote, to wit:

AYES: Supervisors: Turoci, Mikels, Riordan, Hammock, Walker

NOES: Supervisors: None

ABSENT: Supervisors: None

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the Board of Supervisors this 25th day of March, 1991.

EARLENE SPROAT, Clerk
of the Board of Supervisors
of the County of San Bernardino,
State of California

By: Laura Welch
Deputy

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COMPREHENSIVE STORM DRAIN PLAN #3
PROJECT 3-5 AREA DRAINAGE PLAN

EXECUTIVE SUMMARY

This plan is a mechanism for financing the construction of Comprehensive Storm Drain Plan #3, Project 3-5, consisting of regional mainline improvements. The project will provide a system of storm drains, channels, and basin improvements to assist in the protection of properties that are developed or planned for future development or redevelopment. It will also provide a means for partial mitigation of drainage impacts of such new development by providing flood control improvements for the control of the increased rate of runoff that results from development.

The project drainage area is shown on Exhibit "A". It covers a total area of 2,045 acres and includes areas within the Cities of San Bernardino, Rialto, and Colton as well as unincorporated areas of the County of San Bernardino. There presently exists approximately 777 acres of unimproved lands within the watershed.

Only the regional mainline improvements are covered by this plan, however, local drains will be needed to collect the runoff and carry the flows to the mainline improvements. All improvements proposed in this report have been sized to convey the projected surface runoff resulting from a 100 year frequency storm upon full development of the area as currently envisioned by the general plans of the County and Cities of San Bernardino, Rialto, and Colton.

The Flood Control District owns, operates, and maintains the East Rialto Channel and the Pepper, Mill, and Randall Basins located as shown in Exhibit "A". These facilities are not considered adequate to contain major storm flows. In addition an outlet from Randall Basin and drainage facilities to convey storm flows south, under Interstate 10 and Southern Pacific Railroad tracks and to the Santa Ana River are needed. Flood damage has occurred in the past along Valley Boulevard in the vicinity of Pepper and Meridian Avenues.

In 1986 the Cities of Colton and San Bernardino and the Flood Control District entered into an agreement to review alternatives and develop a drainage plan to remedy the aforementioned drainage concerns. During the development of the plan, key impacted property owners and the City of Rialto were contacted to review and comment on the plan.

The proposed improvements are shown on Exhibit "A" and include an additional turnout from East Rialto Channel to Pepper Basin, excavation and outlet structures for Mill and Randall Basins, and a storm drain from the Randall Basin south under Interstate 10, and the railroad tracks to the Santa Ana River.

A developer fee of $7,159 is justified in accordance with AB 1600 and is recommended to finance approximately $5.56 million of the $8.0 million required to construct the aforementioned improvements. It is further recommended that the Cities of Rialto, San Bernardino, and Colton and the County and the Flood Control District continue to work together to develop a means to fund the additional $2.44 million needed to complete the improvements.

A separate account will be established by the County for the deposit of fees collected from the drainage area. The account will be interest bearing and reserved for construction of improvements serving the drainage areas. The County Building and Safety Department adds a $25.00 charge per transaction for collection of the fee for developments in the unincorporated areas.

