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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

March 27, 1995

APPROVED
By the Board of Directors of
The Metropolitan Water District
of Southern California
at its meeting held
APR 11 1995
EXECUTIVE SECRETARY

(Water Problems Committee--Action)
To: Board of Directors (Engineering and Operations Committee--Action)

From: General Manager

Subject: Interim Policy to Manage Total Dissolved Solids in Metropolitan's Supplies

Report

Several water reclamation projects within Metropolitan's service area, which treat water derived from essentially 100-percent Colorado River water supplied by Metropolitan, are having problems attracting and/or retaining customers for their product water. This is due, at least in part, to the total dissolved solids (TDS) concentration of the reclaimed water, and the fact that it is not consistently suitable for irrigation purposes. Until Domenigoni Valley Reservoir is brought on-line, or until demands on Metropolitan rise significantly, Metropolitan cannot control the TDS blend of water served within its system without incurring higher operational costs.

The attached report discusses the impacts of high-TDS water, the current operating strategy, available TDS control strategies, and the two most practical options for a revised operating strategy. It was presented to the Engineering & Operations and Water Problems Committees for discussion in February. Both committees passed resolutions directing that a recommended policy be brought before your Board for action in April, and that an informational Board workshop be held on this subject in May. This letter recommends a plan of action for the current year. Following the workshop, a long-term management policy for the remainder of the interim period will be developed.

Possible Operating Strategies

Several operational options have been reviewed in the attached report, and two are presented below as the most practical alternatives. It is noted that Metropolitan's Act provides "...it shall be the objective of the District that to the extent determined by such District to be reasonable and practical, not less that 50 percent of such blended water shall be water from the State Water

Resources Development System". The Mission Statement implies that Metropolitan will provide a level of service sufficient to reliably meet the members' quantity and quality needs, including TDS levels required for reclamation and groundwater replenishment to the extent practicable.

25-Percent System Blend

One strategy would be to provide a 25-percent system blend from April through September in the Weymouth, Diemer, and Skinner service areas for the interim period (until Domenigoni Valley Reservoir is completed or demands rise enough to eliminate the need for these extraordinary measures). This produces broad benefits to Metropolitan's members, and would better serve our customers through facilitation of reclamation and, indirectly, groundwater replenishment. It would entail the importation of additional East Branch State project water, not otherwise needed to meet quantitative demands, in order to provide sufficient water for blending. A like amount of Colorado River water would have to be left unpumped, or if possible, stored. To accomplish a 25-percent blend for April-September 1995, between 130,000 and 170,000 acre-feet of extra State project water would need to be imported, depending upon overall demands on Metropolitan. Due to the cost differential between East Branch and Colorado River water, the estimated additional operating costs for such a strategy could be between $9 and $12 million in 1995.

Because of surplus conditions and projected low demand this year, the water supply implications of this action are relatively low. However, this strategy will likely require laying off some additional Colorado River water, and the implications of such an action in a water-short year must be considered and fully evaluated. It is also anticipated that the operating costs enumerated above will be similar, or substantially lower, in the remaining years of the interim period. Your Board would be informed on an annual basis through the interim period should these costs be projected to increase significantly, or should the water supply implications dictate considering a change in this strategy.

It should also be noted that some member agencies have requested a 25-percent blend for spreading to replenish groundwater basins. This would involve not only blending at Weymouth, Diemer, and Skinner, but also blending Lake Mathews to 25 percent State project water. The strategy described above would not provide for system blending to this degree. Staff believes that working with the local Regional Water Quality Control Boards (Regional Boards) to recognize the limitations of imported water TDS could

prove fruitful at far less cost than maintaining a specified blend throughout the entire service area.

