

RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
Riverside, California

REPORT ON

MORENO
MASTER
DRAINAGE PLAN

April 1991

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MORENO
MASTER DRAINAGE PLAN

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PURPOSE

The purpose of this report is to investigate and evaluate the drainage problems of the Moreno area and to develop the most economical drainage plan which considers both the natural environment and economy of the area.

The Moreno Watershed is developing with a much higher density than originally anticipated, therefore, prompting the District to revise the master plan adopted in October of 1980. The watershed is located approximately 15 miles east of the City of Riverside, and is bounded generally by Lasselle Street on the west and Theodore Street on the east. The divide in both the hills to the north and south serve to complete the boundary of the drainage area.

The plan presented herein will provide adequate protection to the community when implemented and serve as a guide for the long term construction scheduling of the primary drainage facilities. The plan will also act as a planning guide for the location and sizing of local drainage facilities to be constructed by developers and others within the area.

SCOPE

The drainage area covered by this plan ranges from extremely flat valley terrain to foothills with steep slopes. The extent of the

studies establishing this master plan include:

1. Determination of the quantity and points of concentration of storm runoff in the area.
2. Preparation of a drainage area map.
3. Determination of the location, size and capacity of the proposed drainage structures.
4. Preparation of preliminary design plans and supporting cost estimates.

GENERAL DISCUSSION

This report provides a master drainage plan for the Moreno area. The plan consists of two retention basins, open channels, and a network of underground storm drains. This proposed system will carry storm runoff through this rapidly developing area to an outlet at the upper terminus of the Kitching Street Channel.

A master plan of drainage titled "Report on Master Plan for the Moreno Area" was prepared by the District in September of 1980. This plan was for a "backbone" facility only and did not anticipate the heavy urbanization that has taken place in recent years. Due to the accelerated pace of development and the changing needs of

the community, a more detailed master plan of drainage was required. This plan replaces the plan prepared in 1980.

During periods of runoff, floodwaters, silt, and other debris impact a area of agricultural land and the developing community, causing property damage and leaving roads and highways impassable. Subdivision activity within the plan area has increased dramatically within the last several years. With this rapid rate of development, the drainage problems of the area are being compounded due largely to the increase in runoff created by urbanization thus requiring the need for greater degrees of flood protection.

The Master Drainage Plan presented herein provides the most economical method of collecting and conveying storm runoff through the study areas to outlet into the Perris Valley Storm Drain. The proposed drainage structures will also provide an outlet for local drainage facilities built by developers and others as growth occurs in the area. When completed, the facilities will provide the area with improved drainage and protection from the once in 100 year flood.

CRITERIA

All underground storm drains proposed in this plan are intended to collect local urban runoff and are located either in existing or

proposed street rights of way. Runoff from a 10 year frequency storm is allowed to accumulate in the streets until it reaches the top of a 6-inch curb. At this point the plan proposes an underground drain which intercepts and conveys the entire 10 year storm runoff to an outlet downstream. Flows exceeding the 10 year frequency storm will generally be carried within street rights of way and the combination of both the street and underground storm drain provides 100-year protection.

Open channels are proposed when the discharge is large and the construction and right of way cost for a channel prove to be less than the cost of an underground storm drain. Where open channels are provided, they are designed to carry the runoff from a 100-year frequency storm.

The alignments of all drains and channels are based on hydraulic efficiency, the ability to drain tributary areas, and economics.

HYDROLOGY

The hydrology for the plan was developed by two methods; namely, the rational method and the synthetic unit hydrograph method.

The rational method was used to determine the 10 year frequency design discharge generated in small watersheds. All street systems were rated for these flows and all drain lines were sized according

to these discharges.

The synthetic unit hydrograph method was used to determine the 100 year peak flows for large watersheds (areas greater than 300 acres) and to determine the storage volume requirements for Nason Basin and Sinclair Basin

Methodology and supportive data for the rational and synthetic hydrology can be found in "The Riverside County Flood Control and Water Conservation District Hydrology Manual" dated April 1978. It should be noted that the Sunnymead - Moreno intensity - duration curve was used for the rational hydrology computations, and that assumptions for future land use are based on a map entitled "City of Moreno Valley General Plan": adopted September 20, 1988, by the City Council.