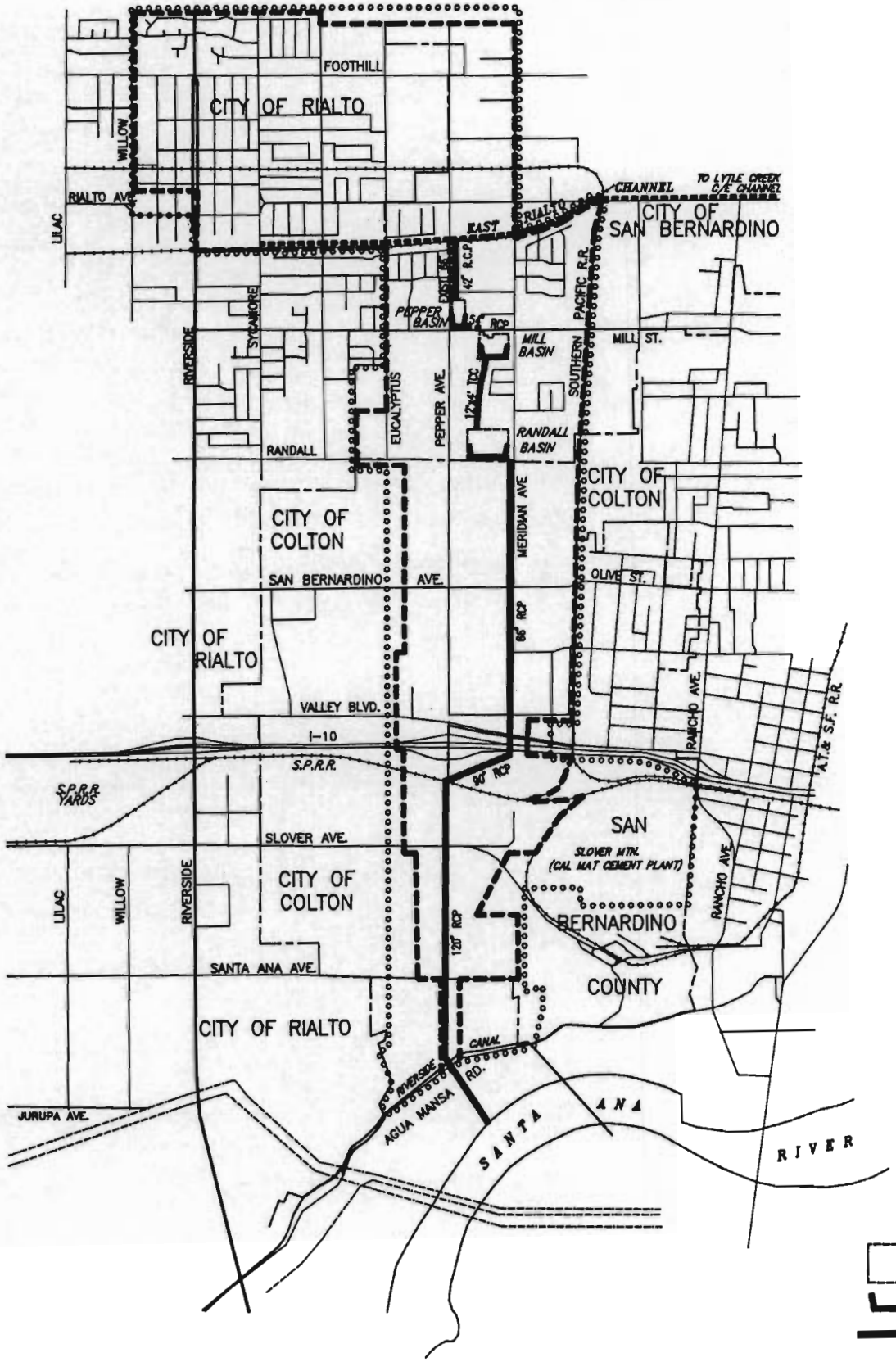
New development in the area should continue to mitigate any incremental increase in runoff generated by the development until adequate downstream facilities are constructed. Also new development south of the East Rialto Channel should be designed such that they are protected from infrequent discharges over the East Rialto Channel spillways and flows from Mill and Randall Basins until adequate improvements have been provided to convey storm flows to the Santa Ana River.

Construction of the project is anticipated to occur over a number of years and involve a number of individual construction projects, each of which would provide a meaningful level of improved flood/drainage protection to new development or mitigate its flows. As each construction project is defined, agreements will be needed between the jurisdictions and other parties (i.e. developers) which may be involved to cooperatively fund the costs of the project.

In some cases developers may be required, as a condition of development, to construct improvements in excess of their fair share of project costs as determined by the fees applicable to their development. In such cases, fees may be used to reimburse developers for these excess costs in accordance with applicable City or County ordinances.

The City of Colton has a fee plan in place for their share of the construction costs of this project. The Cities of San Bernardino and Rialto have participated in the development of this plan and have been advised that a similar fee structure within their jurisdictions would be advantageous in completing the needed facilities. Since each jurisdiction may fund its share of the project using different mechanisms and sources of funds, all jurisdictions need not have identical fee plans.

