

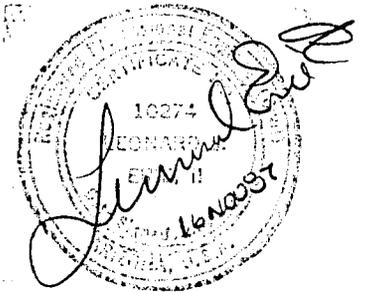
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96th STREET TO 108TH STREET/SHEA TO CAP PARKWAY
DRAINAGE ANALYSIS

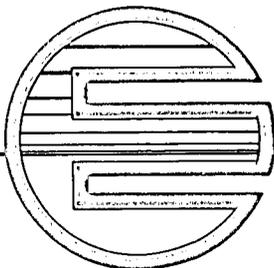
PREPARED FOR:
CITY OF SCOTTSDALE

Prepared By:
ERIE & ASSOCIATES, INC.
CONSULTING ENGINEERS



EA #1243.1

REVISED NOVEMBER 1987
AUGUST 1987



Erie & Associates, Inc.
CONSULTING ENGINEERS

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HYDROLOGIC MODEL DATA SHEET

Date:
By:

Area Modelled: 96th St to 108th St / Shea to Cap Pkwy
FCD File Code: ADOT EA #1243.1
Report Title: 96th St. to 108th St / Shea to Cap Pkwy Drainage
Analysis
Author: Eric & Arsa, Inc
Date: NOV. 1987
FCD Staff Contact:

Hydrologic Model Summary

Computer Model Used: none
version/date:

Total Area: 2 sq. mile (approx)

No. of Subbasins:

Rainfall:
freq. & duration: 100yr - 24 hr (1 hr. retention)
temporal dist.:
~~rainfall depth:~~
areal reduction:

Excess:

Hydrograph:

Routing:

Significant Structures
and Drainage Features:

not discussed

Comments:

Book is a qualitative report on unsatisfactory drainage conditions existing. No modeling or analysis done.

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LOCATION/BACKGROUND

This report is the first phase of a study on the drainage of a tributary area roughly bounded by 96th Street on the west, 108th Street on the east, Shea Boulevard on the south and the C.A.P. Canal on the north (See Appendix B - Aerial Photo for study area boundaries). This roughly two square mile area was hit by an intense thundershower on the afternoon of Friday, July 31, 1987. As a result, a significant portion of the downstream (southerly) area was subjected to flood-related problems.

A number of meetings have been held with the residents of the area and city staff. Based on the information from the flood review, flood damage appears to be the result of both flooding and erosion. Erosion occurred throughout the tributary and; the flood damage was located primarily in the Cactus to Desert Cove area between 98th Street and 102nd Street. Much of this area was subdivided prior to regulation by the City which would have required a drainage report and master plan. The washes in the area are only partially covered by drainage easements (see Appendix D, City Quarter Section Composite Map).

The tributary north of Cactus remained relatively undeveloped until the mid 1970's when the C.A.P. Canal and dikes were constructed. These dikes cut off the major tributary to the north in the McDowell Mountains. In the last 5 years, significant new development started in the area below the C.A.P. Canal and; the new subdivisions were required to have retention of stormwater. Some of the new developments have "on-lot" retention while others have a "common area basin". Existing patterns are shown as Appendix B.

Meetings with City staff and others have resulted in a first phase master plan for retention/detention areas. The resulting plan is attached as Appendix B. The basin at the northeast corner of 100 Street and Cactus is currently under construction.

SUMMARY

This first phase report takes a qualitative review of the tributary with the objective of major recommendations for immediate flood relief and, in addition, provides suggestions for a future quantitatively based report. This subsequent report should make detailed recommendations on a long term master planned drainage system for the area that ties together the proposed detention/retention system.

- . The basic problem is simple, the peak flows from the recently developed upstream areas exceeds the capacity of the relatively undeveloped washes in many of the older developments.
- . The long term solutions will include development of additional upstream detention basins to reduce peak flows and new channels or storm drains downstream to handle the basin releases.
- . It is strongly recommended that, because of the diverse interest in the area, the City take the lead in organizing the master planning, financing (possibly a drainage improvement district), and enforcement of the ultimate maintenance responsibilities for the long term plan.
- . One method of financing this project, which covers a variety of ownerships, is to consider formation of an area based drainage improvement district.
- . Drainage systems on developments with increased densities can, if designed properly, actually decrease the peak downstream flow rates. The majority of the developments in the study area, however, appear to have significantly increased the outflow rates.
- . First phase solutions include local flood proofing, removal of channel obstructions, modification of perimeter roads to drain directly into existing basins or channels, and construction of new or deeper existing retention basins. These issues are discussed in more detail in the following sections.