EXISTING FACILITIES

There are several major drainage facilities existing within the Moreno Master Drainage Plan area. They are: 1) a 60" RCP at Redlands Boulevard (Line D-1); 2) a trapezoidal channel at the Line A alignment between Kalmia Avenue and Locust Avenue; 3) a 5-cell 8'W x 4'H RCB at Cactus Avenue within the Quincy Street Interim Channel; 4) a 40-foot bottom channel at Line F between Iris Avenue and the Line J confluence; 5) a 72" CMP which is to be used as an outlet for the ultimate Sinclair Basin facility; 6) a 48" CMP which

is to be the upstream terminus for Line D-5; 7) a 4'W x 2'H RCB underneath Highway 60 to be an ultimate section of Line D-6; 8) a double 5'W x 3'H RCB, of which one cell is to be used as part of the Line G ultimate facility; 9) a 10'x 5' RCB which is to be used as an outlet for the ultimate Sinclair Basin facility; 10) a segment of Line F between Moreno Beach Boulevard and Cactus Avenue; 11) Line F-3 running along Cactus Avenue; 12) Line F-4 going northerly along Moreno Beach Drive thence running easterly along Cactus Avenue; 13) Line F-5 upstream of Oliver Street; 14) Line F-6 contained within Iris Avenue right of way thence tying into the existing Line F Channel.

RECOMMENDED IMPROVEMENTS

The recommended improvements discussed below area shown on the enclosed map found at the back of this report. Supporting data for all proposed facilities is available for review at the Riverside County Flood Control and Water Conservation District's office. Costs shown on the enclosed map include right of way and 31% for engineering administration and contingencies.

Line A - Line A is an open trapezoidal channel with a 10-foot bottom and 7-feet deep where it outlets into Sinclair Basin. After projecting northerly for 1000 feet, the channel will then run westerly just south of Ironwood Avenue where the channel will transition into a 10.25'W x 5'H RCB which will be contained within

the Quincy Street right of way. The proposed box will then transition to an 8-foot bottom trapezoidal channel located just north of Kalmia Avenue.

Line A-1, a 72-inch storm drain which transitions into reinforced concrete box outlets into the upstream end of Line A and from there makes its way east to the Line A-5 and A-6 junction. Line A-1 constitutes a diversion of natural flows hence the facility will be conveying 100 year flows.

Lines A-2 through A-4 are 10 year underground facilities which drain the northeast Moreno area and outlet into Line A.

Lines A-5 and A-6, a 30-inch pipe and 57-inch pipe, respectively, provide onsite drainage and offsite protection for an existing tract located northeast of the Quincy Street/Locust Avenue intersection. Lines A-5 and A-6 outlet into the Line A-1 diversion pipe located on Locust Avenue.

Line B - Line B is a 2000-foot long trapezoidal channel which outlets into the Line A trapezoidal channel. This trapezoidal channel has a 4-foot bottom and 6.5-foot depth at the outlet.

Line C - Line C is a 1850-foot reach of trapezoidal channel which also outlets into Line A. This trapezoidal channel has a 4-foot bottom and a 5-foot depth where it outlets into Line A. The area

tributary to the channel are the foothills of the Badlands located north of Highland Boulevard.

Line D - Line D is a 3300-foot long underground facility which is to convey the 100-year discharge. The downstream section is a 14.5'W x 4'H RCB which ties into the Line F trapezoidal channel. The upstream terminus of the facility is a 8.5'W x 4'H RCB which drains Lines D-1 and D-2 at Redlands Boulevard.

Line D-1, is an underground facility which conflues with the Line D 100-year facility. The downstream section is a 48-inch RCP which transitions into an existing 60-inch RCP located under Highway 60 at Redlands boulevard. Lines D-2 through D-4 are 10-year facilities which drain local runoff just west of Redlands Boulevard into Line D-1.

Lines D-5 and D-6 are each underground facilities making use of an existing culvert located underneath Highway 60. The tributary area is encompassed by Redlands Boulevard and Sinclair Street at the east and west while the north-south boundaries are located at Eucalyptus Avenue and the proposed Line A trapezoidal channel.