COMPREHENSIVE STORM DRAIN PLAN #3 PROJECT 3-5
AREA DRAINAGE PLAN



LEGEND

- EXISTING BASIN
- BASIN IMPROVEMENT
- MAINLINE STORM DRAIN
- EXISTING STORM DRAIN
- PLAN BOUNDARY
- WATERSHED BOUNDARY
- CITY LIMITS

EXHIBIT A

COMPREHENSIVE STORM DRAIN PLAN #3
PROJECT 3-5

SUMMARY AND COSTS

1.	Placement of 1,100 L.F. of 42" reinforced concrete pipe from East Rialto Channel to Pepper Basin,	$159,500
2.	Excavation of 45,000 cubic yards of material from Mill Basin and construction of a new basin outlet structure,	$115,000
3.	Construction of 1,250 L.F. of trapezoidal concrete channel from Mill Basin to Randall Basin,	$187,500
4.	Excavation of 30,000 cubic yards of material from Randall Basin and construction of a basin drain and spillway,	$240,000
5.	Placement of 5,200 L.F. of 66" reinforced concrete pipe from Randall Basin to north of Valley Blvd.,	$1,144,000
6.	Placement of 500 L.F. of 90" reinforced concrete pipe from north of Valley Blvd. to Interstate 10,	$160,000
7.	Jacking 200 L.F. of 90" reinforced concrete pipe under Interstate 10,	$320,000
8.	Installation of 1200 L.F. of 90" reinforced concrete pipe between Interstate 10 and the Southern Pacific Railroad tracks.	$348,000
9.	Jacking 180 L.F. of 90" reinforced concrete pipe under the Southern Pacific Railroad tracks, and	$288,000
10.	Installation of 7,100 L.F. of 120" reinforced concrete pipe from the Southern Pacific Railroad tracks to the Santa Ana River.	$2,840,000
	sub-total	$5,802,000
	Contingencies, Design & Inspection (30%)	$1,740,600
	1988 total	$7,542,600
	February 1988 cost estimates updated by ENR to December 1989	$8,000,000
	Cost of Existing Improvements	+ $6,640,000
	TOTAL	$14,640,000

RELATIONSHIP BETWEEN FEE AND TRIBUTARY AREA

$$\frac{\$14,640,000}{2045 \text{ Acres}} = \$7,159 \text{ per Acre}$$

Note: Reaches and Costs revised from Planning Division Report due to minor changes in the alignment.

EXHIBIT B

COMPREHENSIVE STORM DRAIN PLAN #3
3-5 AREA DRAINAGE PLAN
COST PER ACRE

$ 6,640,000	Value of the existing facilities.
+ $ 8,000,000	Value of the proposed facilities.
$14,640,000	Total

$$\frac{\text{(value of the facilities) } \$14{,}640{,}000}{\text{2,045 acres (tributary area)}} = \$7{,}159 \text{ per acre}$$

$\$7{,}159/\text{ac.} \times 777 \text{ ac. (vacant area)} = \$5{,}560{,}000$
(proposed amount to be financed by developer fees)

$\$8{,}000{,}000 - \$5{,}560{,}000 = \$2{,}440{,}000$
(total amount of proposed facilities) (financed by other funding mechanisms)

Exhibit C

SCHEDULE A

COMPREHENSIVE STORM DRAIN #3, PROJECT 3-5
PROJECT PRIORITY LIST AND CONSTRUCTION COST ESTIMATE

The plan priority list should be reviewed and updated periodically to account for changes in development activity. The revenue generated from the unincorporated portions of this plan is estimated to be approximately $50,000 per year. This figure is based on past land development activity being very sparse in recent years. The City portions of the watershed have had a great deal of development activity. Additional funding mechanisms are already in place in the other jurisdictions. It is anticipated that the first five years of generated revenue will be applied to participation agreements with the Cities. The revenue will be combined with other funding activities of the Cities to complete the following projects:

YEAR 1-5		1988 COSTS
1.	Jacking 200 L.F. of 90" reinforced concrete pipe under Interstate 10.	**Cost: $ 320,000**
2.	Excavation of 30,000 cubic yards of material from Randall Basin and construction of a basin drain and spillway.	**Cost: $ 240,000**
3.	Placement of 5,200 L.F. of 66" reinforced concrete pipe from Randall Basin to north of Valley Boulevard.	**Cost: $ 1,144,000**

SUBSEQUENT PROJECTS

1.	Excavation of 45,000 cubic yards of material from Mill Basin and construction of a new basin outlet structure.	**Cost: $ 115,000**
2.	Placement of 1,100 L.F. of 42" reinforced concrete pipe from East Rialto Channel to Pepper Basin.	**Cost: $ 159,500**

