64th Street/
Indian School Road

# FINAL DRAINAGE STUDY

ACCEPTED
MASTER DRAINAGE PLAN
REVIEWER:
DATE: 8/23/94
TRANSPORTATION PLANNING

Submitted by:

PB PARSONS BRINCKERHOFF

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
21854
ROBERT J.
BATTISTELLO
Date signed 6/14/94
ARIZONA, U.S.A.

Robert J. Battistello

Submitted to:

CITY OF SCOTTSDALE

CITY OF SCOTTSDALE ARIZONA

June, 1994

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Indian School Road

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## 64th Street/Indian School Road
## Design Concept Study

Contract No. 920075
Project No. 4541P

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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ARIZONA, U.S.A.

Prepared for:

***CITY OF SCOTTSDALE, ARIZONA***

Prepared by:

***PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.***

June, 1994

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## SUMMARY OF TECHNICAL REPORTS DEVELOPED FOR THIS PROJECT BY PARSONS BRINCKERHOFF

Public Participation

Buffering and Landscaping

Native Plant Survey

Drainage

Noise

Alternatives Maps (1" = 50')

10% Roadway And Drainage Plans
(Referred To As Exhibit 5 In Drainage Report)

# I. INTRODUCTION

## A. Background

The 64th Street/Indian School Design Concept Study evolved from the City of Scottsdale North/South Corridor Study completed in 1991. That report recommended that 64th Street from McDowell Road to Thomas Road be widened to four lanes including a median or center turn lane. Additionally, 64th Street from Thomas Road to Indian School Road was recommended for new street construction the same roadway configuration (four-lane etc.) as between McDowell To Thomas Road. Buffer islands were to be incorporated between McDowell and Thomas adjacent to the existing 64th Street. On February 18, 1992 City voters approved funding for the 64th Street widening project. Overall the improvements include 2.25 miles of roadway widening to major collector/minor arterial standards incorporating a 45 m.p.h. design speed. Exhibit 1 depicts a site vicinity map outlining the area of improvements.

## B. Purpose

The purpose of this drainage study will be to undertake a comprehensive field reconnaissance to evaluate and identify drainage watercourses and problems and to quantify runoff for the 10, 50 and 100 year storms. Off-site flows play an important role in the development of storm drain infrastructure to alleviate roadway flooding by intercepting runoff before it reaches the street, as well as relieving flows in the road itself. This study forms a basis for the conceptual design of a storm drain system compatible with the new roadway alignment which meet the above stated objectives. The conceptual design will be shown on roadway plan and profile sheets except for the outfall system which will be shown on the off-site drainage map (Exhibit 3 in map pocket). The development of an infrastructure system will allow quantities to be tabulated and a construction cost estimate to be prepared as part of the overall cost estimate for the 64th Street roadway widening improvements.

This final drainage study for the concept roadway study is intended to present alternative concepts and the identification of a storm drain system that will meet the City of Scottsdale's design criteria and serve to safely route storm runoff around and through the project and find acceptable points of discharge via an outfall system terminating in the existing 84 inch and 90 inch reinforced concrete pipes in Scottsdale Road. The design presented herein is not intended to be a preliminary or final design, as that can only proceed concurrently with the development of construction plans and specifications, but rather a concept from which final plans may be developed without going through an extensive hydrological analysis and feasibility study. Several assumptions were made, as shall be noted, to expeditiously size a

# Site Vicinity Map

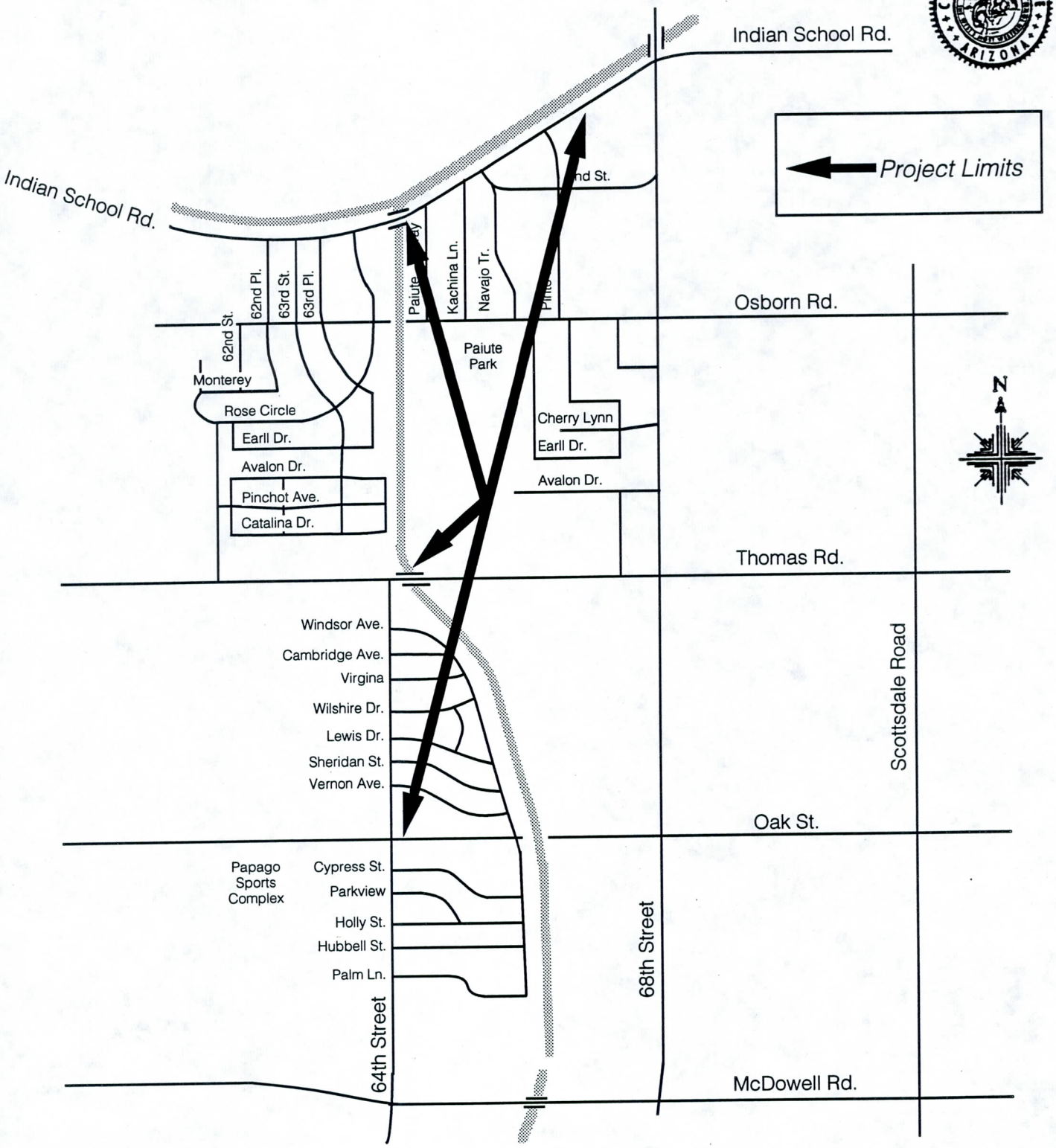



EXHIBIT 1

storm drain network to facilitate the identification of construction costs and viable alternatives to be considered as the project proceeds into the preliminary and final design phases.

## II. SCOPE OF WORK/DESIGN CRITERIA

### A. Contract Requirements

The scope of work includes the following:

1. The Engineer shall conduct a field investigation of the project limits to become familiar with the drainage patterns.

2. The Engineer shall review all reports, maps, aerial photographs as necessary to determine the drainage patterns in the area. Peak runoff discharges shall be computed for 10, 50 and 100 year storms at existing and future points of discharge.

3. The Engineer shall study and evaluate alternative means of conveyance for storm water concentrating at the intersection of 64th Street and Thomas Road.

4. The drainage report shall include applicable design criteria and analysis/computations for the various design alternatives.

5. The final drainage report shall include 10% design drawings and hydraulic calculations for the selected structures and facilities.

### B. Design Criteria

The City of Scottsdale Design Procedures and Criteria, Sections 2, 2.2 and 3 were used in preparing this report (References 1, 2 and 3) and the 10% design plans.

Since all of the basins are less than 160 acres, (1/4 section) the Rational method was used in computing hydrology for the 10, 50 and 100 year events. The minimum time of concentration for urbanized conditions is five minutes and the Kirpich equation was used to compute this, as follows:

(Kirpich) $TC = 0.04593\ L^{0.77}/S^{0.385}$

Where $L$ = The distance to the most hydraulically remote point in the basin.

$S$ = Slope of L, in percent.

Runoff coefficients were used from Figure 2.2-21 (reference 2) and rainfall intensities were taken from Figure 2.2-13 (reference 2). These are included in the technical appendix. The exception to this is hydrology computations for off-site basins in the City of Phoenix (Papago Park Area and north thereof) on the west side of 64th Street from McDowell to Oak Streets.

Other important design criteria used were as follows:

- Maximum depth of flow in street gutters is eight inches for the 100 year storm. According to the City of Scottsdale Ordinance "In no case, shall the depth of Flow be greater than 1 foot".Flow must be contained within the right-of-way upon curb overtopping.

- Valley gutters shall not be used on arterial to arterial or arterial to collector streets.

- Minimum longitudinal street grade shall be 0.40%.

- Use MAG Type 220-A curb and gutter (17 inch pan and effective gutter slope - 4.17%).

- Must maintain at least one dry 12 foot lane in each direction of travel for the 100 year storm for major collector/minor arterial roads. Bypass flow from each inlet shall be taken into account. Appropriate clogging factors must be used. HEC-12 computational procedures are appropriate for inlet design (reference 6).

- Particular care shall be exercised in roadway sag conditions. Inlets must be located in low points and flow spread criteria not violated. Flanking inlets as recommended in HEC-12 are advisable for arterial roadways/freeways (reference 6) and shall be used in the 64th Street design.

- Reinforced concrete pipe (RCP) will be used for storm drain design with a Manning's N=0.012. Minimum velocity shall be 3 feet/second.

- Inlets shall be placed upstream of pedestrian crossings at major intersections.

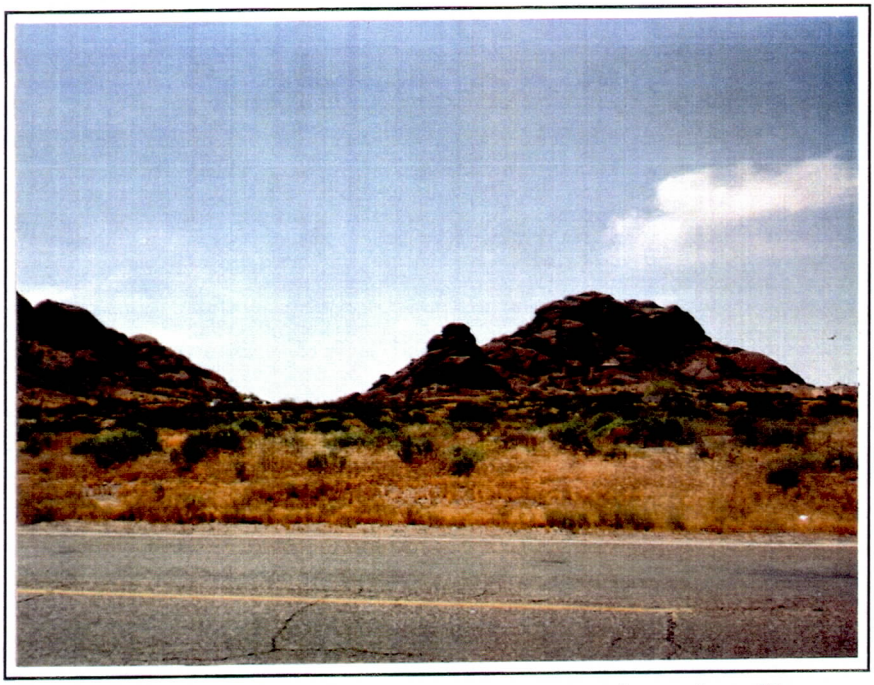
# III. EXISTING CONDITIONS

## A. Off-Site Hydrology

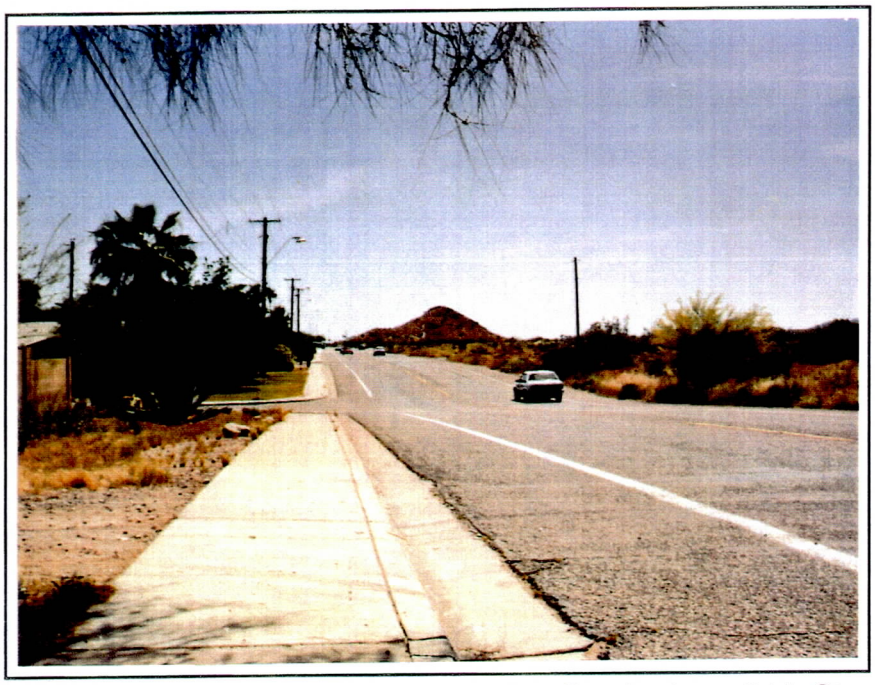
Exhibit 3 - Off-Site Basin Map (map pocket) depicts the entire watershed tributary to the 64th Street improvements and outlines sub-basins within the watershed at particular points of discharge. At these points, times of concentration are given, as well as peak runoff discharges for the 10, 50 and 100-year events. Hydrological design data record computation sheets are located in the technical appendix. The following describes existing conditions along the 64th Street alignment.

- McDowell Road to Oak Street

  Currently, 64th Street is a two-lane roadway along this stretch, without curbs. Drainage on the east side of the road flows away from 64th Street toward the cross cut canal. Drainage from the west side contributes substantial off-site runoff emanating from Papago Buttes and crosses 64th Street after being conveyed in small ditches. A significant portion of this off-site flow concentrates at the Hubble Street dip crossing about 1500 feet north of McDowell Road. This, along with runoff generated from residential dwellings in the Hy-View subdivision results in a ponded backwater condition resulting in a FEMA "A" flood zone. One of the goals of this study will be to mitigate runoff crossing the Hubble dip thereby relieving some of the flooding into the FEMA flood zone. A reasonable approach would be to intercept the 10 year discharge at Design Point 30 into a storm drain collection system. Exhibit 3 - Off-Site Basin Map (map pocket) depicts this and the entire 64th Street watershed along with sub-basins at particular points of discharge. Roadway crests occur at 450 feet and 1,750 feet from the intersection of McDowell Road. Beyond the crest north of Hubble Street the road drains north all the way to the intersection of Thomas Road. All runoff east of 64th Street sheet flows to the east and is non-tributary to 64th Street. Off-Site drainage from the west funnels to collection points shown as No. 10, 20, 30, 40, 50, 60 and 70 and cross 64th Street thus impacting the Hy-View subdivision on the east side of the street. Photographs are shown on the following page of these areas. Runoff to design points 10, 20, 30, 40 and 50 at Oak Street was computed using City of Phoenix Design Criteria, since that area is located inside the corporate boundaries of the City of Phoenix and was obtained largely in part from the final drainage study from the Papago Park development by the City of Phoenix (reference 5)



*Looking West toward Barnes Butte across from AutoPlex and North of McDowell Road. Source of Offsite flow to design points 10, 20, 30, 40 and 50.*



*Dip crossing at Hubbell Street looking South along 64th Street.*

These computations can be found in the Technical Appendix. It is readily apparent from the magnitudes of the peak discharges, that this off-site flow would be more than the future cross section of 64th Street can convey and meet the flow spread criteria mentioned above. Therefore a storm drain collection system will be necessary to intercept the flows before reaching 64th Street. This will be discussed in Section IV, under future conditions and alternatives.

Existing drainage facilities along this portion of 64th Street are as follows:

- Existing 3-36" culvert at Design Point 10 crossing under 64th Street. Outfalls into McDowell Road improvements.

- Existing 4-36" culverts at Design Point 20 crossing under 64th Street. Outfalls into McDowell Road improvements.

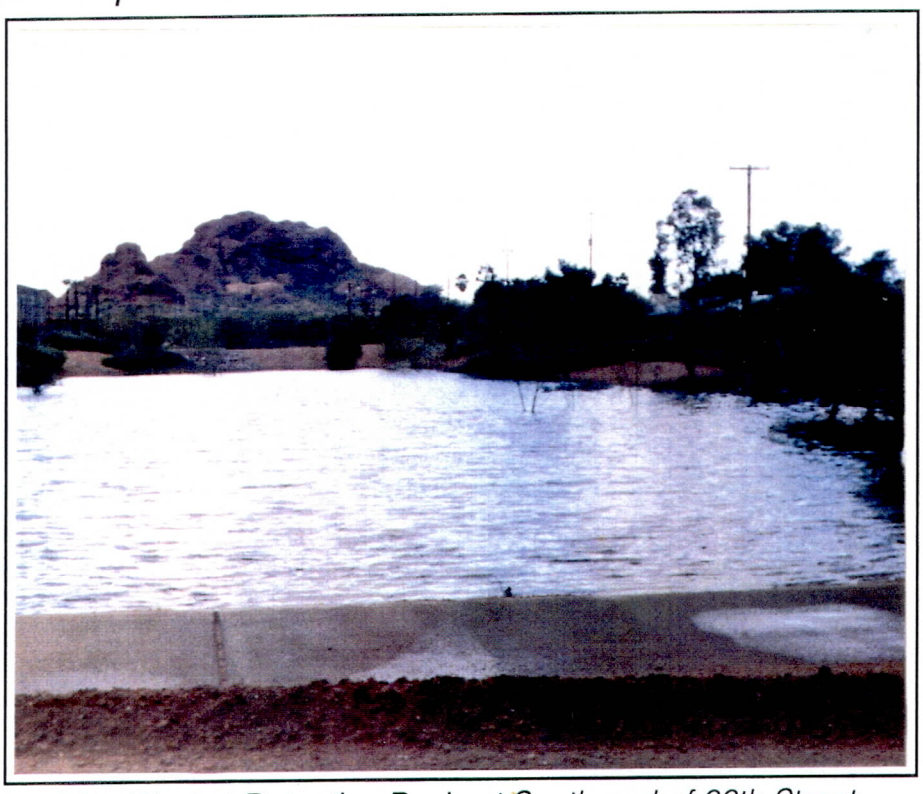
- Roadside ditch along west side of 64th Street intercepting portions of off-site flow from the west.

- Hubble Street dip crossing (roadway sag condition) at Design Point 30 intercepting off-site flow from the west after small roadside ditch capacity is exceeded. Flow from this point continues east then south contributing to flooding problem noted as FEMA "A" flood zone on Exhibit 3 (map pocket). (See photographs on following page)

- <u>Thomas Road to Indian School Road</u>

  At present no through roadway exists across Thomas Road along the 64th Street alignment other than a Salt River Project (SRP) access road from Osborn Road to SRP dispatch operations center and local residential access from Osborn Road to Indian School Road.

  The future 64th Street alignment will parallel the east side of the existing cross cut canal approximately at existing grade providing an extension of the 64th Street corridor from Thomas Road to Indian School Road. The cross cut canal acts like a dam for drainage preventing sheet flow runoff to travel east from residential neighborhoods on the west side of the canal. Minor stormflows pass underneath the cross cut canal via pressurized storm drain into a bubble-up inlet in Paiute Park whereby drainage travels easterly. This runoff will continue to remain non-



*Looking West at Detention Basin at South end of 66th Street and North of AutoPlex. January, 1993.*

*Looking North on 66th Street near Palm Lane, Fema "A" flood zone, January, 1993*

tributary to 64th Street and will not be conveyed into the Osborn Road storm drain outfall system. Therefore runoff tributary to this area emerges from the east from the SRP electrical substation and residential subdivisions (see Exhibit 3 in map pocket).

At present a serious drainage problem occurs at Scottsdale Executive Villas, the commercial property just north of Thomas at the "T" intersection with 64th Street. Although minor gutter flow drainage from Thomas does not enter this site because of the driveway entrance crest designed to direct flow to the east on Thomas, the inlet systems are tied into the dry well system of this commercial site causing extensive runoff to bubbling up from the lowest manhole at the northeast corner of the property adjacent to the west toe of slope of the cross cut canal. This flooding causes the elimination of several parking spaces and blocks entrances to some of the offices facing the east. This is shown in the pictures of Scottsdale Executive Villas provided on the following page. The seriousness of the problem warranted an extensive site visit conducted with the complex manager on March 18, 1993. At that time Parsons Brinckerhoff meet with Mr. Mike Pacheco of JVT Asset Management Company. A walk through of the area was followed by examining JVT's record plans showing the storm drainage tie-ins. In addition to the above, an existing 15" culvert crossing Thomas serving a parcel on the southeast corner of the intersection of 64th Street also ties into the Executive Villas. It appears that this and the inlet storm drains can be tied into the new storm drain outfall running east down Thomas Road thereby eliminating the minor year ponding on this site and resolving their problem. This will be further discussed in Section IV Future Conditions.

Existing drainage midway between Thomas Road and Indian School Road is presently evacuated via a drainage sump pump and 10 inch force main discharging across the cross cut canal into a flow diversion box whereupon it becomes part of SRP's irrigation water. Since the existing grade will be closely followed it will be necessary to relieve drainage from this sag condition (including off-site flow) and find a suitable point of discharge and an outfall system. This will also be discussed in Section IV Future Conditions. In addition, there exists an inverted siphon storm drain crossing under the cross cut canal conveying runoff from approximately 148 acres west of the canal. This is non-tributary drainage which is conveyed to a bubble-up area inlet in Paiute Park. This system acts to

*Flooding in Scottsdale Executive Villas Commercial Office Facility. January, 1993.*

*Entrance of Scottsdale Executive Villas just North of Thomas Road at the 64th Street Intersection. Note flooding in rear of parking lot. January, 1993.*

restrict the flow such that the resulting condition is detentioning in the residential area upstream. Peak flowrates and volumes can be found in Section G of the technical appendix.

- Indian School Road - 64th Street to 68th Street

  At present there appears to be minor ponding along the edge of pavement from 64th Street going east along Indian School Road towards 68th Street. Eventually, runoff sheet flows to the southeast whereupon it makes its way along curbs in the main collector roads toward Scottsdale Road eventually discharging into the 84 inch storm drain interceptor system. Little, if any, future drainage improvements are expected here, even though the road will be widened to add a left turn lane. A final assessment may be made at the time of final design to determine if any minor storm drain improvements are warranted for this area.

## B. On-Site Hydrology

The on-site runoff consists of stormwater collected and conveyed along the roadway itself. At present, since no curbs are found between McDowell Road and Thomas Road, flow is directed toward a drainage ditch on the west side of 64th Street whereupon it travels toward the Hubble dip crossing previously mentioned, or toward the intersections of McDowell and Thomas Roads. (See Exhibit 3 in map pocket). Runoff contribution from the roadway itself is minor in comparison to the off-site flows it receives. No inlets or storm drain conveyance system exists along the roadway, but these improvements will be part of the new infrastructure developed to support the future roadway construction. Outfall systems must be designed to dispose of the runoff and will be of major importance in the overall implementation of a stormwater management system for this project. In conversations with the City of Scottsdale, it was communicated to Parsons Brinckerhoff that they recognize this need and have budgeted some of this system in their future capital improvements plan. More will be discussed on this issue in the next section.

## C. Existing Features

Additional existing conditions that will require attention and coordination with new storm drainage facilities include the following:

1. Papago Park baseball and recreational facility owned by the City of Phoenix. Expansion and major renovations are currently planned for this facility. Exhibit 3 (map pocket) shows the drainage improvements being planned to incorporate

retention facilities. This would act to result in somewhat reduced flows into Design Points 20 and 30 (see Reference 5 and Table 1). Even if these facilities are not constructed, the storm drain outfall presented herein will significantly improve the current condition along 64th street and mitigate, (but not eliminate) the FEMA "A" flood zone downstream of the Hubble Street dip crossing.

2. City of Phoenix water storage reservoir tanks (three circular concrete structures) adjacent to 64th Street and at the southwest corner of Thomas Road and 64th Street. Roadway and drainage facilities must be designed to not disturb these existing tanks.

3. Existing 45 inch abandoned City of Phoenix Verde water supply line in Thomas Road. This line may be used as a storm drain outfall conveying 64th Street runoff to Scottsdale Road. This line is presently being used for such purposes at the intersection of Thomas Road and Scottsdale Road.

4. Cross cut canal north of Thomas Road and radial gate structure near intersection of 64th Street.

5. Extensive SRP electrical power transmission lines and pole structures in vicinity o the intersection of 64th Street and Thomas Road. These facilities will require relocation for the proposed improvements.

6. Drainage pump station and force main approximately half way between Thomas Road and Indian School Road, and invented siphon under the cross cut canal discharging into Paiute Park.

7. The Arizona canal on the north side of Indian School Road running parallel to the proposed improvements from 64th to 68th Streets. Widening in this area may necessitate a retaining wall on the south side of the canal replacing the slope paving.

## D. Previous Studies

Previous studies pertinent to the development of a drainage infrastructure for this project include:

- McDowell Road improvements from 64th to 68th Streets.

- Papago Park Drainage study for the City of Phoenix, involving the construction of modifications to the baseball sports complex.

- Scottsdale Corporate Center development of the Executive Villas commercial office park at the northwest corner of 64th Street and Thomas Road.

- Scottsdale Road storm drain improvements extending to Thomas Road incorporating the existing 90 inch RCP storm drain interceptor conveying discharges to the Indian Bend wash.

  The above was used in the concept planning for drainage improvements and will need to be studied further for preliminary and final design of the improvements.

## E. Special Conditions

Throughout the course of this study it became evident that some conditions played an important role in the development of alternatives and acted as constraints in the planning of a storm drainage system. They are briefly mentioned below.

- <u>McDowell Road Drainage System</u>
  The 64th Street improvements should not adversely impact the existing McDowell Road storm drain system from either off-site or on-site roadway improvements. The Papago Park improvements show the installation of several retention basins aimed at this end (Reference 5). The 64th Street storm drain system will intercept roadway runoff and direct it north into the Thomas Road outfall system.

- <u>FEMA "A" Flood Zone in Hy-View Subdivision</u>
  This subdivision is located west of the cross cut canal between McDowell and Thomas Roads, and east of 64th Street. Although it is beyond the scope of services of this study to remove this area from the flood zone it is desired to be able to mitigate flooding in this area as much as possible. To do this it will be

important to intercept the large off-site storm runoff west of 64th Street as well as the roadway stormwater before it can cross the road and continue east, into the Hubble Street dip crossing and eventually into the FEMA "A' flood zone in the Hy-View neighborhood.

The Hubble dip crossing should be raised to improve headlight site distance requiring some portion of the off-site drainage (10-year storm flows) to be captured before reaching the crossing. This will also help to reduce runoff into the FEMA flood zone.

- 64th Street Continuation North of Thomas Road

  This will require a bridge or culvert structure spanning the cross cut canal (see Reference 4). During initial discussions SRP has indicated that 1.5 feet of freeboard will be necessary for this structure. Also, a radial gate structure is located just before the Thomas Road bridge (north side) whereupon the water surface of the canal drops 2.5 feet. A possibility exists that this gate may have to be moved upstream in order to provide for the minimum clearance necessary over the canal to the new roadway. Concepts will continued to be developed into the preliminary design phase.

- Existing Pump Station Near SRP's Electrical Sub Station

  At present an existing drainage evacuation pump and force main are located east of the cross cut canal about 2,000 feet north of Thomas Road. This acts to dispose of drainage from Indian School Road back to Thomas Road from the SRP maintenance road and residential access from Osborn to Indian School Road. It would be beneficial to design a gravity flow outfall system for this area as a new drainage pump station would be very costly and expensive to maintain. A gravity flow storm drain outfall system, possibly running east on Osborn Road was explored in this study as an alternative to implementing a new pump station. Section IV to follow will discuss this alternative.

# IV. FUTURE CONDITIONS

## A. 64th Street South Of Thomas Road

Exhibit 2, on the following page, shows typical roadway cross sections throughout the project. A more comprehensive viewing of sections can be found in 10% roadway plans submitted with the overall design concept report (Reference 4).

The objective of the drainage design is to provide an infrastructure that will safely convey off-site flows from the west side of 64th Street and also collect surface flows from the new roadway. Exhibit 3 (map pocket) as well as the 10% drainage plans labeled as Exhibit 5 (separate document) show the conceptual improvements. These plans show a comprehensive storm drain system including curb inlets and connector pipes. The level of concept development was sufficient to identify the alternatives and develop an accurate cost estimate of the improvements compatible with new roadway improvements. Technical computations involving inlet hydrology, HEC-12 inlet design and storm drain sizing can be found in the technical appendix. Specific design issues on this part of the project will now be discussed.

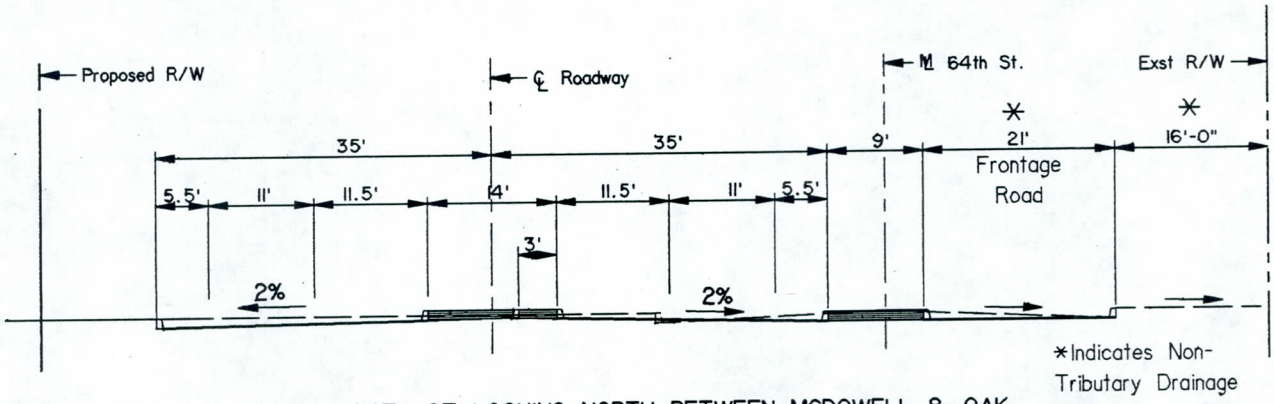
The City of Phoenix is planning to expand the Papago Sports Complex located jut north of McDowell Road. This development can be seen as Exhibit 4. Drainage improvements incorporating the use of several retention basins can be seen in Exhibit 3 (map pocket) as well as Reference 5. Although there is some minor inter-basin transfer of flows mentioned in the Papago Park drainage study no adverse effects are expected. Table 1 summarizes storm runoff discharges for 100-year conditions.