ORDINANCE REQUIREMENTS

Retention requirements by the City have changed from retention of a 50 yr. - 24 hr. duration storm (Ordinance 1015) to the present 100 yr.- 1 hr. retention of the increase in runoff (City of Scottsdale Storm Drainage Manual). The actual requirements by ordinance (#1644, June 1984) are more general than the Scottsdale Drainage Manual requirements.

The ordinance states the following with regard to stormwater retention/detention:

"12. STORM WATER DETENTION OR RETENTION

a. Except as noted below, the development of land within the City which is not within the Hillside District must include provisions for the management of storm water runoff from the property which is to be developed. This management shall consist of the construction of storm water detention systems or retention basins. Storm water detention systems must provide peak rates of outlet flow from the developed property onto downstream property which are no greater than the peak rates of runoff flow from the same property under natural conditions with no development. If a suitable outlet for a detention system is not available or if engineering analysis indicates that available outlet systems would be overtaxed by a detention system outflow, a stormwater retention basin shall be constructed in lieu of a detention system. The requirement for construction of a detention system or a retention basin is waived in the following cases:

(1) An application for a building permit to construct a single-family residential structure.

(2) Development adjacent to a floodway or a drainage channel which has been determined by the Project Review Manager to have been designed and constructed to handle the additional runoff flow without increasing the potential for flood damage on downstream property.

(3) Development of a parcel under one-half acre in an area where it can be demonstrated that no significant increase in the potential for flood damage will be created by the development.

b. Storm water detention and retention facilities shall be designed and constructed according to the procedures and criteria established by the City. No detention or retention basin shall retain standing water longer than 36 hours if the basin has not been designed and constructed to be a permanent body of water with appropriate health, safety, and water quality measures for such a body of water."

There are no requirements in the ordinance for protection of site improvements such as swimming pools, and landscaping from flood damage.

EXISTING FLOOD PATTERNS/FLOOD PRONE AREAS

In general the study area drains from northeast to south or southwest towards a major collection system south of Shea on the Scottsdale Ranch development.

While the C.A.P. dikes cut off the tributary north of the C.A.P. Canal, the existing washes remained and therefore retained a drainage pattern for post C.A.P. conditions. Drainage patterns during the flood event are superimposed on Appendix B - Aerial Photo. New developments have attempted to retain the general drainage pattern, however, some concentration has inevitably occurred.

In addition, the present retention policy of retaining the increase in runoff has only been partially successful. Many individual lot basins are located in the back of the lot and therefore the front area, roof and driveway are free to drain directly to the street. Also, many of the original basins have been filled in by new homeowners. In general the common area basins were significantly more effective than the individual lots in reducing runoff from the tributary during the recent flows. Individual lot basins were incorporated into the drainage design of several developments, and in some cases the basins were assumed to entirely eliminate runoff from the lot. Even when operating properly, the basins will only eliminate increased runoff and existing runoff should be considered to remain. Because the lots actually are contributing to the runoff, the resulting drainage improvements are underdesigned and were overtaxed by the storm.

The washes in the unsubdivided area south of Cactus were inadequate to carry the waters draining from the north. The wash areas are now only partially covered by drainage easements and, in a number of cases, fences and other improvements have encroached into the washes (See Appendix C - City Quarter Section Maps). This results in higher water surface elevations upstream of the encroachment and higher velocities at the encroachment.

There are several areas where tributary areas have been diverted by subdivision improvements. One diversion occurred east of 101st Street at Cactus. A riprap collection channel along the East side of the Powderhorn Ranch development was designed to turn west down another channel along Cactus Road. The channel reportedly however, overtopped at the turn and a significant portion of the flow was diverted south and east into the 102nd Street area. Residents in the 102nd Street and Desert Cove area reported scattered flooding and unusually high flows. This could be partially attributable to this diversion. A number of other diversions have occurred that also contribute to the flows at 102nd Street and Cactus.