3.	Construction of 1,250 L.F. of trapezoidal concrete channel from Mill Basin to Randall Basin.	**Cost:**	**$ 187,500**
4.	Placement of 500 L.F. of 90" reinforced concrete pipe from north of Valley Boulevard to Interstate 10.	**Cost:**	**$ 160,000**
5.	Installation of 1,200 L.F. of 90" reinforced concrete pipe between Interstate 10 and the Southern Pacific Railroad tracks.	**Cost:**	**$ 348,000**
6.	Jacking 180 L.F. of 90" reinforced concrete pipe under the Southern Pacific Railroad tracks.	**Cost:**	**$ 288,000**
7.	Installation of 7,100 L.F. of 120" reinforced concrete pipe from the southerly tracks to the Santa Ana River.	**Cost:**	**$ 2,840,000**
	SUB-TOTAL		**$ 5,802,000**
	CONTINGENCIES, DESIGN, & INSPECTION (30%)		**1,740,600**
	TOTAL PROJECT COSTS (1988)		**$ 7,542,600**
	ADJUSTED TO 1989 DOLLARS		**$ 8,000,000**

Note: Reaches and costs revised from Planning Division Report due to minor changes in the alignment.

COMPREHENSIVE STORM DRAIN PLAN #3 PROJECT 3-5
AREA DRAINAGE PLAN
UNDEVELOPED LANDS

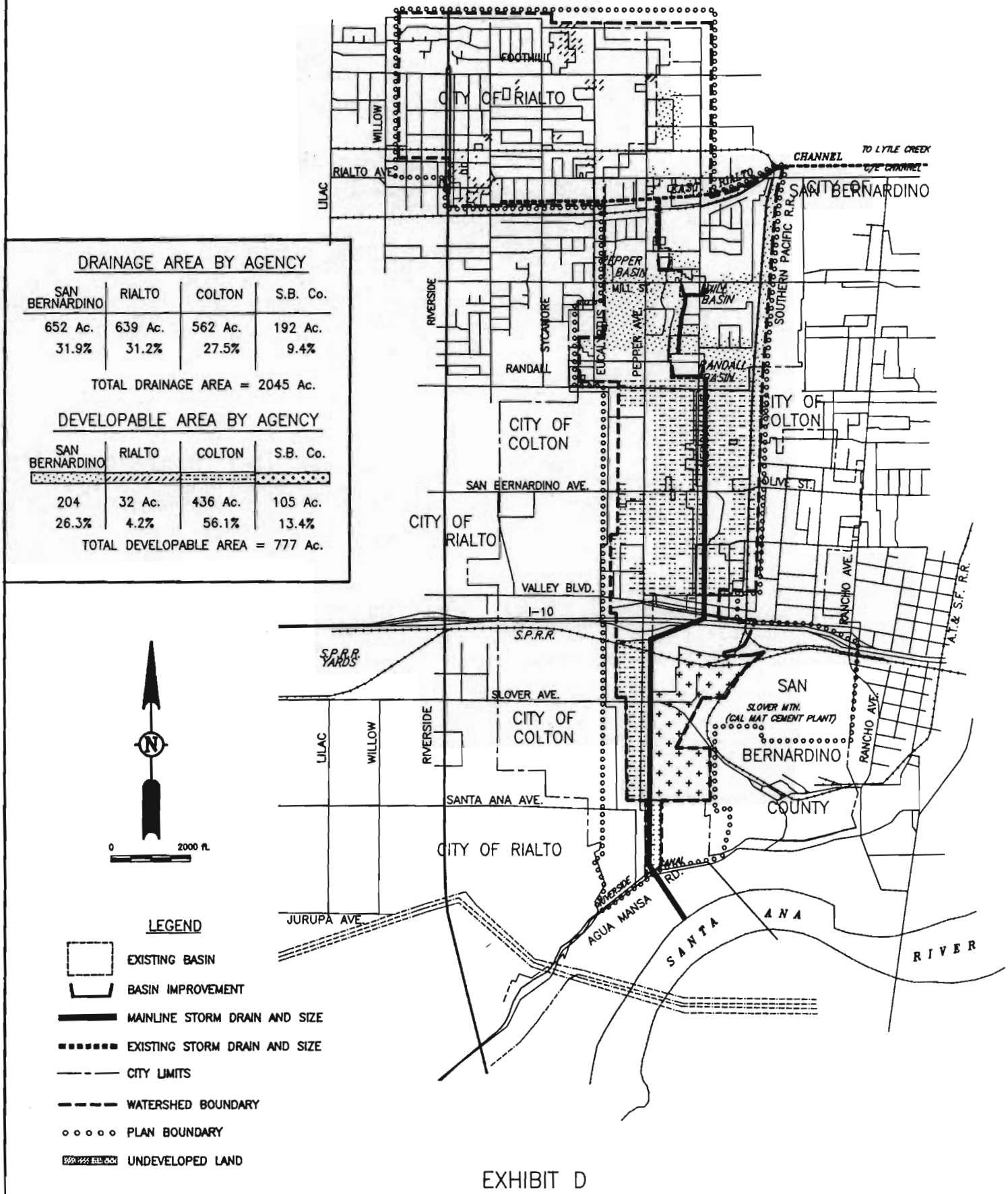


EXHIBIT D

COMPREHENSIVE STORM DRAIN PLAN #3
PROJECT 3-5 AREA DRAINAGE PLAN

ENGINEER'S REPORT

DESCRIPTION

The Comprehensive Storm Drain Plan #3, Project 3-5 Area Drainage Plan consists of approximately a 2,045 acre tributary watershed. The area served by this system can be generally described as a rectangle bounded by Willow Avenue, Cornell and 6th Street, Meridian Avenue and the A.T. and S.F. Railway, a rectangle bounded by Eucalyptus Avenue, the A.T. and S.F. Railway, Meridian Avenue and the San Bernardino Freeway, as well as an irregular shaped area south of the freeway encompassing West Colton railway station and the southwest side of Slover Mountain quarry. The watershed boundary is shown on Exhibit "A". The drainage area includes lands in the Cities of San Bernardino, Rialto, and Colton as well as unincorporated lands in the County of San Bernardino. Exhibit "C" graphically shows the undeveloped properties lying within the different jurisdictions.

BACKGROUND

For many years the City of San Bernardino required developers within the City and the Comprehensive Storm Drain Plan #3, Project 3-5 tributary area to mitigate any possible downstream increase in storm flows into the City of Colton by excavation of Randall Basin. Adequate storm drain improvements from Randall Basin downstream through the City of Colton and under Interstate 10 to the Santa Ana River did not exist. In 1986, continued mitigation by this means did not appear practical until an outlet could be constructed from Randall Basin to the Santa Ana River.

