Summary Report

on the

Findings of Flood Control Plans

for

Maricopa County, Arizona

(Salt and Gila Rivers from Granite Reef Dam to Gillespie Dam)

By

H.A. Einstein

December 1966

University of California
Department of Civil Engineering
Div. of Hydraulic and Sanitary Engineering

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J6-1

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September 22 and 23, 1966, the writer spent in the Phoenix area after having studied the various plans and reports submitted to him. He took a helicopter trip covering the main channel of the Salt and of the Gila rivers from Granit Reef Dam to Gillaspie Dam and some of the watershed and tributary channels north of the main channel. He saw some channel sections from the ground, talked to various engineers of the County Flood Control District and gave a talk to a group of about 70 people that included both political and technical officers of various local and U. S. offices as well as a rather large group of citizens interested in the problem.

The inspection and the meeting were held under the impact of the last ballot in which a proposed bond issue for flood control work was overwhelmingly defeated by the voters. The writer stressed under these circumstances the one point which could explain the action of the voters and still accept the flood control plans as satisfactory (which they are). He had no choice but to conclude that the defeat must have been caused by a misunderstanding between the technical planners and the majority of the voters. He stressed this point, apparently to the discomfort of some of the officials (and he apologizes for making them the scapegoats!), but he is convinced that such a misunderstanding is the cause of the voters' reaction. The voters must have obtained the impression that the majority of their funds were destined for the improvement of the main channel only, of a channel which has proved to be quite adequate during the last flood with respect to their own interest and property. They could not care less if some property owners along the channel were hurt who probably had no business improving that land anyway. They sure did not feel like bailing them out. The writer, too, got to some degree this impression and might very well have reacted in a similar way had he been one of the voters.

Based on the technical information available to him, the writer assesses the needs for flood control work and the means to achieve it as summarized in the following paragraphs:

1. The flood control needs of the county can be discussed effectively only in connection with its water supply problems. Every effort to improve the flood control situation affects in some way the water supply; every effort to improve the water supply affects the flood condition. Any effective plan handling the water situation must cover both aspects.

2. The aim of a comprehensive flood control plan must be the prevention or reduction of flood damage in all parts of the county. The voters must become convinced that they are all to some extent profiting from the proposed plan, individually and collectively.

3. For the understanding of the flood control needs it is helpful to divide the area into three categories: (a) the flood plain of the main channels of the Salt and of the Gila rivers, (b) the channel and flood plains of the tributaries to the main rivers, and (c) the rest of the watershed. This division is somewhat arbitrary and ill defined, but helpful for the understanding of the problems.

4. The flood plain of the main rivers may be defined as the area which is inundated by the main rivers during a given flood. The chosen size of the design flood is somewhat arbitrary. The voters must be advised that larger floods may occur, with the chance of their occurrence decreasing with their size. Main Channels

5. The flood flows in the main river channels are controlled or modified by the operation of all upstream reservoirs. The schedule of this operation may be adjusted as to result in a maximum water supply for the area or may be modified to reduce the probability of valley flooding. The two aims are to a certain degree contradictory.

6. The Maricopa County Flood Control District (FCD) made its plans under the premise that the reservoirs are to be operated for water supply only. Water was released only for use or when the safety of the dam called for it. If the voters wish to change this pattern of operation, they must be warned that it would cause a loss of water supply, which must be replaced by the provision of new reservoir space or by water imports, both expensive. The FCD instead proposed improvement of the main channels as the least expensive method of flood control which was not accepted by the voters.

7. The next step should be zoning. The channel area must be defined. No structural encroachment into the so designated channel area should be permitted, unless such lost channel area is otherwise replaced by new channel area (across the river) without increasing the tortuosity of the channel flow. Natural growth in the channel area must be controlled to a state at which it will not reduce the flow capacity.

8. The channel contains a large amount of gravel with a size larger than 4". No permit should be given to crush or export this material as it is responsible for the stability of the channel. Its removal may cause widespread damage by scour in future floods, particularly to permanent river crossings and bank structures.