**TABLE 1**

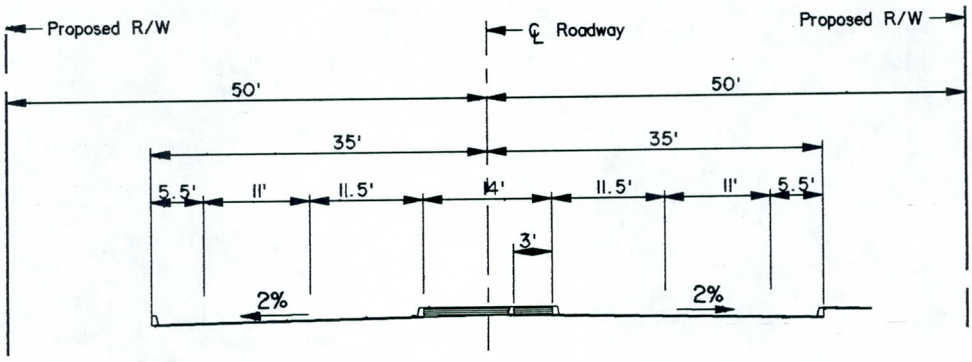
**SUMMARY OF STORM RUNOFF LEAVING PAPAGO PARK**

| Basin | Des. Pt. | Q100 Existing (cfs) | Q100 Developed (cfs) |
|---|---|---|---|
| A | 10 | 41 | 48 |
| B | 20 | 85 | 90 |
| C | 30 | 58 | 44 |
| Total Runoff Leaving the Site | | | 184 182 |

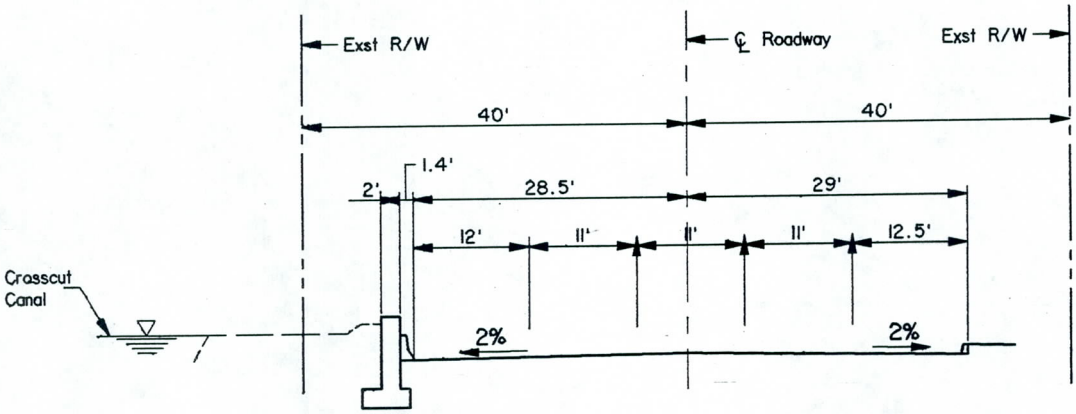
# Typical Roadway Cross Sections




64TH ST LOOKING NORTH BETWEEN MCDOWELL & OAK

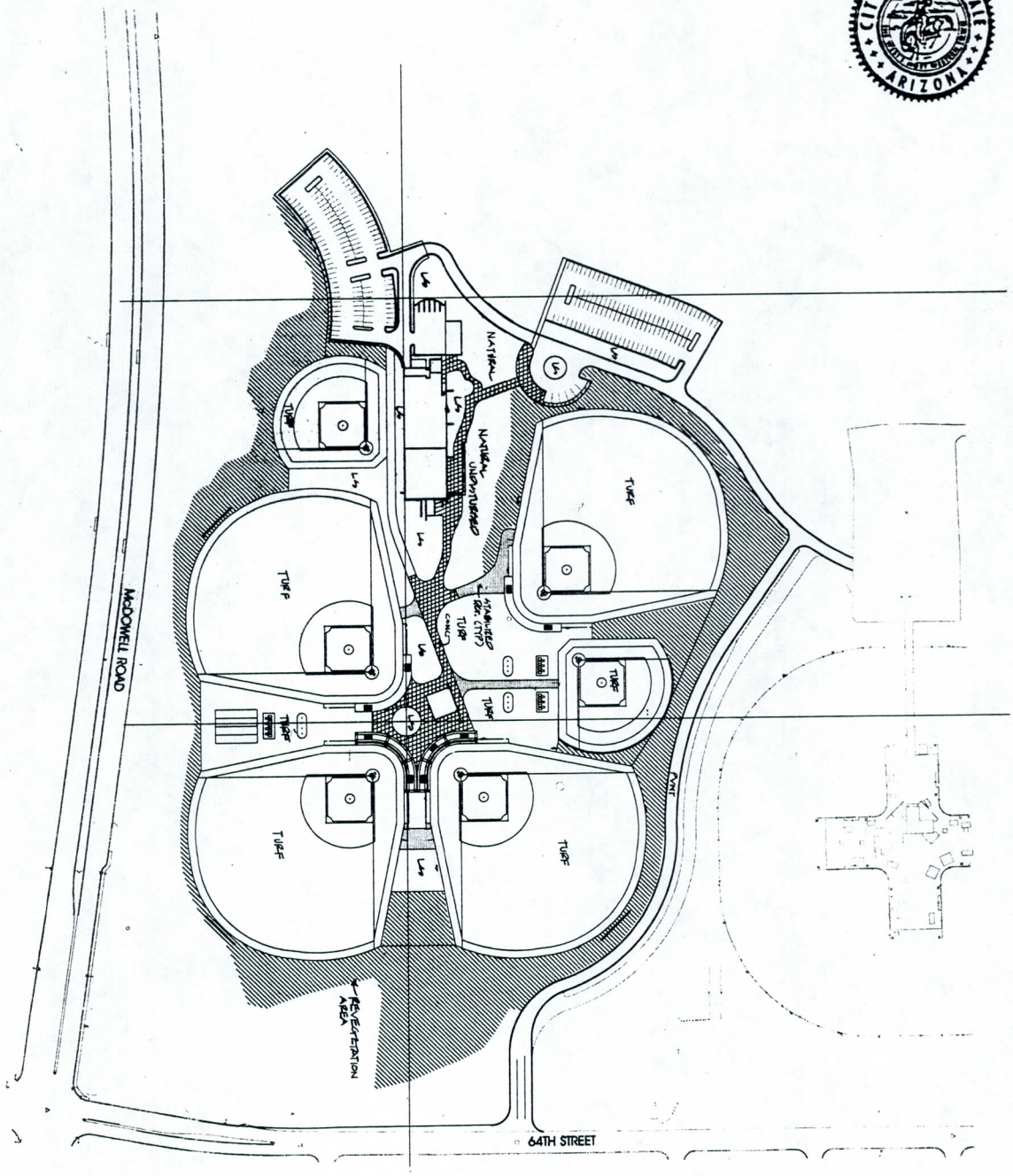



64TH ST LOOKING NORTH BETWEEN THOMAS & OSBORN




64TH ST LOOKING NORTH BETWEEN OSBORN & INDIAN SCHOOL
(Bike Lane Removed)

EXHIBIT 2




DESIGN DEVELOPMENT

# EXHIBIT 4

GROUND TREATMENT PLAN

309211300
12-22-92

DLR Group

LESCHER AND MAHONEY ARCHITECTS AND ENGINEERS

PAPAGO PARK IMPROVEMENTS BASEBALL TRAINING FACILITY

The above shows an increase in developed flows in Basins A and B. The final design along this portion of 64th Street should analyze what effect, if any, these increased flows may have upon the existing multi-barrel culverts routing flows into the McDowell Road storm drain system. It may be appropriate for the City of Phoenix to do this at the time it completes the drainage study for Papago Park Sports Complex. The benefit of the increase to Basins A and B is the decrease of flows in Basin C (24% reduction) at design Point 30, which directly contributes flow into the Hubble dip crossing and eventually to the FEMA "A" flood zone to the east. This reduction has acted to lessen the effects directly associated with the floodplain to the Hy-View subdivision. In addition, improvements associated with this study have extended the storm drain system to a point approximately 800 feet north of the intersection of McDowell. This acts to collect the street flows intercepting most of the pavement drainage before it gets to the Hubble dip crossing so that the full benefit received from the 24% reduction described above is preserved. In addition, the storm drain system is designed to convey the 10 year off-site runoff. This means that only flows greater than a 10 year storm can overtop and contribute storm flows into the Hubble dip section. The 24% reduction then applies to flows exceeding this. It is beyond the scope of this study to eliminate the above described FEMA flood zone.

Inlet design for the roadway was performed in accordance with City of Scottsdale criteria as mentioned in Section II-B, and the level of protection for street encroachment is the 100-year storm.

Another area bears mentioning in the future planning of stormwater management facilities along this stretch of 64th Street. Basin F concentrates flow to Design Point 60 approximately half way between Oak Street and Thomas Road on the west side of 64th Street. Although the headwaters to this basin originate in a residential subdivision a substantial portion contiguous to 64th Street remains undeveloped. Hydrology for this basin was computed given the present land cover assuming City requirements to include the installation of a detention/retention basin as a requirement for development. This would act to keep the basin in a "balanced" hydrological condition keeping storm flows reduced as much as possible by allowing the outfall storm drain to be smaller in size and consequently the outfall system returning east in Thomas Road. Additionally, incorporating retention or over-detentioning would reduce storm flows even further possibly allowing the storm drain to be further down sized. In the event that the City of Scottsdale feels that it can not incorporate detention in this area any re-analysis would be best left to the final design portion of the project whereby the

Thomas Road outfall storm drain would require a final drainage study as an update to this master study, supporting the construction documents of that project.

In developing the storm drain system shown along the proposed west right-of-way of 64th Street (see Exhibit 3 in map pocket), an open channel was investigated as an alternate to the closed conduit system. Early in the design process it was discovered that a 4 or 5 foot depth of channel would be required to capture off-site as well as road drainage from inlets. This would require between 40 and 50 foot of right-of-way from the back of curb or sidewalk. This would require additional encroachment into Papago Park. Additionally, there was restricted right-of-way to install an open channel south of Thomas Road adjacent to the City of Phoenix water storage tanks. In this area the storm drain system must be constructed in the roadway due to the installation of a retaining wall accommodating roadway construction. The storm drain on 64th Street as shown was located outside the roadway prism whenever possible to make future off-site tap-ins easier and to allow for maintenance outside the traveled way. Also, the added benefit of a smoother driving surface is a consideration since this is a major collector roadway having a design speed is 45 mph. Since the project is in the study/concept phase at this point, storm drains and the outfall systems were designed for open channel flow using Manning's equation with an N value = 0.012. The 10-year event was used to size the storm drain. Fine tuning the storm drain system will occur during the preliminary design phase and continue throughout final design when an acceptable pressurized system can be developed and hydraulic grade line computed for the entire storm drain system. Computations for open channel sizing can be found in the technical appendix to this report.

The final issue for discussion along this segment of the project is the outfall trunk line traveling east down Thomas Road between 64th Street and Scottsdale Road. Exhibit 3 (map pocket) shows two alternative concepts which will be discussed. Neither concept included storm flows east of the intersection of 64th Street as tributary to the outfall system, as this would go beyond the scope of work for this project. This can be investigated at the time of final design of the outfall system upon request by the City of Scottsdale.

- Thomas Road Storm Drain Outfall - Alternate No. 1

  This alternate incorporates the use of an existing 45 inch abandoned City of Phoenix waterline (employing an approximate capacity of 95 to 100 cfs) and a parallel 54 inch RCP of 5,300 feet in length tying into the existing 90 inch storm drain running south in Scottsdale Road turning east on Thomas Road. Preliminary discussions with the City of Phoenix indicate that they would allow the use of the line to the City of Scottsdale for this purpose. The advantage of this alternate is a cost saving of up to $250,000. The disadvantage is that a split flow structure and flow convergence structure will have to be built merging the two drainage systems at 64th Street and combining them into the existing 90 inch storm drain in Scottsdale Road. Before preliminary design proceeds on this option, an inspection of the existing 45 inch waterline should be performed verifying it's suitability to be used as part of a stormwater outfall system.

- Thomas Road Storm Drain Outfall - Alternate No. 2

  This alternative provides for a single point of discharge and does not us the existing 45 inch abandoned waterline. The advantage of this option is that only conventional junction structures need be installed and no split flow or flow convergence structures need be constructed. The disadvantage is the additional cost of installing a 66 inch pipe verses a 54 inch pipe over a distance of 5,300 linear feet. As mentioned above, the increase in cost is estimated to be $250,000. Of course, if the existing 45 inch abandoned waterline can not be used for some reason this alternate becomes the most viable option.

  In conversations with the City of Scottsdale they indicated that they have provided for expenditures in their future capital improvements to construct a drainage outfall system in Thomas Road. Again, pipe sizes will have to be fine tuned during preliminary/final design when hydraulic grade lines are developed, possibly using pressure flow. This may allow a slightly smaller pipe size depending on the hydraulic conditions and constraints.

## B. 64th Street North Of Thomas Road To Indian School Road

The first topic of discussion will be the resolution of the existing flooding problem at the Scottsdale Executive Villas located just north of Thomas Road at the intersection of 64th Street. The description of existing conditions was discussed previously in Section III-A. The problem can be resolved by connecting existing roadway curb inlets in the vicinity of the

intersection, as well as an existing culvert into the new storm drain system in Thomas Road. This will prevent current flows from being routed via manholes into the dry well system of the commercial site whereby existing manholes within the site, particularly at the northeast corner, "bubble up" and overflow causing flooding. The field reconnaissance and discussion with the property manager indicate the dry well system does keep up with the on-site flows but can not handle the off-site flows it receives from Thomas Road via the storm drain system. The sheet flow runoff from Thomas Road across the entrances does not overflow into the parking lot areas and into the site. Exhibit 6 depicts the re-routing of the storm drain system to resolve their flooding problems in the future.

The next area of discussion is the storm system for Thomas to Indian School. From the roadway plans and Exhibit 5 (separate document), it can be seen that the roadway design includes a sag or sump condition approximately 1,000 feet south of Osborn Road. All off-site and roadway runoff between Thomas Road and Indian School Road is collected at this point and must be conveyed to an outfall system. The only existing system is a small SRP pump station which conveys minor drainage into the cross cut canal via 10 inch force main. Three alternatives for an outfall system were examined. They are as follows:

<u>Alternate No. 1</u> - Install a pump station employing approximately 1,700 feet of 36 inch diameter force main to the point of delivery in Thomas Road. Total Dynamic Head (TDH) is composed of Total Static Head (difference in elevation) = H, plus the total friction head loss through the pipe/valve delivery system = $H_L$ plus the Velocity Head, $H_V = V^2/2g$.

Therefore: $TDH = H + H_L + H_V$ where;

$H_L$ by Darcy's Equation, $= f\left(\frac{L}{D}\right)\left(\frac{V^2}{2g}\right)$ Use f = 0.013 (Concrete Pipe)

$H_V = \frac{V^2}{2g}$ = Velocity Head

Using a 10-year flow rate of Q10 = 108 cfs (see Exhibit 3 in map pocket) and 36 inch RCP force main (Area = 7.069 $FT^2$).

The Static Head difference to Thomas Road is approximately 16.5 feet.

Velocity V = 108/7.069 = 15.28 fps

$$H_L = 0.013 \left(\frac{1700}{3}\right)\left(\frac{15.28^2}{2(32.2)}\right) = 26.7 \text{ feet}$$

Headloss, $H_L$ = Say 30 feet (Add 3.3 feet for miscellaneous valve losses)

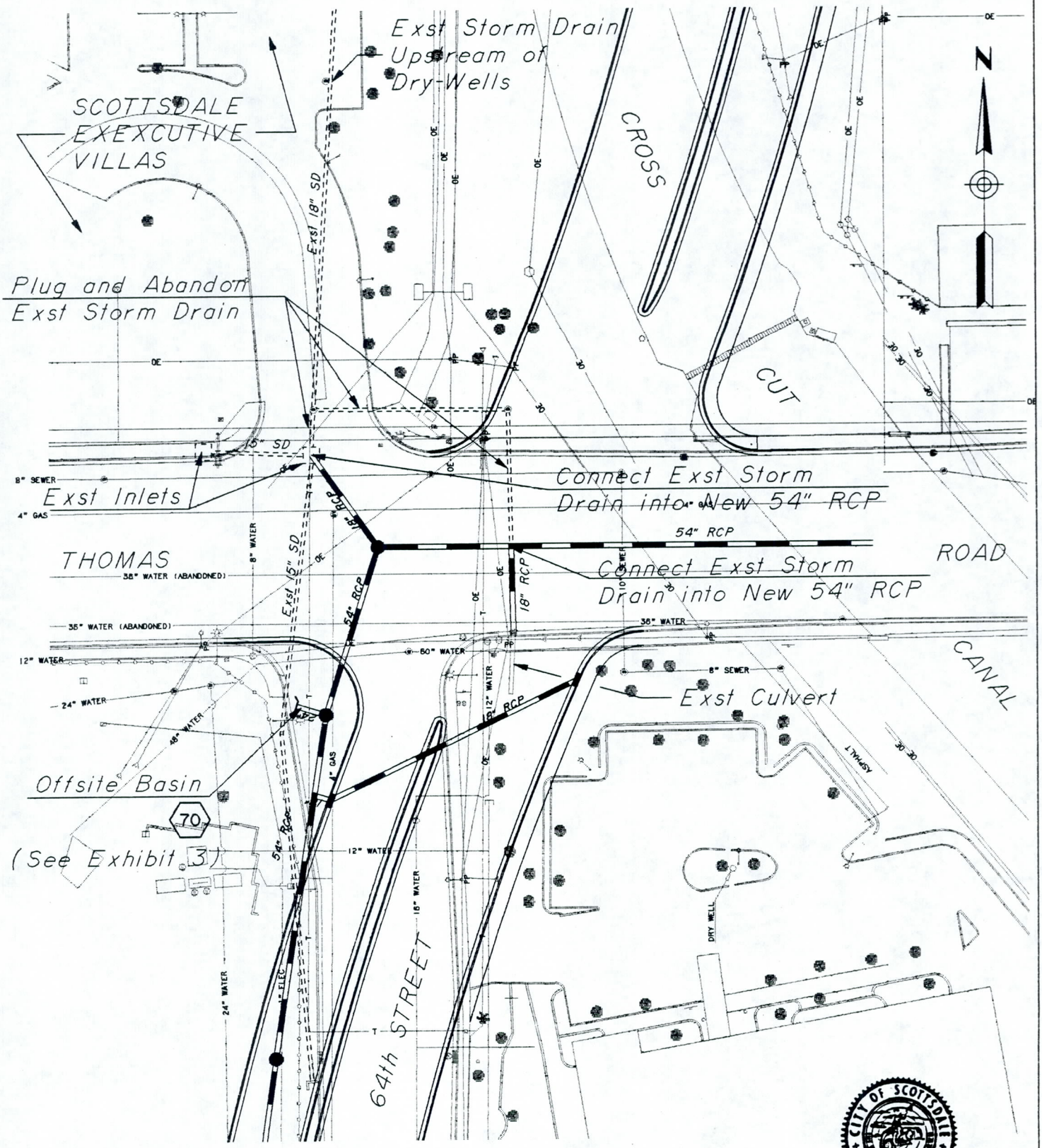

Exst Storm Drain Upstream of Dry-Wells
SCOTTSDALE EXECUTIVE VILLAS
CROSS
CUT
Exst 18" SD
Plug and Abandon Exst Storm Drain
15" SD
8" SEWER
Exst Inlets
4" GAS
Connect Exst Storm Drain into New 54" RCP
54" RCP
THOMAS
ROAD
Exst 15" SD
18" RCP
Connect Exst Storm Drain into New 54" RCP
36" WATER (ABANDONED)
36" WATER
12" WATER
60" WATER
8" SEWER
CANAL
24" WATER
Exst Culvert
48" WATER
Offsite Basin
70
(See Exhibit 3)
12" WATER
18" WATER
64th STREET
DRY WELL
ASPHALT
N

EXHIBIT 6

Velocity Head = $H_V = \left( \frac{15.28^2}{2(32.2)} \right)$ = 3.6 feet, Use 4 feet

TDH = 16.5 + 30 + 3.6 = 50.1 (round off)

Use TDH = 50 feet with 36 inch force main.

Computations reveal that using a 42 inch force main required a TDH = 33 feet. The cost savings in pump requirements are offset by the additional cost of the pipe and appurtenances over 1,700 feet x $30/l.f. = $50,000. The above TDH of 50 feet appears satisfactory for purposes of this concept study. The horsepower requirements of the pump are given by the equation:

$HP = \frac{QrH}{550}$ / Efficiency (as a decimal)  H = total dynamic head, TDH

Assuming an efficiency of 80% = 0.80

$HP = \frac{108\ (62.4)\ (50)}{550}$ / 0.80

HP of Pump = 765 (rounded) (For 36" Force Main)

HP of Pump = 505 (For 42" Force Main)

The above information was provided to demonstrate the significant cost that will be incurred by this alternate. It doesn't include other associated costs such as energy for electrical power and maintenance over the lifetime of the facility. These requirements are for a 10-year storm to be evacuated.

Also, the outfall system shown in Exhibit 3 (map pocket) in Thomas Road, as Alternate 1 and 2, would have to be increased in size to accommodate this flow. Using a triangular hydrograph approach to combine hydrographs at Design Points 70 and 99, due to the different times of concentration, a 10 year peak flow of approximately 330 cfs is obtained. This flow can not be conveyed by the 66 inch conduit in open channel flow, shown in Alternate 2, in Map Exhibit 3 (map pocket). Therefore the pipe must be upsized to 72 inch for this scenario. This pipe will convey up to 370 cfs in open channel flow, 12% more capacity then is needed.

For reasons described above, this alternate was rejected early in the concept process because it doesn't appear to support a favorable benefit/cost ratio, even though a complete economic analysis was not performed. The City of Scottsdale may undertake such an economic analysis as part of its capital improvements program or as part of preliminary/final design of this project.

Alternate No. 2 - Install a pump station employing approximately 950 feet of 36 inch diameter force main to the point of delivery in Osborn Road. This has the advantage of saving 750 feet of force main over Alternate No. 1. In addition, because the length of force main is shorter and the static head is less at about 3.0 feet, the TDH under the alternate is reduced to 24 feet, less than half of that for Alternate 1. Also the horsepower requirement is reduced to 370, similarly about 50% less than Alternate 1, using a pump efficiency of 80%.

The disadvantage of this alternate is that a new outfall system in Osborn will be required resulting in the construction of about 5,150 feet of conduit terminating in Scottsdale Road where it taps into an existing 84" RCP storm drain interceptor upstream of the termination point of the Thomas Road outfall system. A significant advantage of the Osborn Road outfall system is the possibility of capturing additional runoff from the residential area between 64th Street and Scottsdale Road. This system would require a 48 inch outfall line in Osborn (under open channel conditions under maximum capacity) at a grade of about 0.35%. An additional disadvantage would be that this alternate, like Alternate 1, employs a pump station requiring operation and maintenance expense over the lifetime of the facility. For this reason Alternate 2 was also rejected, even if the up front cost would be a little less than that of a deeper gravity system employing a larger outfall conduit.

Alternate No. 3 - Install a gravity flow outfall storm drain in Osborn Road. It is feasible to construct a gravity flow outfall system, however the installation cost would be more expensive than conventional techniques. This alternative would require 750 feet of 48 inch gravity storm drain, falling at 0.50% grade to the intersection of Osborn Road. The cover depth ranges from 2.5 feet at the roadway sag at station 79 + 11 to about 14 feet at the intersection of Osborn. This will make installation more expensive and protective sheeting may be necessary. Since this 48 inch pipe is running adverse to the road grade it enters Osborn Road 7.5 feet deeper than Alternate 2. This means that the available grade to connect to Scottsdale Road is about 0.20%. This would require a 54 inch storm drain under gravity flow conditions. Another disadvantage of Alternate 3 is that this 54 inch would have to be constructed quite deep in Osborn Road. The cover depth is 14 feet at 64th Street (19.5 feet deep to the bottom of pipe) and four feet at Scottsdale Road (9.5 feet deep to bottom of pipe). This depth will require non-conventional construction techniques, such as protective shoring/bracing or special

trenching slip form techniques and may result in installation costs 50% greater than normally expected. However, once the system is installed it won't require any mechanical pumping nor the operational and maintenance expenses associated with a pump. Even though it is likely that the gravity system may be more expensive initially, the payback period would be short in relative terms to the useful life of the system. It is for this reason that Parsons Brinckerhoff recommends Alternate 3 as the best solution to constructing a storm drain outfall system for that portion of 64th Street draining between Thomas and Osborn Roads. Table 2 below shows a summary of the alternatives discussed above and the important parameters presented for comparison.

**TABLE 2**

**OSBORN/THOMAS ROAD STORM DRAIN OUTFALL ALTERNATIVES**

| Alternative | Pump Requirements | | Force Main | | Storm Drain Outfall | | Remarks |
|---|---|---|---|---|---|---|---|
| | TDH | HP | Size | Length | Size | Length | |
| 1 Thomas Road | 50 | 765 | 36" | 1,700 | 72" | 5,300 | The cost comparisons involve the cost of a pump and station, plus operation and maintenance, 36" force main and increasing the outfall in Thomas Road from 66 inch to 72 inch storm drain. |
| 2 Osborn Road | 24 | 370 | 36" | 950 | 48" | 5,150 | Cost comparisons involve the cost of a pump and station, plus operation and maintenance, 36" force main and installing a 48 inch outfall storm drain in Osborn Road. |
| 3* Osborn Road | N/A | | N/A | | 48"<br>54" | 950<br>5,150 | Cost comparisons involve the installation of 48 inch and 54 inch gravity storm drain in Osborn Road involving deep excavation and more expensive installation construction costs. But low maintenance costs, over lifetime. |

*Indicates recommended alternative by Parsons Brinckerhoff.

Table 3 shows relative pipe cost, excluding pump station and O&M costs, to depict an order of magnitude cost of the alternatives presented herein.

**TABLE 3**

**OSBORN/THOMAS ROAD STORM DRAIN OUTFALL**

**ALTERNATIVE COST COMPARISONS**

**Alternative 1**

- Include Pump Station and O&M Costs
- Increase in Thomas Road Outfall Storm Drain from 66" to 72" = 5,300 l.f. x $45/l.f. = $238,500
- 36" Force main = 1,700 l.f. x $55/l.f. = $93,500
- Pump Station And Backup Generator = $725,000
- Operation, Maintenance And Replacement Over 20 Years = $686,430

ROUNDED TOTAL COST = $1,700,000
(Pump is 765 H.P. with TDH = 50 feet)

**Alternative 2**

- Include Pump Station and O&M Costs
- 48" Storm Drain in Osborn Road = 5,150 l.f. x $100/l.f. (Normal Exc.) = $515,000
- 36" Force Main = 950 l.f. x $55/l.f. = $52,250
- Pump Station And Backup Generator = $625,000
- Operation, Maintenance And Replacement Over 20 years = $457,620

ROUNDED TOTAL COST = $1,650,000
(Pump is 370 H.P. with TDH = 24 feet)

**Alternative 3**

- Gravity Flow System (No Pumps)
- 48" Storm Drain Outfall on 64th Street 950 l.f. x $100/l.f. = $95,000
- 54" Storm Drain Outfall in Osborn Road 5,150 l.f. x $150/l.f. (over excavation) = $772,500

ROUNDED TOTAL COST = $870,000

(See Technical Appendix "H" for Economic Analysis)

## C. Indian School Road, 64th Street To 68th Street

The extent of storm drain and drainage improvements will be minimal for this part of the project since it is at the top of the watershed and we will only be adding a left turn lane. Therefore no hydrology was developed for this section of road as it will be better left for preliminary/final design. Exhibit 3 (map pocket) indicates that present drainage sheet flows southeasterly. it is not foreseen that this pattern will change due to adding the lane. Please see Exhibit 5 - On-Site/Roadway Drainage Plans (Separate document) for the developed storm drain system of the entire project.

## D. City Of Phoenix Sports Complex

Exhibit 4 shows the extent of improvements for this facility. Reference 5 was used to obtain off-site hydrology for the site. Since that project has done a suitable job of conveying and retaining excess peak flows due to the development, no adverse impacts were found to the 64th Street project. Remaining off-site flows from Papago Park have been directed into a storm drain system and thereby directed into the Thomas Road outfall system. Again, even if the above improvements to the sports complex are never built this outfall system improves the existing condition substantially.

## E. Arizona Cross Cut Canal Crossing

At present there exists a bridge crossing at the intersection of the cross cut canal and Thomas Road. Approximately 25 feet upstream (north) of this crossing is a radial gate structure in the canal that acts to lower the water surface profile about 2.5 feet downstream of the gate prior to flow entering the bridge section under Thomas Road. SRP was contacted to obtain a high water surface profile of the cross cut canal. Parsons Brinckerhoff was directed to use the "black mark" indicating previous high water levels since operations personnel at SRP indicated the computed water surface profile was not available since the canal was built many years ago.

It is expected that the radial gate structure will need to be moved upstream to a position north of the end of a new bridge structure over the cross cut canal to facilitate the extension of the new 64th Street alignment. This new roadway will approach the canal crossing at a downward minimum grade of 0.40% intended to provide as much clearance over the canal as possible. The relocation of the radial gate will further help this cause. SRP has indicated that 1.5 feet of freeboard will be necessary at the new canal crossing. It is estimated that 4.5 to 5.0 feet of clearance will be needed from the new roadway finish grade to the high water surface level.

## F. Developed Hydrology

The hydrology computations were developed using the RATIONAL Method for inlet design employing curb opening inlets without a grate section such as the City of Phoenix Standard Detail P-1569, Type "M" with wing sizes of 3, 6, 10 or 17 feet. A minimum time of concentration, for urban conditions, of 5 minutes was used. HEC-12 computational procedures were used in sizing and spacing the inlets to meet the city of Scottsdale's flow spread requirements for the 100-year event, allowing at least one dry lane of travel in each direction for major collector/minor arterial streets. The computations can be found in the Technical Appendix of this report.

As mentioned previously, off-site flows that were substantial in nature, such as those into design points 30, 50, and 70, from south of Oak Street to the intersection of McDowell, were separated from the roadway runoff. Capturing this flow into the storm drain system separate from inlet drainage is desirable, thereby allowing inlet hydrology to be done separately from the off-site flows. The storm drain trunk line would then consider the controlling peak flow from the maximum time of concentration. In larger systems this is frequently the case. The downstream inlets in the system do not add to the peak flow of the outfall and computations are based on the controlling flows, e.g. off-site flows in this case.

In the section of 64th street from Thomas Road to Indian School Road portions of the off-site tributary areas were combined with the street flows where areas were small and runoff coefficients below fully paved conditions were present. These areas were:

1. That area west of 64th Street up to and beyond the retaining wall. Essentially this will include the area east of the cross cut canal to the edge of the new 64th Street alignment. This occurs over the full distance from Thomas to Indian School Roads.

2. That area east of 64th Street in the residential neighborhood, primarily consisting of apartment complexes, noted as Basin "J" in Exhibit No. 3. The limits of this area run from Indian School Road to Osborn Road. All other off-site basins, e.g. Basins H, I and K were kept separate from roadway hydrology as was done above from McDowell to Thomas Road.

# V. SUMMARY/RECOMMENDATIONS

## A. Summary Of Drainage Improvements

Exhibit 3 (Off-Site Basin Map in map pocket) and Exhibit 5 (On-Site/Roadway Plans a separate document), show the proposed storm drain infrastructure developed for the widening and new alignment of 64th Street. The storm drain system is comprehensive in nature and presents alternative conceptual designs that will meet the needs of local residents and the City for years to come.

A particular challenge of this study was to develop outfall drainage systems and present alternatives therein. It is realized that the recommended improvements lie outside of the normal funding for 64th Street and must be implemented from the City of Scottsdale's capital improvement plan for storm drainage facilities.