Line E - Line E is a 2000-foot long underground facility located within the Bay Avenue right of way which is to convey a 10-year discharge. The tributary area is located between Line F and Redlands Boulevard. Lines E-1 and E-2 are respectively, located

within the Cottonwood Avenue and Dracaea Avenue rights of way. The watershed size of each three facilities is approximately 100 acres. Lines E, E-1 and E-2 constitute a diversion of the natural flows but allow the facilities downstream to be greatly reduced in size.

Line F - Sinclair Channel - Line F should be distinguished as the main channel for the entire Moreno Watershed. There are basically two reaches within the Line F master-planned channel. The downstream reach is located between the existing 40-foot bottom channel and the downstream portion of the Moreno Valley golf course. The upstream reach is located between the four cell box at Cactus Avenue and the existing 72" CMP located under Highway 60 which functions as an outlet for the Sinclair Basin. The entire Line F facility will be designed to convey a 100-year discharge. Line F-1 is a 36-inch RCP which is draining a tributary area located just north of Alessandro Boulevard. Line F-2 is a 5900-foot long underground facility which will convey 10 year discharges for a tributary area of about 200 acres. The downstream section of the lateral ties into the Line F trapezoidal channel and terminates at the Line F-12 junction located at the Dracaea Avenue/Redlands Boulevard intersection. Lines F-9 and F-13 are 36-inch & 33-inch storm drain pipes, respectively, which will tie into the existing Line F-4 facility located in Cactus avenue. Lines F-11 and F-12 are 36-inch RCP with a tributary area of approximately 80 acres each that confluence with the Line F-2 master-planned facility.

Line G - Quincy Street Drain - Line G is an underground 100 year facility which drains approximately 1.2 square miles. The watershed is encompassed by Quincy Street and Moreno Beach Drive to the east and west and by Juniper Avenue and the proposed Line F facility to the north and south. The downstream terminus of the facility is a 12'W x 4'H RCB which is located between existing culverts at Cactus Avenue and Alessandro Boulevard. The segment between the existing Alessandro Boulevard culvert and the existing double 5'W x 3'H RCB is mainly an 84-inch RCP. Line G is designed to convey a 100-year discharge of 990 cfs downstream of the Line G-1 confluence and a discharge of 390 cfs just downstream of the 60 freeway. Line G-1 is a 10 year underground facility which is diverting approximately 80 acres. The facility size is 45 inch in diameter with a length of approximately 1300 feet. Lines G-2 and G-3 are each located within the Brodiaea Avenue and Cactus Avenue street right of way. Each line is a 10-year facility which drains approximately 40 acres. Lines G-4 and G-5 make use of the existing double 5'W x 3'H RCB located underneath Highway 60. Lines G-4 will be providing protection for proposed 1/2 acre single family lots, according to the General Plan. The G-4 facility will be draining a total of 160 acres which is surrounded by the ridge just each of Nason Basin and Quincy Street to the east. The north-south boundaries entail the 60 freeway and a tiny portion of Kalmia Avenue. Line G-5 is a proposed 100-year trapezoidal channel which will provide protection for 80 acres which are located just north of the 60 freeway. G-5 is also confluencing into the existing

double box located under the 60 freeway.

Line G-6 is a 500-foot section of 36-inch RCP which will drain local runoff from the proposed Moreno Auto Mall into the Line G facility. Line G-7 will make use of an existing culvert located underneath the 60 freeway at Quincy Street and convey 170 cfs at the downstream end into Line G. The approximate alignment of Line G-7 is to follow the well defined watercourse running along Quincy Street.