9. Downstream from the main urban area the channel should be opened up by removal of the perennial vegetation. The annual maintenance may be performed by local residents with the help of farm machinery under the supervision of the FCD. With a straight channel alignment the remaining vegetation may be sufficient to make the river build up its own banks. A wooded strip of 200-foot width should be zoned on both sides of the open flow channel as flood area (park) and should be permanently covered with trees or brush that stands inundation and sand deposits (such as willows). Wherever the stream cuts into its so developed banks, permeable structures (jacks, fences) should be applied to restore the chosen bank line.

10. Tributary channels and local drainage channels should be zoned as such in undeveloped areas with estimated maximum water levels and flow rates. Building permits should be given in these zones only if sufficient channel capacity is provided by the builder. Such channels may be vegetated or developed as park areas. The capacity of these channels should be sufficient for the runoff from its watershed after complete urbanization. Tributary Channels

11. Tributary channels and local drainage channels in developed areas may be designed as open channels through the back yards, as pipe storm sewers under streets or sidewalks or with the streets as

surface drains. All should be developed for the runoff from the entire area after full urbanization.

12. Reservoirs as built and proposed by the FCD on some of the major tributaries contribute greatly in relieving the channel design problems in the lower part of the particular channels where the slopes are lower and where space is at a premium. They are planned in connection with parks and ground water recharge facilities. The reservoir or retention basins must be designed and operated as sediment traps if the water from them is to be recharged into the ground water basin.

13. In residential areas low velocity channels with vegetated banks are usually preferred for the drains. Excavated material may be deposited in the location where houses will be built to give the dwellings additional flood protection. Streets crossing the channel should not reduce the channel capacity. They may be developed as dips with small culverts for low flows or should bridge the entire channel section with sufficiently large individual openings to reduce the danger of clogging by floating debris.

14. In highly developed areas, both industrial and commercial, space is usually at a premium. Rectangular cross sections are often preferred with high flow velocities. Such channels can later easily be decked over and thus transformed into culverts. However, such decking must be done carefully in a fashion as to minimize the added friction.

15. Where tributary channels or local drains should not or cannot be developed as surface channels, one may use pipes or culverts under the streets or sidewalks. This solution is in most cases very expensive and it is questionable if this solution needs to be applied in Phoenix where heavy precipitations are rare and where lack of space exists only in few central areas.

16. Where small discharges must be drained, it may be most advantageous to build the streets such as to act as channels during concentrated rains. They must be built in such fashion that automobile traffic is still possible: rough pavement to provide the necessary traction, sufficiently high curbs to permit loading in the dry, small crown and a very carefully designed even grade to keep the flow even.

Other Areas

17. In the minor drainage ways and in the remaining watershed area the roads will probably be relied on for drainage of rain water. Development of such areas should be such as to design the road surface sufficiently below the general land area that they automatically act as drains. Sidewalks, driveways and all house floors should be higher than the street level and continuously slope towards the street.

Planning

18. The planning of the system must begin with an estimate of the degree of urbanization which may be expected to occur in the next, say 50 years. For this status the hydrology must be projected and

a drainage pattern developed based on the existing topography of the area. At this stage the division should be made between area drainage by street drainage and concentration of runoff in channels. The channel system is laid out and the design discharges established for the individual channel sections. In this process drainage problems will be uncovered such as that caused by the Arizona Canal in Scottsdale.

19. While the planning and design must begin at the upstream end, the construction should begin along the main river channel and proceed from there upstream. Exceptions should be made only where strictly local problems are remedied.

20. Urbanization of the Phoenix area causes an increase of the flood runoff during times of strong precipitation. This increased flood runoff was previously percolating into the ground and was replenishing the ground water supply. The ground water level of the area is fast receding and added ground water recharge is needed. It has been proposed to import Colorado River water for that purpose. It is well known that the quality of the Colorado River water at the downstream end of the river is rather low while the storm runoff from the County is probably of better quality. It is proposed here to study the question how this storm runoff may be collected between Phoenix and Yuma in a reservoir and returned to the area for ground water recharge or direct use. Water Recovery

21. It is the writer's conviction that the same voters who declined bonds for what they thought was only a flood control channel for the Salt and Gila rivers would accept an integrated flood control plan covering all aspects of flood damage in the entire area, using all possible means from zoning and supervision of developer design to channel construction, even if the total expense may be higher than that proposed for the last bond issue.