The overall cost of the infrastructure presented in this study are in the range of $2.4 million dollars. This does not include a new bridge structure for crossing the cross cut canal north of Thomas Road. Please refer to the Design Concept Report for the overall project cost estimate (Reference 4).

## B. Recommendations

The contents of this report are intended to present a comprehensive concept plan for drainage improvements for this project. Some refinement of these improvements will be necessary during the preliminary/final design when construction plans and specifications are prepared. The study provides a framework for the City of Scottsdale to choose between alternatives. This study also provides a basis for which future storm drainage capital improvements are warranted, in conjunction with the implementation of this project.

In addition, this report will allow the development of phasing of construction improvements should the City decide to proceed in that manner.

In conclusion, it is recommended that this study be utilized in the development of future roadway widening and street construction for 64th Street, for any private development which occurs along this corridor, or any upstream developments tributary to these intended improvements. Although it is not the intended purpose of this study to eliminate the FEMA "A"

flood zone downstream from this project, this study incorporates mitigation measures that will help in that regard and future measures that would have to be taken in order to eliminate the FEMA flood zone. No adverse impacts are expected to occur as a result of the storm drainage improvements presented herein. On the contrary, these improvements will facilitate new roadway improvements for 64th Street while at the same time improving conditions downstream and responsibly conveying upstream headwaters from off-site tributary lands.

## VI. REFERENCES


1. City of Scottsdale, Arizona, *"Design Procedures And Criteria"*, Section 2, Drainage Report Preparation, Revised July 1985.

2. City of Scottsdale, Arizona, *"Hydrology Design Standards and Procedures"*, Section 2.2, Revised February 1992.

3. City of Scottsdale, Arizona, *"Design of Facilities To Manage Stormwater Runoff"*, Section 3, most recent edition.

4. *"Design Concept Report for 64th Street/Indian School Road"* for the City of Scottsdale, by Parsons Brinckerhoff, September 1993.

5. *"Final Drainage Study For Papago Park"* for the City of Phoenix Engineering and Architecture Services Department, by Desert Land Engineering, DLE-Job No. 92119, February 1993.

6. *"Drainage of Highway Pavements"*, Hydraulic Engineering Circular No. 12 (HEC-12) by the U.S. Department of Transportation, Federal Highway Administration, FHWA-TS-84-202, March 1984.

7. *"Storm Drain Design Manual - Storm Drains with Paving of Major Streets"*, City of Phoenix, Revised July 1987.

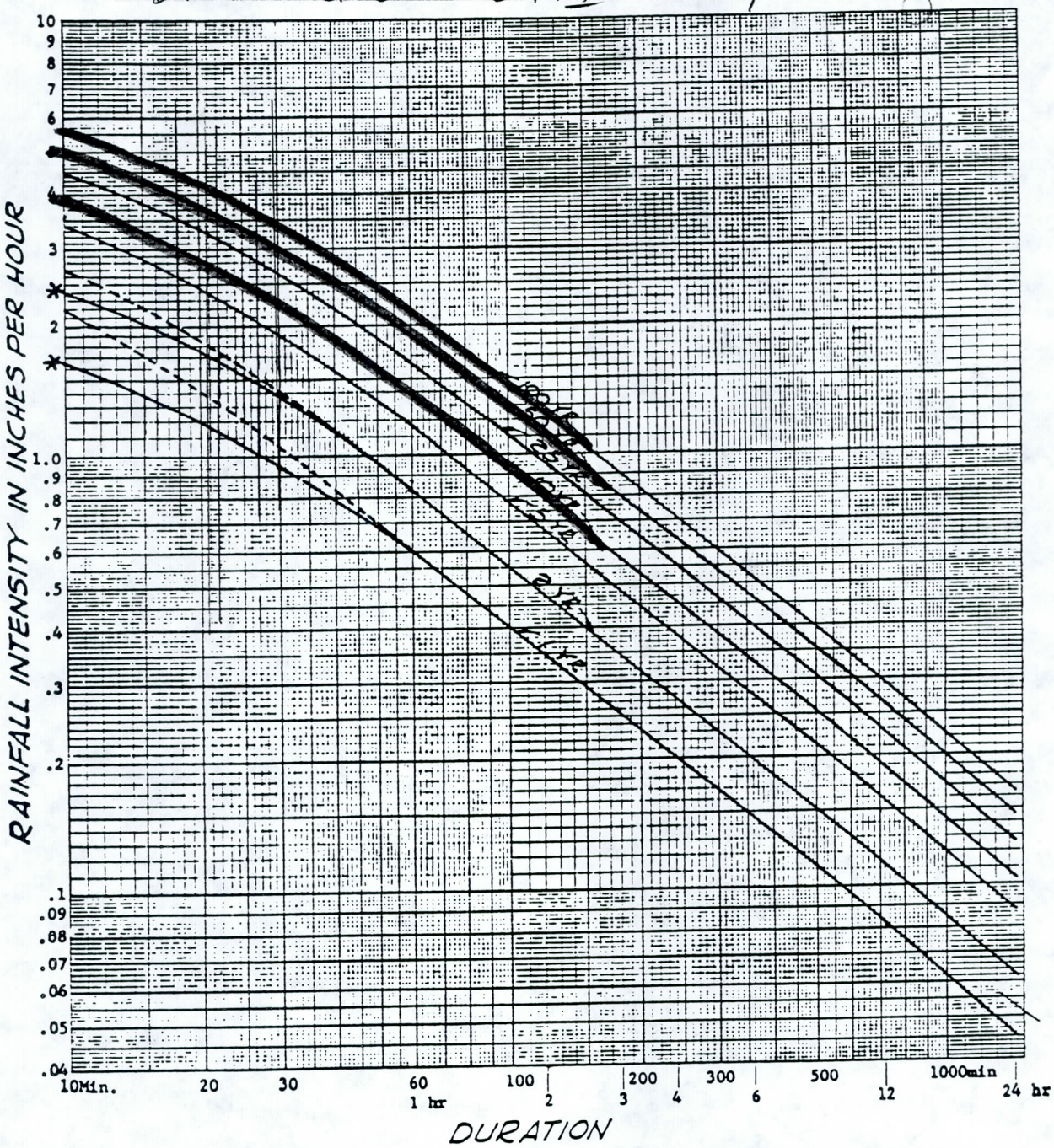
8. *"Open Channel Hydraulics"* by Ven Te Chow, Ph.D., 1959, McGraw-Hill book publishers.

9. *"Handbook of Hydraulics"*, 5th Edition by King and Brater, 1963, McGraw-Hill publishers.

# Part A Off-Site Hydrology Computations

07-20-93

USE FOR RUNOFF @ DESIGN POINTS 10, 20, 30 & 40
WITHIN CITY OF PHOENIX, @ PAPAGO PARK DEVELOPMENT.
DRAINING ONTO 64th STREET, NORTH OF McDOWELL RD




RAINFALL INTENSITY-DURATION-FREQUENCY RELATION
FOR PHOENIX, ARIZONA
(Partial Duration Series)

Curves are based on methods of U.S. Weather Bureau Technical Papers Nos. 28 and 40 and rainfall data prepared by U.S. Weather Bureau Office of Hydrology for the Soil Conservation Service, March 1967

* Curves revised June 1975 to reflect new information from WR-44.

— DEVELOPED CONDITIONS —

**ARIZONA HIGHWAY DEPARTMENT**
**BRIDGE DIVISION**

BASIN "A"

**HYDROLOGIC DESIGN DATA SHEET**
**RATIONAL METHOD**

## LOCATION DATA

Highway 64TH STREET / SCOTTSDALE County MARICOPA
Location MCDOWELL TO THOMAS
Project No. 454 IP 108 Station
Name of Stream OFFSITE FLOWS TO DES. POINT (10) PAPAGO PARK (PHOENIX)

## DESIGN DATA

| | | | | | |
|---|---|---|---|---|---|
| Design Frequency | | 10 | 50 | 100 | years |
| Drainage Area | $A_1$ | | | | acres |
| | $A_2$ | " | " | 27.10 | acres |
| Drainage Length | | " | " | 2800 | feet |
| Elevation | | | | | |
| Top of Drainage Area | | | | 1338 | feet |
| At Structure | | | | 1285 | feet |
| Drainage Area Slope | | | | 1.9 | % |
| Precipitation | | | | | |
| P = 6-hour | | | | | inches |
| P = 24-hour | | | | | inches |

## DESIGN COMPUTATIONS

| | | | | | |
|---|---|---|---|---|---|
| Precipitation $P_1$ = 1-hour | | | | | inches |
| Time of Concentration 17 + 4 MIN (KIRPICH EQU.) From Des Pt 1 | Tc | " | " | 21 | minutes |
| Rainfall Intensity (SEE REF. 7) | i | 2.8 | 3.7 | 4.2 | * inches/hour. |
| Curve Numbers | $CN_1$ | | | | |
| | $CN_2$ | | | | |
| Weighted Curve Number | $CN_W$ | | | | |
| Runoff Coefficient | C | " | " | 0.42 | |
| Peak Discharge Qp = CiA = | | 32 | 42 | 48 | cfs |

$T_c = \frac{0.04593 L^{0.77}}{S^{0.385}}$ (SIN %)

* C.O.P. RAINF. INTEN. USED

Computed by B. BATTISTELLO Date 07-22-93

CHECKED BY _____ DATE: _____

# FIGURE 2-22

NOTE: FLOWS FOR 10 & 100 YR. TAKEN FROM PAPAGO PK. DRAINAGE STUDY (REF. 7)

07-22-93
2/12

– DEVELOPED CONDITIONS

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

BASIN "B"

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

## LOCATION DATA

Highway 64TH STREET / SCOTTSDALE County MARICOPA
Location McDOWELL TO THOMAS
Project No. 4541P108 Station PAPAGO PK. DEV.
Name of Stream OFFSITE FLOWS TO DES PT. (20) IS DES PT. 30 IN PAPAGO PK. REP.

## DESIGN DATA

| | | | | | |
|---|---|---|---|---|---|
| Design Frequency | | 10 | 50 | 100 | years |
| Drainage Area | $A_1$ | | | | acres |
| | $A_2$ | " | " | 53.80 | acres |
| Drainage Length | | " | " | 3550 | feet |
| Elevation | | | | | |
| Top of Drainage Area | | | | 1340 | feet |
| At Structure | | | | 1286 | feet |
| Drainage Area Slope | | | | 1.5 | % |
| Precipitation | | | | | |
| P = 6-hour | | | | | inches |
| P = 24-hour | | | | | inches |

## DESIGN COMPUTATIONS

| | | | | | |
|---|---|---|---|---|---|
| Precipitation $P_1$ = 1-hour | | | | | inches |
| Time of Concentration | Tc | | | 22 | minutes |
| Rainfall Intensity | i | 2.7 | 3.6 | 4.0 | inches/hour |
| Curve Numbers | $CN_1$ | | | | |
| | $CN_2$ | | | | |
| Weighted Curve Number | $CN_W$ | | | | |
| Runoff Coefficient | C | " | " | 0.42 | |
| Peak Discharge Qp = CiA = | | 61 | 81 | 90 | cfs |

Computed by B. BATTISTELLO Date 07-22-93

CHECKED BY _____ DATE _____

# FIGURE 2-22

NOTE: FLOWS FOR 10 & 100 YR TAKEN FROM PAPAGO PK. DRAINAGE STUDY (REF 7.)

07-22-93

3/12

— DEVELOPED CONDITIONS —

**ARIZONA HIGHWAY DEPARTMENT**
**BRIDGE DIVISION**

BASIN "C"

**HYDROLOGIC DESIGN DATA SHEET**
**RATIONAL METHOD**

## LOCATION DATA

Highway 64TH STREET / SCOTTSDALE County MARICOPA
Location McDOWELL TO THOMAS
Project No. 4541 P108 Station PAP. PARK DEV.
Name of Stream OFFSITE FLOW TO DES. PT. (30), IS DES. PT. 40 IN PAPAGO PK. REPORT

## DESIGN DATA

| | | | 10 | 50 | 100 | |
|---|---|---|---|---|---|---|
| Design Frequency | | | | | | years |
| Drainage Area | DESERT PARK | $A_1$ | | | 28.6 | acres |
| | | $A_2$ | | | 7.3 | acres |
| | | | " | " | 35.9 = TOT. | |
| Drainage Length | | | " | " | 3750 | feet |
| Elevation | | | | | | |
| Top of Drainage Area | | | | | 1335 | feet |
| At Structure | | | | | 1289 | feet |
| Drainage Area Slope | | | | | 1.2 | % |
| Precipitation | | | | | | |
| P = 6-hour | | | | | | inches |
| P = 24-hour | | | | | | inches |

## DESIGN COMPUTATIONS

| | | | | | | |
|---|---|---|---|---|---|---|
| Precipitation $P_1$ = 1-hour | | | | | | inches |
| Time of Concentration 5+22 | | Tc | | | 27 | minutes |
| Rainfall Intensity | | i | 2.4 | 3.2 | 3.6 | inches/hour |
| Curve Numbers $\frac{28.6}{35.9}(0.42)$ = | | $CN_1$ | | | 0.33 | $\frac{1.00}{35.9}(.95)$ + |
| | | $CN_2$ | | | 0.31 | $\frac{6.3}{35.9}(0.20)$ = 0.0 |
| Weighted Curve Number | | $CN_W$ | | | | |
| Runoff Coefficient | | $C_W$ | | | 0.34 | |
| Peak Discharge Qp = CiA = | | | 30 | 39 | 44 | cfs |

Computed by B. BATTISTELLI Date 07-22-93

CHECKED BY _____ DATE _____

# FIGURE 2-22

NOTE: FLOWS FOR 10 & 100 YR WERE TAKEN FROM PAPAGO PK DRAINAGE STUDY (REF.)
→ $i_{10}$ GIVEN AS 2.8 WAS INCORRECT — SHOULD BE = 2.4 IN/HR.

07-23-93

4/12

— EXISTING CONDITIONS —
(PRESENTLY UNDEVELOPED)

**ARIZONA HIGHWAY DEPARTMENT**
**BRIDGE DIVISION**

BASIN "D"

**HYDROLOGIC DESIGN DATA SHEET**
**RATIONAL METHOD**

## LOCATION DATA

Highway 64TH. STREET / SCOTTSDALE County MARICOPA
Location McDOWELL TO THOMAS RD.
Project No. 4541P108 Station PAPAGO PARK DEVEL.
Name of Stream OFFSITE FLOW TO DES. PT. (40) IS DES. PT 50 IN PAPAGO PK REPORT

## DESIGN DATA

| | | | | | |
|---|---|---|---|---|---|
| Design Frequency | | 10 | 50 | 100 | years |
| Drainage Area | $A_1$ | | | | acres |
| | $A_2$ | " | " | 22.1 | acres |
| Drainage Length | | " | " | 1650 | feet |
| Elevation | | | | | |
| Top of Drainage Area | | | | 1336 | feet |
| At Structure | | | | 1297 | feet |
| Drainage Area Slope | | | | 2.4 | % |
| Precipitation | | | | | |
| P = 6-hour | | | | | inches |
| P = 24-hour | | | | | inches |

## DESIGN COMPUTATIONS

| | | | | | |
|---|---|---|---|---|---|
| Precipitation $P_1$ = 1-hour | | | | | inches |
| Time of Concentration | Tc | | | 10 | minutes |
| Rainfall Intensity | i | 3.8 | 5.0 | 5.5 | inches/hour |
| Curve Numbers | $CN_1$ | | | | |
| | $CN_2$ | | | | |
| Weighted Curve Number | $CN_W$ | | | | |
| Runoff Coefficient | C | " | " | 0.35 | Desert Soil Group B to C |
| Peak Discharge Qp = CiA = | | 30 | 39 | 43 | cfs |

$$T_c = \frac{0.04593\, L^{0.77}}{S^{0.385}}$$
(S IN %)

Computed by B. BATTISTELLO Date 07-23-93
CHECKED BY: DATE

# FIGURE 2-22

NOTE: FLOWS FOR 10 & 100 YR. WERE TAKEN FROM PAPAGO PK. DRAINAGE ST. (REF.)
TC ADJUSTED TO BE 10 MIN (MINIMUM) ($i_{10}$ = 3.8, $Q_{10}$ = 30 & $i_{10}$ = 5.5, $Q_{100}$ = 43)

Rev. 9-13-93

5/12

PRESENT DEVELOPED CONDITION
(INCLUDES RUNOFF FROM BASINS C, D & E)

**ARIZONA HIGHWAY DEPARTMENT**
**BRIDGE DIVISION**

@ BASIN "E"

**HYDROLOGIC DESIGN DATA SHEET**
**RATIONAL METHOD**

**LOCATION DATA**

Highway 64TH STREET/SCOTTSDALE County MARICOPA
Location 64TH AND OAK ST. INTERSECTION
Project No. 4541P108 Station SEE EXHIBIT 3
Name of Stream OFFSITE FLOW TO DES. PT. (50) LABELED AS DES PT. 45 IN PAPAGO PARK REPORT.
— INCLUDES RUNOFF FROM NATIONAL GUARD ARMORY —

**DESIGN DATA**

| | | | | | |
|---|---|---|---|---|---|
| Design Frequency | | 10 | 50 | 100 | years |
| Drainage Area | $A_1$ | 22.1 | " | " | acres |
| | $A_2$ | 24.8 | " | " | acres |
| (BASIN "C") | $A_3$ | 35.9 | " | " | |
| Drainage Length = 3000' | $A_{TOT}$ | 82.8 | " | " | feet |
| Elevation | | | | | |
| Top of Drainage Area | | | | 1336 | feet |
| At Structure | | | | 1284 | feet |
| Drainage Area Slope | | | | 1.7 | % |
| Precipitation | | | | | |
| P = 6-hour | | | | | inches |
| P = 24-hour | | | | | inches |

FROM DES. PT. NO. 40

Tc FROM PT 40 = $0.04593(3000^{0.77})/(1.7)^{0.385}$

$T_{c(40)}$ = 17.8 MIN.

Longest Tc → FROM BASIN "C" CONTROLS

**DESIGN COMPUTATIONS**

| | | | | | |
|---|---|---|---|---|---|
| Precipitation $P_1$ = 1-hour | | N/A | " | " | inches |
| Time of Concentration | Tc | 29.5 | 29.5 | 29.5 | minutes |
| Rainfall Intensity | i | 2.25 | 3.0 | 3.4 | inches/hour |
| ~~Curve Numbers~~ "C" COEFFICIENTS | $C_1$ $CN_1$ | | | 0.35 | Area = 22.1 Ac. |
| | $C_2$ $CN_2$ | | | 0.71 | Area = 24.8 " (*) |
| ~~Weighted Curve Number~~ | $C_3$ $CN_W$ | | | 0.34 | Area = 35.9 |
| Runoff Coefficient | $C_W$ | 0.45 | 0.45 | 0.45 | |
| Peak Discharge Qp = CiA = | | 84 | 112 | 127 | cfs |

Tc = 27 + 1100/7.3 fps(60) = 27 + 2.5 = 29.5 MIN (FROM BASIN "C")

(Tc FROM BASIN "C" CONTROLS)

$C_W = \frac{22.1}{82.8}(0.35) + \frac{24.8}{82.8}(0.71) + \frac{35.9}{82.8}(0.34)$

$C_W = 0.45$

Computed by B. BATTISTELLO Date 09-13-93 (Rev.)

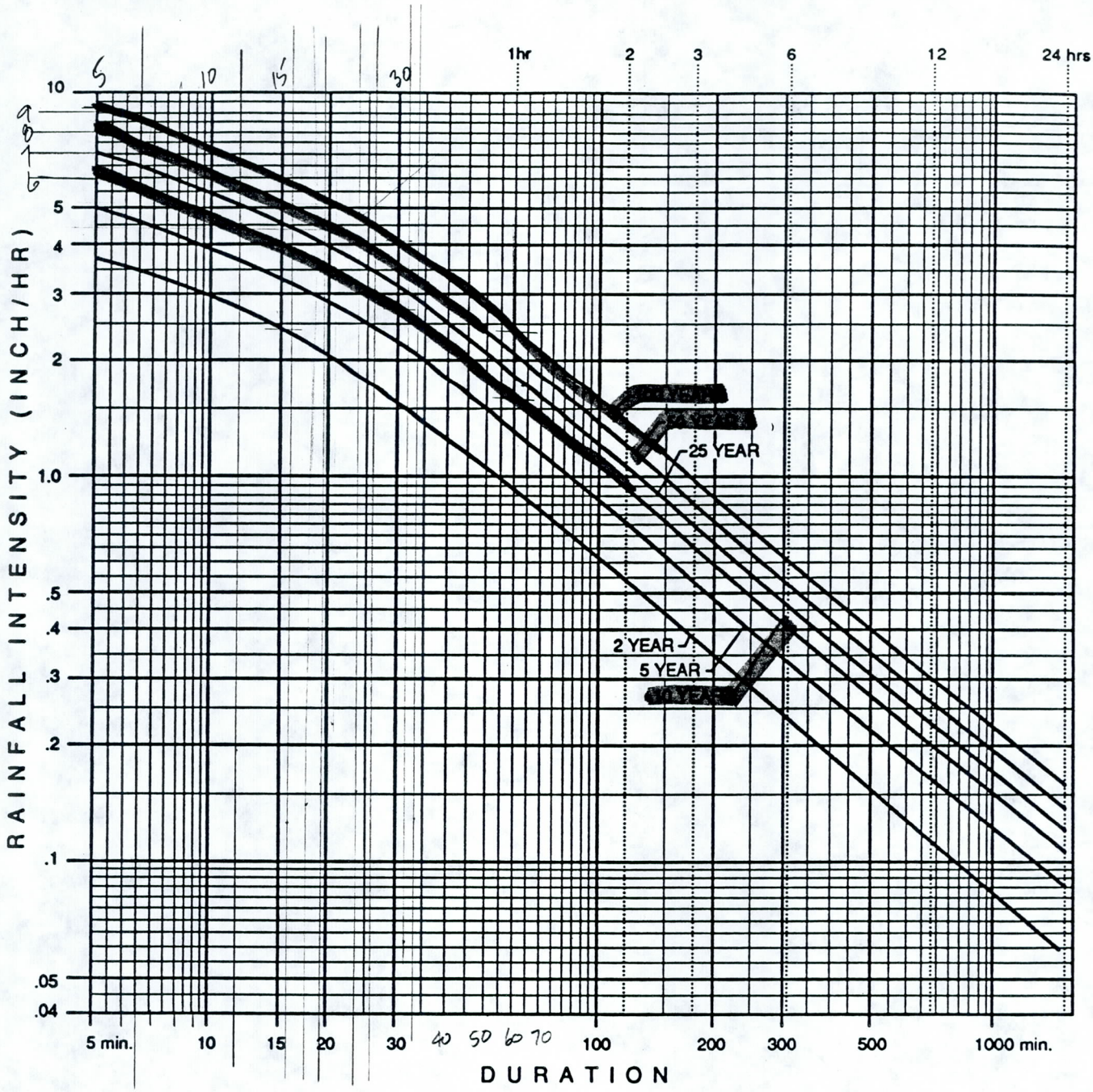
(*) $C_2$ TO DES. PT. (50)

$C_a$ (COMMERCIAL) $= 0.90\left(\frac{450 \times 1350}{43,560}\right)/24.8$
$= 0.51$

$C_b = \frac{10.85\ Ac}{24.8} \times 0.45 = 0.20$

$C_2 = C_a + C_b = 0.51 + 0.20 = 0.71$

**FIGURE 2-22**




# FIGURE 2.2-13

Rainfall Intensity-Duration-Frequency Relation (Phoenix Metro Area)

Source: Hydrologic Design Manual for Maricopa County

| Land Use | "C" Value |
|---|---|
| **Composite Area-wide Values** | |
| Commercial and industrial areas: | 0.90 |
| Residential areas-single family (average lot size): | |
| R1-190, 130, 70, 43 (one acre or greater/lot): | 0.45 |
| R1-35 (35,000 sq. ft./lot): | 0.48 |
| R1-18 (18,000 sq. ft./lot): | 0.52 |
| R1-10 (10,000 sq. ft./lot): | 0.57 |
| R1-7 (7,000 sq. ft./lot): | 0.63 |
| Townhouses: | 0.55 |
| Apartments and condominiums: | 0.65 |
| **Specific Surface Type Values** | |
| Paved streets or parking lot (concrete or asphalt), roofs, dirveways, etc. | 0.95 |
| Lawns, golf courses, and parks (grassed areas): | |
| Hydrologic soil group B: | 0.33 |
| Hydrologic soil group C: | 0.56 |
| Hydrologic soil group D: | 0.66 |
| Undisturbed natural desert or desert landscaping (no impervious weed barrier): | |
| Hydrologic soil group B: | 0.31 |
| Hydrologic soil group C: | 0.49 |
| Hydrologic soil group D: | 0.56 |
| Desert landscaping (with impervious weed barrier) | 0.70 |
| Mountain terrain - slopes greater than 10%: | 0.70 |
| Agricultural areas (Flood Irrigated Fields): | 0.20 |

# FIGURE 2.2-21

Runoff Coefficients (C) for use with the Rational Formula (Q=CIA)

ACCUMULATIVE Tc AND PEAK RUNOFF to DESIGN PT. (60) BASIN "F" Rev. 09-13-93
(INCLUDES BASINS C, D, E & F) 6/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

### LOCATION DATA

PROJECT: 64TH ST./SCOTTSDALE CONCENTRATION POINT: BASIN "F" DES PT. (60)

LOCATION: 1/2 WAY BETWEEN OAK ST. & THOMAS ON the WEST SIDE OF 64th.

PROJECT NO.: 4541P108 STATION: ~Approx. 48+50

NAME OF STREAM/WATERSHED: 64th ST. Improvements

### DESIGN DATA

| DESIGN FREQUENCY: | | 2 | 5 | (10) | 25 | (50) | (100) | YEARS |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA: To DES. PT (50) | A1 @64TH & OAK | | | 82.8 | | " | " | ACRES |
| RESIDENTIAL SUB. (R1-18) 18K FT² Ave LOT | A2 RES. | | | 22.5 | | " | " | ACRES |
| IN BASIN "F" | A3 COMM. | | | 8.25 | | | | ACRES |
| ~~TOTAL (A)~~ | A4 UNDEV. | | | 40.25 | | | | ACRES |
| N/A ~~DRAINAGE LENGTH:~~ | TOTAL (A) | | | 153.8 | | 153.8 | 153.8 | ~~FEET~~ Acres |
| ELEVATION: TOP OF DRAINAGE AREA: | N/A | | | | | | | FEET |
| AT STRUCTURE | Tc CONTROLED FROM | | | | | | | FEET |
| DRAINAGE AREA SLOPE: | DES. PT. 50 | | | | | | | PERCENT |

$$T_c = 29.5 + \frac{1300}{(8.8)(60)} = 32 \text{ MIN.}$$

### DESIGN COMPUTATIONS

| | | 1.00 | 1.00 | (1.00) | 1.10 | (1.20) | (1.25) | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | | | | | | | |
| TIME OF CONCENTRATION: | $T_c$ | | | 32 | | 32 | 32 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 2.65 | | 3.5 | 4.0 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | 0.45 | | | | | | |
| | C2 | 0.52 | | | | | | |
| | C3 | 0.90 | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: $C_4$ ~~$C_w$~~ | | 0.31 | | | | | | |
| PEAK DISCHARGE $Q_p = C_wIA(F)$: $C_w$ | | 0.45 | | 0.45 | | 0.45 | 0.45 | ~~cfs~~ |
| | | | | 184 | | 291 | 346 | cfs $Q=(F)CiA$ |

$$w = \frac{82.8}{153.8}(0.45) + \frac{22.5}{153.8}(0.52) + \frac{8.25}{153.8}(0.90) + \frac{40.25}{153.8}(0.31) = 0.45$$

COMPUTED BY: B. BATTISTELLO DATE: 09-13-93

CHECKED BY: DATE:

NOTE: FUTURE DETENTION/RETENTION IS ADVISABLE FOR DES. PT. (60) IN BASIN "F"

**FIGURE 2.2-22**
Hydrologic Design Data Record

ACCUMULATIVE Tc AND PEAK RUNOFF to DES. PT. (70) → BASIN "G"
(INCLUDES BASINS C, D, E, F & G)

REV. 09-13-93 B.B.

CITY OF SCOTTSDALE

7/12

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

### LOCATION DATA

PROJECT: 64TH ST./SCOTTSDALE CONCENTRATION POINT: DES. PT 70, BASIN G

LOCATION: @ INTERSECTION OF 64TH STREET & THOMAS RD.

PROJECT NO.: 4541P108 STATION: ~STA. 62+14±

NAME OF STREAM/WATERSHED: 64th ST. IMPROVEMENTS

### DESIGN DATA

| | | 2 | 5 | 10 | 25 | 50 | 100 | |
|---|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | | | 10 | | 50 | 100 | YEARS |
| DRAINAGE AREA: To Des Pt 60 → | A1 | BASINS C-F | | 153.8 | | " | " | ACRES |
| Comm/Indust Area → | A2 | BASIN "G" | | 30.0 | | | | ACRES |
| Road Pavement → | A3 | THOMAS RD | | 2.0 | | | | ACRES |
| | TOTAL (A) | | | 185.8 | | 185.8 | 185.8 | ACRES |
| DRAINAGE LENGTH: | | 1400' PIPE | | | | | | FEET |
| ELEVATION: | | | | | | | | |
| TOP OF DRAINAGE AREA: | | N/A | | | | | | FEET |
| AT STRUCTURE | | | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | | | | | | | PERCENT |

$T_c = 32 + \frac{1400}{(12.08)(60)} = 34$ MIN.

### DESIGN COMPUTATIONS

| | | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | | | | | | | |
| TIME OF CONCENTRATION: | $T_c$ | | | 34 | | 34 | 34 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 2.55 | | 3.30 | 3.80 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | | | 0.45 | | | | |
| | C2 | | | 0.90 | | | | |
| | C3 | | | 0.95 | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | $C_W$ | | | 0.53 | | 0.53 | 0.53 | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | | | | 252 | | 390 | 468 | cfs |

$C_w = \frac{153.8}{185.8}(0.45) + \frac{30.0}{185.8}(0.90) + \frac{2.0}{185.8}(0.95)$

$Q = (F)CiA$

$C_w = 0.53$

← USE FOR DESIGNING S. DRAIN OUTFALL IN Thomas RD

COMPUTED BY: B. BATTISTELLO DATE: 09-13-93

CHECKED BY: _____ DATE: _____

**FIGURE 2.2-22**
Hydrologic Design Data Record

BASIN H – NORTH OF THOMAS RD.

08-05-93

8/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

## LOCATION DATA

PROJECT: 64TH ST. / SCOTTSDALE CONCENTRATION POINT: BASIN "H", DES. PT. (80)

LOCATION: FROM INT. OF 64TH. & THOMAS RD. to 950 FT. NORTH THEREOF.

PROJECT NO.: 4541P108 STATION: INT. OF THOMAS to ~ STA. 71+50

NAME OF STREAM/WATERSHED: 64TH STREET IMPROVEMENTS.

## DESIGN DATA

| | | 2 | 5 | (10) | 25 | (50) | (100) | |
|---|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | | | | | | | YEARS |
| DRAINAGE AREA: BARE GROUND @ CAN | A1 | 0.72 AC. | | " | | " | " | ACRES |
| ROADWAY | A2 | 1.53 AC. | | | | | | ACRES |
| COMMERC. (SRP) FAC. | A3 | 11.56 AC. | | | | | | ACRES |
| | TOTAL (A) | 13.81 AC. | | 13.81 | | 13.81 | 13.81 | ACRES |
| DRAINAGE LENGTH: | | * 950' (ROAD) | | — BASIN "H" WILL CONTROL | | | | FEET |
| | | 1150 (BASIN H) | | | | | | |
| ELEVATION: | | | | | | | | |
| TOP OF DRAINAGE AREA: | | 1264.5± | | | | | | FEET |
| AT STRUCTURE | | 1260.75 | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | 0.33 % | | | | | | PERCENT |

(ROAD $T_c$ @ V = 2fps = 950'/2x60 ≅ 8 MIN, ∴ $T_c$ CONTROLED BY OFFSITE BASIN "H".)