Dilution of Reclaimed Water on a Hardship Basis

This strategy would be to provide dilution water to specific reclamation projects based on hardship, rather than attempt to alter the system blend at this time. It appears feasible from an expediency and economic standpoint to supply dilution water to at least three Local Project Program (LPP) reclamation facilities in order that their product water be of sufficiently low TDS to be usable for irrigation as originally intended when the reclamation projects were developed. This option would require amendments to the LPP contracts with agencies who receive the dilution water. Staff estimates that the volume of water necessary for currently known critical dilution purposes on LPP facilities is approximately 3,200 acre-feet for 1995. Because of this relatively small volume of water, the water supply implications appear negligible. It is estimated that Metropolitan's additional cost for such dilution operations would be $120 per acre-foot (the cost of pumping East Branch State project water plus chemicals for treatment), or about $384,000 in 1995. It does not include estimated costs for temporary facilities (piping, valves, etc.) needed to deliver dilution water. These costs could be significant, but are unknown at this time.

Clearly, the cost of this strategy could rise as problem situations at other LPP reclamation facilities are identified. Since it is reasonable to expect others to come forward, the cost could rise significantly. Additionally, the precedent of providing no-cost water to resolve a problem is of concern. Another significant issue related to the dilution strategy is whether it is possible to develop specific hardship criteria to determine which reclamation facilities would be supplied with dilution water by Metropolitan. Also, in the effort to manage the problem at the lowest possible cost by selectively applying the dilution strategy, there is an issue of fairness and equity which would most likely arise.

Implications of a TDS Management Strategy

The decision of which strategy to use in 1995 and subsequent years of the interim period to manage total dissolved solids must take into account several issues. These include the level of customer service in terms of the adequacy of the response to the TDS problems at reclamation facilities, the scope of benefits and associated costs of the strategy, equity and fairness

issues, and the potential precedents of the chosen strategy. The addition of Domenigoni Valley Reservoir to the system, as well as the projected increase in demands on Metropolitan, will both serve to eliminate the current problem in five to seven years.

Regardless of the management strategy chosen for this year to respond to the immediate problem, a longer term solution for the balance of the interim period must be carefully developed. As a first step to that end, staff will schedule a Board workshop on the subject to be held in May. This workshop will address the issues related to management of total dissolved solids in Metropolitan's service area. A strategy for the longer-term solution will be developed based upon feedback from the Board workshop.

Recommendation

It is recommended that for 1995, Metropolitan provide a 25-percent system blend to the Weymouth, Diemer, and Skinner service areas for the April through September period. Following a workshop for your Board in May, a strategy for 1996 and the remainder of the interim period will be developed and brought to your Board for action.

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Report on System Blends: Management and Revised Operating Strategy

Metropolitan's Preliminary Strategic Plan contains an objective related to Water Quality which states: "Develop a specific objective for total dissolved solids (TDS) by 1995, to minimize aesthetic and economic impacts to the public and optimize water management programs." Also, a strategy calls for Metropolitan to "cooperatively fund or assist in the implementation of new reclamation projects producing an additional 50,000 acre-feet per year by 1995, and 190,000 acre-feet per year by 2000." Another strategy states that the region will "develop 225,000 acre-feet (above 1991) of groundwater available in a dry year by 1995, and 375,000 acre-feet (above 1991) by 2000." It is also an objective to implement these strategies in as low-cost a manner as possible. In order to implement this objective, it is necessary to review the current situation related to system blends, and develop a specific operational strategy. The strategy should include consideration for existing operational conditions that affect the ability to provide blended water to all parts of the distribution system, as well as the aesthetic and economic impacts to the public of higher TDS water. Several options to modify current operations in order to achieve a specified blend are considered, and the operational and economic impacts of changing the current system blending strategy are assessed.

Impacts of High-TDS Water

At least two uses of Metropolitan's supplies are greatly affected by the TDS concentration. These are use of reclaimed water to irrigate landscaping and crops, and use to replenish groundwater basins. The TDS blend provided by the system can greatly impact suitability for these uses. In addition, financial implications related to these uses are connected with the blend of water provided by Metropolitan.