Storm water runoff from the tributary has generally increased over existing due to a faster basin response time (streets carrying water) and more impervious area contributing runoff (streets and houses).

Because the tributary is steep, the response time from rainfall to runoff is very short, and the runoff is characterized by sharp peaks and relatively low volumes. This type of tributary is very sensitive to relatively small storage volumes and short duration intense storm events such as occurred. Summer storms are characteristically short and intense while winter storms generally have longer durations and a lower intensity of rainfall. This matter and its significance with regard to the recommendations is discussed further in the following section.

SHORT TERM RECOMMENDATIONS

The recommendations given in this portion of the report are based on field observations, discussions with residents and a list of immediate improvements requested by homeowners in an August 3, meeting at City Hall (see Appendix A - Homeowners Suggestions) and consultation with staff.

The short term recommendations in this report were formulated to help provide immediate relief for individual areas and in general should result in a significant reduction in storm runoff over existing conditions. The effectiveness of the proposed basins and perimeter modifications will depend on the eventual construction details. In addition, some temporary loss of emergency access may result as a tradeoff against reduced flood levels. The short term recommendations are in no order of significance as follows:

- A. Provide local flood proofing of homes by running contoured earth berms around both sides of the upstream side of the home.
 - . The berm should be set a minimum of 0.5' above the observed water levels and should tie around both sides of the house without blocking existing drainage past the house. In addition, they should not block drainage away from the house itself (from inside the berms).
 - . The interior drainage should be allowed to leave the site at grade at the downstream side of the lot.
 - . It may be necessary to add erosion protection (river run cobbles) to the "wet side" of the berm. Each case should be treated individually. Any replacement of eroded granite should be with larger, more erosion resistant rock.

- B. Remove undersized culverts in Paradise Drive near 100th Street and replace temporarily with a graded dip section (Has been done). This crossing should be replaced with appropriately sized culverts as a part of the master plan.
- C. Remove chain link fences within the 100 year floodplain and other type fence openings and improvements within 20' either side of the existing washes. Also, consider trimming existing growth to above the water levels (3' to 4' minimum). If easements are not now dedicated, review possibility with City Attorney of enforcing flood plain ordinance for removals (action has been initiated).
- D. For safety purposes, regrade channel along 100th Street North of Ocotillo to provide a 4H to 1V bank adjacent to the street. Also see Item K.
- E. For safety purposes, fill in the scour hole south of Cactus on the 98th Street alignment with head sized cobbles to the grade of the bottom of the ditch.
- F. Disseminate information on the availability of flood insurance. The entire area is eligible (Zone B) and additional information is available through the State Department of Water Resources, Ms. Terry Miller (255-1566), or local knowledgeable insurance brokers. The insurance will cover the structure and contents, it will not however, cover site improvements such as pools, landscaping and corrals (Has been done).
- G. One suggestion by the residents involved directing the water from the collection channel along the east side of the Powderhorn development to the east onto the drainage channel south of Cactus (through Roaslie Ranch). We do not recommend this. The water arriving at this point has already been diverted from both the east and west, and continuing that could cause additional flooding in areas downstream of 102nd Street and Cactus. The original concept of putting this water back into its natural course, near 100th Street, should be maintained. Also see Item K. The height of the outside of the channel bend at Cactus may need to be raised to account for the energy head and super elevation of the water coming from the north. In addition, the channel banks may need to be raised to convey the water to the new basin at 100th and Cactus. It is suggested, however, that the delivery channel be increased in size to provide some storage volume and then metered out. In addition, the outlet channel capacity should be increased as much as possible and ultimately supplemented by a larger channel or pipe downstream of 100th and Cactus.

- H. Cactus Road east of 102nd Street crosses a number of culverted washes without any spillways into the existing washes. Spillways should be added at the wash crossings. In addition, a new temporary spillway has been installed on the south side of Cactus east of the entrance to the Rosalie Ranch.
- I. A number of fences with grated openings have been installed over the Rosalie Ranch channel. These should be removed or modified to allow passage of the 100 year storm below the existing finish floor elevations (Compliance order issued by City).
- J . Inspect and enforce the retention requirements in the tributary, particularly north of Cactus to the C.A.P.
- . Retention should also be located in front yards to eliminate direct street runoff.
 - . Any new retention areas should be designed as a common area or as a common basin on a larger lot.
 - . Streets in subdivisions should be directed into basins before leaving the development, including perimeter collector streets. This will require construction of new road dips and curb cuts.
- K. It may be necessary after review of the design, that the basins should be deepened. A minimum basin volume should be one inch of rainfall over the entire tributary in order to have a significant effect on downstream flows. Preferably these areas could be designed with a bleedoff to handle multiple storm events. The areas recommended for modification are shown on Appendix B - Proposed Area Modifications.