## DESIGN COMPUTATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | 1.00 | 1.00 | (1.00) | 1.10 | (1.20) | (1.25) | |
| TIME OF CONCENTRATION: | $T_c$ | | | 16 | | 16 | 16 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 3.85 | | 5.1 | 5.8 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | 0.31 | | | | | | |
| | C2 | 0.95 | | | | | | |
| | C3 | 0.90 | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | $C_W$ | 0.87 | | 0.87 | | 0.87 | 0.87 | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | | | | 46 | | 74 | 87 | cfs = Q = (F)CiA |

$$T_c = \frac{0.04593 L^{0.77}}{S^{0.385}}$$ (Kirpich Eqn.)

IN %

$$C_w = C_1 \frac{A_1}{A_T} + C_2 \frac{A_2}{A_T} + C_3 \frac{A_3}{A_T}$$

COMPUTED BY: B. BATTISTELLO DATE: 08-05-93

CHECKED BY: _____ DATE: _____

**FIGURE 2.2-22**
Hydrologic Design Data Record

BASIN J – SOOTH OF INDIAN SCHOOL RD.

08-05-93

9/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

### LOCATION DATA

PROJECT: 64TH ST. / SCOTTSDALE CONCENTRATION POINT: BASIN J. DES. PT. (90)

LOCATION: FROM INT. OF INDIAN SCHOOL RD. to ~1000' SOUTH thru of

PROJECT NO.: 4541P108 STATION: DES. PT 90 ~ STA. 89+00 @ OSBORN RD.

NAME OF STREAM/WATERSHED: 64TH ~~STREET~~ IMPROVEMENTS.

### DESIGN DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | 2 | 5 | (10) | 25 | (50) | (100) | YEARS |
| DRAINAGE AREA: Bare Ground @ Canal | A1 | 0.45 Ac | | | | | | ACRES |
| ROADWAY & ret. wall; 61 x 1000' | A2 | 1.40 " | | | | | | ACRES |
| Apts | A3 | 2.12 " | | | | | | ACRES |
| | TOTAL (A) | 3.97 | | 3.97 | | 3.97 | 3.97 | ACRES |
| DRAINAGE LENGTH: | | | | | | | | FEET |
| ELEVATION: | | | | | | | | |
| TOP OF DRAINAGE AREA: | | | | | | | | FEET |
| AT STRUCTURE | | | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | | | | | | | PERCENT |

Tc = 1 MIN to GUTTER FROM OVERLAND (APTS)
+ 450 FT / 4.67 fps x 60 + 550 FT / 2.40 fps x 60
Tc = 6.43 MIN USE Tc = 6.5 MIN

### DESIGN COMPUTATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | 1.00 | 1.00 | (1.00) | 1.10 | (1.20) | (1.25) | |
| TIME OF CONCENTRATION: | $T_c$ | 6.5 | | 6.5 | | 6.5 | 6.5 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 5.6 | | 7.45 | 8.5 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | 0.31 | | | | | | |
| | C2 | 0.95 | | | | | | |
| | C3 | 0.65 | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | $C_W$ | 0.72 | | 0.72 | | 0.72 | 0.72 | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | | | | 16 | | 26 | 30 | cfs |

Tc CONTROLED BY GUTTER FLOW PER SHAPE OF BASIN, ∴ DON'T USE KIRPICH EQU.

(SEE HEC-12 RUNS FOR GUTTER FLOW VEL'S NEXT 2 PG'S.)

(1) SEE NOTE BELOW

$Q = (F)CiA$

$C_W = C_1 \frac{A_1}{A_T} + C_2 \frac{A_2}{A_T} + C_3 \frac{A_3}{A_T}$

COMPUTED BY: D. BATTISTELLO DATE: 08-05-93

CHECKED BY: DATE:

(1) Q10 BASIN J = 16 cfs, To Comput Tc's Q10 WAS Approximated @ 17.35 cfs Using HEC-12 RUN to Est. Velocities w/IN 8.5%
∴ Velocities & Tc COMPUTED OK (W/IN ACCEPTABLE RANGE) SEE FOLLOWING 2 SHEETS.

**FIGURE 2.2-22**
**Hydrologic Design Data Record**

64th Street
Scottsdale
Pg 1/2

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

Analyze Roadway for Curb Velocities to Compute Tc @ Des. Pt (90)

From Indian Sch Rd. to 450 Ft. South Thereof
Road Grade = 2.65%

DESIGNER: BOB B DATE: 08-05-1993

PROJECT: 64 TH STREET PROJECT NO.: 4541P108

INLET NO.: 90 STATION: OSBORN

DRAINAGE AREA: Acres DESIGN FREQUENCY: 10 Years

Est. Tc = 5 min. (minimum)
∴ $i_{10}$ (5 min.) = 6.1 in/hr.
Est $Q_{10} = CiA = 0.95(6.1)(1.79)$
= 7.85 cfs

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.027 | 0.020 | 0.016 | 7.85 | 12.86 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.289 | 0.29 | 4.67 |

Use in Computing Tc

64th Street
Scottsdale
Pg 2/2

***** ROADWAY DRAINAGE DESIGN *****

**********

HEC-12

ANALYZE ROADWAY FOR CURB VELOCITIES TO COMPUTE Tc @ DES PT. (90)

DESIGNER: BOB B

DATE: 08-05-1993

PROJECT: 64 TH STREET

PROJECT NO.: 4541P108

INLET NO.: 90

STATION: OSBORN

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 10 Years

FROM A POINT 450 FT SOUTH OF INDIAN SCH. RD. to OSBORN RD.
GRADE = 0.40%

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.004 | 0.020 | 0.016 | 9.49 | 19.81 |

EST. $T_c = 5_{MIN}$ (MIN.)
Compute est Tot. $Q_{10}$ to Des Pt. 90 & SUBTRACT out 7.85 cfs from
$GRADE_1 = 2.65\%$

$\therefore Q_{10} = 0.72(6.1)(3.97) - 7.8$
$= 17.44 - 7.85$
$\cong 9.5$ cfs

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.190 | 0.43 | 2.40 |

USE IN COMPUTING Tc

ACCUMULATIVE TC AND PEAK RUNOFF to DES. PT. (95), BASINS H+I

08-05-93

10/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

## LOCATION DATA

PROJECT: 64TH ST. / SCOTTSDALE CONCENTRATION POINT: BASINS H + I, DES PT. (95)

LOCATION: FROM INT. OF THOMAS TO SAG PT. STA 79+11 ±

PROJECT NO.: 4541P108 STATION: ~ TO LOW POINT STA.

NAME OF STREAM/WATERSHED: 64TH STREET IMPROVEMENTS.

## DESIGN DATA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | | 2 | 5 | 10 | 25 | 50 | 100 | YEARS |
| DRAINAGE AREA: | BASIN H | A1 | 13.81 AC | | | | | | ACRES |
| | BARE GROUND | A2 | 0.59 " | | | | | | ACRES |
| BASIN I | ROADWAY | A3 | 1.25 " | | | | | | ACRES |
| | COMMERC. SRP | A4 TOTAL (A) | 10.69 | | | | | | ACRES |
| | | TOTAL(A) | 26.34 | | 26.34 | | 26.34 | 26.34 | FEET |
| DRAINAGE LENGTH: | | | 775' IN GUTTER (BASIN I) | | | | | | |
| ELEVATION: | | | | | | | | | |
| TOP OF DRAINAGE AREA: | | | N/A | | | | | | FEET |
| AT STRUCTURE | | | N/A | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | | N/A | | | | | | PERCENT |

$T_c$ = 16 MIN. + GUTTER TRAVEL TIME TO DES PT 95
= 775 FT / 3.75 × 60 =

$T_c \doteq 19.5$ MIN

## DESIGN COMPUTATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 | |
| TIME OF CONCENTRATION: | $T_c$ | 19.5 | | 19.5 | | 19.5 | 19.5 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 3.6 | | 4.5 | 5.25 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | 0.87 | | | | | | |
| | C2 | 0.31 | | | | | | |
| | C3 | 0.95 | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | C4 ~~$C_W$~~ | 0.90 | | | | | | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | Cw | 0.87 | | 0.87 | | 0.87 | 0.87 | ~~cfs~~ |
| | | | | 82 | | 124 | 150 | cfs Q=(F)CiA |

COMPUTED BY: B. BATTISTELLO DATE: 08-05-93

CHECKED BY: DATE:

**FIGURE 2.2-22**
Hydrologic Design Data Record

# 4541P108

64th STREET / SCOTTSDALE ~ STA 79+11 (SAG)

COMPUTE Tc TO DES. PT. 95 BASINS H+I

```
*****************************************
*****    ROADWAY DRAINAGE DESIGN    *****
*****************************************
```

HEC-12 RUN

DESIGNER: BOB B  DATE: 08-05-1993

PROJECT: 64TH STREET  PROJECT NO.: 4541P108

INLET NO.: 95  STATION: ROAD SAG

DRAINAGE AREA: Acres  DESIGN FREQUENCY: 10 Years

64TH STREET ROAD CAPACITY ALONG BASIN "I" TO DESIGN PT. 95

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.008 | 0.020 | 0.016 | 20.18 | 23.16 |

LEAVES 1-12' LANE OPEN IN NORTHBOUND DIRECTION

Qcap = 20.2 cfs

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.162 | 0.49 | 3.74 |

USE THIS TO COMPUTE TRAVEL TIME IN GUTTER IN Tc CALC. TO DES PT. 95

ACCUMULATE Tc AND PEAK RUNOFF TO DES. PT. (97), BASINS J & K
08-05-93
11/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

## LOCATION DATA

PROJECT: 64th St. / Scottsdale CONCENTRATION POINT: BASINS J & K, DES PT (97)

LOCATION: From INT. OF INDIAN SCH RD. to Sag Pt. @ STA. 79+11 ±

PROJECT NO.: 4541P108 STATION: 79+91 ±

NAME OF STREAM/WATERSHED: 64TH STREET IMPROVEMENTS

## DESIGN DATA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | | 2 | 5 | 10 | 25 | 50 | 100 | YEARS |
| DRAINAGE AREA: | BASIN J. | A1 | 3.97 AC. | | | | | | ACRES |
| | BARE GROUND | A2 | 0.41 " | | | | | | ACRES |
| BASIN K | ROADWAY | A3 | 1.60 " | | | | | | ACRES |
| | Apt's. | ~~TOTAL (A)~~ | 3.99 " | | | | | | ACRES |
| DRAINAGE LENGTH: | | TOTAL (A) | 9.97 | | 9.97 | | 9.97 | 9.97 | FEET |
| ELEVATION: | | | 1000' (BASIN K) | | | | | | |
| TOP OF DRAINAGE AREA: | | | N/A | | | | | | FEET |
| AT STRUCTURE | | | N/A. | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | | N/A | | | | | | PERCENT |

Tc FROM IND. SCH RD. = BASIN J + BASIN K
= 6.5 + 1000/3x60
≅ 12 MIN

## DESIGN COMPUTATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 | |
| TIME OF CONCENTRATION: | $T_c$ | 12 Min. | | 12 | | 12 | 12 | MINUTES |
| RAINFALL INTENSITY (I): | | | | 4.5 | | 5.75 | 6.75 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | C1 | 0.72 | | | | | | |
| | C2 | 0.31 | | | | | | |
| | C3 | 0.95 | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | C4 ~~$C_W$~~ | 0.65 | | | | | | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | Cw | 0.71 | | 0.71 | | 0.71 | 0.71 | ~~cfs~~ |
| | | | | 32 | | 49 | 60 | cfs, Q=(F)CiA |

COMPUTED BY: B. BATTISTELLO DATE: 08-05-93

CHECKED BY: _____ DATE: _____

**FIGURE 2.2-22**
Hydrologic Design Data Record

ACCUMULATIVE PEAK RUNOFF TO DES. PT. 99
INCLUDES BASINS H, I, J & K TO ROADWAY SUMP POINT.

12/12

CITY OF SCOTTSDALE

# HYDROLOGIC DESIGN DATA RECORD
## RATIONAL METHOD

### LOCATION DATA

PROJECT: 64TH ST. / SCOTTSDALE CONCENTRATION POINT: 99

LOCATION: @ ROADWAY SAG (SUMP POINT.) ~ STA. 79+11

PROJECT NO.: 4541P108 STATION: 79+11 ±

NAME OF STREAM/WATERSHED: 64TH. STREET IMPROVEMENTS

(USE GREATEST Tc to the DESIGN POINT)

### DESIGN DATA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN FREQUENCY: | | | 2 | 5 | 10 | 25 | 50 | 100 | YEARS |
| DRAINAGE AREA: | BASIN H+I | A1 | 26.34 Ac | | | | | | ACRES |
| | BASIN J+K | A2 | 9.97 " | | | | | | ACRES |
| | | A3 | | | | | | | ACRES |
| | | TOTAL (A) | 36.31 " | | 36.31 | | 36.31 | 36.31 | ACRES |
| DRAINAGE LENGTH: | | | | | | | | | FEET |
| ELEVATION: | | | | | | | | | |
| TOP OF DRAINAGE AREA: | | | | | | | | | FEET |
| AT STRUCTURE | | | | | | | | | FEET |
| DRAINAGE AREA SLOPE: | | | | | | | | | PERCENT |

### DESIGN COMPUTATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY FACTOR (F): | | | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 | |
| TIME OF CONCENTRATION: | DES. PT 95 CONTROLS | Tc | 19.5 | | 19.5 | | 19.5 | 19.5 | MINUTES |
| RAINFALL INTENSITY (I): | | | | | 3.6 | | 4.5 | 5.25 | INCHES/HOUR (Figure 2.2-13) |
| RUNOFF COEFFICIENT (c): | | C1 | 0.87 | | | | | | |
| | | C2 | 0.71 | | | | | | |
| | | C3 | | | | | | | |
| WEIGHTED RUNOFF COEFFICIENT: | | $C_W$ | 0.83 | | 0.83 | | 0.83 | 0.83 | |
| PEAK DISCHARGE $Q_p = C_W IA(F)$: | | | | | 108 | | 163 | 198 | cfs = Q=(F)CiA |

REPRESENTS TOTAL FLOWS INTO A PUMP STATION

COMPUTED BY: B. BATTISTELLO DATE: 08-06-93

CHECKED BY: _____ DATE: _____

**FIGURE 2.2-22**
Hydrologic Design Data Record

| Land Use | "C" Value |
|---|---|
| **Composite Area-wide Values** | |
| Commercial and industrial areas: | 0.90 |
| Residential areas-single family (average lot size): | |
| R1-190, 130, 70, 43 (one acre or greater/lot): | 0.45 |
| R1-35 (35,000 sq. ft./lot): | 0.48 |
| R1-18 (18,000 sq. ft./lot): | 0.52 |
| R1-10 (10,000 sq. ft./lot): | 0.57 |
| R1-7 (7,000 sq. ft./lot): | 0.63 |
| Townhouses: | 0.55 |
| Apartments and condominiums: | 0.65 |
| **Specific Surface Type Values** | |
| Paved streets or parking lot (concrete or asphalt), roofs, dirveways, etc. | 0.95 |
| Lawns, golf courses, and parks (grassed areas): | |
| Hydrologic soil group B: | 0.33 |
| Hydrologic soil group C: | 0.56 |
| Hydrologic soil group D: | 0.66 |
| [redacted] (no impervious weed barrier): | |
| Hydrologic soil group B: | 0.31 |
| Hydrologic soil group C: | 0.49 |
| Hydrologic soil group D: | 0.56 |
| Desert landscaping (with impervious weed barrier) | 0.70 |
| Mountain terrain - slopes greater than 10%: | 0.70 |
| Agricultural areas (Flood Irrigated Fields): | 0.20 |

# FIGURE 2.2-21

Runoff Coefficients (C) for use with the Rational Formula (Q=CIA)

# Part B On-Site/Roadway Hydrology Computations

**Parsons Brinckerhoff Computation Sheet**

Page 1 of 30 454P103
Made by Bob B.
Date 08-10-93
Checked by
Date

Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES. THOMAS TO IND. SCH RD.

1/ NORTHBOUND DIRECT. — THOMAS TO INDIAN SCH RD. — REFERENCE

Requirement: MUST MAINTAIN @ LEAST 1 — DRY 12' LANE
① IN EACH DIRECTION OF TRAVEL FOR Q100 YR.
② DEPTH OF FLOW @ CURB ≤ 8" & CONTAINED IN R/W

(A.) EAST 1/2 OF 64TH ROAD + R/W + OFFSITE (WHERE APPLICABLE)

1. NB @ INT. OF THOMAS RD. — GRADE OUT = 0.40%
CURB CAP. = 4.96 cfs — T = 15.5 FT.
AVAILABLE depth OF FLOW = 0.34 FT. — = 4"+

(a.) COMPUTE INLET SPACING TO 1ST INLET.

Weighted $C_W = 0.95\left(\frac{30}{50}\right) + 0.60\left(\frac{20}{50}\right) = 0.81$ (PER L.F.) — 50' 1/2, R/W

$4.96 = 1.25 C_W i A = 1.25(0.81)(9.2)\left(\frac{50 \times L}{43{,}560}\right)$ — $i_{100}$ (5 MIN) = 9.2"/.

$L_{MAX.} = 463.9$ FT. USE 460 FT. — VALID UP TO 615' @ 2.05 (SEE HEC-12 RU.

$\therefore Q_{100} = 1.25(0.81)(9.2)\left(\frac{460 \times 50'}{43{,}560}\right) = 4.92$ cfs

1ST INLET Needed @ STA 62+14.5 + 460 = 66+75 ±

— ASSUME OFFSITE FLOW Routed IN ditch PARALLEL to ROADWAY —
— USE CURB OPENING INLET w/ 2" LOCAL DEPRESSION — — n = 0.016 STREET
EFFICIENCY = 80% PER HEC-12.

→ Q capture (10' Wing + 3' Sump) = 4.3 cfs w/ B/P = 0.62 cfs + (SEE HEC-12 RUN)

USE CURB INLET w/ 10' Wing @ N.B. STA. 66+75 (2" dep.)

2. NORTH OF V.P.I. STA 66+00 ON 1.80% GRADE
CURB CAP. = 10.54 cfs

Weighted $C_W = 0.81$ (SAME AS 1)

$10.54 - 0.62(B/P) = 1.25(0.81)(9.2)\left(\frac{50 \times L}{43{,}560}\right)$

$L_{MAX.} = 927$ FT. VERY Long —
Locate 2ND INLET 325' North of 1ST N.B. INLET (BEFORE TRANS. to 0.788% GRADE) — @ STA. 70+00

$\therefore Q_{100} = 1.25(0.81)(9.2)\left(\frac{325 \times 50'}{43{,}560}\right) = 3.47$ cfs — < Cap, OK

2ND N.B. INLET @ STA 70+00

**Parsons Brinckerhoff Computation Sheet**

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Made by Bob B.

Date 08-10-93

Checked by

Date

Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES – THOMAS TO IND SCH.

V 2.) Cont'd. Q capture (10' Wing & 3' Sump) = 2.8 cfs
B/P = 0.67 cfs.

REFERENCE

USE CURB INLET w/ 10' WING @ N.B. STA. 70+00 (2" dep.)

SEE HEC-12 RUN

3.) NORTH OF V.P.I. STA. 70+50 ON 0.788% GRADE
CURB CAP. = 6.97 cfs.

Weighted $C_w$ = 0.81 (SAME AS 1)

6.97 − 0.67 = AVAIL. TRIB AREA = $1.25(0.81)(9.2)\left(\frac{50 \times L}{43{,}560}\right)$

$L_{(MAX.)} \doteq 590$ FT. → USE 500'

$\therefore Q_{100} = 1.25(0.81)(9.2)\left(\frac{500 \times 50}{43{,}560}\right) = 5.35$ cfs ← Cap. OK

PLACE 3rd N.B. INLET FROM THOMAS @ 75+00

Q capture (10' Wing & 3' Sump) = 4.2 cfs
B/P = 1.15 cfs.

→ SEE HEC-1 RUN.

Assume OFFSITE FLOW IS NON-TRIBUTARY. — SAME AS 1. ABOVE

USE CURB INLET w/ 10' WING @ N.B. STA. 75+00 (2" dep.)

4. FLANKING INLET @ S. SIDE OF ROAD SAG STA. 78+50

Q cap = 6.97 cf.
G = 0.788%

SINCE THIS SETS LENGTH BETWEEN INLETS COMPUTE $Q_{100}$

$Q_{100} = 1.25(0.81)(9.2)\left(\frac{350 \times 50}{43{,}560}\right) = 3.74$ cfs ← Cap. OK

4TH. N.B. INLET @ STA 78+50 → LOCATE FLANKING INLET 0.24 F. ABOVE L.P. OF SAG.

Q capture (6' Wing & 3' Sump) = 2.6 cfs
B/P = 1.14 cfs

ASSUME OFFSITE FLOW to be NON-TRIBUTARY

USE CURB INLET w/ 6' WING @ N.B. STA 78+50 (2" dep.)

5. 1ST. INLET SOUTH OF INDIAN SCHOOL RD. GRADE 2.47%

60' Pvmt. 80 R/W @ THIS I.

COMPUTE $C_w$ / L.F. TO CALC INLET SPACING
(SEE NEXT PG.)

CURB CAP = 10.74 cfs.
depth FLOW = 0.32'

**Parsons Brinckerhoff Computation Sheet**

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Made by JOB B.
Date 08-11-93
Checked by
Date

Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET - DES. - THOMAS to INDIAN SCH RD.

4 5.) CONT'D. $C_W/L.F. = 0.95\left(\frac{30'}{130}\right)(0.65)\left(\frac{100}{130}\right) = 0.72$ (Apts.)

REFERENCE: Assume Uniform Width of Offsite Flow = 130' 30' ½ Road 100' Offsite

Est. Tc for 300 ft. of Roadway @ 1 fps 100' Overland Flow $= \frac{100}{1} \times 60 = 1.67$ MIN.

$\frac{300' \text{ Curb}}{5.0 \text{ fps} \times 60} = 1.0 + 1.67 = 2.67$ MIN.

∴ Use $T_c$ (MIN.) = 5 Min. ⇒ $i_{100}$ (5 MIN.) = 9.2 IN/hr.

→ SINCE Q cap. = 10.74 cfs ON 2.65% GRADE
— Compute Inlet Spacing Req'd. —

$Q_{cap} = 10.74 \text{ cfs} = 1.25\, CiA = 1.25(0.72)(9.2)\left(\frac{130 \times L}{43{,}560}\right)$

$L_{(MAX.)} = 434$ FT.

Install Inlet @ STA. 97+00 (270 FT. FROM INT. IND. SCH. RD.)

$Q_{100} = 1.25(9.2)(0.72)\left(\frac{270 \times 100}{43{,}560}\right)$

$Q_{100} = 5.13$ cfs INTO 1ST INLET S. OF IND. SCH RD. @ STA. 97+00

SEE HEC-1 RUN

Q capture = 4.47 cfs & Q B/P = 0.66 cfs

USE CURB INLET W/ 17' WING @ N.B. STA. 97+00 (2" dep.)

6. 2ND CURB INLET SOUTH OF INDIAN SCH RD., Q B/P = 1.73 cfs
GRADE = 0.40% (MIN.) $Q_{100}$ CAP = 4.96 cfs.

Compute DISTANCE to Next INLET

$4.96 - 0.66 = 1.25(0.72)(9.2)\left(\frac{L \times 130}{43{,}560}\right)$

$L_{(MAX.)} \cong 175$ FT.

Use $T_c$ = 5 M MINIMUM

Locate 2ND INLET S. OF IND. SCH. @ STA. 95+25

$Q_{100} = 1.25(0.72)(9.2)\left(\frac{175 \times 130}{43{,}560}\right) = 4.32$ cfs + B/P = Qcap = 4.97 c

Q CAPTURE = 4.40 cfs W/ Q B/P = 0.57 cfs

USE CURB INLET W/ 10' WING @ N.B. STA 95+25 (2" dep.)

**Parsons Brinckerhoff Computation Sheet**

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Made by BOB B.
Date 08-12-93
Checked by
Date

Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES. - THOMAS to IND SCH.

I NORTHBOUND DIRECT - THOMAS TO INDIAN SCH RD., CONT'D. — REFERENCE

7. 3rd CURB INLET SOUTH OF INT. of IND. SCH. RD.

GRADE IS AT 0.400% Q CAP. = 4.96 cfs
Q B/P = 0.57 cfs. — FROM 2ND INLET FROM IND. SCH.

COMPUTE MAX. DIST. to NEXT INLET.

$4.96 - 0.57 = 1.25(0.72)(9.2)\left(\frac{L \times 130}{43{,}560}\right)$

$L_{MAX.} = 177.66$

USE L = 175 Ft. → TRIB. AREA = $\frac{175(130)}{43{,}560}$ = 0.5 AC

STA. OF 3rd. CURB INLET S. OF IND. SCH. RD. = 93+50

$Q_{100} = 4.32 + 0.57 = 4.89$ cfs INTO 3rd INLET < Qcap = 4.96 OK

USE CURB INLET w/ 10' WING Qcap = 4.35 cfs.
→ B/P = 0.54 "

**USE CURB INLET w/ 10' WING @ N.B. STA. 93+50 (2" dep.)**

8. 4TH. CURB INLET SOUTH OF INT. OF INDIAN SCH RD.

GRADE IS @ 0.400% Q CAPACITY = 4.96 cfs & B/P = 0.54 cfs
VERY SIMILAR to 7. ABOVE, PLACE NEXT INLET 175' downstm.
@ STA. 91+75

$Q_{100} = 1.25(0.72)(9.2)\left(\frac{175 \times 130}{43{,}560}\right) = 4.32$ cfs
+ 0.54 = B/P
4.86 cfs < 4.96 = Q cap. OK

USE CURB INLET w/ 10' WING
Qcap. = 4.33 cfs
→ B/P = 0.53 "

**USE CURB INLET w/ 10' WING @ N.B. ST. 91+75 (2" dep.)**

**Parsons Brinckerhoff Computation Sheet**

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Made by Bob B.
Date 08-12-93
Checked by
Date

Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES. - THOMAS TO IND. SCH.

I CONT'D.

9. 5TH INLET SOUTH OF INT. OF INDIAN SCHOOL RD.

IT WOULD BE MOST DESIRABLE TO PLACE THIS INLET @ THE N.W. CURB RETURN @ OSBORN SINCE IT IS ONLY 235 FT S. OF THE 4TH INLET S. OF INDIAN SCH.

$Q_{100} = 1.25(0.72)(9.2)\frac{(235' \times 120')}{43{,}560} = 5.36$ cfs

THE OFFSITE FLOW DIMINISHES SOMEWHAT @ THE INTERSECTION

USE W = 120' HERE.

$Q_{100}$ (TOT.) = TRIB AREA + B/P = 5.36 + 0.53 = 5.89 cfs.
= 5.89 cfs.

> $Q_{cap}$ = 4.94 cfs

→ THIS FLOW REPRESENTS A 18.75% INCREASE OVER THE ALLOWABLE CAPACITY — CHECK THE ROAD / GUTTER HYDRAULICS TO SEE IF THE FLOW SPREAD IS IN AN ACCEPTABLE RANGE. → SEE HEC-12 RUN

GUTTER FLOW COMPS SHOW THAT FOR S = 0.40% & n = 0.016
Q = 5.89 cfs.

FLOW SPREAD = 16.5 FT. W/ 1/2 WIDTH = 28 FROM CURB FACE
REMAINING LANE = 11.5 FT. (4% UNDER 12' REQ'MT.)

→ THIS SHOULD BE FINE SINCE ON THIS PROJECT WE ARE USING DOWN TO 11 FT. LANES. (IS ACCEPTABLE)

OK IN ACCEPTABLE RANGE.

⇒ USE $Q_{100}$ = 5.89 cfs & RUN INLET HYDRAULICS.

USING A 10' WING Q INLET CAP. = 4.94 cfs
B/P = 0.95 cfs

NOTE: SINCE THE FLOW SPLITS EAST DOWN OSBORN & CONTINUES SOUTH DOWN 64TH EST. THAT 1/2 OF B/P GOES EACH WAY SO THAT B/P FLOW TO 6TH INLET ON 64 (S. OF IND SCH RD.)

$B/P = \frac{0.95}{2} = 0.48$ cfs

→ THIS RESULTS IN AN EQUITABLE IMPACT AS FAR AS WHAT EXIST. COND. ARE FOR THIS AREA.

USE CURB INLET W/ 10' WING @ N.B. STA 89+40 (2" dep.)

**Parsons Brinckerhoff Computation Sheet**

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Made by Bob B.
Date 08-12-93
Checked by
Date

Subject 64TH. STREET / SCOTTSDALE
CONCEPTUAL INLET DES. – THOMAS to IND. SCH.

CONT'D. N.B. FLOWS – THOMAS to IND. SCH. RD. | REFERENCE

10.) 6TH INLET SOUTH OF INDIAN SCH. RD.

GRADE = 1.42% | S. OF OSBORN

Curb depth = 4" @ $Q_{100}$ cap. = 7.86 cfs | SEE HEC 12 RUNS

B/P FROM 5TH INLET = 0.48 cfs.

- Compute Cw for Ave $\frac{150}{2}$ = 75' OFFSITE from the EAST. → APT'S.

PER L.F. $C_w = 0.95 \times \frac{27}{108} + \text{MED.} @ 0.60 \times \frac{6}{108} + \text{OFF } 0.65 \frac{75}{108}$ → 108' = TOTAL WIDTH

$C_w = 0.72$

Compute MAX. DIST. to THIS INLET w/out Exceeding Curb Cap. Assume $T_c$ = 5 MIN MINIMUM CONTL CURB V < 3.7

$Q_{100} = 7.86 - 0.48 = 1.25(0.72)\left(\frac{L \times 108}{43{,}560}\right)(9.2 \text{ in/hr.})$

$L_{max} \cong 360$ FT., OK

Locate INLET @ STA. 86+50 @ BEGINNING OF TRANS to 0.50% GRADE.

L = 290 FT. FROM 5TH INLET

$\therefore Q_{100} = 1.25(0.72)(9.2)\left(\frac{290 \times 108}{43{,}560}\right) = 5.95$ cfs.

TOTAL FLOW to INLET = 5.95 + B/P = 0.48 = 6.43 cfs < $Q_{cap}$ = 7.86 cfs OK

USING CURB INLET w/ 17' WING  Q capture = 5.64
B/P = 0.79

**USE CURB INLET w/ 17' WING @ N.B. STA. 86+50 w/ (2" dep.)**

11.) 7TH INLET SOUTH OF INDIAN SCHOOL RD.  GRADE = 0.500%  $Q_{cap}$ = 5.55

ASSUMPTION: IN THIS AREA THERE IS 105 FT. AVAILABLE BETWEEN THE EXIST. MASONRY BLOCK WALL to the east AND the West Curb of 64th. IT IS ADVANTAGEOUS & DESIRABLE to PUT IN A GRADER DITCH to Capture OFFSITE FLOW FROM the EAST to ALLOW DOWNSIZING OF the roadway INLETS.

Compute MAX. Spacing to this INLET w/ Q B/P = 0.79 cfs.

Composite $C_w$ PER L.F. $= 0.95\left(\frac{35}{50}\right) + .60\left(\frac{15}{50}\right) = 0.85$  $Q_{cap}$ =

**Parsons Brinckerhoff Computation Sheet**

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Checked by
Date

Subject 64TH ST. / SCOTTSDALE
CONCEPTUAL INLET DES. – THOMAS TO INDIAN SCH.

11. Cont'd Compute MAX. SPACING to INLET — REFERENCE

$T_C = 5$ MIN (MINIMUM)

$(Q_{cap} - B/P = 5.55 - 0.79) = 1.25\,(9.2''/h.)(0.85)\left(\frac{50 \times L}{43{,}560}\right)$

$L_{(MAX.)} = 424$ FT.