Reclaimed Water

Residential use of water typically adds about 250 to 450 mg/l of TDS to wastewater. Conventional and most advanced wastewater treatment facilities do not reduce TDS as water is processed. Unless processes such as reverse osmosis are used in reclamation facilities, little or no reduction of TDS is obtained. A water supply which starts out at 600 to 700 mg/l of TDS will result in a reclaimed supply containing 850 to 1,150 mg/l or more of TDS. While such reclaimed water still has numerous uses, some potential uses are foregone due to unacceptable TDS levels for certain agricultural or municipal and industrial (M&I) uses. For example, crops such as citrus, avocados, and strawberries, as well as many varieties of ornamental landscaping, need water with TDS levels much below 1,000 mg/l. This concentration, however, is considered by many

to be a practical working target level for reclaimed water, and there are a number of cash crops, as well as many types of landscaping plants, which will tolerate TDS levels in this range. April to September is the critical time frame when most reclaimed water irrigation occurs. Recently, Metropolitan was notified by San Diego County Water Authority and Coastal MWD that reclamation projects within their service areas have been seriously affected by high TDS levels.

Groundwater Replenishment

Depending upon location, some groundwater basins within Metropolitan's service area have limitations on the use of high-TDS water for replenishment purposes. These restrictions are generally the result of water quality objectives developed by the governing Regional Water Quality Control Board (Regional Board). The TDS concentration objectives vary widely from basin to basin, ranging from 220 to 800 mg/l within Metropolitan's service area. The use of imported supplies for replenishment is coming under increasing limitations as the various regional boards implement regulations to achieve these objectives. It should also be noted that in addition to TDS considerations, most basins also have objectives related to chloride concentrations. In some cases, use of State project water for replenishment of groundwater may be limited at times, depending on conditions (e.g., chlorides) and facilities in the Sacramento/San Joaquin Delta. Staff believes that there is some potential to successfully work with the various regional boards to recognize the TDS limitations of imported water supplies, and to provide flexibility for imported water recharge operations.

Financial Impacts

Given the sensitivity of Metropolitan's system to react to changes in demands, a requirement to use more State project water for system blending at certain times of the year increases the potential need to reduce Colorado River water use, and possibly Colorado River Aqueduct (CRA) pumping. Whenever the opportunity to pump Colorado River water is foregone, an additional cost of about $70 per acre-foot is incurred--the premium to replace it with State project water to meet demands at a later time. Another cost to Metropolitan is the loss of energy generation revenue associated with delivering the additional State project water for blending. This results from having to re-route deliveries within the system to achieve the desired blend.

For the end user, the cost of higher TDS water comes in many forms. The inability to use reclaimed water on certain crops and ornamental landscaping due to high TDS requires the use instead of potable supplies that could otherwise be used for general M&I purposes. Similarly, use for groundwater replenishment may be limited in some basins. Finally, there is a cost associated with more rapid deterioration of plumbing for all end users of imported water and to a lesser extent, the publicly owned infrastructure.

Current Operating Strategy

Metropolitan's system has historically been operated to fully utilize the lowest-cost available supplies first. Since 1983, this has meant primarily the maximum utilization of Colorado River water to base load the system. The TDS concentrations supplied by Metropolitan to its member agencies are determined in large part by the ability to blend lower TDS water from the State Water Project with Colorado River water in the course of simply meeting all demands on the system. Attachment 1 depicts the historic TDS concentrations of CRA, West Branch, and East Branch sources. With the normal variations in demands placed on the system, TDS concentrations vary in the blend areas due to the use of State project water as the peaking supply for the system. As the system is currently configured, areas served by the Weymouth, Diemer, and Skinner filtration plants are the portions of the system capable of receiving treated, blended water. Attachment 2 shows how the ability to provide a system blend has historically been driven by the overall demand level on Metropolitan. In addition, a few raw water service connections can also receive blended water.

Unlike the State Water Project's California Aqueduct, which was designed to operate with daily flow variations, the CRA must operate under steady flow conditions over relatively long periods of time, due largely to the inability to store water within the system once it has been pumped from the river. Lake Mathews must currently be operated such that with normal demand patterns on the system, it is able to absorb most of the seasonal fluctuations in demands. If Lake Mathews is not cycled annually by at least 60,000 acre-feet, there is a greatly increased likelihood that pumping on the CRA would have to be reduced during low-demand periods such as late winter and early spring. Under present operating plans, about 70,000 acre-feet of cycling is scheduled for Lake Mathews on an annual basis. To cycle Lake Mathews any deeper results in use of emergency supplies and loss of energy generation.