Line H - Oliver Street Drain - The Line H storm drain has been re-aligned when comparing to the facility adopted 10 years ago. The 100-year facility is a proposed 10-foot bottom trapezoidal channel downstream of Cactus Avenue which will convey 1,740 cfs adjacent to Oliver Street. Upstream of Cactus Avenue there will be an underground storm drain which will still carry the 100-year discharge. The 14.5'W x 6'H RCB contained within the Oliver Street right-of-way will then run westerly along Alessandro Boulevard and meander its way up an existing watercourse running 1300 feet east of Nason Street. The 100-year facility will then run westerly when it intersects Cottonwood Avenue. The Line H facility will convey 10 year flows when it projects northerly along the existing watercourse located 650 feet east of Nason Street. The Line H facility terminates with a 30-inch RCP approximately 330 feet north of Cottonwood Avenue. Line H-1 is a combination 10-year/100-year underground storm drain which will drain approximately 480 acres

located north of Alessandro Avenue and south of the foothills adjacent to Cottonwood Avenue. Line H-1 is a 7'W x 5'H 100-year RCB just west of Oliver Street since this reach will be considered a diverted section. The reach just east of Oliver Street will be a 10-year facility. The underground drain will then run northerly between Moreno Beach Drive and Quincy Street. The upstream terminus is a 30-inch RCP which ends approximately 600 feet downstream of Cottonwood Avenue. Lines H-2 and H-3 are both 10-year facilities which are parallel to the Line H-1 facility. Both lines cease at Cottonwood Avenue and confluence downstream with the H-1 storm drain. The tributary areas to Lines H-2 and H-3 are, respectively, 210 and 170 acres of proposed single family dwellings. A small section of Line H-4 is a 30-inch RCP which will pick up runoff from the foothills located just east of the facility. Lines H-5 through H-10 are all facilities which will each pick up 10 year runoff from approximately 70 acres of proposed 1/4 acre residences. Each line will be contained within street right of way (Brodiaea Avenue, Cactus Avenue, and Delphinium Avenue) and will confluence with the Line H 100-year storm drain.

Line I - Nason Street Drain - The primary function of the Line I 100-year facility is to outlet runoff from the Nason Street Retention Basin. The Line I drain will mainly be conveying 650 cfs within the Nason Street right-of-way. The downstream terminus of the drain is a 10'W x 6'H RCB which is conveyed by tying into Line F while the majority portion of the drain is a 78-inch RCP. The

drainage area downstream of the freeway is very slender therefore allocating the need for catch basins within the street.

Line J - Morrison Street Drain - Line J is a 100-year facility which will drain approximately 1.78 square miles. The previous Moreno Drainage Plan called for an open channel facility to convey 100-year flows. Currently there are proposals to develop the UCR property below Brodiaea Avenue therefore requiring the need for an underground facility within the proposed development.

Line J will project easterly when the Line J southerly alignment intersects John F. Kennedy Drive. The facility grade will be relatively flat until it makes a southward protection about 1300 feet eastward of the Morrison Street/JFK Drive intersection. The alignment will terminate downstream at the proposed Line F open channel, hence conveying 1100 cfs of residential runoff. Lines J-1 through J-14 are 10-year laterals which contribute local runoff into the Line J mainline. These lines are all running in the east-west direction and are contained within streets right of way. Most of the east-west streets in the area have very little grade and therefore require relatively large structures.

Line K - Line K is a 100-year collector channel which will be collecting runoff from Reche Canyon and outletting 2070 cfs into the proposed Nason Street Retention Basin. The downstream portion north of the storm drain is a 10-foot bottom trapezoidal channel with a depth of 7 feet. Upstream of Juniper Avenue the open

channel will transition into a 9.5'W x 7'H RCB to be aligned within the Moreno Beach Drive right-of-way. The Line K facility will then be aligned westerly along Reche Canyon Road where both Moreno Beach and Locust Avenue meet. The proposed facility will transition from a 14'W x 7'H RCB to a 10-foot bottom trapezoidal channel at the previously mentioned intersection. The primary intent of the open channel at the upstream end is to provide added protection for the anticipated debris flows running off Reche Canyon. Line K-1 is a combination 10-year/100-year facility. The first 2100 feet of the structure will be picking up 100-year diverted flows of approximately 540 cfs between the Pettitt Street/Ironwood Avenue intersection and the K-1 outlet. The Line K-1 facility will then convey 10 year flows when it is projecting northward along the Pettitt Street right-of-way. The facility terminates with an inlet structure at the well defined watercourse immediately upstream of Locust Avenue. Lines K-2 through K-4 are all 10 year laterals which will be drainage the proposed 1/2 acre residences into Line K-1. The total drainage area for the Line K-1 mainline is approximately 390 acres.