The proposal for handling these flows, shown by Project 3-5, was deemed cost prohibitive and did not include flow attenuation provided by Pepper, Mill, and Randall Basins which could reduce downstream storm drain sizes and overall project costs.

In September 1986, the Cities of San Bernardino and Colton agreed to participate with the Flood Control District to have the Flood Control staff conduct a re-evaluation of the Project 3-5 system. This study was to be based on the County's 1986 Hydrology Manual and include evaluation of flow attenuation in the existing Flood Control District Basins.

The San Bernardino County Planning Division, working with the affected cities, prepared a study of various alternatives. The "Area Drainage Plan, Project 3-5, Engineer's Report", referenced here as Appendix D-1, was completed in April 1990.

In the last few years, major developers have been conditionally required to mitigate any increased flows. The majority of the flood control facilities serving the area are, however, still interim facilities such as partially unimproved basins. These interim facilities will not be adequate to convey the higher rates of runoff generated by additional development much less major storm events.

PURPOSE

The area is experiencing growth and the needed flood control facilities can not be fully funded by traditional revenue sources. Supplemental funding sources must be developed if the major components of an adequate flood control system for the watershed are to be constructed.

The District's funding comes from property taxes, federal, and state aid on specific projects, rents and royalties, and local water agencies. The funding for existing flood control and water conservation facilities associated with Project 3-5 have been funded by the existing development. In addition, the ongoing operation and maintenance functions, paid out of the District's budget, have kept the flood hazards to a minimum. The funds generated from the past Zone 2 budget to acquire lands, easements, and rights-of-way, the construction of the existing facilities as well as the past expenditure for operation and maintenance of those facilities was generated by existing development. The total value, in todays dollars, of the existing improvements is estimated to be $6.64 million.