Experience in recent years has demonstrated the sensitivity of the system to changes in demands, which can quickly present the possibility of having to reduce CRA pumping in order to avoid spill conditions at Lake Mathews. In 1990 and 1991, and again this winter, cool wet weather combined with reduced demands due to conservation during the drought found Lake Mathews gaining storage at the rate of more than 1,500 acre-feet per day in January, February, and March. Very few alternatives to reducing CRA pumping exist at that time of the year under those conditions in order to avoid spilling. Trying to establish a particular system blend by using more State project water and less Colorado River water generally has a similar effect on the system, depending upon the time of year and the overall level of demands being placed on the system at the time.

Colorado River water currently has a TDS concentration at Parker Dam in excess of 700 mg/l, while State project water is generally less than 450 mg/l of TDS (Attachment 1). Federally cost-shared salinity control projects are being implemented in the Colorado River basin and are to maintain the TDS concentration at Parker Dam at or below 747 mg/l. The TDS level in the river has risen continuously since the late 1980s as fresh water from the 1983/84 high runoff period is being replaced with higher TDS water. The Federal portion of funding for salinity control projects is on an annual basis, and thus could fall behind schedule at any time should Congress fail to sufficiently fund the projects required to continue to meet the established TDS criteria.

Interim Nature of the Situation

It is anticipated that the addition of Domenigoni Valley Reservoir to Metropolitan's distribution system will aid significantly in the ability to serve a consistent blend of water to all areas capable of receiving blended water. Until that time, however, the above considerations will have to be taken into account to formulate any operating strategy to manage the blends. As previously noted, the ability to maintain a specified system blend is highly dependent upon demands on Metropolitan. In general, under low demand conditions, more "extra" State project water must be imported over and above what is needed to quantitatively meet those demands. Conversely, as demands on Metropolitan increase, the amount of "extra" State project water needed solely to maintain a desired system blend is reduced. Increasing demands, coupled with the completion of Domenigoni Valley Reservoir, will eventually eliminate in about five to seven years this need for additional State project water solely to maintain a desired system blend.

Implications of System Blend

Any decision to develop a revised practice regarding the system blend must take into account the implications of the associated commitment. For example, in order to demonstrate Metropolitan's support for good groundwater management within its service area, efforts must be made to supply imported water for replenishment that does not conflict with the goals of groundwater management agencies to comply with the basin objectives for TDS. Similarly, the commitment to support water reclamation projects within the service area carries with it the need to provide imported supplies whose TDS levels do not prevent reclamation of the water for reuse. With respect to costs and potential water supply impacts, some options run the risk of committing to the use of more expensive State project water in-lieu of Colorado River water, which could remain unpumped. Also, there are political ramifications to leaving Colorado River water unused in a year in which California agencies are water short, and relying instead upon scarce State project supplies. Such an operational strategy could reduce supply reliability, particularly if State project carryover supplies are depleted. Provision of site-specific dilution water at reclamation facilities, rather than attempting to change the system blend, would negate several of these issues, but would introduce several new disadvantages as well.

Available Options

Several options were considered to address the TDS issue. The options were as follows:

- **Provide a specified system blend.** Use of additional State project water as needed to reach the desired system blend would result in reductions in CRA pumping, particularly during low-demand periods. If the system blend were held at 25 percent at Weymouth, Diemer, and Skinner for April-September 1995, this would mean bringing in significantly more "extra" State project water, over and above what is needed to meet quantitative demands. Due to high flows needed in the Upper Feeder to meet Central Pool demands, there would be a need to route some of this extra State project water for blending to Weymouth via the San Dimas Power Plant and the La Verne Pipeline rather than Etiwanda Power Plant. However, due to rates paid to Metropolitan for such generation, the revenue impact for this shift would be essentially neutral. As demands on Metropolitan increase over the next few years, the annual amount of extra State project water needed for

system blending would decline. This is demonstrated by an analysis of recent history which indicates that the amount of this extra State project water needed for blending is highly dependent upon the overall demand level. It is assumed that CY 1995 demands on Metropolitan will be between 1.60 and 1.75 million acre-feet. Attachments 3 and 4 depict the amount of this extra water that would have been necessary in 1990 (a high-demand year) and 1993 (a low-demand year) to produce a 25-percent system blend. Below are highlighted some other considerations associated with the maintenance of a specified system blend:

---Were a 25-percent blend to be provided in April-September 1995, it is estimated that at least 130,000 acre-feet of Colorado River water would be unpumped. The extra State project water needed to accomplish this would cost $9.1 million. Attachment 5 illustrates the amount of extra State project water that must be provided. It shows the amount needed if the blend were provided year-round, and for the April-September period only. It includes additional State project water that would be needed to increase the blend in Lake Skinner to 25 percent in order to permit deliveries of a blend beginning in April. This 130,000 acre-feet includes about 10,000 acre-feet to raise the blend in Lake Skinner to 25 percent by mid-April, and assumes 1.75 million acre-feet of demand on Metropolitan in CY 1995. Attachment 6 illustrates how this amount of required extra State project water will decrease over the next few years, based on the presumption that increased demands will require sufficient additional State project water to result in the ability to produce the desired system blend without any extra water.

---Any extra State project water delivered for blending will result in an equal amount of unneeded Colorado River water which must either be stored or left unpumped. As a means of storage, the unneeded Colorado River water could be delivered to the Desert Water Agency and Coachella Valley Water District (DWCV) to recharge the Coachella Basin at times when demands are low to avoid leaving Colorado River water unpumped. At least 130,000 acre-feet of unneeded Colorado River water would have to be delivered to DWCV in 1995, for which Metropolitan incurs a pumping cost of $40 per acre-foot. Added to this is the cost for additional State project water to achieve the desired blend, which is $110 per acre-foot. Thus, the cost would be $150 per acre-foot,

or $19.5 million for the year, to store 130,000 acre-feet at DWCV. The revenue impact for the shift of generation from Etiwanda to San Dimas would be virtually neutral. Once again, as demands increase, the amount of Colorado River water that would be delivered to DWCV would decrease as future demands would require it to be brought into the service area anyway to meet demands.

---As another means to avoid laying off a portion of this Colorado River water, the Lakeview Pipeline can be used to deliver Colorado River water to the Mills plant via the Perris Pumpback Facility. The amount of Colorado River water needed at Mills under such a scenario is estimated to be 3,000 acre-feet for the desired 6-month period. The additional cost for such pumping from the CRA to Mills is estimated at $45 per acre-foot for a total cost of $85 per acre-foot. Thus, the annual associated pumping cost would be $255,000. In addition, generation revenues of $12,000 would be lost at the Perris Power Plant under this scenario. This, however, would only partially achieve the desired system blend level because it could not be done simultaneously with delivering State project water to the Skinner service area, which also requires use of the Lakeview Pipeline (flowing in the opposite direction).

---Facilities do exist to deliver some East Branch State project water to Lake Mathews. This would provide blended service to the Central Pool for uses including direct groundwater replenishment, but would require even more "extra" State project water to accomplish. Raw water demands on the Upper and Lower Feeders, evaporative losses from Lake Mathews, and additional water needed to raise the current blend in the lake to 25 percent would have to be included. It is estimated that at an overall demand level of 1.75 million acre-feet, at least 180,000 acre-feet of extra water would be needed in 1995 under such a scenario, at a cost of $12.6 million. Water quality issues related to delivery of raw State project water would also have to be resolved.

- **Pay for TDS reduction at enhanced reclamation plants.** This would most likely involve process enhancement through the addition of reverse osmosis or similar technology to lower TDS in reclamation plant effluents prior to reuse, either partially or totally at Metropolitan's expense. The need for such facilities would be dependent upon the

ultimate use for the reclaimed water. The cost would be directly related to the desired level of TDS removal and the size of the facility. For a removal of 400 mg/l of TDS, it is estimated that the unit costs for 5 mgd and 50 mgd plants would be $700 and $300 per acre-foot, respectively. Given the temporary nature of the blend issue, which will disappear as demands rise, large capital expenditures of this nature are probably not desirable.