Nason Street Retention Basin - This basin, located between Hemlock Avenue and Highway 60 and just east of Nason Street, was proposed because of the inability of an existing 10'W x 5'H RCB to convey the 100 year discharge, 2070 cfs, under the freeway. The peak inflow from the basin is 650 cfs, which can easily be conveyed by the RCB.

Sinclair Street Retention Basin - This is the larger of the two proposed retention basins, with a storage volume of 190 ac-feet. This basin is located between Hemlock avenue and Theodore Street and just east of Sinclair Street. The need for this basin became apparent when it was found that the existing 72" CMP could not pass the 100 year discharge of 2,440 cfs. With the proposed basin and its 960 cfs outflow, the pipe functions well and the Line F Channel will have adequate freeboard to allow inflow from Line D.

Conclusions - Based on the studies and investigations made for this report it is concluded that:

1. The Moreno area had experienced serious flooding problems in the past. As this area converts from primarily agriculture to more urban uses, these damages are expected to increase. A more orderly growth pattern can safely occur with the construction of these proposed facilities.
2. A drainage system is required to safely convey storm runoff through the area with the least interruption to public services. The Master Drainage Plan presented in this report is such a system and is the most economical and environmentally balanced of the alternatives studied.
3. The proposed plan lends itself to stage construction as funds become available.

4. The total cost of the recommended improvements, including right-of-way, engineering and contingencies (April 1991) is estimated to be \$69,941,290.

Recommendations - It is recommended that:

1. The Master Drainage Plan as set forth herein be adopted by the Riverside County Flood Control and Water Conservation District's Board of Supervisors as part of the overall master plan for the County.
2. The Master Drainage Plan as set forth herein be used as a guide for all future developments in the study area and that such developments be required to conform to the plan insofar as possible.
3. The right of way required for the plan be protected from encroachment.
4. The Moreno Area Drainage Plan, prepared by the Riverside County Flood Control and Water Conservation District, be amended to account for the changes proposed in this Master Drainage Plan.

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TABLE I

MORENO MASTER DRAINAGE PLANCOST SUMMARY

| <u>FACILITY</u> | <u>CONST. COST</u> | <u>31% ENGR. & ADM.</u> | <u>+ R/W</u> | <u>MDP COST</u> |
|-----------------|------------------------|---------------------------------|------------------|---------------------|
| A | \$2,509,900 | \$778,000 | \$1,170,000 | \$4,457,970 |
| A-1 | 47,500 | 14,730 | -- | 62,230 |
| A-2 | 415,050 | 128,660 | -- | 543,700 |
| A-3 | 223,780 | 69,370 | -- | 293,150 |
| A-4 | 64,140 | 19,880 | -- | 84,020 |
| A-5 | 75,140 | 23,290 | -- | 98,430 |
| A-6 | 235,160 | 72,900 | -- | 308,060 |
| B | 316,080 | 97,980 | 190,000 | 604,060 |
| C | 164,370 | 50,950 | 140,000 | 355,320 |
| D | 1,046,010 | 324,260 | -- | 1,370,270 |
| D-1 | 344,710 | 106,860 | -- | 451,570 |
| D-2 | 83,040 | 25,740 | -- | 108,780 |
| D-3 | 194,210 | 60,210 | -- | 254,420 |
| D-4 | 179,830 | 55,750 | -- | 235,580 |
| D-5 | 246,870 | 76,530 | -- | 323,400 |
| D-6 | 449,440 | 139,330 | -- | 588,770 |
| E | 336,730 | 104,390 | -- | 441,120 |
| E-1 | 327,630 | 101,570 | -- | 429,200 |
| E-2 | 353,630 | 109,630 | -- | 463,260 |
| *F | 5,756,170 | 1,784,410 | 4,440,000 | 11,980,580 |
| F-1 | 118,260 | 36,660 | -- | 154,920 |
| F-2 | 794,720 | 180,930 | -- | 975,650 |
| F-3 | 234,890 | 72,820 | -- | 307,710 |
| F-4 | 238,120 | 73,820 | -- | 311,940 |
| F-5 | 680,900 | 211,080 | -- | 891,980 |
| F-6 | 363,900 | 112,810 | -- | 476,710 |
| F-7 | 116,450 | 36,100 | -- | 152,550 |
| F-9 | 166,210 | 51,530 | -- | 217,740 |
| F-10 | 114,640 | 35,540 | -- | 150,180 |
| F-11 | 156,260 | 48,440 | -- | 204,700 |
| F-12 | 152,960 | 47,420 | -- | 200,380 |
| F-13 | 165,960 | 51,450 | -- | 217,410 |
| G | 3,116,610 | 966,150 | -- | 4,082,760 |
| G-1 | 190,460 | 59,040 | -- | 249,500 |
| G-2 | 106,300 | 32,950 | -- | 139,250 |
| G-3 | 77,690 | 24,080 | -- | 101,770 |
| G-4 | 771,200 | 239,070 | -- | 1,010,270 |
| G-5 | 65,750 | 20,380 | 60,000 | 146,130 |
| G-6 | 67,990 | 21,080 | -- | 89,070 |
| G-7 | 625,100 | 193,780 | -- | 818,880 |
| H | 2,777,230 | 860,940 | 300,000 | 3,938,170 |
| H-1 | 932,660 | 289,120 | -- | 1,221,780 |