FOR CONVIENCE POT INLET @ STA. 83+00 ($L = 350'$) < $L_{MAX}$, OK

$Q_{100} = 1.25\,(0.85)(9.2)\left(\frac{50 \times 350'}{43{,}560}\right) = 3.93$ cfs.

$Q_{100}$ TO INLET $= 3.93 + B/P = 3.93 + 0.79 = 4.72$ cfs < $Q_{cap} = 5.55$ cfs.

USE CURB INLET w/ 10' WING ⇒ $Q_{capture} = 4.13$ cfs, $B/P = 0.59$ cfs — SEE HEC-12 RUN

**USE CURB INLET w/ 10' WING @ N.B. STA. 83+00 w/ (2" dep.)**

12. 8TH INLET SOUTH OF INDIAN SCHOOL RD. (FLANKING INLET TO SUMP) — @ ROADWAY SAG PT.

THIS INLET SHOULD BE LOCATED TO BE 0.25' (3") ABOVE SAG. LOW. PT. TO LIMIT INUNDATION @ THE SAG.

LOCATE THIS INLET @ STA. 79+80 (GRADE = 0.500%) — $Q_{B/P} = 0.59$, $Q_{cap} = 5.55$

$Q_{100}$ B/P + AREA $= 0.59 + 1.25\,(0.85)(9.2)\left(\frac{320' \times 50'}{43{,}560}\right)$

$Q_{100\,(TOT.)} = 4.18$ cfs.

USE CURB INLET w/ 6' WING ⇒ $Q_{CAPTURE} = 3.05$ cfs, $B/P = 1.13$ cfs. — SEE HEC-12 RUN.

**USE CURB INLET w/ 6' WING @ N.B. STA. 79+80 w/ 2" dep.**

13. SAG (or SUMP.) INLET @ L.P. STA 79+11 ± (GRADE N/A) — MUST CAPTURE 100% OF FLOWS

$Q_{100\,(TOT.)}$ TO INLET $= B/P_N + B/P_S + 1.25\,(0.85)(9.2)\left(\frac{50 \times 130}{43{,}560}\right)$

$= 1.14 + 1.13 + 1.46$ cfs

$Q_{100\,(TOT.)} = 3.73$ cfs (INTO SUMP INLET)

(SUMP COMB. B/P = Ø)

**USE CURB INLET w/ 3' WING @ N.B. STA. 79+11 ±, w/ 2" dep.** — SEE HEC-12 RUN

**Parsons Brinckerhoff Computation Sheet**

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Date

Subject 64th Street / Scottsdale
Conceptual Inlet Des. – Thomas to Ind. Sch.

## IV Southbound Direction – Thomas to Indian Sch. Rd.

See Pg. 1 for Requirements

Reference

(A.) West Half of 64th Street (Toward Cross-Cut Canal)

1. 1st Inlet North of Thomas Rd. Intersection – Match Loc. of 1st N.B. Inlet @ Sta 66+75 – Have Offsite Adj. to Canal

$$C_W = \frac{(0.95 \times 0.37)}{0.37 + 0.12} + \frac{0.60 \times 0.12 Ac.}{0.37 + 0.12} = 0.86$$

$T_c = 5$ min. (Minimum)

$Q_{100} = 1.25 CiA = 1.25(0.86)(9.2)(0.49) = 4.87$ cfs. < $Q_{cap} = 4.96$ OK

Use Same Inlet As on East Curb.

$Q_{capture} = 4.39$ cfs, $Q$ B/P. $= 0.48$

See HEC-12 Rules (Typ.)

**Use Curb Inlet w/ 10' Wing @ S.B. Sta. 66+75 – w/ 2" dep.**

2. 2nd S.B. Inlet. North of Thomas Rd. (Grade = 1.80%)

Again Use Inlet Across from N.B. Side & Check Cap.

Use $T_c = 5$ min minimum

Inlet @ Sta. 70+00, $C_W = \frac{0.95 \times 0.26}{0.63} + \frac{0.60 \times 0.37}{0.63} = 0.74$

$Q_{100}$ (Trib Area.) $= 1.25(0.74)(9.2)(0.63) = 5.36$

$Q_{100}$ (Tot.) to Inlet $= 5.36 + (B/P = 0.48) = 5.84$ cfs OK < $Q_{cap} = 10.54$

Using Curb Inlet w/ 17' Wing $Q_{capture} = 5.12$ cfs
$Q$ B/P $= 0.72$"

**Use Curb Inlet w/ 17' Wing @ S.B. Sta. 70+00 w/ 2" dep.**

3. 3rd S.B. Inlet North of Thomas Rd. (Grade = 0.788%)

$Q_{cap.} = 6.97$ cfs

Similarly Try to Use Same Location As N.B. Side

⇒ Locate Inlet @ Sta. 75+00

Offsite Flow Adjac. to Canal

$$C_W = \frac{35 \times 500/43{,}560 \times .95}{0.40 + 0.49} + \frac{42.5' \text{ Ave.} \times 500/43{,}560 \times 0.60}{0.49 + 0.40} = 0.76$$

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Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES. — THOMAS TO IND SCH.

V 3. CONT'D. $Q_{100}$ (TRIB AREA) = 1.25(0.76)(9.2)(0.89 Ac.) = 7.78 | REFERENCE
$Q_{100}$ (TOT.) = 7.78 + (B/P = 0.72) = 8.50 cfs | $Q_{100}$ Cap ≅ 7.0

FLOW IS 21 % OVER Cap. Need INLET FURTHER UPSTM. | N/G.
(FLOW SPREAD = 16.6 FT w/d = 4.4" LEAVES 10.5' LANE OPEN)

COMPUTE L(MAX.) $6.97 - 0.72 = 1.25(0.76)(9.2)\left(\frac{L \times 77.5}{43{,}560}\right)$
L (MAX.) = 401.93, USE 400 FT.

PLACE NEXT INLET (THIS ONE) @ STA. 400 + 70 + 00 = 74+00

∴ $Q_{100}$ (TRIB AREA) = $1.25(0.76)(9.2)\left(\frac{400 \times 77.5}{43{,}560}\right)$ = 6.22 cfs. | Area = 0.71 Ac.

$Q_{100}$ (TOT.) INTO INLET = 6.22 + B/P = 6.22 + 0.72 = 6.94 cfs < Qcap = 6.97 cfs (OK)

USING CURB INLET w/ 17' WING $Q_{CAPTURE}$ = 6.37 cfs
B/P = 0.57 "

SEE HEC-12 RUN

USE CURB INLET w/ 17' WING @ S.B. STA. 74+00 — 2" dep.

4. 4TH. S.B. INLET NORTH OF THOMAS (FLANKING INLET BEFORE SUMP.)

GRADE ≅ 0.80 %

LOCATE FLANKER @ S.B. STA 78+50 (PONDS FROM SUMP NO MORE THAN 3")

COMPUTE Cw. = $\frac{0.95 \times \left(\frac{450 \times 35}{43{,}560}\right)}{0.36 + 0.32} + \frac{0.60 \times \left(\frac{31 (AVG) \times 450}{43{,}560}\right)}{0.32 + 0.36} = 0.78$ | AREA = 0.68 Ac. | Tc = 5 MIN

∴ $Q_{100}$ (TRIB) = 1.25(0.78)(9.2)(0.68) = 6.10 cfs.
$Q_{100}$ (TOTAL) INTO INLET = 6.10 + B/P = 6.10 + 0.51 = 6.61 cfs < Qcap ≅ 7.0 cfs

USING CURB INLET w/ 10' WING, $Q_{CAPTURE}$ = 4.77 cfs
B/P = 1.84 " INTO SUMP OK

SEE HEC-12 RUN

USE CURB INLET w/ 10' WING @ S.B. STA. 78+50 — w/ 2" dep.

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CONCEPTUAL INLET DES. – THOMAS TO IND SCH.

II SOUTHBOUND DIRECTION – THOMAS TO IND. SCH. RD. — REFERENCE

5. 1ST INLET SOUTH OF INDIAN SCH RD. (S.B. SIDE)
TAKE FLOW TO 0.400 % GRADE AS IS APPEARS THAT ONE WON'T BE NEEDED SOONER SINCE THERE IS LITTLE OFFSITE

(a.) Weighted $C_w$ (PER L.F.) $= \frac{0.95 \times 30'}{30+20'} + \frac{0.60 \times 20'}{20+30'} = 0.81$ — $T_c = 5$ min. minimum

$Q_{cap.} = 4.96$ — CG = 0.400 %

(b.) Compute L(MAX)
$4.96 = 1.25(0.81)(9.2)\left(\frac{50 \times L}{43,560}\right)$
$L_{(MAX.)} = 464$ ft.

Locate Curb Inlet @ Sta. 95+25, L = 425' for convence → Across from 2ND N.B. Inlet

$\therefore Q_{100} = 1.25(0.81)(9.2)\left(\frac{50 \times 425}{43,560}\right) = 4.54$ cfs → < $Q_{cap.} = 4.97$ OK

Using Curb Inlet w/ 10' Wing — $Q_{capture} = 4.13$ cfs, B/P = 0.41

**USE CURB INLET w/ 10' WING @ S.B. STA 95+25, dep = 2"** — SEE HEC-12 RUN

6. 2ND INLET SOUTH OF INDIAN SCH RD. (S.B. SIDE)
$C_w = 0.81$ SAME AS S. ABOVE — GRADE = 0.400 %, $Q_{100}$ CAP = 4.96 cfs

Compute L(MAX.) $4.96 - 0.41(B/P) = 1.25(0.81)(9.2)\left(\frac{L \times 50}{43,560}\right)$
$L_{(MAX.)} \doteq 425$ Ft.

⇒ FOR CONVIENCE PLACE INLET @ STA. 91+75, L = 350' – ACROSS FROM 4" N.B. INLET.

$\therefore Q_{100\,(TRIB.)} = 1.25(0.81)(9.2)\left(\frac{50 \times 350}{43,560}\right) = 3.74$ cfs — Area = 0.401

$Q_{TOT.}$ FOR INLET DES. = 3.74 + (B/P = 0.41) = 4.15 cfs.
Using Curb Inlet w/ 10' Wing, $Q_{capture} = 3.87$ cfs w/ B/P = 0.2

**USE CURB INLET w/ 10' WING @ S.B. STA. 91+75, w/ 2" dep.** — SEE HEC-12 – RUN –

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CONCEPTUAL INLET DES. – THOMAS TO INDIAN SC.

7. 3rd INLET SOUTH OF INDIAN SCH RD. (S.B. SIDE) — REFERENCE

B/P FROM 6. = 0.28 cfs. GRADE = 1.467 % $Q_{cap}$ = 7.86 cfs.

$C_w$ = 0.81 – SAME AS 5.

Tc = 5 MIN. MINIMUM (TYP.)

COMPUTE $L_{(MAX.)} = 7.86 - 0.28 = 1.25(0.81)(9.2)\left(\frac{L \times 50}{43{,}560}\right)$

$L_{(MAX.)}$ = 708 ft.

PLACE INLET @ STA. 86+50 – ACROSS FROM 6TH. N.B. INLET FROM INDIAN SCH.

L = 525 FT.

∴ $Q_{100}$ (TRIB AREA) $= 1.25(0.81)(9.2)\left(\frac{525 \times 50}{43{,}560}\right) = 5.61$ cfs — AREA = 0.60 ac

$Q_{100}$ TO INLET = 5.61 cfs + (B/P = 0.28) = 5.89 cfs.

USING CURB INLET w/ 17' WING, $Q_{CAPTURE}$ = 5.28 cfs, B/P = 0.61

**USE CURB INLET w/ 17' WING @ S.B. STA. 86+50 w/ 2" dep.** — SEE HEC-12 RUN

8. 4TH INLET SOUTH OF IND. SCH. RD. (S.B. SIDE) — GRADE = 0.500 %, $Q_{cap.}$ = 5.55

RE-COMPUTE $C_w$ FOR CHANGING CONDS.

$C_w$ PER L.F. $= \frac{.95 \times 35}{35+16} + \frac{0.60 \times 16}{16+35} = 0.84$

Compute $L_{(MAX)} = 5.55 - 0.61 = 1.25(0.84)(9.2)\left(\frac{L \times 51}{43{,}560}\right)$

$L_{(MAX.)}$ = 437 FT.

DISTANCE TO FLANKING INLET = 86+50 – 79+80 = 670 FT. — TOO LONG SINCE > 437

LOCATE INLET @ STA. 83+00 ACROSS FROM N.B. INLET. — L = 350 FT.

∴ $Q_{100}$ (TRIB AREA) $= 1.25(0.84)(9.2)\left(\frac{350 \times 51}{43{,}560}\right) = 3.96$ cfs → AREA = 0.41 ac

$Q_{100}$ (TOT.) INTO INLET = 3.96 + (B/P = 0.61) = 4.57 cfs

USING CURB INLET w/ 10' WING $Q_{capture}$ = 4.04 cfs, B/P = 0.53 cfs

**USE CURB INLET w/ 10' WING @ S.B. STA. 83+00 w/ 2" dep.** — SEE HEC-12 RUN

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CONCEPTUAL INLET DES. THOMAS TO IND. SCH.

IV 9. 5TH INLET SOUTH OF INDIAN SCH RD. (S.B. SIDE)
FLANKING INLET (NORTH SIDE OF SUMP)
LOCATE @ STA. 79+80, L FROM PREV. = 320 FT.

REFERENCE
G = 0.500 %
Qsump = 5.55 cfs

$Q_{100}$ (TRIB. AREA.) = 1.25 (0.84)(9.2) $\left(\frac{320 \times 51}{43,560}\right)$ = 3.62 cfs

AREA = 0.37 A

$Q_{100}$ INTO INLET = 3.62 + (B/P = 0.53) = 4.15 cfs.

USING INLET w/ 6' WING  Qcapture = 3.04 cfs.
B/P = 1.11 cfs

USE CURB INLET w/ 6' WING @ S.B. STA. 79+80, w/ 2" dep.

SEE HEC-12 RUN.

10. 6TH INLET SOUTH OF INDIAN SCH RD. (S.B. SIDE)
(SUMP INLET @ L.P. OF ROAD SAG.)
B/P FROM NORTH = 1.11 cfs
B/P FROM SOUTH = 1.84 cfs.

$Q_{100}$ (TRIB AREA) = 1.25 (0.84)(9.2) $\left(\frac{55 \times 130'}{43,560}\right)$ = 1.59 cfs

AREA = 0.16 A

$Q_{100}$ (TOT) INTO. SUMP INLET = 1.59 + 1.84 + 1.11 = 4.54 cfs

NO B/P ALLOWED

USE CURB INLET w/ 3' WING @ S.B. STA. 79+11 ± w/ 2" dep.

SEE HEC-12 RUN

IV LOCATE & SIZE AREA INLETS BEHIND RETAINING WALL ADJACENT TO WEST CURB. (THOMAS TO INDIAN SCH RD)

THIS WILL BE NEEDED IF THE RETAINING WALL SCENARIO INVOLVES A CURB NEXT TO THE EXIST. CANAL THEREBY BLOCKING OFF DRAINAGE NECESSITATING AREA INLETS BEHIND THE WALL

FOR STUDY STAGE RANDOMLY PUT IN 3 OR 4 AREA INLETS IN CASE THEY ARE NEEDED.

NOTE: THE ROAD CURB INLETS WERE DESIGNED CONSERVATIVELY ACCOUNTING FOR THIS OFFSITE RUNOFF ALL THE WAY TO THE EAST EDGE OF THE CANAL.

## IV SIZE INLET COLLECTOR MAIN ROUTING to SUMP OUTFALL

REFERENCE

### (A.) From the South Beginning @ Int. of Thomas Rd.

1. @ 1ST INLETS N.B & S.B. STA. 66+75

$Q_{(TOT.)} = 4.37 + 4.34 = 8.71$ cfs.

Slope = 1.80 % (SAME AS ROAD GRADE)

$n = 0.012$ (RCP)

USE 24" ϕ R.C.P. (MIN. SIZE FOR A MAIN) FOR MAINTENANCE.

depth = 0.70 FT.
V = 8.84 fps
F = 2.17
(35 % FULL)

$Q_{CAP} = 24.66$ cfs.

USE 24" R.C.P. @ 1.80 % Slope.

@ Tc = 5 MIN. (MINIMUM)

SEE Computer RUN

2. @ 2ND INLETS N.B. & S.B., STA. 70+00

Compute travel time IN PIPE = $\frac{325 = \text{Spacing}}{8.84 \text{ fps} \times 60 \text{ sec/MIN}} = 0.61$ MIN

TOTAL Tc = 5 + 0.61 = 5.61 (MIN.)

→ CLOSE ENOUGH FOR STUDY to JUST ADD PEAK INLET FLOWS SINCE THEIR Tc = 5 MIN

$Q_{TOT.} = 8.71$ (ABOVE) $+ 2.84 + 5.12 = 16.67$ cfs

Slope = 0.7882 % (SAME AS ROAD GRADE)

$n = 0.012$ (RCP)

TRY 24" ϕ RCP.

depth = 1.31 FT.
V = 7.64 fps
F = 1.26
(65.5% FULL)

USE 24" R.C.P. @ 0.788 % Slope

SEE Compt. RUN.

3. PICK UP S.B. INLET @ STA. 74+00, Q = 6.37 cfs.

TRAVEL TIME = 400' / 7.64 fps × 60 sec/MIN = 0.87 MIN.

Tc (TOT.) = 5.61 + 0.87 = 6.48 MIN. AGAIN USE 5 MIN to BE CONSERV.

$Q_{TOT} = 16.67 + 6.37 = 23.04$ cfs. (JUST ADD INLET FLOWS)

USE 24" ϕ R.C.P. (88.5 % FULL)

d = 1.77 FT.
V = 7.83 fps

USE 24" R.C.P. @ 0.788 % Slope

S = 0.788 % SAME AS ROAD

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Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET / S.D. DES. THOMAS TO IND SCH.

IV 4. PICK UP INLET @ N.B. STA. 75+00 — REFERENCE

Q FROM INLET = 4.20 cfs.
TRAVEL TIME FROM 74+00 = 100'/7.83 x 60 = 0.21 MIN.
TOTAL Tc = 6.48 + 0.21 = 6.7 MIN.

TAKE deduction FOR REDUCED INTENSITIES @ THIS PT. SINCE INLET Tc'S ARE ALL 5 MIN. (MINIMUM)

i100 (5 MIN.) = 9.2 IN/HR. i100 (6.7 MIN) = 8.50 IN/HR.
8.5/9.2 = 92.39 % (TAKE 7.6 % DEDUCTION) → QUICK & DIRTY METHOD CLOSE ENOUGH FOR STUDY.

QTOT. = 0.9239 (4.20 + 23.04) = 25.17 cfs

SLOPE = 0.0079 1/1
n = 0.012
USE 30" ϕ R.C.P.
d = 1.45 ft.
V = 8.53 fps
F = 1.37
(~60% FULL)

Qcap. = 29.6 cfs. @ V = 6.03 fps

USE 30" R.C.P. @ 0.788% SLOPE

5. PICK UP INLETS @ N.B. & S.B. STA. 78+50 (FLANKING INLETS)

Q FROM INLETS (S.B. = 4.77) + (N.B. = 2.65) = 7.42 cfs.
(@ 78+50)

QTOT. = 27.24 + 7.42 = 34.66 → BEFORE REDUCTION ACCOUNTING FOR LOWER Tc. TO THIS POINT
(@ 5 MIN = Tc)

PIPE TRAVEL TIME from 4. = 350'/8.53 x 60 = 0.68 MIN.
Tc = 0.68 + 6.7 = 7.4 MIN.

i100 (5 MIN.) = 9.2 IN/HR., i100 (7.4 MIN.) = 8.1 IN/HR.
Reduction = i8 MIN / i5 MIN = 8.1/9.2 = 0.88 (e.g. 88 %)
Q(TOT.) = 34.66 (0.88) = 30.52 cfs.

SLOPE = 0.00791 1/1
USE 30" ϕ R.C.P. — d = 1.65 ft.
~~SEE~~ ABOVE Qcap = 39.5 cfs = FULL CAP.
V = 8.88 fps
(.67 % FULL)

USE 30" R.C.P. @ 0.788% SLOPE

SYSTEM EMPTIES INTO 48" ϕ S.D. @ SUMP PT. SIZED FOR OFFSITE FLOW

Parsons Brinckerhoff **Computation Sheet**

Subject: 64TH. STREET / SCOTTSDALE CONCEPTUAL INLET // S.D. DES. THOMAS TO INDIAN SCH. RD.

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IV SIZE INLET COLLECTOR MAIN ROUTING TO SUMP OUTFALL | REFERENCE

(B.) FROM the NORTH, BEGINNING @ INT. OF INDIAN SCH. RD.

1. 1ST INLET N.B. @ STA 97+00

Q(TOT.) = 4.47 cfs  Tc = 5 MIN. (MINIMUM)
SLOPE = 0.400 % (SAME AS ROAD), n = 0.012
USE 24" φ – MINIMUM SIZE FOR MAINT.
depth FLOW = 0.74 FT.  → Qcap. = 15.50 cfs.
V = 4.27 fps
(37 % FULL)

USE 24" φ R.C.P. @ 0.40% SL.

2. PICK UP INLETS @ N.B. & S.B. STA. 95+25

Q(TOT.) = 4.47 + 4.13 + 4.40 = 13.00 cfs @ Tc = 5 MIN
TIME TRAVEL to this INLET = 175' / 4.27 x 60 = 0.68 MIN
TOTAL Tc = 5 + 0.68 = 5.68 MIN. (Close Enough to ADD INLETS Q's
SLOPE = 0.400 %, n = 0.012
USE 24" φ – MIN. SIZE
d = 1.40 FT.
V = 5.53 fps
(70 % FULL)

USE 24" R.C.P. @ 0.400% SLOPE

3. PICK UP INLET @ N.B. STA. 93+50

Q(TOT.) = 13.00 cfs. + 4.35 = 17.35 cfs
TIME TRAVEL = 175' / 5.53 x 60 = 0.53 MIN.
TOTAL Tc = 5.68 + 0.53 = 6.21 MIN. → SINCE CLOSE to 24" Cap. TAKE REDUCTION IN FLOW Due to INCR. Tc.
i100 (5 MIN) = 9.2 in/hr., i100 (6.2 MIN) = 8.6 in/hr.
REDUCTION = 8.6 / 9.2 = 0.93
QTOT = 0.93 (17.35) = 16.22 cfs.  V = 5.6 fps.
SLOPE = 0.400 %, n = 0.012
USE 24" φ –
d = 1.74' (100% FULL) CLOSE But OK)

USE 24" R.C.P. @ 0.400% Slope  | 1s @ FULL CAP.

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CONCEPTUAL INLET / S.D. DES. - THOMAS TO INDIAN SCH RD.

IV (B.) 4. PICK UP INLETS @ N.B. & S.B. STA. 91+75 — REFERENCE

$Q_{(TOT)} = 16.22$ cfs FROM 3. ABOVE

$Q_{(INLETS)} = 4.33 + 3.87 = 8.20$ cfs w/ Tc = 5 MIN @ 91+75

PIPE TRAVEL TIME = 175' / 5.6 x 60 = 0.52 MIN

TOT. TC = 6.21 + 0.52 = 6.73 MIN.

$i_{100}$ (5 MIN) = 9.2 IN/HR, $i_{100}$ (6.73 MIN) = 7.9 IN/HR

REDUCTION = 7.9 / 9.2 = 0.86

Q INLETS = 8.20 (0.86) = 7.04 cfs

Q (TOT) INTO S.D. = 7.04 + 16.22 = 23.26 cfs

USE 30" ϕ R.C.P. w/ $S_L$ = 0.400 %

d = 1.73 FT

V = 6.48 fps

USE 30" ϕ R.C.P. @ 0.400% SLOPE

5. PICK UP INLET @ S.B. STA. 89+40, $Q_{INLET}$ = 4.94 cfs

PIPE TRAVEL TIME = 235 / 6.48 x 60 = 0.60 MIN.

TOTAL TC = 0.60 + 6.73 = 7.33 MIN.

$i_{100}$ (5 MIN.) = 9.2 IN/H., $i_{100}$ (7.33 MIN.) = 8.0

REDUCTION = 8.0 / 9.2 = 0.87

INLET Q = 0.87 (4.94) = 4.30 cfs.

Q (TOT) = 4.30 + 23.26 = 27.56 cfs

USE 30" ϕ R.C.P. w/ $S_L$ = 0.400 %

d = 2.01 FT. (80.3 % FULL)

V = 6.53 fps

Qcap = 28.10

USE 30" ϕ R.C.P. @ 0.400 % SLOPE

END OF INLET & S.D. DESIGN FOR 64TH ST. BETWEEN THOMAS RD & INDIAN SCHOOL RD.

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CONCEPTUAL INLET DES. - McDOWELL TO THOMAS

V NORTHBOUND DIRECTION — McDOWELL RD to THOMAS RD. | REFERENCE

(SEE Pg. 1 FOR REQUIREMENTS.)

1. • BEGIN TRIB @ CREST OF ROADWAY STA. 13+70 ±
R. GRADE = 0.400 %, Qcap. = 4.96 cfs — Tc = 5 MIN MINIMUM

Compute Weighted Cw PER L.F. OF ROAD $= \frac{.95(32')}{32+23'} + \frac{0.60(23')}{23+32} = 0.80$

Compute STA OF INLET $\rightarrow 4.96 = 1.25(9.2)(0.80)\left(\frac{55 \times L}{43,560}\right)$

L (MAX.) = 427 Ft. @ STA. 18+00

∴ $Q_{100}$ = 4.96 cfs (w/ NO B/P — SINCE from Crest)
(NO OFFSITE FLOW — DRAINS TOWARD EAST)

Q capture = 4.40 cfs.
B/P = 0.56 cfs. } USING 10' WING — SEE HEC-12 RUN.

USE CURB INLET w/ 10' WING @ N.B. STA 18+00 w/ 2" dep.

2. 2ND INLET N.B. from Crest @ STA 13+70 ±
GRADE = 0.633 %, Qcap = 5.73 cfs — FLOWS ON NEW 64TH WILL BE PICKED UP VIA INLETS & WON'T IMPACT FRONTAGE RD.

WEIGHTED Cw = 0.95 ALL STREET DRAINAGE

ASSUME FLOWS ON FRONTAGE RD. WILL REMAIN the SAME AND ARE NOT TRIBUTARY to FLOWS ON NEW 64TH ST.

Compute L(MAX) $5.73 - (B/P = 0.56) = 1.25(0.95)(9.2)\left(\frac{L \times 42}{43,560}\right)$

L (MAX.) = 490 Ft.

SINCE AN INLET IS NEEDED @ STA. 24+25 (625' FROM 1. ABOVE)
SPACE 1/3 WAY BET these @ STA. 21+00 (L = 300')

∴ $Q_{100}$ (TRIB AREA) $= 1.25(9.2)(0.95)\left(\frac{42 \times 300}{43,560}\right) = 3.16$ cfs — A = 0.29 Ac

$Q_{100}$ TO INLET = 3.16 + B/P = 0.56
= 3.72 cfs < Q cap = 5.73 (OK)

USING A 10' WING Qcap. = 3.40 cfs
B/P = 0.32 " — SEE HEC-12 RUN (TYP.)

USE CURB INLET w/ 10' WING @ N.B. STA. 21+00 w/ 2" dep.

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Subject 64TH STREET / SCOTTSDALE
CONCEPTUAL INLET DES.- McDOWELL TO THOMAS

CONT'D. FLANKING INLET ON S. SIDE OF HUBBEL DIP. — REFERENCE

3. 3RD N.B. INLET FROM McDOWELL @ HUBBEL DIP

Need Inlet @ STA. 23+80 (L = 280') @ END OF — 0.633'/' GRADE

$\therefore Q_{100}(TRIB.) = 1.25 \times (0.95)(9.2)\left(\frac{42 \times 280}{43{,}560}\right) = 2.95$ cfs — AREA = 0.27

$Q_{100}(TOT.) = 2.95 + (B/P = 0.22)$
$= 3.27$ cfs $< 5.73$ cfs Cap. @ 0.63% Grade (OK)

Using 10' Wing | Q capture = 3.09 cfs, B/P = 0.18 cfs

⇒ WANT to MINIMIZE BY-PASS here BECAUSE excess TRAVELS down the HUBBEL DIP. — Tc = 5 MIN (TYP.)

(a.) Compute 100 YR. STREET FLOW FROM NEW 64TH ST. that either B/P or is TRIBUTARY to HUBBEL DIP.

- From the SOUTH = $B/P = 0.18 + 1.25(9.2)(0.95)\left(\frac{100 \times 42'}{43{,}560}\right)$
$= 0.18 + 1.05 = 1.23$ cfs — OK, It's REASONABLE

USE CURB INLET w/ 10' WING @ N.B. STA. 23+80 w/ 2" depression. (Local)

4. 4TH N.B. INLET FROM McDOWELL @ HUBBEL DIP (L = 240')

FLANKING INLET ON N. SIDE OF CREST @ STA. 27+70 & INLET NEEDED @ STA. 25+30 — GRADE = 1.2 @ THIS PT IN 200' V.C.

$Q_{TRIB\,100} = 1.25(0.95)(9.2)\left(\frac{42 \times 240}{43{,}560}\right) = 2.53$ cfs

— NO BY-PASS @ THIS LOCATION —

$Q_{100}$ (INLET) = 2.53 cfs.

Using A 10' Wing | Q capture = 2.38 cfs, B/P = 0.15 cfs. — SEE HEC-1 RUN.

USE CURB INLET w/ 10' WING @ N.B. STA. 25+30 w/ 2" dep.

(4a.) ⇒ Compute total B/P DOWN HUBBEL FROM $Q_{100}$

- From the SOUTH = 1.23 cfs (SEE 3. ABOVE)
- From the NORTH = B/P + TRIB AREA = $0.15 + 1.25(9.2)(0.95)\left(\frac{48 \times 4}{43{,}56}\right)$
$= 0.15 + 0.51 = 0.66$

@ SAG COND. ⇒ TOTAL B/P 100 YR. DOWN HUBBEL = 1.23 + 0.66 = 1.89 cfs — OK, REASONABLE

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5. 5TH. N.B. Inlet From McDowell

REFERENCE

From the Roadway Crest @ Sta. 27+70± All Runoff Travels to the North Until it Eventually Reaches the Intersection of Thomas Rd.

Check For Capacity Limit @ End Of 0.45% Grade @ P/L Sta 31+20.

$Q_{100} = 1.25(0.95)(9.2)\left(\frac{42 \times 350 \text{ Ft.}}{43{,}560}\right) = 3.69$ cfs → $Q_{cap} = 4.83$

Since $Q_{100} = 3.69 < Q_{cap} = 4.83$ Proceed Further on 0.9267% Grade → $Q_{cap} = 6.94$ cfs

Compute L(max.)

$6.94 = 1.25(0.95)(9.2)\left(\frac{L \times 42}{43{,}560}\right)$

$L(max.) = 658$ Ft.

An Inlet Will be Needed @ S.E. Corner of Oak & 64th. @ Sta 35+20 (This L = 750 Ft. From Crest)

∴ Locate This Inlet @ Sta. 33+50 (L = 580 Ft.)

$Q_{100}$ Into Inlet $= 1.25(0.95)(9.2)\left(\frac{580 \times 42}{43{,}560}\right) = 6.11$ cfs $< 6.94$ OK

Using 17' Wing / $Q_{capture} = 5.71$ cfs
B/P = 0.40 cfs

See HEC-1 Run.

**Use Curb Inlet w/ 17' Wing @ N.B. Sta. 33+50 w/ 2" dep.**

6. 6TH. N.B. Inlet From McDowell @ S.E. Corner of Oak St.

B/P = 0.40 cfs. $Q_{cap} = 5.21$ cfs.