This plan is a mechanism for financing improvements which will provide facilities necessary for flood protection in the watershed for the unincorporated areas of San Bernardino County. All types of development will benefit from the construction of these facilities. The properties will be protected by the storm drains, channel, and basin improvements and will benefit by providing an outlet to convey and attenuate the higher peak flows from new development without adversely impacting downstream properties.

PROJECT DESIGN

In May 1973, a study entitled "Comprehensive Storm Drain Plan #3" was prepared by Verpet Engineering Company for the San Bernardino County Flood Control District. That report, referenced as Appendix "D-2", is in two volumes. Volume I consists of the hydrologic and hydraulic design criteria and discussion of the proposed plan. The hydrological analysis sized the facilities necessary to provide 25 year capacity for the storm flows from the watersheds of these systems to the Santa Ana River and did not consider flow attenuation that could be provided in the District's Pepper, Mill, and Randall Basins. Volume II provided a preliminary plan and profile for the proposed improvements. The Verpet proposed Project 3-5 would convey a 25 year peak flow of 1,880 cubic feet per second to the Santa Ana River.

The report entitled "Area Drainage Plan, Project 3-5, Engineer's Report" was prepared by the Planning Division of San Bernardino County Flood Control District. The purpose of that report, referenced as Appendix "D-1", was to update the hydrology and design to convey 100 year storm flows with flow attenuation provided by the District basins and develop cost data on which to base recommendations for development fees to fund Project 3-5. The Planning Division proposed Project 3-5 will convey a 100 year attenuated peak flow of $1,000/cfs to the Santa Ana River. The unit prices used in the preliminary construction cost estimates of that report were updated to December of 1989 and are estimated to be $8.0 million.

The recommended plan, Alternate A-5, as identified in the Planning Division report consists of the following:

1. Placement of 1,100 linear feet of 42" reinforced concrete pipe from East Rialto Channel to Pepper Basin.

2. Excavation of 45,000 cubic yards of material from Mill Basin and construction of a new basin outlet structure.

3. Construction of 1,250 linear feet of trapezoidal concrete channel from Mill Basin to Randall Basin.

4. Excavation of 30,000 cubic yards of material from Randall Basin and construction of a basin drain and spillway.

5. Placement of 5,200 linear feet of 66" reinforced concrete pipe from Randall Basin to north of Valley Boulevard.

6. Placement of 500 linear feet of 90" reinforced concrete pipe from north of Valley Boulevard to Interstate 10.

7. Jacking 300 linear feet of 90" reinforced concrete pipe under Interstate 10 and northerly under Southern Pacific Railroad (SPRR) tracks.

8. Installation of 850 linear feet of 90" reinforced concrete pipe between the northerly and southerly Southern Pacific Railroad tracks.

9. Jacking 150 linear feet of 90" reinforced concrete pipe under the southerly Southern Pacific Railroad tracks.

10. Installation of 7,100 linear feet of 120" reinforced concrete pipe from the southerly tracks to the Santa Ana River.

During meetings with the property owners some minor changes in the alignment and reaches occurred. The revisions as shown in this report did not have a significant impact on the overall cost of the project.

According to the Planning Division report, the total value of the existing ($6.64 million) and proposed ($8.0 million) facilities is a total of $14.64 million. Assuming the costs ($14.64 million) are spread over the total tributary area of 2,045 acres, the fair share distribution is $7,159 per acre. This method of spreading the costs to the overall watershed acreage thereby includes the past contributions of both the developed and the undeveloped lands. A developer fee in this amount applied to the vacant area of 777 acres could fund $5.56 million of $8.0 million required to provide the recommended Project 3-5 improvements. It is not anticipated that new development will contribute additionally to the costs of the Project 3-5 facilities, beyond the fee payment, except for the normal contribution through flood control tax dollars.

Further recommendations as outlined in the report are:

1. The Cities of Rialto, San Bernardino, Colton, the County of San Bernardino, and the San Bernardino County Flood Control District adopt the recommended plan presented in this study as the "C.S.D.P. #3, Project 3-5 Area Drainage Plan".

2. The aforementioned cities and County draft and adopt appropriate ordinances to implement a $7,159 developer fee to fund $5.56 million of the required $8.0 million for the construction of the "Project 3-5 Area Drainage Plan" within the tributary area shown as Exhibit "A".

3. The aforementioned cities, County, and District evaluate funding sources for the remaining $2.44 million required to complete the project.