| <u>FACILITY</u> | <u>CONST. COST</u> | <u>31% ENGR. 4 ADM.</u> | <u>+ R/W</u> | <u>MDP COST</u> |
|-----------------|------------------------|-----------------------------|------------------|---------------------|
| H-2 | 363,720 | 112,750 | -- | 476,470 |
| H-3 | 482,590 | 149,600 | -- | 632,190 |
| H-4 | 52,900 | 16,400 | -- | 69,300 |
| H-5 | 148,640 | 46,080 | -- | 194,720 |
| H-6 | 263,830 | 81,790 | -- | 345,620 |
| H-7 | 84,090 | 26,070 | -- | 110,610 |
| H-8 | 289,480 | 89,740 | -- | 379,220 |
| H-9 | 113,390 | 35,150 | -- | 148,540 |
| H-10 | 160,710 | 49,820 | -- | 210,530 |
| I | 4,027,550 | 1,248,540 | -- | 5,276,090 |
| J | 4,304,840 | 1,334,500 | -- | 5,639,340 |
| J-1 | 161,700 | 50,130 | -- | 211,830 |
| J-2 | 152,540 | 47,920 | -- | 200,460 |
| J-3 | 74,380 | 23,060 | -- | 97,440 |
| J-4 | 171,010 | 53,010 | -- | 224,020 |
| J-5 | 85,690 | 26,560 | -- | 112,250 |
| J-6 | 176,210 | 54,630 | -- | 230,840 |
| J-7 | 68,480 | 21,230 | -- | 89,710 |
| J-8 | 181,860 | 56,380 | -- | 238,240 |
| J-9 | 331,280 | 102,700 | -- | 433,980 |
| J-10 | 171,860 | 53,280 | -- | 225,140 |
| J-11 | 174,460 | 54,080 | -- | 228,540 |
| J-12 | 195,610 | 60,640 | -- | 256,250 |
| J-13 | 171,400 | 53,130 | -- | 224,530 |
| J-14 | 395,340 | 122,560 | -- | 517,900 |
| K | 2,194,440 | 680,280 | 770,000 | 3,644,720 |
| K-1 | 1,410,000 | 437,100 | -- | 1,847,100 |
| K-2 | 74,640 | 23,140 | -- | 97,780 |
| K-3 | 72,890 | 22,600 | -- | 95,490 |
| K-4 | 56,320 | 17,460 | -- | 73,780 |
| Sinclair Basin | 1,453,230 | 450,500 | 2,330,000 | 4,233,730 |
| Nason Basin | <u>1,116,530</u> | <u>346,120</u> | <u>2,200,000</u> | <u>3,662,650</u> |
| TOTAL | \$44,584,710 | \$13,756,580 | \$11,600,000 | \$69,941,290 |

*A portion of Line F was designated as Line F-8 on the previous master drainage plan.

+ R/W costs=\$100.000/acre