Locate Inlet @ Sta. 35+20 @ Grade = 0.56%

$Q_{100(TRIB)} = 1.25(0.95)(9.2)\left(\frac{42 \times 170}{43{,}560}\right) = 1.79$ cfs.

$Q_{100}$ (to Inlet) $= 1.79 + (B/P = 0.40) = 2.19$ cfs

Use 6' Wing / $Q_{capture} = 1.98$ cfs
B/P = 0.21 cfs → Will Return East on Oak St

**Use Curb Inlet w/ 6' Wing @ N.B. Sta. 35+20 w/ 2" dep.**

7. 7TH N.B. Inlet From McDowell

Grade = 0.40%
$Q_{cap} = 4.96$ cfs

– No B/P to This Inlet –

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7. Com'b. Compute L(MAX.) = 1.25(9.2)(0.95)$\left(\frac{L \times 42}{43{,}560}\right)$ 4.962 — REFERENCE G=0.4050%

L(MAX.) = 471 Ft.

Locate Inlet @ STA 40+50 ⇒ L = 450' ≤ 471 OK

Q100 (INLET) = 1.25(9.2)(0.95)$\left(\frac{42 \times 450}{43{,}560}\right)$ — AREA=0.43 AC.

= 4.74 cfs ≤ Qcap = 4.96 OK (NO – B/P)

Using A 10' Wing / Q CAPTURE = 4.25 cfs
B/P = 0.49 cfs — SEE HEC-12 RUN

USE CURB INLET w/ 10' WING @ N.B. STA 40+50 w/ 2" dep.

8. 8TH. N.B. INLET FROM McDOWELL — B/P = 0.49 cfs, GRADE = 0.400%, Qcap = 4.96 cfs.

Compute L(MAX.)

4.96 – 0.49 = 1.25(9.2)(0.95)$\left(\frac{L \times 42}{43{,}560}\right)$

L(MAX.) = 424 Ft.

LOCATE INLET @ STA 44+75 L = 425'

Q100 (TRIB.) = 1.25(9.2)(0.95)$\left(\frac{425 \times 42}{43{,}560}\right)$ = 4.48 cfs — AREA=0.41 AC.

Q100 (INLET) = 4.48 + (B/P = 0.49)
= 4.97 cfs.

Using A 10' Wing / Q CAPTURE = 4.40 cfs
B/P = 0.57 cfs — SEE HEC-12

USE CURB INLET w/ 10' WING @ N.B. STA. 44+75 w/ 2" dep.

9. 9TH N.B. INLET FROM McDOWELL — B/P = 0.57 cfs, GRADE = 0.400%, Qcap = 4.96 cfs.

NEED to Locate INLET @ STA 48+75 @ S.E. CORNER OF WILSHIRE & 64th. St. → L = 400 Ft.

Q100 (TRIB.) = 1.25(9.2)(0.95)$\left(\frac{400' \times 42}{43{,}560}\right)$ = 4.21 cfs — Area = 0.39A

Q100 (INLET) = 4.21 + 0.57
= 4.78 cfs

Using A 10' Wing / Q capture = 4.23 cfs.
B/P = 0.55 cfs

USE CURB INLET w/ 10' WING @ N.B. STA 48+75 w/ 2" dep. SEE HEC

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10. 10TH N.B. INLET FROM McDOWELL (NO BY-PASS)
GRADE = 0.5962 %

REFERENCE

NOTE: NORTH OF WILSHIRE THE N.B. ROADWAY NARROWS DOWN TO 22.5' → AS THE 5.5' BIKE LANE IS ELIMINATED.

ONE-11 LANE
ONE-11.5' LANE

THEREFORE THE ALLOWABLE FLOW SPREAD TO KEEP ONE-12' LANE OPEN = 22.5' - 12 = 10.5'
RUN HEC-12 TO COMPUTE NEW ROAD CAPACITY.

$Q_{cap} = 2.19$ cfs. Compute L (MAX.)

$$2.19 = 1.25(9.2)(0.95)\left(\frac{32.5 \times L}{43{,}560}\right)$$

$L_{(MAX.)} = 268.67$ Ft.

LOCATE INLET @ STA 52+00 ⇒ L = 260 FT OK

$$Q_{100\,(INLET)} = 1.25(0.95)(9.2)\left(\frac{260 \times 32.5}{43{,}560}\right) = 2.12 \text{ cfs}$$

NO OFFSITE FLOWS ONTO 64TH ALL THE WAY TO THOMAS

USING INLET W/ 6' WING / $Q_{CAPTURE} = 1.92$ cfs
B/P = 0.20 cfs

$A_{100} = 0.19$ AC

USE CURB INLET W/ 6' WING @ N.B. STA. 52+00 W/ 2" dep.

SEE HEC-12

11. 11TH INLET (N.B.) FROM McDOWELL
B/P = 0.20 cfs
$Q_{CAP} = 2.19$ cfs

GRADE = .596%

Compute L (MAX.) $2.19 - 0.20 = 1.25(0.95)(9.2)\left(\frac{L \times 32.5}{43{,}560}\right)$

$L_{(MAX)} = 244.2'$ Ft. (USE 250') CALL CLOSE ENOUGH

$Q_{100} = 2.04 + 0.19 = 2.23$ cfs (1.8 % over des., OK)

Area = 0.19 Ac.

(Locate INLET @ STA. 54+50)
USING INLET W/ 6' WING / $Q_{CAPTURE} = 1.99$ cfs
B/P = 0.24 cfs

USE CURB INLET W/ 6' WING @ N.B. STA. 54+50 W/ 2" dep.

SEE HEC-12

12. 12TH INLET N.B. FROM McDOWELL
B/P = 0.24 cfs.
$Q_{cap} = 2.19$ cfs

GRADE = 0.596

SINCE TRIB COND'S CHANGE W/ BUFFER AREA

Compute Cw / L.F. $= \frac{0.65(10)}{10 + 28.5} + \frac{0.95(28.5')}{28.5 + 10} = 0.87$

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V Cont'd.

12. 12TH Inlet N.B. From McDowell Rd.

Compute L(MAX) To Inlet
$2.19 - 0.24 = 1.25(9.2)(0.87)\left(\frac{L \times 38.5}{43,560}\right)$
L(MAX) = 221 Ft. → USE 225 Ft. Close Enough

$Q_{100}$(TRIB.) $= 1.25(9.2)(0.87)\left(\frac{225 \times 38.5}{43,560}\right) = 1.99$ cfs

$Q_{100}$ (@Inlet) = 1.99 + (B/P = 0.24) = 2.23 cfs.

Using A 10' Wing / Q capture = 2.23 cfs, B/P = 0
Flow Spread = 10.55 ft.
i.e. Dry Lane = 11.95 Ft. (Close Enough +12')

USE Curb Inlet w/ 10' Wing @ N.B. Sta. 56+75 (Sag)

REFERENCE

Tc = 5 MIN — MINIMUM —

Area = 0.20 Ac

→ Do This to Max. the Inlet Spacing So That Only 2 More will be Req'd to Int. of Thomas Rd.

13. 13TH Inlet N.B. From McDowell Rd.

Hydrologic Conditions ARE Similar to 12 Above
Cw = 0.87 (Still OK) GRADE = 0.596 %
Compute L(MAX.) $= 2.19 = 1.25(9.2)(0.87)\left(\frac{L \times 38.5}{43,560}\right)$ Qcap = 2.19 cfs
L(MAX.) = 247.6
USE L = 250 Ft. $Q_{100} = 1.25(9.2)(0.87)\left(\frac{250 \times 38.5}{43,560}\right)$
$Q_{100}$ (Inlet) = 2.21 cfs

Area = 0.22 Ac

In Order to Use Only 2 More Inlets to Thomas Rd.
Pick Up 100% of Flow - Allow No B/P.
Using A 6' Wing / Q capture = 1.98 cfs, B/P = 0.23 cfs

USE Curb Inlet w/ 6' Wing @ N.B. STA 59+25 w/ 2" depression

SEE HEC-16 — RON —

14. 14TH Inlet N.B. From McDowell Rd.

B/P = 0.23 cfs.

$Q_{100}$ (TRIB) $= 1.25(9.2)(0.95)\left(\frac{255 \times 40}{43,560}\right)$ = 2.56 (@ Int Thomas Rd. Have Extra Road Cap. w/ Lt Turn Lane @ Intersection)
$Q_{100}$ (To Inlet) = 2.56 + 0.23
= 2.79 cfs.

Using A 10' Wing / Q capture = 2.73 cfs, B/P = 0.06 cfs (OK)

USE Curb Inlet w/ 10' Wing @ N.B. STA 61+80 w/ 2" Dep.

END OF N.B. Inlets From McDowell to Thomas Rd.

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VI SOUTHBOUND DIRECTION — McDOWELL RD. to THOMAS RD. (SEE Pg. 1 FOR Requirements)

REFERENCE

1. 1ST Inlet S.B. From McDowell — ROAD GRADE = 0.40% — Q cap = 4.96 → EXCLUDING LT TURN BAYS.

DRAINAGE ENSUES NORTH FROM ROAD CREST @ STA. 13+70 ± — Permit WIDTH AVE = 35', CONT. FROM R/W = 15'

USE Tc = 5 MIN MINIMUM (TYP.)

$C_W = \frac{0.95(35')}{35+15} + \frac{0.65(15')}{15+35} = 0.86.$ PER L.F.

Compute $L(MAX.) = 4.96 = 1.25(9.2)(0.86)\frac{(L \times 50)}{43{,}560}$

$L(MAX) = 437$ Ft. (Approx.)

IT IS DESIRABLE TO Locate AN Inlet @ S.B. Sta. 18+70 — @ PAPAGO PK ENT.

Compute FLOW Spread & Evaluate:

$Q_{100}$ (TO INLET) $= 1.25(9.2)(0.86)\frac{(500 \times 50)}{43{,}560} = 5.68$ cfs.

— RUN HEC-12 & Eval. FLOW Spread. —

FLOW SPREAD = 16.3 Ft — THIS LEAVES 1 DRY LANE OF 28 − 16.3 = 11.7 Ft → Close ENOUGH

USING Inlet w/ 10' WING / Q capture = 4.82 cfs, B/P = 0.86 cfs.

USE CURB INLET w/ 10' WING @ S.B. STA 18+70 w/ 2" dip. @ INT. OF PAPAGO PARK.

2. 2ND Inlet S.B. From McDowell — ROAD GRADE = 0.633% — Q capacity = 5.73 cfs

Compute L(MAX) to Next Inlet — B/P = 0.86 from 1.

$L(MAX) = 5.73 - (B/P = 0.86) = 1.25(9.2)(0.86)\frac{(L \times 50)}{43{,}560}$

$L(MAX) = 429$ Ft. (Would be 150' S.W. OF HUBBLE DIP X-ING)

Therefore Locat Inlet. @ SAME Locat. AS N.B. @ Sta. 21+00 — L = 230 ft, Area = 0.36 AC

$Q_{100}$ (TRIB) $= 1.25(9.2)(0.86)\left(\frac{230 \times 50}{43{,}560}\right) = 2.61$ cfs

$Q_{100}$ (TO INLET) $= 2.61 + 0.86 = 3.47$ cfs

USING Inlet w/ 10' WING / Q capture = 3.23 cfs, B/P = 0.24 cfs — Use 10' Wing Because Going Into A Sump Cond.

USE CURB INLET w/ 10' WING @ S.B. STA. 21+00 w/ 2" dip.

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CONCEPTUAL INLET DES. – MCDOWELL TO THOMAS RD.
(FLANKING INLET TO SUMP)

VI 3. 3rd S.B. INLET FROM MCDOWELL  B/P = 0.24 cfs  GRADE = 0.633%  | REFERENCE

Locate Inlet @ S.B. STA. 23+80 (SAME AS N.B.) ⇒ L = 280 FT.

$Q_{100}(TRIB) = 1.25(9.2)(0.86)\left(\frac{280 \times 50}{43{,}560}\right) = 3.18$ cfs

$Q_{100}(INLET) = 3.18 + 0.24 = 3.42$ cfs.

OFFSITE FLOWS NON-TRIB TO STREET

Using A 6' Wing / $Q_{capture} = 2.61$ cfs, B/P = 0.82 cfs

USE CURB INLET w/ 6' Wing @ S.B. Sta 23+80 w/ 2" Dep.

4. 5TH S.B. INLET (FLANKED) FROM ROAD Acst @ STA. 27+67  | SUMP @ STA 24+34

– (NOTE:) 4TH S.B. INLET WILL BE IN SUMP. –

Locate Inlet @ STA 25+30 (SAME AS N.B.)  GRADE = 1.27 INV. C.

$Q_{100}(TRIB.) = 1.25(9.2)(0.86)\left(\frac{237 \times 50}{43{,}560}\right) = 2.69$ cfs. → NO B/P SINCE TOP OF BASIN @ ROAD Acst.

$Q_{100}(INLET) = 2.69$ cfs.

Using Inlet w/ 6' Wing / $Q_{capture} = 2.02$ cfs, B/P = 0.67 cfs

USE CURB INLET w/ 6' Wing @ S.B. STA. 25+30 w/ 2" Dep.

5. 4TH. S.B. INLET, (Sump Inlet) FROM MCDOWELL

B/P FROM NORTH = 0.82 cfs
B/P FROM SOUTH = 0.67 cfs | S.T. = 1.49 cfs.

$Q_{100}(TRIB) = 1.25(9.2)(0.86)\left(\frac{150 \times 50}{43{,}560}\right) = 1.70$ cfs.

$Q_{100}(INLET) = 1.70 + 1.49 = 3.19$ cfs

DES. A Sump Inlet
Using No Wing & Just 3" Sump Length
Flow Spread T = 12.88 Ft. Leaves 15.12 DRY LANE over 12' = OK)

USE CURB INLET (Sump.) w/ No Wing @ S.B. Sta 24+34
(Use 2" Depression)

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CONCEPTUAL INLET DESIGN – McDOWELL TO THOMAS RD.

VI 6TH S.B. INLET FROM McDOWELL

B/P = 0 cfs
Crest @ STA 27+97
GRADE = 0.9267 %
Q cap = 6.94 cfs

REFERENCE

6. TRY to Locacate INLET @ STA. 33+50
SAME AS N.B. SIDE
$C_W$ = 0.86 SAME AS PREVIOUSLY

$Q_{100}$ (TRIB.) = $1.25(9.2)(0.86)\left(\frac{553 \times 50}{43,560}\right)$ = 6.28 cfs. < 6.94

$Q_{100}$ (TO INLET) = 6.28 cfs.
USING A 17' WING / Q cap = 5.83 cfs.
B/P = 0.45 cfs.

Tc = 5 MIN. (MINIMUM)

Area = 0.63 ft. OK

USE CURB INLET w/ 17' WING @ S.B. STA. 33+50 w/ 2" Dep.

7. 7TH S.B. INLET FROM McDOWELL @ INTERSECTION OF OAK ST.
Locate INLET @ STA. 35+20 SAME AS N.B. SIDE

$Q_{100}$ (TRIB) = $1.25(9.2)(0.86)\left(\frac{50 \times 170}{43,560}\right)$ = 1.93 cfs

B/P = 0.45 cfs.
GRADE = 0.56 %
Q cap = 5.21 cfs

$Q_{100}$ (INLET) = 1.93 + 0.45 = 2.38 cfs

USING A 6' WING / Q capture = 2.10 cfs.
B/P = 0.28 cfs.

USE CURB INLET w/ 6' WING @ S.B. STA. 35+20 w/ 2" dep.

8. 8TH S.B. INLET FROM McDOWELL
(Locate INLET @ 40+50 SAME AS N.B.)
L = 450 FT.

B/P = 0.28 cfs.
GRADE = 0.4050 %
Q cap = 4.96 cfs

$Q_{100}$ (TRIB.) = $1.25(9.2)(0.86)\left(\frac{450 \times 50}{43,560}\right)$ = 5.11 cfs.

$Q_{100}$ (INLET) = 5.11 + 0.28
= 5.39 cfs. → FLOW SPREAD = 15.95 FT LEAVES 1 DRY LANE / 2.05 OK

USING A 10' WING @ S.B. STA. 40+50 w/ 2" Dep

9. 9TH S.B. INLET FROM McDOWELL
LOCATE INLET @ STA. 44+75, SAME AS N.B.

Q B/P = 0.74 cfs

$Q_{100}$ (TRIB.) = $1.25(9.2)(0.86)\left(\frac{425 \times 50}{43,560}\right)$ = 4.82 cfs

$Q_{100}$ (TOT. TO INLET) = 4.82 + 0.74 = 5.56 cfs

Area = 0.49 ft.

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CONCEPTUAL INLET DES. MCDOWELL to THOMAS

VI 9. CONT'D. $Q_{100}$ (INLET) = 5.56 cfs GRADE = 0.400 % — REFERENCE

USING A 17' WING Q capture = 5.56 cfs.
B/P = 0

FLOW SPREAD = 16.2 FT. ⇒ DRY LANE = 28.0 − 16.2 = 11.8 FT. — CLOSE ENOUGH TO 12 FT. OK

USE CURB INLET W/ 17' WING @ S.B. STA. 44+75 W/ 2" dep.

10. 10TH INLET S.B. FROM MCDOWELL — B/P = 0, GRADE = 0.400 %

Locate INLET @ STA. 48+75 @ WILSHIRE AVE (SAME AS N.B.)

$Q_{100}$ (TRIB & INLET) = 1.25 (9.2)(0.86)$\left(\frac{400 \times 50}{43{,}560}\right)$ = 4.54 cfs. — AREA = 0.46 AC

Q cap. = 4.96 cfs, OK

USING AN INLET W/ 10' WING / Q capture = 4.13 cfs.
B/P = 0.41 cfs

USE CURB INLET W/ 10' WING @ S.B. STA. 48+75, W/ 2" dep.

11. 11TH S.B. INLET FROM MCDOWELL — B/P = 0.41 cfs. GRADE = 0.5962 % — Q cap = 5.58

Locate INLET @ STA. 54+50 (L = 575.01)

$Q_{100}$ (TRIB.) = 1.25 (9.2)(0.86)$\left(\frac{575 \times 50}{43{,}560}\right)$ = 6.53 cfs. N/G — Capacity Exceeded

Compute L(MAX.) = 5.58 − 0.41 = 1.25 (9.2)(0.86)$\left(\frac{L \times 50}{43{,}560}\right)$
L(MAX) = 455.4 ft.

Locate @ STA 53+30 (L = 455 FT.) $Q_{100}$ INLET = 5.17 cfs

USE INLET W/ 10' WING
Q capture = 4.29 cfs.
B/P = 0.88 cfs

USE CURB INLET W/ 10' WING @ S.B. STA 53+30 W/ 2" dep.

12. 12TH INLET S.B. FROM MCDOWELL — B/P = 0.88 cfs. GRADE = 0.5962 % — Q CAP = 5.58 cfs

HAVE BUFFER ISLAND Compute New Cw.

Cw / L.F. = $\frac{0.95(34')}{34' + 25'} + \frac{0.65(4' + 15')}{25 + 34}$ = 0.82

Compute L(MAX.) = 5.58 − 0.88 = 1.25 (9.2)(0.82)$\left(\frac{L \times 59}{43{,}560}\right)$
( L(MAX.) = 368 FT. )

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CONCEPTUAL INLET DES. McDOWELL TO THOMAS

12. CONT'D. Locate Inlet @ STA. 56+75 (Same As N.B.) | REFERENCE

$Q_{100}$ (TRIB.) $= 1.25(9.2)(0.82)\left(\frac{335 \times 59}{43,560}\right) = 4.15$ cfs. | Area = 0.44 A

$Q_{100}$ (INLET) $= 4.15 + 0.88 = 5.03$ cfs.

Using Inlet w/ 10' Wing / Q capture = 4.21 cfs
B/P = 0.82 "

**USE CURB INLET w/ 10' WING @ S.B. STA. 56+75 w/ 2" DEP.**

13. 13TH. INLET S.B. from McDowell | B/P = 0.82 cfs, Grade = 0.5962%

L(MAX) IS IN RANGE OF 370 FT.
IT'S 455' to PCR of THOMAS RD. Do Calc & Check out FLOW SPREAD SINCE LT. HAND TURN LANE MAKES BASIN Smaller.

Compute AREA & Cw

$C_w = \frac{0.65(16 \times 455)}{21,930 \text{ ft}^2} + \frac{0.95(14,650 \text{ ft}^2)}{21,930 \text{ ft}^2} = 0.85$ | A = 0.50 AC

$Q_{100}$ (TRIB.) $= 1.25(9.2)(0.85)(0.50) = 4.89$ cfs

$Q_{100}$ (INLET) $= 4.89 + 0.82 = 5.71$ cfs. ( FLOW SPREAD = 15.2 FT, Leaves 12.8 FT. DRY LANE, OK

Using A 17' Wing / Q capture = 5.61 cfs
B/P = 0.10 cfs onto Thomas Rd.

**USE CURB INLET w/ 17' WING @ S.B. STA. 61+30 w/ 2" DEP.** | SEE HEC RUNS

— END OF INLET DESIGN —
( SEE Pg. 28 for STORM DRAIN DESIGN )
BEGINNING @ ≈ 800' NORTH OF McDOWELL RD. —

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Concept INLET AND STORM DRAIN DESIGN

VII SIZE INLET COLLECTOR MAINS FROM McDOWELL to THOMAS | REFERENCE

1. 1ST INLETS N.B. & S.B. @ STA. 18+00 N.B. & 18+70 S.B.
   Q (INLET) = 4.40 + 4.82 = 9.22 cfs.
   USE 24" ϕ R.C.P. MIN. (FOR MAINT.)
   SLOPE @ 0.500 %, n = 0.012 (TYP.)
   depth = 1.04 Ft, Q CAP. = 17.33 cfs
   V = 5.60 fps, SIZE CONTROLED BY Q10 OFFSITE FROM BASIN "C" = 30 cfs ∴ Use 30" ϕ
   52% FULL
   USE 30" R.C.P @ 0.50% SLOPE — SEE Computer RUN

2. PICK UP INLETS @ STA. 21+00, N.B. & S.B
   Q INLETS = 3.40 + 3.29 = 6.69 cfs.
   PIPE TRAVEL TIME = 230 FT / 5.60 x 60 = 0.68 Min.
   TOTAL TC = 5.68 MIN. (Check Close Enough to Tc = 5) TO ADD ALL INLET FLOWS

   Q TOT. = 9.22 + 6.69 = 15.91 cfs.
   USE 24" ϕ R.C.P.
   Slope = 0.500 %, Q cap = 17.33 cfs, N/G
   depth = 1.51 Ft., SIZE CONTROLED BY Q10 OFFSITE FROM BASIN "C" = 30 cfs ∴ Need 30" ϕ R.C.P.
   V = 6.26 fps
   75.5% FULL
   USE 30" R.C.P. @ 0.500% SLOPE

3. PICK UP INLETS @ STA 23+80, N.B. & S.B.
   Q INLETS = 3.09 + 2.61 = 5.70 cfs.
   PIPE TRAVEL TIME = 280' / 6.26 x 60 = 0.75 MIN.
   TOTAL Tc = 5.68 + 0.75 = 6.43 MIN.
   TAKE Reduction for Lower RAINFALL INTENSITIES Resulting FROM higher Tc  I100 (5 MIN) = 9.2"/hr, I100 (6.43) = 8.55 in/hr.
   Reduction = 8.55/9.2 (5.70 + 15.91) = 20.1 cfs.
   Q TOT = 20.1 cfs.
   Slope = 0.500 %, Q cap = 31.4 cfs. — AGAIN Q10 OFFSITE FROM BASIN "C" WILL CONTROL @ Q10 = 30 cfs 30" ϕ R.C.P. IS OK
   depth = 1.45 Ft.
   V = 6.79 fps
   USE 30" ϕ R.C.P
   USE 30" R.C.P. @ 0.50% Slope

Parsons Brinckerhoff **Computation Sheet**

Page 29 of 30 | 4541P103

Made by BOB B.

Date 08-17-93

Checked by

Date

Subject 64TH ST. / SCOTTSDALE

Concept Storm Drain Des. McDowell to THOMAS.

REFERENCE

IV 4.) PICK UP SUMP INLET @ STA. 24+33.5±

PIPE TRAVEL TIME = 55' / 6.79 x 60 = 0.14 MIN

TOTAL TC = 6.43 + 0.14 = 6.57 MIN.

REDUCTION = 2'100 (5 MIN.) = 9.2 , 2'100 (6.57) MIN = 8.5 IN/HR. = 8.5 / 9.2 = 0.92

Q(INLET) = 3.19 (0.92) = 2.95.

TOTAL Q = 2.95 + 20.1 = 23.05 cfs.

USE 30" ϕ R.C.P.
SL = 0.50 %
V = 7.0 fps.
} Qcap. = 31.4 cfs.

USE 30" ϕ R.C.P. @ SL = 0.50%

5. PICK UP INLETS @ STA. 25+30 N.B. & S.B.

Q THESE INLETS = 2.38 + 2.02 = 4.40 cfs.

PIPE TRAVEL TIME = 97' / 7.0 x 60 = 0.23 MIN.

TOTAL TC. = 6.57 + 0.23 = 6.80 MIN. 2'100 (6.8) = 8.4 IN/HR. REDUCTION = 0.91

Q(2 INLETS) = (8.4/9.2)(4.40) + 23.05 = 27.07 cfs.

USE 30" ϕ R.C.P.
SL = 0.50 %
V = 7.2 fps.
depth = 1.79 Ft.
} Qcap = 31.4 cfs.

USE 30" ϕ R.C.P. @ SL = 0.50%

6. PICK UP INLETS @ STA. 33+50 N.B. & S.B.

PIPE TRAVEL TIME = 820 / 7.2 x 60 = 1.9 MIN.

TOTAL TC = 1.9 + 6.8 = 8.70 MIN 2'100 (8.7) = 7.6 IN/HR.

Q(2 INLETS) = 5.71 + 5.83 = 11.54 cfs. , REDUCE 7.6 / 9.2 = 0.83

= .83 (11.54) = 9.53

TOTAL Q(INLETS) = 9.53 + 27.07 = 36.60 cfs.

USE 30" ϕ R.C.P.
SL = 0.65 %
V = 8.3 fps.
(100% FULL)

@ Capacity.

USE 30" ϕ R.C.P. @ SL. 0.65%

Parsons Brinckerhoff **Computation Sheet**

Subject 64TH ST. / SCOTTSDALE
Concept STORM DRAIN System

Page 30 of 50 | 45-21-P153
Made by BOB B.
Date 08-17-93
Checked by
Date

REFERENCE

VI 7. PICK UP INLETS @ Sta. 35+20 N.B & S.B.

Q (2 INLETS) = 1.98 + 2.10 = 4.08 cfs
TAKE REDUCTION = 81.5% (EST.) CLOSE ENOUGH
Q (TOT) TO INLETS = (4.08 x .815) + 36.60 cfs.
Q (TOT.) = 39.93 = 40 cfs.

Use 30" ϕ S.D. @ $S_L$ = 0.700 %
V = 8.43 fps
depth = 2.31 FT.
(100 % FULL)
} @ Qcap = 40 cfs.
Use 30" ϕ R.C.P. @ 0.700 %

@ INTERSECTION OF OAK ST.

BEYOND THIS POINT the STORM DRAIN OUTFALL CONDUIT IS CONTROLLED BY OFFSITE FLOW for the 10 YR. STORM & NOT INLET FLOW FROM 100 YR. STORM.

$Q_{10}$ @ OAK ST. = 76 cfs.
(OFFSITE)

$Q_{100}$ from INLETS = 40 cfs.

— END OF S. DRAIN & INLET DESIGN —

# Part C HEC-12 Curb Capacity Computations

N.B. 64TH @ WILSHIRE AVE.
(CURB CAPACITY CALC.)