- **Desalt Colorado River Aqueduct water.** Reduction of the TDS of Colorado River water before it enters the distribution system would ensure that all users of that source would receive the benefits of lower TDS levels. Under such a scenario, a reverse osmosis facility would be built in the desert to treat a portion of the CRA flow to nearly zero TDS. That effluent would then be blended with the remainder of the aqueduct flow to achieve the desired TDS level. Assuming a reduction from 747 mg/l (the numeric criteria for salinity control below Parker) to 500 mg/l, it is estimated the cost would be in the range of $200 per acre-foot. The total annual cost to reduce the TDS of the full 1.2 million acre-feet to 500 mg/l by this method would be $240 million per year. This cost would be exclusive of brine disposal, which would likely have high costs and major environmental issues. Also, as with enhanced reclamation to remove TDS, a large capital cost such as TDS removal in the CRA is very questionable given the interim nature of the problem.

- **No change from current practice.** Currently, the system is base loaded with Colorado River water, and the demands which cannot be met from the CRA are met with State project water. This provides the lowest cost option. With respect to the system blend, however, this method of operation does not allow for a numerical target for the system blend. The blend is variable and is solely dependent upon the level of State project water needed to meet demands. Higher demand levels require more State project water to be brought into the system and thus provides more opportunity to blend to a lower TDS level over more of the service area. Conversely, when demands are low, lesser amounts of State project water are needed to meet demands and lesser amounts are consequently available to blend to a lower system TDS level. Maintaining the current practice does not provide the quality of water critical to the success of certain reclamation projects in Metropolitan's service area.

- **Dilution of reclaimed water on a hardship basis.** Based upon information provided by member agencies, Metropolitan would identify "hardship" situations in which the financial integrity of a reclaimed water project is critically affected by the TDS level of Metropolitan's water. If feasible, on a case-by-case basis, Metropolitan would provide sufficient dilution water for the product stream of the reclamation facility such that the TDS concentration is reduced to levels acceptable to the reclaimed water customer for the originally contracted purposes. In order to properly account for costs associated with providing such dilution water, the LPP contracts will need to be amended for participating facilities. Three reclaimed water facilities identified thus far would require approximately 3,200 acre-feet in CY 1995 to achieve the desired blend. The estimated cost would be about $120 per acre-foot, or $384,000. It is also estimated that additional such projects, should they qualify, could increase this cost to $1.2 million for CY 1995. These projected costs do not include estimates for piping and valving which may be necessary to deliver dilution water to the qualifying reclamation projects. These costs could be substantial in some cases, but are unknown at this time. Other than the "No change from current practice" strategy, this offers the lowest cost option to respond to the immediate problem for 1995. A major precautionary note should be made here. It is anticipated that several other reclamation projects within Metropolitan's service area could make similar claims of hardship due to TDS concentrations. Attachment 7 shows how many facilities already have high TDS situations and could claim a hardship. Thus, the cost of this option could increase substantially.

Revised Operating Strategy

From a cost and expediency standpoint, it appears that the two most feasible options for a revised operating strategy for 1995 are (1) to maintain a system blend of 25 percent for the April-September period, or (2) to provide dilution water to selected LPP reclamation facilities to lower the TDS of the product water from those facilities. The first of these strategies can be implemented with no new facilities. For the dilution strategy, based upon preliminary information, there appear to be only minor needs for new facilities (access to water and associated plumbing) to supply dilution water to the three LPP reclamation facilities identified so far. Thus, either of these strategies could be selected to respond to problems associated with high TDS in 1995.

Briefly, the 25-percent system blend would provide for replacement of between 130,000 and 169,000 acre-feet Colorado River water with State project water in 1995. The exact amount is dependent upon the overall level of demands on Metropolitan, with those corresponding levels being 1.75 and 1.60 million acre-feet, respectively. The associated cost would range from $9.1 to $11.8 million for 1995, assuming the unused Colorado River water remains unpumped.