This final suggestion ties in with the preliminary suggestions for long term work.

LONG TERM RECOMMENDATIONS

These recommendations are based on a qualitative review of the flood problems. This portion of the report should be expanded to a quantitatively based detailed area master plan as a future phase.

A. Improvements

A number of basins are shown for the purpose of intercepting runoff. These basins were sized to provide a storage volume of 2.5 inches of runoff over the tributary. With potential infiltration this could be roughly equivalent to a 100 year-24 hour duration storm (4 inches). It is expected, however, that some first phase

basins may be overtaxed until the whole system is in. In no case, however, will the resultant outflows be increased. The net effect even with the limited improvements now under construction should be a significant decrease in outflows.

- . A combination of channels, storm drains and basins should be considered. The channelization or storm drain should start at Shea Boulevard or upstream if the existing engineered channels have adequate capacity.
- . It is suggested, as a minimum, that a new channel or storm drain be considered along or near the 100th Street alignment that would substantially increase the capacity of the existing channel. This would tie into the channel north of Cactus east of 100th and into a channel, or storm drain possibly along 100th Street north of Cactus.
- . A number of potential new major detention basin sites have been identified. They are shown on Appendix C and work on several has been initiated.
- . In addition, modification of existing common areas within the tributary appears to be warranted (see Appendix C). This work is currently under design.

The volume and location of these basins will have a direct bearing on the recommended size of the new outlet drainage system. A final plan with sizes would be developed as part of a future area master drainage plan.

B. Ordinance

In addition, a revision to the drainage ordinance should be considered that would incorporate the following: Retain or detain a 100 yr. - 2 hr. storm (not the increased volume). Only common area or extra large lot basins with drainage easements should be allowed. If the basin is not built with a detention (bleedoff) concept, the effect of the basin should be ignored in setting finish floors. It may be possible to replat certain existing areas to allow common basins while not decreasing the number of lots as an incentive to private investment in the master plan recommendations.

C. Rainfall Data

Finally, the basic data on storm events in the area is very limited, it is therefore recommended that all public buildings (firehouses, police stations, public yards, parks, and libraries) be equipped with rain gauges and a person be assigned at each location to record and annually compile a rainfall summary.

APPENDIX A
HOMEOWNERS SUGGESTIONS

The homeowners immediate improvement suggestions are listed as follows:

1. Cactus and 102nd Street - open flow north of Cactus to basin on south side of Street.
2. Make lot retention on Powderhorn Ranch take place.
3. Drainage ditches - install walls to meter flow from Powderhorn Ranch area.
4. Retention Basin - put in new basins on Powderhorn in southwest area.
5. Install new culverts or remove and grade a swail in Cactus, 100th Street, and Paradise Drive.
6. Close spillway on Cactus east of 100th Street.
7. Need a new ditch on 100th Street north of Cactus.
8. 100th Street and Cactus raise road and realign wash.
9. Sweetwater at 100th Street and 102nd Street needs improvement.

(These suggestions were submitted by Mr. George Irwin of 9940 E. Paradise Drive.)

The following comments are offered with regard to these suggestions:

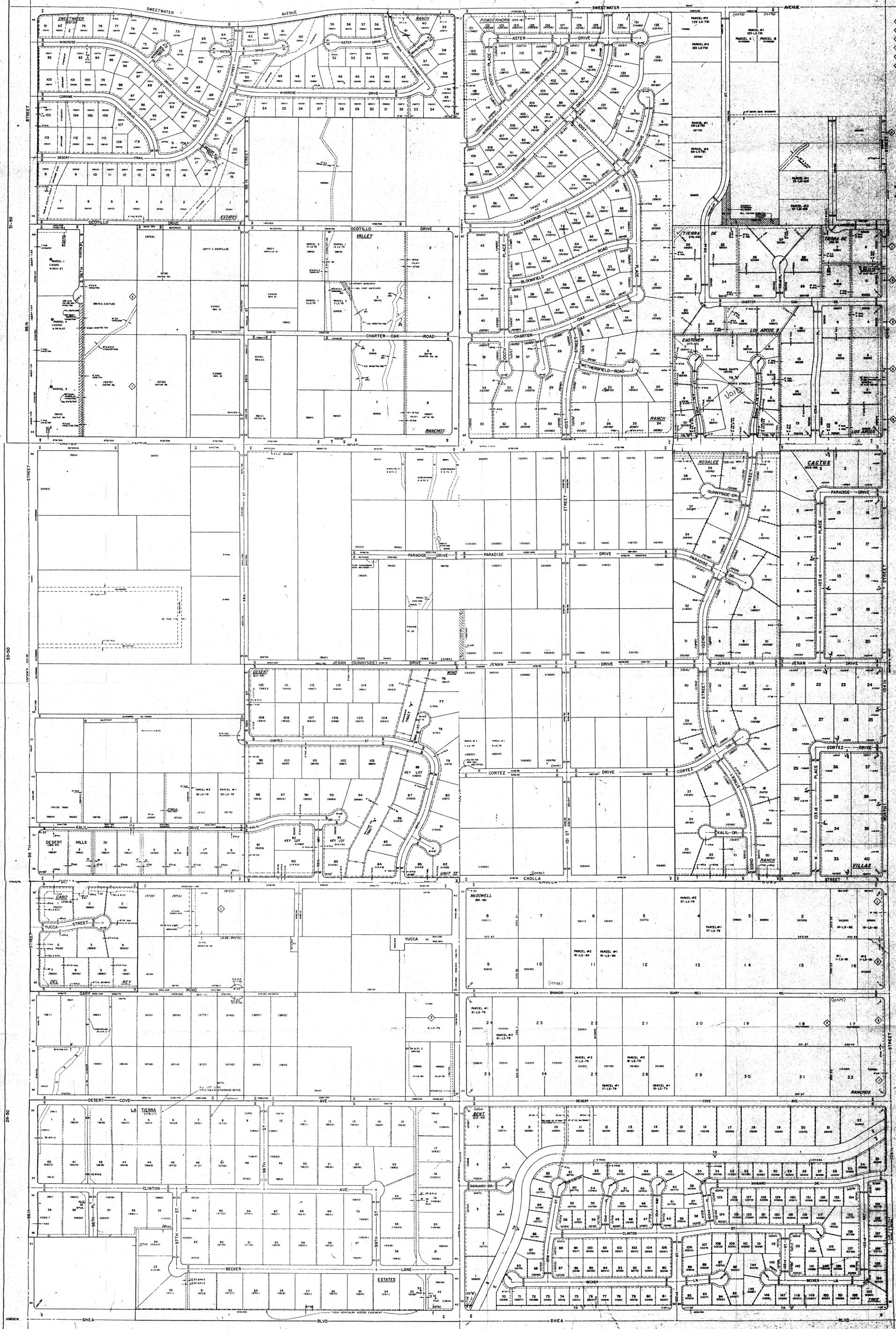
1. See response under Short Term Recommendations Item G.
2. See response under Short Term Recommendations Item J.
3. See response under Short Term Recommendations Item G.
4. See response under Short Term Recommendations Item J.
5. See response under Short Term Recommendations Item B.
6. See response under Short Term Recommendations Item G.
7. See response under Short Term Recommendations Item G.
8. See response under Short Term Recommendations Item G.
9. This ties in with the long term recommendations with respect to improvements associated with an area master drainage plan.

APPENDICES B & C

AERIAL PHOTOS

APPENDIX B - (Aerial Photo) Proposed Area Modifications

APPENDIX C - City Quarter Section Maps



CITY OF SCOTT'S
 CITY QUARTER SECT. MAP
 31-52
 CITY OF SCOTT'S
 CITY QUARTER SECT. MAP
 30-52
 CITY OF SCOTT'S
 CITY QUARTER SECT. MAP
 29-52



APPENDIX B
PROPOSED AREA MODIFICATION
SCALE: 1" = 200'

LEGEND
Tributary Boundary
Proposed Basins

Eric S.
CONSULTING ENGINEER