HEC-12

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.006 | 0.020 | 0.016 | 2.19 | 10.50 ALLBL. |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.350 | 0.24 | 1.95 |

ROAD CAPACITY NORTH OF WILSHIRE

— ROADWAY CAPACITY CALC. —

GRADE OUT OF SAG, CONDITION @ V.P.I. STA. 79+00 = 0.500%

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

DESIGNER: BOB B

DATE: 08-11-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.005 | 0.020 | 0.016 | 5.55 | 15.50 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.241 | 0.34 | 2.29 |

— ROADWAY CAPACITY CALC. —

GRADE UP TO INDIAN SCHOOL RD. FROM V.P.I. STA 96+50 = 2.65 %

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*****************************************
*****     ROADWAY DRAINAGE DESIGN     *****
*****************************************
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HEC-12

DESIGNER: BOB B  DATE: 08-11-1993

PROJECT: 64TH STREET  PROJECT NO.: 4541P108

INLET NO.:  STATION:

DRAINAGE AREA: Acres  DESIGN FREQUENCY: 100Years

---

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.027 | 0.020 | 0.016 | 10.74 | 14.50 |

---

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.257 | 0.32 | 5.05 |

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*****************************************
*****     ROADWAY DRAINAGE DESIGN     *****
*****************************************
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GRADE OUT OF VERT. CURVE TRANS. @ V.P.I. STA. 86+00 = 1.42 %

DESIGNER: BOB B  DATE: 08-11-1993

PROJECT: 64TH STREET  PROJECT NO.: 4541P108

INLET NO.:  STATION:

DRAINAGE AREA: Acres  DESIGN FREQUENCY: 100Years

## ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.014 | 0.020 | 0.016 | 7.86 | 14.50 |

## GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.257 | 0.32 | 3.70 |

HEC-12

@ N.B. LANES @ INT. OF 64TH ST. AND OSBORN RD.
COMPUTE FLOW SPREAD TO PLACE INLET @ NORTH CURB RETURN
@ "T" INTERSECTION

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

DESIGNER: BOB B

DATE: 08-12-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.004 | 0.020 | 0.016 | 5.89 | 16.53 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.226 | 0.36 | 2.13 |

@ INT. OF THOMAS AND 64TH ST. — OUTGOING GRADE = 0.40%
— ROADWAY CAPACITY CALC. —

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

DESIGNER: BOB B

DATE: 08-10-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.004 | 0.020 | 0.016 | 4.96 | 15.50 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.241 | 0.34 | 2.05 |

— ROADWAY CAP CALC. —
NORTH OF V.P.I. STA. 66+00 INTO 1.800 % GRADE

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

DESIGNER: BOB B

DATE: 08-11-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.018 | 0.020 | 0.016 | 10.54 | 15.50 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.241 | 0.34 | 4.34 |

— ROADWAY CAP. CALC. —

GRADE INTO SAG CONDITION @ V.P.I. STA. 79+00 — = 0.7882 %

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

HEC-12

DESIGNER: BOB B

DATE: 08-11-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.008 | 0.020 | 0.016 | 6.97 | 15.50 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.241 | 0.34 | 2.87 |

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*****************************************
*****     ROADWAY DRAINAGE DESIGN     *****
*****************************************
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DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

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ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.006 | 0.020 | 0.016 | 5.73 | 15.00 |

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GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 2.52 |

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*****************************************
*****     ROADWAY DRAINAGE DESIGN     *****
*****************************************
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DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.005 | 0.020 | 0.016 | 4.83 | 15.00 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 2.11 |

**********
***** ROADWAY DRAINAGE DESIGN *****
**********

DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.009 | 0.020 | 0.016 | 6.94 | 15.00 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 3.05 |

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*****************************************
*****    ROADWAY DRAINAGE DESIGN    *****
*****************************************
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DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.007 | 0.020 | 0.016 | 6.03 | 15.00 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 2.65 |

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*****************************************
*****    ROADWAY DRAINAGE DESIGN     *****
*****************************************
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DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.010 | 0.020 | 0.016 | 7.21 | 15.00 |