4. As the alignment of Pepper Avenue south of Interstate 10 is finalized, the Area Drainage Plan alignment, peak flow rate(s), facility size(s), and boundary (tributary area) be modified. Based on these modifications and evaluation of possible benefits to the developing lands, the fee be adjusted.

5. New development within the tributary area should continue to mitigate any incremental increase in runoff generated by the development until adequate downstream facilities are constructed.

6. New development south of the East Rialto Channel should be designed such that they are protected from infrequent discharges over the East Rialto Channel spillways and flow from Mill and Randall Basins until adequate improvements have been provided to convey storm flows to the Santa Ana River.

WATERSHED DYNAMICS

Development changes the characteristics of the watershed. Natural catchment areas are eliminated or altered to insure adequate drainage of development areas. Recontouring and compaction during grading for development and the addition of streets, paved areas, buildings, and other facilities in the development substantially reduces the percolation capabilities of the soils. The alteration of the natural characteristics of the watershed generally results in increased rates of runoff and higher peak flows.

In accordance with the existing San Bernardino Hydrology Manual, in estimating loss rates for design hydrology, a watershed curve number (CN) is determined for each soil-cover complex within the area. The working range of CN values is between 0 and 98, where a low CN indicates low runoff potential (high infiltration). Selection of a CN takes into account the major factors affecting loss rates on pervious surfaces including the hydrologic soil group, cover type and quality, and antecedent moisture condition (AMC).

Also, included in the CN selection are the affects of "initial abstraction" (IA) which represents the combined effects of other effective rainfall losses including depression storage, vegetation interception, evaporation, and transpiration among other factors.

The permeable portions of a watershed experience an initial soil-moisture storage identified as Upper Zone Tension which must be totally filled before moisture becomes available to enter other storages. Tension water is the water that is closely bound to the soil particles. Upper Zone Tension represents that volume of precipitation which would be required to meet all the interception requirements and to provide sufficient moisture to the upper soil mantle so that percolation to deeper zones can begin. In undeveloped watersheds this action is generally uniform, based on soil types in the watershed. The addition of impervious areas such as parking lots, rooftops, and adjacent concreted areas inhibits this natural penetration. Compaction and the nature of the top soil brought into an area for landscaping also varies the ability of the soils in the Upper Zone to provide percolation to lower levels.

When the Upper Zone Tension has been filled, excess moisture is temporarily accumulated in the Upper Zone Free Water. Free Water is that which is not bound to soil particles and it is free to descend vertically to deeper portions of the soil mantle or to move laterally through the soil (inter-flow).

COMPREHENSIVE STORM DRAIN PLAN #3
PROJECT 3–5
RECOMMENDED PLAN

1.	Placement of 1,100 L.F. of 42" reinforced concrete pipe from East Rialto Channel to Pepper Basin,	$159,500
2.	Excavation of 45,000 cubic yards of material from Mill Basin and construction of a new basin outlet structure,	$115,000
3.	Construction of 1,250 L.F. of trapezoidal concrete channel from Mill Basin to Randall Basin,	$187,500
4.	Excavation of 30,000 cubic yards of material from Randall Basin and construction of a basin drain and spillway,	$240,000
5.	Placement of 5,200 L.F. of 66" reinforced concrete pipe from Randall Basin to north of Valley Blvd.,	$1,144,000
6.	Placement of 500 L.F. of 90" reinforced concrete pipe from north of Valley Blvd. to Interstate 10,	$160,000
7.	Jacking 200 L.F. of 90" reinforced concrete pipe under Interstate 10,	$320,000
8.	Installation of 1200 L.F. of 90" reinforced concrete pipe between Interstate 10 and the Southern Pacific Railroad tracks.	$348,000
9.	Jacking 180 L.F. of 90" reinforced concrete pipe under the Southern Pacific Railroad tracks, and	$288,000
10.	Installation of 7,100 L.F. of 120" reinforced concrete pipe from the Southern Pacific Railroad tracks to the Santa Ana River.	$2,840,000
	sub–total	$5,802,000
	Contingencies, Design & Inspection (30%)	$1,740,600
	1988 total	$7,542,600
	February 1988 cost estimates updated by ENR to December 1989	$8,000,000
	To be financed by other funding mechanisms	– $2,440,000
	Total amount to be financed by developer fees	$5,560,000

Note: Reaches and Costs revised from Planning Division Report due to minor changes in the alignment.