The dilution strategy would provide sufficient water to two reclamation facilities in San Diego County and one in Orange County which have been identified as having TDS-related problems. It is estimated that these three facilities would require about 3,200 acre-feet in 1995 to reduce TDS concentrations to acceptable levels. The cost to Metropolitan is assumed to be about $120 per acre-foot, or about $384,000. These costs are exclusive of any new "plumbing" which may be needed at qualifying reclamation projects. Should other facilities be identified as having similar situations, this could easily raise the amount to 10,000 acre-feet or more, with the associated cost rising to $1.2 million or higher.

While both options have the capability to respond to the problem at hand, each of these two strategies has distinct advantages and disadvantages. A specified system blend will provide broad benefits to most of the Metropolitan service area, but at a significant additional operating cost. The dilution alternative, on the other hand, appears to have clear cost advantages (depending upon the ultimate number of facilities requesting dilution water), but has the potential to establish an undesirable precedent, as well as equity and fairness considerations. All of these factors will have to be weighed in making the determination of which strategy is ultimately chosen.

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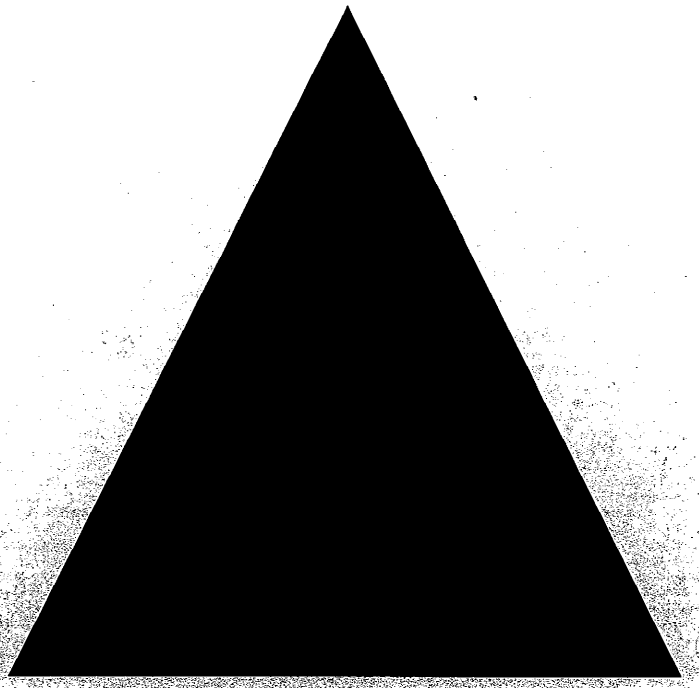

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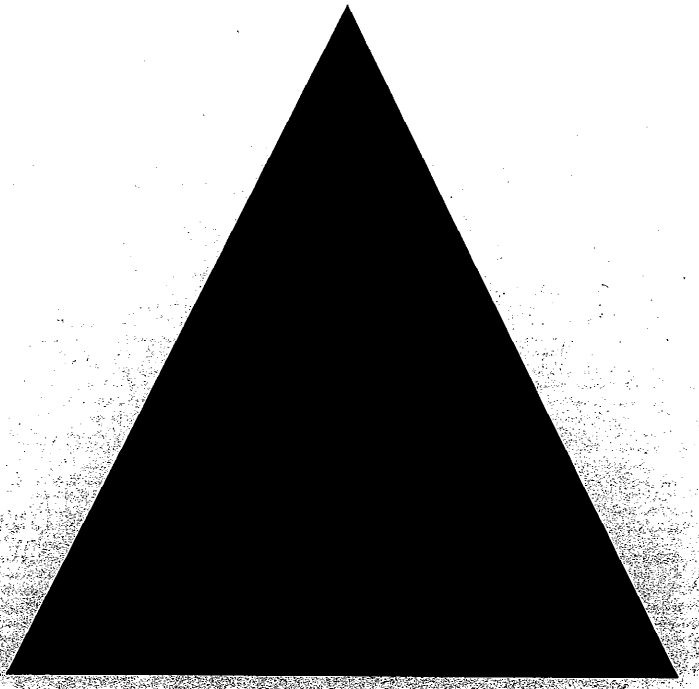

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