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 3.17 |

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****************************************
*****    ROADWAY DRAINAGE DESIGN    *****
****************************************
```

DESIGNER: BOB B

DATE: 08-14-1993

PROJECT: 64TH STREET

PROJECT NO.: 4541P108

INLET NO.:

STATION:

DRAINAGE AREA: Acres

DESIGN FREQUENCY: 100Years

---

ROADWAY & DISCHARGE DATA

| Cross-Slope | S (ft/ft) | Sx (ft/ft) | n | Q (cfs) | T (ft) |
|---|---|---|---|---|---|
| Composite | 0.006 | 0.020 | 0.016 | 5.58 | 15.00 |

---

GUTTER FLOW

| W (ft) | Sw (ft/ft) | a (in) | Eo | d (ft) | V (fps) |
|---|---|---|---|---|---|
| 1.42 | 0.042 | 0.00 | 0.249 | 0.33 | 2.45 |

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# Part D HEC-12 Inlet Capacity Computations (McDowell Road to Thomas Road)

STORM DRAIN BETWEEN MCDOWELL & THOMAS
1ST N.B. INLET

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 18+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.960 |
| SPREAD-Ft.--T | = | 15.485 |
| Average Velocity-V-fps | = | 2.234 |
| FLOW in Gutter-CFS--Q | = | 1.200 |
| % Flow in Gutter-CFS--Eo | = | 24.184 |
| Velocity of Flow in Gutter-fps | = | 2.715 |
| Depth at Curb Line-Inches--d | = | 4.091 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.960 |
| Velocity of Flow in Gutter-fps | = | 2.715 |
| FLOW in Gutter-CFS--Q | = | 1.200 |
| Depth at Curb Line-Inches--d | = | 4.091 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.502 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.268 | 1.329 | 3.631 |
| 6.583 | 0.526 | 2.610 | 2.350 |
| 9.583 | 0.707 | 3.507 | 1.453 |
| 13.583 | 0.886 | 4.395 | 0.565 |
| 20.583 | 1.000 | 4.960 | 0.000 |

2ND N.B. INLET FROM INCLOW

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 21+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.633 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.720 |
| SPREAD-Ft.--T | = | 12.709 |
| Average Velocity-V-fps | = | 2.519 |
| FLOW in Gutter-CFS--Q | = | 1.088 |
| % Flow in Gutter-CFS--Eo | = | 29.255 |
| Velocity of Flow in Gutter-fps | = | 2.998 |
| Depth at Curb Line-Inches--d | = | 3.425 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.720 |
| Velocity of Flow in Gutter-fps | = | 2.998 |
| FLOW in Gutter-CFS--Q | = | 1.088 |
| Depth at Curb Line-Inches--d | = | 3.425 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.639 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.283 | 1.051 | 2.669 |
| 6.583 | 0.552 | 2.053 | 1.667 |
| 9.583 | 0.737 | 2.741 | 0.979 |
| 13.583 | 0.913 | 3.396 | 0.324 |
| 20.583 | 1.000 | 3.720 | 0.000 |

3rd N.B. INLET Fr. McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. ST. 23+80 CHECKER - PAGE
FLANKEL S. SIDE OF HUBBEL DIP.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.633 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.270 |
| SPREAD-Ft.--T | = | 12.095 |
| Average Velocity-V-fps | = | 2.452 |
| FLOW in Gutter-CFS--Q | = | 1.003 |
| % Flow in Gutter-CFS--Eo | = | 30.667 |
| Velocity of Flow in Gutter-fps | = | 2.902 |
| Depth at Curb Line-Inches--d | = | 3.278 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.270 |
| Velocity of Flow in Gutter-fps | = | 2.902 |
| FLOW in Gutter-CFS--Q | = | 1.003 |
| Depth at Curb Line-Inches--d | = | 3.278 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 13.604 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.302 | 0.989 | 2.281 |
| 6.583 | 0.586 | 1.915 | 1.355 |
| 9.583 | 0.775 | 2.535 | 0.735 |
| 13.583 | 0.944 | 3.087 | 0.183 |
| 20.583 | 1.000 | 3.270 | 0.000 |

4TH N.B. INLET From Mc DOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MC DOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 25+30 CHECKER - PAGE
FLANKER - N. SIDE OF HUBBEL

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.270 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.530 |
| SPREAD-Ft.--T | = | 9.571 |
| Average Velocity-V-fps | = | 3.076 |
| FLOW in Gutter-CFS--Q | = | 0.966 |
| % Flow in Gutter-CFS--Eo | = | 38.173 |
| Velocity of Flow in Gutter-fps | = | 3.527 |
| Depth at Curb Line-Inches--d | = | 2.672 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.530 |
| Velocity of Flow in Gutter-fps | = | 3.527 |
| FLOW in Gutter-CFS--Q | = | 0.966 |
| Depth at Curb Line-Inches--d | = | 2.672 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 13.722 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.300 | 0.759 | 1.771 |
| 6.583 | 0.582 | 1.472 | 1.058 |
| 9.583 | 0.771 | 1.950 | 0.580 |
| 13.583 | 0.941 | 2.380 | 0.150 |
| 20.583 | 1.000 | 2.530 | 0.000 |

STH. N.B. INLET FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 33+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.927 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 6.110 |
| SPREAD-Ft.--T | = | 14.285 |
| Average Velocity-V-fps | = | 3.250 |
| FLOW in Gutter-CFS--Q | = | 1.598 |
| % Flow in Gutter-CFS--Eo | = | 26.148 |
| Velocity of Flow in Gutter-fps | = | 3.918 |
| Depth at Curb Line-Inches--d | = | 3.803 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 6.110 |
| Velocity of Flow in Gutter-fps | = | 3.918 |
| FLOW in Gutter-CFS--Q | = | 1.598 |
| Depth at Curb Line-Inches--d | = | 3.803 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 21.132 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.200 | 1.223 | 4.887 |
| 6.583 | 0.403 | 2.463 | 3.647 |
| 9.583 | 0.556 | 3.395 | 2.715 |
| 13.583 | 0.727 | 4.444 | 1.666 |
| 20.583 | 0.934 | 5.707 | 0.403 |

6TH N.B. INLET FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 35+20 CHECKER - PAGE
@ S.E. CORNER OF OAK & 64TH.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.560 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.190 |
| SPREAD-Ft.--T | = | 10.610 |
| Average Velocity-V-fps | = | 2.153 |
| FLOW in Gutter-CFS--Q | = | 0.760 |
| % Flow in Gutter-CFS--Eo | = | 34.697 |
| Velocity of Flow in Gutter-fps | = | 2.505 |
| Depth at Curb Line-Inches--d | = | 2.921 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.190 |
| Velocity of Flow in Gutter-fps | = | 2.505 |
| FLOW in Gutter-CFS--Q | = | 0.760 |
| Depth at Curb Line-Inches--d | = | 2.921 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 10.526 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.382 | 0.836 | 1.354 |
| 6.583 | 0.713 | 1.562 | 0.628 |
| 9.583 | 0.904 | 1.980 | 0.210 |
| 13.583 | 1.000 | 2.190 | 0.000 |
| 20.583 | 1.000 | 2.190 | 0.000 |

1TH INLET N.B. FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 40+50 CHECKER - PAGE
JUST SOUTH OF VERNON AVE.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.405 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.740 |
| SPREAD-Ft.--T | = | 15.184 |
| Average Velocity-V-fps | = | 2.223 |
| FLOW in Gutter-CFS--Q | = | 1.168 |
| % Flow in Gutter-CFS--Eo | = | 24.649 |
| Velocity of Flow in Gutter-fps | = | 2.697 |
| Depth at Curb Line-Inches--d | = | 4.019 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.740 |
| Velocity of Flow in Gutter-fps | = | 2.697 |
| FLOW in Gutter-CFS--Q | = | 1.168 |
| Depth at Curb Line-Inches--d | = | 4.019 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.157 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.274 | 1.297 | 3.443 |
| 6.583 | 0.536 | 2.542 | 2.198 |
| 9.583 | 0.719 | 3.407 | 1.333 |
| 13.583 | 0.897 | 4.251 | 0.489 |
| 20.583 | 1.000 | 4.740 | 0.000 |

6TH INLET N.B. FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 44+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.970 |
| SPREAD-Ft.--T | = | 15.497 |
| Average Velocity-V-fps | = | 2.235 |
| FLOW in Gutter-CFS--Q | = | 1.201 |
| % Flow in Gutter-CFS--Eo | = | 24.166 |
| Velocity of Flow in Gutter-fps | = | 2.716 |
| Depth at Curb Line-Inches--d | = | 4.094 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.970 |
| Velocity of Flow in Gutter-fps | = | 2.716 |
| FLOW in Gutter-CFS--Q | = | 1.201 |
| Depth at Curb Line-Inches--d | = | 4.094 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.520 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.268 | 1.330 | 3.640 |
| 6.583 | 0.526 | 2.613 | 2.357 |
| 9.583 | 0.707 | 3.512 | 1.458 |
| 13.583 | 0.886 | 4.402 | 0.568 |
| 20.583 | 1.000 | 4.970 | 0.000 |

9TH INLET N.B. FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 48+75 CHECKER - PAGE
@ S.E. CORNER OF WILSHIRE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.780 |
| SPREAD-Ft.--T | = | 15.269 |
| Average Velocity-V-fps | = | 2.216 |
| FLOW in Gutter-CFS--Q | = | 1.172 |
| % Flow in Gutter-CFS--Eo | = | 24.516 |
| Velocity of Flow in Gutter-fps | = | 2.690 |
| Depth at Curb Line-Inches--d | = | 4.039 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.780 |
| Velocity of Flow in Gutter-fps | = | 2.690 |
| FLOW in Gutter-CFS--Q | = | 1.172 |
| Depth at Curb Line-Inches--d | = | 4.039 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.185 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.273 | 1.306 | 3.474 |
| 6.583 | 0.535 | 2.559 | 2.221 |
| 9.583 | 0.718 | 3.431 | 1.349 |
| 13.583 | 0.896 | 4.283 | 0.497 |
| 20.583 | 1.000 | 4.780 | 0.000 |

10TH INLET N.B. FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA 52+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.120 |
| SPREAD-Ft.--T | = | 10.351 |
| Average Velocity-V-fps | = | 2.193 |
| FLOW in Gutter-CFS--Q | = | 0.753 |
| % Flow in Gutter-CFS--Eo | = | 35.506 |
| Velocity of Flow in Gutter-fps | = | 2.543 |
| Depth at Curb Line-Inches--d | = | 2.859 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.120 |
| Velocity of Flow in Gutter-fps | = | 2.543 |
| FLOW in Gutter-CFS--Q | = | 0.753 |
| Depth at Curb Line-Inches--d | = | 2.859 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 10.477 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.383 | 0.812 | 1.308 |
| 6.583 | 0.716 | 1.517 | 0.603 |
| 9.583 | 0.906 | 1.922 | 0.198 |
| 13.583 | 1.000 | 2.120 | 0.000 |
| 20.583 | 1.000 | 2.120 | 0.000 |

11TH INLET N.B. FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-14-1993

PROJECT NAME- 64TH ST / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS DESIGNER - BOB B.
LOCATION - N.B. STA. 54+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.230 |
| SPREAD-Ft.--T | = | 10.556 |
| Average Velocity-V-fps | = | 2.215 |
| FLOW in Gutter-CFS--Q | = | 0.777 |
| % Flow in Gutter-CFS--Eo | = | 34.863 |
| Velocity of Flow in Gutter-fps | = | 2.576 |
| Depth at Curb Line-Inches--d | = | 2.908 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.230 |
| Velocity of Flow in Gutter-fps | = | 2.576 |
| FLOW in Gutter-CFS--Q | = | 0.777 |
| Depth at Curb Line-Inches--d | = | 2.908 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 10.785 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.373 | 0.833 | 1.397 |
| 6.583 | 0.701 | 1.562 | 0.668 |
| 9.583 | 0.893 | 1.991 | 0.239 |
| 13.583 | 1.000 | 2.230 | 0.000 |
| 20.583 | 1.000 | 2.230 | 0.000 |

10TH N.B. INLET FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 56+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.230 |
| SPREAD-Ft.--T | = | 10.556 |
| Average Velocity-V-fps | = | 2.215 |
| FLOW in Gutter-CFS--Q | = | 0.777 |
| % Flow in Gutter-CFS--Eo | = | 34.861 |
| Velocity of Flow in Gutter-fps | = | 2.576 |
| Depth at Curb Line-Inches--d | = | 2.908 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.230 |
| Velocity of Flow in Gutter-fps | = | 2.576 |
| FLOW in Gutter-CFS--Q | = | 0.777 |
| Depth at Curb Line-Inches--d | = | 2.908 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 10.784 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.373 | 0.833 | 1.397 |
| 6.583 | 0.701 | 1.562 | 0.668 |
| 9.583 | 0.893 | 1.991 | 0.239 |
| 13.583 | 1.000 | 2.230 | 0.000 |
| 20.583 | 1.000 | 2.230 | 0.000 |

15TH N.B. INLET THRU THE CURVE

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH STREET / SCOTTSDALE TRACS NO.- _____
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 59+25 CHECKER - _____ PAGE_____

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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.210 |
| SPREAD-Ft.--T | = | 10.519 |
| Average Velocity-V-fps | = | 2.211 |
| FLOW in Gutter-CFS--Q | = | 0.773 |
| % Flow in Gutter-CFS--Eo | = | 34.975 |
| Velocity of Flow in Gutter-fps | = | 2.570 |
| Depth at Curb Line-Inches--d | = | 2.900 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.210 |
| Velocity of Flow in Gutter-fps | = | 2.570 |
| FLOW in Gutter-CFS--Q | = | 0.773 |
| Depth at Curb Line-Inches--d | = | 2.900 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 10.729 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.375 | 0.829 | 1.381 |
| 6.583 | 0.703 | 1.554 | 0.656 |
| 9.583 | 0.895 | 1.979 | 0.231 |
| 13.583 | 1.000 | 2.210 | 0.000 |
| 20.583 | 1.000 | 2.210 | 0.000 |

14TH & EAST N.B. INLET FROM [illegible]

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 61+80 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.790 |
| SPREAD-Ft.--T | = | 11.511 |
| Average Velocity-V-fps | = | 2.318 |
| FLOW in Gutter-CFS--Q | = | 0.897 |
| % Flow in Gutter-CFS--Eo | = | 32.140 |
| Velocity of Flow in Gutter-fps | = | 2.726 |
| Depth at Curb Line-Inches--d | = | 3.137 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.790 |
| Velocity of Flow in Gutter-fps | = | 2.726 |
| FLOW in Gutter-CFS--Q | = | 0.897 |
| Depth at Curb Line-Inches--d | = | 3.137 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 12.260 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.333 | 0.928 | 1.862 |
| 6.583 | 0.636 | 1.774 | 1.016 |
| 9.583 | 0.829 | 2.313 | 0.477 |
| 13.583 | 0.980 | 2.734 | 0.056 |
| 20.583 | 1.000 | 2.790 | 0.000 |

IT IS DESIRABLE TO LIMIT B/P FLOW FROM 64TH STREET RETURNING EAST DOWN THOMAS RD. @ THE INTERSECTION.

1ST S.B. INLET FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 18+70 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.680 |
| SPREAD-Ft.--T | = | 16.305 |
| Average Velocity-V-fps | = | 2.300 |
| FLOW in Gutter-CFS--Q | = | 1.306 |
| % Flow in Gutter-CFS--Eo | = | 23.001 |
| Velocity of Flow in Gutter-fps | = | 2.809 |
| Depth at Curb Line-Inches--d | = | 4.288 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.680 |
| Velocity of Flow in Gutter-fps | = | 2.809 |
| FLOW in Gutter-CFS--Q | = | 1.306 |
| Depth at Curb Line-Inches--d | = | 4.288 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 16.720 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.250 | 1.418 | 4.262 |
| 6.583 | 0.494 | 2.805 | 2.875 |
| 9.583 | 0.669 | 3.797 | 1.883 |
| 13.583 | 0.849 | 4.821 | 0.859 |
| 20.583 | 0.999 | 5.677 | 0.003 |

2ND S.B. INLET FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 21+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.633 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.470 |
| SPREAD-Ft.--T | = | 12.374 |
| Average Velocity-V-fps | = | 2.483 |
| FLOW in Gutter-CFS--Q | = | 1.041 |
| % Flow in Gutter-CFS--Eo | = | 30.009 |
| Velocity of Flow in Gutter-fps | = | 2.946 |
| Depth at Curb Line-Inches--d | = | 3.345 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.470 |
| Velocity of Flow in Gutter-fps | = | 2.946 |
| FLOW in Gutter-CFS--Q | = | 1.041 |
| Depth at Curb Line-Inches--d | = | 3.345 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.072 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.293 | 1.017 | 2.453 |
| 6.583 | 0.570 | 1.978 | 1.492 |
| 9.583 | 0.757 | 2.628 | 0.842 |
| 13.583 | 0.930 | 3.228 | 0.242 |
| 20.583 | 1.000 | 3.470 | 0.000 |

2nd S.B. Inlet From McDowell

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- McDOWELL TO THOMAS
LOCATION - S.B. STA. 23+80

TRACS NO.-
DESIGNER - BOB B.
CHECKER -
PAGE

---

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.633 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.420 |
| SPREAD-Ft.--T | = | 12.305 |
| Average Velocity-V-fps | = | 2.475 |
| FLOW in Gutter-CFS--Q | = | 1.032 |
| % Flow in Gutter-CFS--Eo | = | 30.169 |
| Velocity of Flow in Gutter-fps | = | 2.935 |
| Depth at Curb Line-Inches--d | = | 3.328 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.420 |
| Velocity of Flow in Gutter-fps | = | 2.935 |
| FLOW in Gutter-CFS--Q | = | 1.032 |
| Depth at Curb Line-Inches--d | = | 3.328 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 13.956 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.295 | 1.010 | 2.410 |
| 6.583 | 0.574 | 1.962 | 1.458 |
| 9.583 | 0.762 | 2.605 | 0.815 |
| 13.583 | 0.934 | 3.193 | 0.227 |
| 20.583 | 1.000 | 3.420 | 0.000 |

5TH S.B. INLET FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS. DESIGNER - BOB B.
LOCATION - S.B. STA. 25+30 CHECKER - PAGE
FLANKING INLET N. of SUMP- @ HUBBEL DIP.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.270 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.690 |
| SPREAD-Ft.--T | = | 9.803 |
| Average Velocity-V-fps | = | 3.113 |
| FLOW in Gutter-CFS--Q | = | 1.004 |
| % Flow in Gutter-CFS--Eo | = | 37.342 |
| Velocity of Flow in Gutter-fps | = | 3.582 |
| Depth at Curb Line-Inches--d | = | 2.728 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.690 |
| Velocity of Flow in Gutter-fps | = | 3.582 |
| FLOW in Gutter-CFS--Q | = | 1.004 |
| Depth at Curb Line-Inches--d | = | 2.728 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.215 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.290 | 0.781 | 1.909 |
| 6.583 | 0.565 | 1.521 | 1.169 |
| 9.583 | 0.752 | 2.023 | 0.667 |
| 13.583 | 0.926 | 2.491 | 0.199 |
| 20.583 | 1.000 | 2.690 | 0.000 |

4TH S.B. INLET FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-15-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS DESIGNER - BOB B.
LOCATION - S.B. STA. 24+33.5± CHECKER - PAGE
(Sump Inlet)

CURB OPENING INLET--IN SUMP — 2" LOCAL DEPRESSION

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Depth at Curb Line-Inches--d | = | 2.728 |
| Flow-CFS--Q | = | 3.190 |
| Local Gutter Depression-Inches | = | 2.000 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | d(weir) | d(orifice) | d(INLET) | SPREAD |
|---|---|---|---|---|
| 3.083 | 5.466 | 4.347 | 5.466 | 12.881 |
| 6.583 | 3.962 | 0.953 | 3.962 | 6.612 |
| 9.583 | 3.279 | 0.450 | 3.279 | 3.766 |
| 13.583 | 2.712 | 0.224 | 2.712 | 1.418 |
| 20.583 | 2.133 | 0.098 | 2.133 | 1.115 |

*** d(INLET) is Greater of WEIR or ORIFICE Depth.! ***

6TH S.B. 11-27 FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-16-1993

PROJECT NAME- 64TH ST/SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS DESIGNER - BOBB.
LOCATION - S.B. STA. 33+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.927 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 6.280 |
| SPREAD-Ft.--T | = | 14.436 |
| Average Velocity-V-fps | = | 3.269 |
| FLOW in Gutter-CFS--Q | = | 1.626 |
| % Flow in Gutter-CFS--Eo | = | 25.884 |
| Velocity of Flow in Gutter-fps | = | 3.946 |
| Depth at Curb Line-Inches--d | = | 3.839 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 6.280 |
| Velocity of Flow in Gutter-fps | = | 3.946 |
| FLOW in Gutter-CFS--Q | = | 1.626 |
| Depth at Curb Line-Inches--d | = | 3.839 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 21.461 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.197 | 1.239 | 5.041 |
| 6.583 | 0.398 | 2.497 | 3.783 |
| 9.583 | 0.549 | 3.446 | 2.834 |
| 13.583 | 0.719 | 4.518 | 1.762 |
| 20.583 | 0.928 | 5.825 | 0.455 |

USE 1' WING TO ELIMINATE PONDING @ OAK ST. INTER.

/TH. S.B. INLET FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-16-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- MCDOWELL TO THOMAS RD.
LOCATION - S.B. STA 35+20
@ INTERSECTION OF OAK ST.

TRACS NO.-
DESIGNER - BOB B.
CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.560 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 2.380 |
| SPREAD-Ft.--T | = | 10.957 |
| Average Velocity-V-fps | = | 2.189 |
| FLOW in Gutter-CFS--Q | = | 0.801 |
| % Flow in Gutter-CFS--Eo | = | 33.667 |
| Velocity of Flow in Gutter-fps | = | 2.558 |
| Depth at Curb Line-Inches--d | = | 3.005 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 2.380 |
| Velocity of Flow in Gutter-fps | = | 2.558 |
| FLOW in Gutter-CFS--Q | = | 0.801 |
| Depth at Curb Line-Inches--d | = | 3.005 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 11.040 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.366 | 0.870 | 1.510 |
| 6.583 | 0.689 | 1.639 | 0.741 |
| 9.583 | 0.882 | 2.098 | 0.282 |
| 13.583 | 0.999 | 2.379 | 0.001 |
| 20.583 | 1.000 | 2.380 | 0.000 |

6TH S.B. INLET FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-16-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- MCDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 40+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.405 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.390 |
| SPREAD-Ft.--T | = | 15.945 |
| Average Velocity-V-fps | = | 2.285 |
| FLOW in Gutter-CFS--Q | = | 1.267 |
| % Flow in Gutter-CFS--Eo | = | 23.506 |
| Velocity of Flow in Gutter-fps | = | 2.785 |
| Depth at Curb Line-Inches--d | = | 4.202 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.390 |
| Velocity of Flow in Gutter-fps | = | 2.785 |
| FLOW in Gutter-CFS--Q | = | 1.267 |
| Depth at Curb Line-Inches--d | = | 4.202 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 16.285 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.256 | 1.379 | 4.011 |
| 6.583 | 0.505 | 2.722 | 2.668 |
| 9.583 | 0.682 | 3.675 | 1.715 |
| 13.583 | 0.862 | 4.646 | 0.744 |
| 20.583 | 1.000 | 5.390 | 0.000 |

7TH S.B. INLET FROM MCDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-16-1993

PROJECT NAME- 64TH ST./SCOTTSDALE
HIGHWAY NAME- MCDOWELL TO THOMAS
LOCATION - S.B. STA. 44+75

TRACS NO.-
DESIGNER - BOB B.
CHECKER -
PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.560 |
| SPREAD-Ft.--T | = | 16.173 |
| Average Velocity-V-fps | = | 2.290 |
| FLOW in Gutter-CFS--Q | = | 1.289 |
| % Flow in Gutter-CFS--Eo | = | 23.184 |
| Velocity of Flow in Gutter-fps | = | 2.794 |
| Depth at Curb Line-Inches--d | = | 4.256 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.560 |
| Velocity of Flow in Gutter-fps | = | 2.794 |
| FLOW in Gutter-CFS--Q | = | 1.289 |
| Depth at Curb Line-Inches--d | = | 4.256 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 16.522 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.252 | 1.404 | 4.156 |
| 6.583 | 0.499 | 2.774 | 2.786 |
| 9.583 | 0.675 | 3.750 | 1.810 |
| 13.583 | 0.855 | 4.753 | 0.807 |
| 20.583 | 1.000 | 5.560 | 0.000 |

10TH INLET S.B. FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-16-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS DESIGNER - BOB B.
LOCATION - S.B. STA. 48+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.540 |
| SPREAD-Ft.--T | = | 14.972 |
| Average Velocity-V-fps | = | 2.192 |
| FLOW in Gutter-CFS--Q | = | 1.134 |
| % Flow in Gutter-CFS--Eo | = | 24.987 |
| Velocity of Flow in Gutter-fps | = | 2.655 |
| Depth at Curb Line-Inches--d | = | 3.968 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.540 |
| Velocity of Flow in Gutter-fps | = | 2.655 |
| FLOW in Gutter-CFS--Q | = | 1.134 |
| Depth at Curb Line-Inches--d | = | 3.968 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.753 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.281 | 1.274 | 3.266 |
| 6.583 | 0.548 | 2.489 | 2.051 |
| 9.583 | 0.733 | 3.327 | 1.213 |
| 13.583 | 0.909 | 4.129 | 0.411 |
| 20.583 | 1.000 | 4.540 | 0.000 |

11TH INLET S.O. FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-17-1993

PROJECT NAME- 64TH. ST. / SCOTTSDALE
HIGHWAY NAME- McDOWELL TO THOMAS.
LOCATION - S.B. STA 53+30

TRACS NO.-
DESIGNER - BOB B.
CHECKER -
PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.170 |
| SPREAD-Ft.--T | = | 14.580 |
| Average Velocity-V-fps | = | 2.636 |
| FLOW in Gutter-CFS--Q | = | 1.325 |
| % Flow in Gutter-CFS--Eo | = | 25.637 |
| Velocity of Flow in Gutter-fps | = | 3.186 |
| Depth at Curb Line-Inches--d | = | 3.874 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.170 |
| Velocity of Flow in Gutter-fps | = | 3.186 |
| FLOW in Gutter-CFS--Q | = | 1.325 |
| Depth at Curb Line-Inches--d | = | 3.874 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 17.390 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.241 | 1.244 | 3.926 |
| 6.583 | 0.478 | 2.469 | 2.701 |
| 9.583 | 0.649 | 3.354 | 1.816 |
| 13.583 | 0.829 | 4.285 | 0.885 |
| 20.583 | 0.995 | 5.144 | 0.026 |

12TH INLET S.B. FROM McDOWELL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-17-1993

PROJECT NAME- 64TH ST / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD DESIGNER - BOB B.
LOCATION - S.B. STA 56+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.030 |
| SPREAD-Ft.--T | = | 14.428 |
| Average Velocity-V-fps | = | 2.621 |
| FLOW in Gutter-CFS--Q | = | 1.303 |
| % Flow in Gutter-CFS--Eo | = | 25.898 |
| Velocity of Flow in Gutter-fps | = | 3.164 |
| Depth at Curb Line-Inches--d | = | 3.838 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.030 |
| Velocity of Flow in Gutter-fps | = | 3.164 |
| FLOW in Gutter-CFS--Q | = | 1.303 |
| Depth at Curb Line-Inches--d | = | 3.838 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 17.124 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.244 | 1.228 | 3.802 |
| 6.583 | 0.484 | 2.434 | 2.596 |
| 9.583 | 0.657 | 3.302 | 1.728 |
| 13.583 | 0.837 | 4.208 | 0.822 |
| 20.583 | 0.997 | 5.016 | 0.014 |

1ST & LAST S.B. INLET FROM McDOWEL

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-17-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- McDOWELL TO THOMAS RD. DESIGNER - BOB B.
LOCATION - S.B. STA 61+30 CHECKER - PAGE
@ S.W. PCR OF THOMAS RD.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.596 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.710 |
| SPREAD-Ft.--T | = | 15.143 |
| Average Velocity-V-fps | = | 2.693 |
| FLOW in Gutter-CFS--Q | = | 1.411 |
| % Flow in Gutter-CFS--Eo | = | 24.714 |
| Velocity of Flow in Gutter-fps | = | 3.266 |
| Depth at Curb Line-Inches--d | = | 4.009 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.710 |
| Velocity of Flow in Gutter-fps | = | 3.266 |
| FLOW in Gutter-CFS--Q | = | 1.411 |
| Depth at Curb Line-Inches--d | = | 4.009 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 18.387 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.228 | 1.304 | 4.406 |
| 6.583 | 0.455 | 2.599 | 3.111 |
| 9.583 | 0.621 | 3.548 | 2.162 |
| 13.583 | 0.800 | 4.568 | 1.142 |
| 20.583 | 0.983 | 5.612 | 0.098 |

# Part E HEC-12 Inlet Capacity Computations (Thomas Road To Indian School Road)

HEC-12

5.E
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ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- THOMAS TO INDIAN SCH RD.
LOCATION - S.B. STA. 79+11 ± (@ Sump INLET)

TRACS NO.-
DESIGNER - BOB B.
CHECKER -
PAGE

CURB OPENING INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Depth at Curb Line-Inches--d | = | 3.702 |
| Flow-CFS--Q | = | 4.540 |
| Local Gutter Depression-Inches | = | 2.000 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | d(weir) | d(orifice) | d(INLET) | SPREAD |
|---|---|---|---|---|
| 3.083 | 6.916 | 7.612 | 7.612 | 21.822 |
| 6.583 | 5.013 | 1.931 | 5.013 | 10.991 |
| 9.583 | 4.148 | 0.911 | 4.148 | 7.390 |
| 13.583 | 3.431 | 0.454 | 3.431 | 4.401 |
| 20.583 | 2.698 | 0.198 | 2.698 | 1.411 |

*** d(INLET) is Greater of WEIR or ORIFICE Depth.! ***

HEC-12

SD.
5S

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- THOMAS TO INDIAN SCH RD.
LOCATION - S.B. STA. 79+80
(FLANKING INLET)

TRACS NO.-
DESIGNER - BOB B.
CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.500 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.150 |
| SPREAD-Ft.--T | = | 13.864 |
| Average Velocity-V-fps | = | 2.348 |
| FLOW in Gutter-CFS--Q | = | 1.117 |
| % Flow in Gutter-CFS--Eo | = | 26.912 |
| Velocity of Flow in Gutter-fps | = | 2.822 |
| Depth at Curb Line-Inches--d | = | 3.702 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.150 |
| Velocity of Flow in Gutter-fps | = | 2.822 |
| FLOW in Gutter-CFS--Q | = | 1.117 |
| Depth at Curb Line-Inches--d | = | 3.702 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.761 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.280 | 1.164 | 2.986 |
| 6.583 | 0.548 | 2.275 | 1.875 |
| 9.583 | 0.733 | 3.040 | 1.110 |
| 13.583 | 0.909 | 3.773 | 0.377 |
| 20.583 | 1.000 | 4.150 | 0.000 |

HEC-12

S.D
4S

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH. ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - S.B. STA 83+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.500 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.570 |
| SPREAD-Ft.--T | = | 14.384 |
| Average Velocity-V-fps | = | 2.396 |
| FLOW in Gutter-CFS--Q | = | 1.187 |
| % Flow in Gutter-CFS--Eo | = | 25.974 |
| Velocity of Flow in Gutter-fps | = | 2.891 |
| Depth at Curb Line-Inches--d | = | 3.827 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.570 |
| Velocity of Flow in Gutter-fps | = | 2.891 |
| FLOW in Gutter-CFS--Q | = | 1.187 |
| Depth at Curb Line-Inches--d | = | 3.827 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.585 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.267 | 1.219 | 3.351 |
| 6.583 | 0.524 | 2.395 | 2.175 |
| 9.583 | 0.704 | 3.219 | 1.351 |
| 13.583 | 0.884 | 4.038 | 0.532 |
| 20.583 | 1.000 | 4.570 | 0.000 |

HEC-12

S.t
3S

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - S.B. STA 86+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.467 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.890 |
| SPREAD-Ft.--T | = | 12.902 |
| Average Velocity-V-fps | = | 3.866 |
| FLOW in Gutter-CFS--Q | = | 1.698 |
| % Flow in Gutter-CFS--Eo | = | 28.836 |
| Velocity of Flow in Gutter-fps | = | 4.610 |
| Depth at Curb Line-Inches--d | = | 3.471 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.890 |
| Velocity of Flow in Gutter-fps | = | 4.610 |
| FLOW in Gutter-CFS--Q | = | 1.698 |
| Depth at Curb Line-Inches--d | = | 3.471 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 22.980 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.185 | 1.089 | 4.801 |
| 6.583 | 0.374 | 2.203 | 3.687 |
| 9.583 | 0.518 | 3.053 | 2.837 |
| 13.583 | 0.684 | 4.030 | 1.860 |
| 20.583 | 0.897 | 5.281 | 0.609 |

HEC-12

S.D
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ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - S.B. STA 91+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.150 |
| SPREAD-Ft.--T | = | 14.468 |
| Average Velocity-V-fps | = | 2.150 |
| FLOW in Gutter-CFS--Q | = | 1.072 |
| % Flow in Gutter-CFS--Eo | = | 25.829 |
| Velocity of Flow in Gutter-fps | = | 2.596 |
| Depth at Curb Line-Inches--d | = | 3.847 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.150 |
| Velocity of Flow in Gutter-fps | = | 2.596 |
| FLOW in Gutter-CFS--Q | = | 1.072 |
| Depth at Curb Line-Inches--d | = | 3.847 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.027 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.294 | 1.220 | 2.930 |
| 6.583 | 0.571 | 2.371 | 1.779 |
| 9.583 | 0.759 | 3.150 | 1.000 |
| 13.583 | 0.932 | 3.866 | 0.284 |
| 20.583 | 1.000 | 4.150 | 0.000 |

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-13-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS / TO / INDIAN SCH. RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 95+25 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.540 |
| SPREAD-Ft.--T | = | 14.972 |
| Average Velocity-V-fps | = | 2.192 |
| FLOW in Gutter-CFS--Q | = | 1.134 |
| % Flow in Gutter-CFS--Eo | = | 24.987 |
| Velocity of Flow in Gutter-fps | = | 2.655 |
| Depth at Curb Line-Inches--d | = | 3.968 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.540 |
| Velocity of Flow in Gutter-fps | = | 2.655 |
| FLOW in Gutter-CFS--Q | = | 1.134 |
| Depth at Curb Line-Inches--d | = | 3.968 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.753 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.281 | 1.274 | 3.266 |
| 6.583 | 0.548 | 2.489 | 2.051 |
| 9.583 | 0.733 | 3.327 | 1.213 |
| 13.583 | 0.909 | 4.129 | 0.411 |
| 20.583 | 1.000 | 4.540 | 0.000 |

HEC-12

4 S.D.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- THOMAS TO INDIAN SCH RD.
LOCATION - S.B. STA. 48+50 (FLANKING INLET)

TRACS NO.-
DESIGNER - BOGB.
CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.800 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 6.610 |
| SPREAD-Ft.--T | = | 15.139 |
| Average Velocity-V-fps | = | 3.119 |
| FLOW in Gutter-CFS--Q | = | 1.634 |
| % Flow in Gutter-CFS--Eo | = | 24.720 |
| Velocity of Flow in Gutter-fps | = | 3.783 |
| Depth at Curb Line-Inches--d | = | 4.008 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 6.610 |
| Velocity of Flow in Gutter-fps | = | 3.783 |
| FLOW in Gutter-CFS--Q | = | 1.634 |
| Depth at Curb Line-Inches--d | = | 4.008 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 21.354 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.198 | 1.310 | 5.300 |
| 6.583 | 0.399 | 2.640 | 3.970 |
| 9.583 | 0.551 | 3.642 | 2.968 |
| 13.583 | 0.722 | 4.772 | 1.838 |
| 20.583 | 0.930 | 6.145 | 0.465 |

HEC-12

3 S.D.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 74+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.800 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 6.940 |
| SPREAD-Ft.--T | = | 15.422 |
| Average Velocity-V-fps | = | 3.152 |
| FLOW in Gutter-CFS--Q | = | 1.685 |
| % Flow in Gutter-CFS--Eo | = | 24.280 |
| Velocity of Flow in Gutter-fps | = | 3.829 |
| Depth at Curb Line-Inches--d | = | 4.076 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 6.940 |
| Velocity of Flow in Gutter-fps | = | 3.829 |
| FLOW in Gutter-CFS--Q | = | 1.685 |
| Depth at Curb Line-Inches--d | = | 4.076 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 21.944 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.193 | 1.340 | 5.600 |
| 6.583 | 0.390 | 2.705 | 4.235 |
| 9.583 | 0.539 | 3.738 | 3.202 |
| 13.583 | 0.708 | 4.912 | 2.028 |
| 20.583 | 0.918 | 6.369 | 0.571 |

HEC-12

2 S.D.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 70+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.800 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.840 |
| SPREAD-Ft.--T | = | 12.365 |
| Average Velocity-V-fps | = | 4.185 |
| FLOW in Gutter-CFS--Q | = | 1.754 |
| % Flow in Gutter-CFS--Eo | = | 30.030 |
| Velocity of Flow in Gutter-fps | = | 4.966 |
| Depth at Curb Line-Inches--d | = | 3.342 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.840 |
| Velocity of Flow in Gutter-fps | = | 4.966 |
| FLOW in Gutter-CFS--Q | = | 1.754 |
| Depth at Curb Line-Inches--d | = | 3.342 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 23.952 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.178 | 1.038 | 4.802 |
| 6.583 | 0.360 | 2.105 | 3.735 |
| 9.583 | 0.501 | 2.924 | 2.916 |
| 13.583 | 0.663 | 3.873 | 1.967 |
| 20.583 | 0.877 | 5.120 | 0.720 |

FROM INTIC THOMAS RD TO S.D.

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH. RD. DESIGNER - BOB B.
LOCATION - S.B. STA. 66+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.870 |
| SPREAD-Ft.--T | = | 15.378 |
| Average Velocity-V-fps | = | 2.225 |
| FLOW in Gutter-CFS--Q | = | 1.186 |
| % Flow in Gutter-CFS--Eo | = | 24.348 |
| Velocity of Flow in Gutter-fps | = | 2.703 |
| Depth at Curb Line-Inches--d | = | 4.066 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.870 |
| Velocity of Flow in Gutter-fps | = | 2.703 |
| FLOW in Gutter-CFS--Q | = | 1.186 |
| Depth at Curb Line-Inches--d | = | 4.066 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.344 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.271 | 1.317 | 3.553 |
| 6.583 | 0.531 | 2.585 | 2.285 |
| 9.583 | 0.712 | 3.470 | 1.400 |
| 13.583 | 0.891 | 4.339 | 0.531 |
| 20.583 | 1.000 | 4.870 | 0.000 |

HEC-12

N.B. Sump

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 79+11 ± CHECKER - PAGE
IN ROAD SUMP @ L.P. OF SAG.

CURB OPENING INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Depth at Curb Line-Inches--d | = | 0.000 |
| Flow-CFS--Q | = | 3.730 |
| Local Gutter Depression-Inches | = | 2.000 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | d(weir) | d(orifice) | d(INLET) | SPREAD |
|---|---|---|---|---|
| 3.083 | 6.067 | 5.943 | 6.067 | 15.384 |
| 6.583 | 4.397 | 1.304 | 4.397 | 8.426 |
| 9.583 | 3.639 | 0.615 | 3.639 | 5.267 |
| 13.583 | 3.010 | 0.306 | 3.010 | 2.645 |
| 20.583 | 2.367 | 0.133 | 2.367 | 1.238 |

*** d(INLET) is Greater of WEIR or ORIFICE Depth.! ***

3.083 YIELDS 1 DRY LANE = 11.6 FT. CLOSE (12' MIN Is desir.)

SINCE IT'S A Sump Condition BE Conservative

USE L = 6.583' (e.g. 3' WING + 3' Sump @ Inlet)
FLOW Regiem Is Weir. ALLOWS for More Clogging & DEBRIS BLOCKAGE.

B.B.
8-12-93

NOTE: WING CAN POINT EITHER NORTH OR SOUTH, SINCE The FLOW COMING INTO the Sump from each direction Is the SAME.

HEC-12

N.B. 8S

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 79+80 CHECKER - PAGE
(FLANKING INLET)

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.500 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.180 |
| SPREAD-Ft.--T | = | 13.903 |
| Average Velocity-V-fps | = | 2.351 |
| FLOW in Gutter-CFS--Q | = | 1.122 |
| % Flow in Gutter-CFS--Eo | = | 26.841 |
| Velocity of Flow in Gutter-fps | = | 2.827 |
| Depth at Curb Line-Inches--d | = | 3.711 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.180 |
| Velocity of Flow in Gutter-fps | = | 2.827 |
| FLOW in Gutter-CFS--Q | = | 1.122 |
| Depth at Curb Line-Inches--d | = | 3.711 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 14.821 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.279 | 1.168 | 3.012 |
| 6.583 | 0.546 | 2.283 | 1.897 |
| 9.583 | 0.730 | 3.053 | 1.127 |
| 13.583 | 0.907 | 3.792 | 0.388 |
| 20.583 | 1.000 | 4.180 | 0.000 |

HEC-12

N,t
73

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 83+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.500 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.720 |
| SPREAD-Ft.--T | = | 14.563 |
| Average Velocity-V-fps | = | 2.413 |
| FLOW in Gutter-CFS--Q | = | 1.211 |
| % Flow in Gutter-CFS--Eo | = | 25.666 |
| Velocity of Flow in Gutter-fps | = | 2.915 |
| Depth at Curb Line-Inches--d | = | 3.870 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.720 |
| Velocity of Flow in Gutter-fps | = | 2.915 |
| FLOW in Gutter-CFS--Q | = | 1.211 |
| Depth at Curb Line-Inches--d | = | 3.870 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.870 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.262 | 1.237 | 3.483 |
| 6.583 | 0.516 | 2.436 | 2.284 |
| 9.583 | 0.695 | 3.281 | 1.439 |
| 13.583 | 0.875 | 4.129 | 0.591 |
| 20.583 | 1.000 | 4.720 | 0.000 |

HEC-12

N.B. 6S.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 86+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.420 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 6.430 |
| SPREAD-Ft.--T | = | 13.426 |
| Average Velocity-V-fps | = | 3.887 |
| FLOW in Gutter-CFS--Q | = | 1.785 |
| % Flow in Gutter-CFS--Eo | = | 27.757 |
| Velocity of Flow in Gutter-fps | = | 4.656 |
| Depth at Curb Line-Inches--d | = | 3.597 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 6.430 |
| Velocity of Flow in Gutter-fps | = | 4.656 |
| FLOW in Gutter-CFS--Q | = | 1.785 |
| Depth at Curb Line-Inches--d | = | 3.597 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 23.972 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.178 | 1.141 | 5.289 |
| 6.583 | 0.360 | 2.316 | 4.114 |
| 9.583 | 0.500 | 3.217 | 3.213 |
| 13.583 | 0.663 | 4.262 | 2.168 |
| 20.583 | 0.876 | 5.635 | 0.795 |

HEC-12

N.B.
5S.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH. RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 89+40 CHECKER - PAGE

@ N.E. CURB RET. @ 64TH & OSBORN RD.

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.890 |
| SPREAD-Ft.--T | = | 16.531 |
| Average Velocity-V-fps | = | 2.318 |
| FLOW in Gutter-CFS--Q | = | 1.337 |
| % Flow in Gutter-CFS--Eo | = | 22.694 |
| Velocity of Flow in Gutter-fps | = | 2.835 |
| Depth at Curb Line-Inches--d | = | 4.342 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.890 |
| Velocity of Flow in Gutter-fps | = | 2.835 |
| FLOW in Gutter-CFS--Q | = | 1.337 |
| Depth at Curb Line-Inches--d | = | 4.342 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 17.061 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.245 | 1.443 | 4.447 |
| 6.583 | 0.485 | 2.859 | 3.031 |
| 9.583 | 0.658 | 3.878 | 2.012 |
| 13.583 | 0.839 | 4.939 | 0.951 → 1/2 GOES EAST |
| 20.583 | 0.998 | 5.876 | 0.014 1/2 GOES SOUTH |

HEC-12

N.E. 43

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH. ST. / SCOTTSDALE TRACS NO.- _____
HIGHWAY NAME- THOMAS TO IND. SCH. RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 91+75 CHECKER - _____ PAGE _____

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.860 |
| SPREAD-Ft.--T | = | 15.366 |
| Average Velocity-V-fps | = | 2.224 |
| FLOW in Gutter-CFS--Q | = | 1.184 |
| % Flow in Gutter-CFS--Eo | = | 24.367 |
| Velocity of Flow in Gutter-fps | = | 2.701 |
| Depth at Curb Line-Inches--d | = | 4.063 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.860 |
| Velocity of Flow in Gutter-fps | = | 2.701 |
| FLOW in Gutter-CFS--Q | = | 1.184 |
| Depth at Curb Line-Inches--d | = | 4.063 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.326 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.271 | 1.316 | 3.544 |
| 6.583 | 0.531 | 2.582 | 2.278 |
| 9.583 | 0.713 | 3.465 | 1.395 |
| 13.583 | 0.892 | 4.333 | 0.527 |
| 20.583 | 1.000 | 4.860 | 0.000 |

HEC-12

N.B
3S

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-12-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH.RD DESIGNER - BOB B.
LOCATION - N.B. STA. 93+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.890 |
| SPREAD-Ft.--T | = | 15.402 |
| Average Velocity-V-fps | = | 2.227 |
| FLOW in Gutter-CFS--Q | = | 1.189 |
| % Flow in Gutter-CFS--Eo | = | 24.311 |
| Velocity of Flow in Gutter-fps | = | 2.705 |
| Depth at Curb Line-Inches--d | = | 4.071 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.890 |
| Velocity of Flow in Gutter-fps | = | 2.705 |
| FLOW in Gutter-CFS--Q | = | 1.189 |
| Depth at Curb Line-Inches--d | = | 4.071 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.379 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.270 | 1.320 | 3.570 |
| 6.583 | 0.530 | 2.591 | 2.299 |
| 9.583 | 0.711 | 3.478 | 1.412 |
| 13.583 | 0.890 | 4.352 | 0.538 |
| 20.583 | 1.000 | 4.890 | 0.000 |

HEC-12

N.B.
23

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 95+25 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.970 |
| SPREAD-Ft.--T | = | 15.497 |
| Average Velocity-V-fps | = | 2.235 |
| FLOW in Gutter-CFS--Q | = | 1.201 |
| % Flow in Gutter-CFS--Eo | = | 24.166 |
| Velocity of Flow in Gutter-fps | = | 2.716 |
| Depth at Curb Line-Inches--d | = | 4.094 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.970 |
| Velocity of Flow in Gutter-fps | = | 2.716 |
| FLOW in Gutter-CFS--Q | = | 1.201 |
| Depth at Curb Line-Inches--d | = | 4.094 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.520 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.268 | 1.330 | 3.640 |
| 6.583 | 0.526 | 2.613 | 2.357 |
| 9.583 | 0.707 | 3.512 | 1.458 |
| 13.583 | 0.886 | 4.402 | 0.568 |
| 20.583 | 1.000 | 4.970 | 0.000 |

HEC-12

N.B. 13

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 97+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 2.650 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.130 |
| SPREAD-Ft.--T | = | 10.918 |
| Average Velocity-V-fps | = | 4.753 |
| FLOW in Gutter-CFS--Q | = | 1.733 |
| % Flow in Gutter-CFS--Eo | = | 33.779 |
| Velocity of Flow in Gutter-fps | = | 5.553 |
| Depth at Curb Line-Inches--d | = | 2.995 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.130 |
| Velocity of Flow in Gutter-fps | = | 5.553 |
| FLOW in Gutter-CFS--Q | = | 1.733 |
| Depth at Curb Line-Inches--d | = | 2.995 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 24.263 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.175 | 0.900 | 4.230 |
| 6.583 | 0.356 | 1.828 | 3.302 |
| 9.583 | 0.495 | 2.540 | 2.590 |
| 13.583 | 0.657 | 3.369 | 1.761 |
| 20.583 | 0.870 | 4.465 | 0.665 |

FROM INT OF THOMAS & N.
BEFORE SAG

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 78+50 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.788 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.740 |
| SPREAD-Ft.--T | = | 12.211 |
| Average Velocity-V-fps | = | 2.750 |
| FLOW in Gutter-CFS--Q | = | 1.137 |
| % Flow in Gutter-CFS--Eo | = | 30.391 |
| Velocity of Flow in Gutter-fps | = | 3.259 |
| Depth at Curb Line-Inches--d | = | 3.305 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.740 |
| Velocity of Flow in Gutter-fps | = | 3.259 |
| FLOW in Gutter-CFS--Q | = | 1.137 |
| Depth at Curb Line-Inches--d | = | 3.305 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.428 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.269 | 1.007 | 2.733 |
| 6.583 | 0.528 | 1.976 | 1.764 |
| 9.583 | 0.710 | 2.654 | 1.086 |
| 13.583 | 0.888 | 3.323 | 0.417 |
| 20.583 | 1.000 | 3.740 | 0.000 |

HEC-12

3 N.B.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE
HIGHWAY NAME- THOMAS TO / NO. SCH RD.
LOCATION - N.B. STA. 75+00

TRACS NO.-
DESIGNER - BOB B.
CHECKER -
PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.788 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 5.350 |
| SPREAD-Ft.--T | = | 14.006 |
| Average Velocity-V-fps | = | 2.964 |
| FLOW in Gutter-CFS--Q | = | 1.426 |
| % Flow in Gutter-CFS--Eo | = | 26.651 |
| Velocity of Flow in Gutter-fps | = | 3.567 |
| Depth at Curb Line-Inches--d | = | 3.736 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 5.350 |
| Velocity of Flow in Gutter-fps | = | 3.567 |
| FLOW in Gutter-CFS--Q | = | 1.426 |
| Depth at Curb Line-Inches--d | = | 3.736 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 18.896 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.223 | 1.191 | 4.159 |
| 6.583 | 0.445 | 2.379 | 2.971 |
| 9.583 | 0.608 | 3.253 | 2.097 |
| 13.583 | 0.786 | 4.204 | 1.146 |
| 20.583 | 0.975 | 5.217 | 0.133 |

HEC-12

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST./SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO INDIAN SCH RD. DESIGNER - BOB B.
LOCATION - N.B. S/A. 70+00 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 1.800 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 3.470 |
| SPREAD-Ft.--T | = | 10.113 |
| Average Velocity-V-fps | = | 3.765 |
| FLOW in Gutter-CFS--Q | = | 1.259 |
| % Flow in Gutter-CFS--Eo | = | 36.280 |
| Velocity of Flow in Gutter-fps | = | 4.353 |
| Depth at Curb Line-Inches--d | = | 2.802 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 3.470 |
| Velocity of Flow in Gutter-fps | = | 4.353 |
| FLOW in Gutter-CFS--Q | = | 1.259 |
| Depth at Curb Line-Inches--d | = | 2.802 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 17.785 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.236 | 0.818 | 2.652 |
| 6.583 | 0.469 | 1.626 | 1.844 |
| 9.583 | 0.638 | 2.213 | 1.257 |
| 13.583 | 0.817 | 2.836 | 0.634 |
| 20.583 | 0.991 | 3.438 | 0.032 |

HEC-12

/N.B.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
URBAN HIGHWAY SECTION

08-11-1993

PROJECT NAME- 64TH ST. / SCOTTSDALE TRACS NO.-
HIGHWAY NAME- THOMAS TO IND. SCH. RD. DESIGNER - BOB B.
LOCATION - N.B. STA. 66+75 CHECKER - PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

| | | |
|---|---|---|
| Roadway Grade-% Per cent--G | = | 0.400 |
| Roadway Cross-Slope-Ft./Ft.--Sx | = | 0.020 |
| Shoulder Width-Ft.-- | = | 20.000 |
| Shoulder Slope-Ft./Ft.--Ss | = | 0.020 |
| Gutter Width-Ft.--W | = | 1.420 |
| Gutter Slope-Ft./Ft.--Sw | = | 0.042 |
| Gutter Depression-Inches-- | = | 0.716 |
| Manning's 'N | = | 0.016 |
| Flow-CFS--Q | = | 4.920 |
| SPREAD-Ft.--T | = | 15.438 |
| Average Velocity-V-fps | = | 2.230 |
| FLOW in Gutter-CFS--Q | = | 1.193 |
| % Flow in Gutter-CFS--Eo | = | 24.256 |
| Velocity of Flow in Gutter-fps | = | 2.710 |
| Depth at Curb Line-Inches--d | = | 4.080 |

CURB OPENING--ADOT STD. C-15.20

| | | |
|---|---|---|
| Flow-CFS--Q | = | 4.920 |
| Velocity of Flow in Gutter-fps | = | 2.710 |
| FLOW in Gutter-CFS--Q | = | 1.193 |
| Depth at Curb Line-Inches--d | = | 4.080 |
| Local Gutter Depression-Inches | = | 2.000 |
| Length of opening: TOTAL Intercept--Ft. | = | 15.432 |
| CLOGGING FACTOR--CURB OPEN. | = | 0.800 |

| LENGTH | Efficiency | Q(Captured) | Q(By-Pass) |
|---|---|---|---|
| 3.083 | 0.269 | 1.324 | 3.596 |
| 6.583 | 0.528 | 2.599 | 2.321 |
| 9.583 | 0.709 | 3.491 | 1.429 |
| 13.583 | 0.888 | 4.371 | 0.549 |
| 20.583 | 1.000 | 4.920 | 0.000 |

STORM DRAIN COL. TO INLETS @ STA

TO 1ST INLETS N.B. & S.B.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLETS @ STA 66+75 N.B.&S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.00 ft | 24"ϕ R.C.P. |
| Slope..... | 0.0180 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 8.71 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 0.70 ft |
| Velocity..... | 8.84 fps |
| Flow Area..... | 0.99 sf |
| Critical Depth.... | 1.05 ft |
| Critical Slope.... | 0.0043 ft/ft |
| Percent Full..... | 35.14 % |
| Full Capacity..... | 32.88 cfs |
| QMAX @.94D..... | 35.37 cfs |
| Froude Number..... | 2.17 (flow is Supercritical) |

COLLECTION FROM INLETS @ STA. 66+75, N.B. & S.B.

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN THOMAS & INDIAN-CH RD.

TO 2ND. INLETS N & S.B.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLETS @ STA 70+00 N.B.&S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.00 ft | 24" R.C.P. |
| Slope..... | 0.0079 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 16.67 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.31 ft |
| Velocity..... | 7.64 fps |
| Flow Area..... | 2.18 sf |
| Critical Depth.... | 1.47 ft |
| Critical Slope.... | 0.0058 ft/ft |
| Percent Full..... | 65.54 % |
| Full Capacity..... | 21.78 cfs |
| QMAX @.94D..... | 23.43 cfs |
| Froude Number..... | 1.26 (flow is Supercritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA 70+00 (N.B.&S.B)

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN THOMAS & INDIAN SCH. RD.
TO 3rd S.B. INLET

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLET @ STA 74+00 S.B.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.00 ft 24" ϕ R.C.P. |
| Slope..... | 0.0079 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 23.04 cfs |

Computed Results:

| | |
|---|---|
| Depth..... | 1.77 ft |
| Velocity..... | 7.83 fps |
| Flow Area..... | 2.94 sf |
| Critical Depth.... | 1.71 ft |
| Critical Slope.... | 0.0083 ft/ft |
| Percent Full..... | 88.54 % |
| Full Capacity..... | 21.78 cfs |
| QMAX @.94D..... | 23.43 cfs |
| Froude Number..... | 0.91 (flow is Subcritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 74+00 (S.B.)

Open Channel Flow Module, Version 3.41 (c) 1991
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STORM DRAIN BETWEEN THOMAS & INDIAN CH RD.
TO 3rd N.B. INLET

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLET @ STA 75+00 N.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30" ϕ R.C.P. |
| Slope..... | 0.0079 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 25.17 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.45 ft |
| Velocity..... | 8.53 fps |
| Flow Area..... | 2.95 sf |
| Critical Depth.... | 1.71 ft |
| Critical Slope.... | 0.0049 ft/ft |
| Percent Full..... | 57.99 % |
| Full Capacity..... | 39.49 cfs |
| QMAX @.94D..... | 42.48 cfs |
| Froude Number..... | 1.37 (flow is Supercritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 75+00 (N.B.

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN THOMAS & INDIAN SCH. RD.
TO FLANKING INLETS.
S. SIDE

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLETS @ STA 78+50 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30" ϕ R.C.P. |
| Slope..... | 0.0079 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 30.52 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.65 ft |
| Velocity..... | 8.88 fps |
| Flow Area..... | 3.44 sf |
| Critical Depth.... | 1.88 ft |
| Critical Slope.... | 0.0056 ft/ft |
| Percent Full..... | 65.99 % |
| Full Capacity..... | 39.49 cfs |
| QMAX @.94D..... | 42.48 cfs |
| Froude Number..... | 1.30 (flow is Supercritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 78+50 (N.B.&S.B.)

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STORM DRAIN BETWEEN THOMAS & INDIAN SCHOOL RD.
TO 1ST N.B. INLET S. OF IND SCH

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLET @ STA 97+00 N.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.00 ft | 24" ϕ R.C.P. |
| Slope..... | 0.0040 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 4.47 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 0.74 ft |
| Velocity..... | 4.27 fps |
| Flow Area..... | 1.05 sf |
| Critical Depth.... | 0.74 ft |
| Critical Slope.... | 0.0038 ft/ft |
| Percent Full..... | 36.77 % |
| Full Capacity..... | 15.50 cfs |
| QMAX @.94D..... | 16.67 cfs |
| Froude Number..... | 1.02 (flow is Supercritical) |

COLLECT FLOW FROM INLET @ N.B. STA 97+00

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STORM DRAIN BETWEEN THOMAS & INDIAN SCH.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLETS @ STA 95+25 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.00 ft | 24" ϕ R.C.P. |
| Slope..... | 0.0040 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 13.00 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.40 ft |
| Velocity..... | 5.53 fps |
| Flow Area..... | 2.35 sf |
| Critical Depth.... | 1.30 ft |
| Critical Slope.... | 0.0049 ft/ft |
| Percent Full..... | 70.09 % |
| Full Capacity..... | 15.50 cfs |
| QMAX @.94D..... | 16.67 cfs |
| Froude Number..... | 0.86 (flow is Subcritical) |

COLLECT FROM ALL INLETS TO STA. 95+25 (N.B + S.B.)

Open Channel Flow Module, Version 3.41 (c) 1991
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STORM DRAIN BETWEEN THOMAS & INDIAN SCH RD.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLET @ STA 93+50 N.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.00 ft | 24"ϕ R.C.P. |
| Slope..... | 0.0040 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 16.22 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.74 ft |
| Velocity..... | 5.59 fps |
| Flow Area..... | 2.90 sf |
| Critical Depth.... | 1.45 ft |
| Critical Slope.... | 0.0057 ft/ft |
| Percent Full..... | 86.92 % |
| Full Capacity..... | 15.50 cfs |
| QMAX @.94D..... | 16.67 cfs |
| Froude Number..... | 0.67 (flow is Subcritical) |

COLLECT ALL INLETS TO STA. 93+50 N.B.

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STORM DRAIN BETWEEN THOMAS & INDIAN SCHOOL RD.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLETS @ STA 91+75 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30" ϕ R.C.P. |
| Slope..... | 0.0040 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 23.26 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 1.73 ft |
| Velocity..... | 6.40 fps |
| Flow Area..... | 3.64 sf |
| Critical Depth.... | 1.64 ft |
| Critical Slope.... | 0.0046 ft/ft |
| Percent Full..... | 69.39 % |
| Full Capacity..... | 28.10 cfs |
| QMAX @.94D..... | 30.23 cfs |
| Froude Number..... | 0.90 (flow is Subcritical) |

COLLECTION FROM ALL INLETS TO STA. 91+75 (N.B + S.B.)

Open Channel Flow Module, Version 3.41 (c) 1991
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# Part F Open Channel Flow Storm Drain Computations

STORM DRAIN BETWEEN
McDONELL RD & THOMAS RD.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET DRAINAGE

Comment: SIZE S. DRAIN AT DESIGN PT. 30 FOR Q10=30CFS (USE 30"ϕ PIPE)

CHECK STREET FLOW FOR Q100 TO INSURE THAT CONDITION DOES NOT CONTROL the DESIGN.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.50 ft |
| Slope..... | 0.0050 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 30.00 cfs |

Computed Results:

| | |
|---|---|
| Depth..... | 1.95 ft |
| Velocity..... | 7.29 fps |
| Flow Area..... | 4.12 sf |
| Critical Depth.... | 1.87 ft |
| Critical Slope.... | 0.0055 ft/ft |
| Percent Full..... | 78.18 % |
| Full Capacity..... | 31.42 cfs |
| QMAX @.94D..... | 33.80 cfs |
| Froude Number..... | 0.91 (flow is Subcritical) |

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET S.DRAIN

Comment: COLLECTION TO INLET @ STA 89+40 S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30" ϕ R.C.P. |
| Slope..... | 0.0040 ft/ft | |
| Manning's n..... | 0.012 | |
| Discharge..... | 27.56 cfs | |

Computed Results:

| | |
|---|---|
| Depth..... | 2.01 ft |
| Velocity..... | 6.53 fps |
| Flow Area..... | 4.22 sf |
| Critical Depth.... | 1.79 ft |
| Critical Slope.... | 0.0052 ft/ft |
| Percent Full..... | 80.27 % |
| Full Capacity..... | 28.10 cfs |
| QMAX @.94D..... | 30.23 cfs |
| Froude Number..... | 0.79 (flow is Subcritical) |

COLLECTION FROM ALL INLETS TO STA 89+40 (N.B.)

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN MCDOWELL AND THOMAS RD. /

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: STORM DRAIN NORTH OF MCDOWELL

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.00 ft |
| Slope..... | 0.0050 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 9.22 cfs |

24" ϕ R.C.P. ?
USE 30" ϕ - AS PIPE SIZE CONTROLLED BY Q10 OFFSITE = 30 cfs TOWARD HUBBLE DIP @ DES. PT. 30 (SEE Sheet 0)

Computed Results:

| | |
|---|---|
| Depth..... | 1.04 ft |
| Velocity..... | 5.60 fps |
| Flow Area..... | 1.65 sf |
| Critical Depth.... | 1.08 ft |
| Critical Slope.... | 0.0043 ft/ft |
| Percent Full..... | 51.88 % |
| Full Capacity..... | 17.33 cfs |
| QMAX @.94D..... | 18.64 cfs |
| Froude Number..... | 1.09 (flow is Supercritical) |

COLLECTION FROM INLETS @ STA 18+00 N.B & 18+70 S.B.

STORM DRAIN BETWEEN McDOWELL & THOMAS RD

2

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLETS @ STA 21+00 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.00 ft 24"ϕ R.C.P. |
| Slope..... | 0.0050 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 15.91 cfs |

USE 30"ϕ — AS PIPE SIZE IS CONTROLED BY Q10 OFFSITE = 30 cfs TOWARD HUBBLE DIP X-ING @ DES. PT. 30 (SEE SHEET 0)

Computed Results:

| | |
|---|---|
| Depth..... | 1.51 ft |
| Velocity..... | 6.26 fps |
| Flow Area..... | 2.54 sf |
| Critical Depth.... | 1.44 ft |
| Critical Slope.... | 0.0056 ft/ft |
| Percent Full..... | 75.44 % |
| Full Capacity..... | 17.33 cfs |
| QMAX @.94D..... | 18.64 cfs |
| Froude Number..... | 0.91 (flow is Subcritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 21+00 N.B & S.B.

Open Channel Flow Module, Version 3.41 (c) 1991
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STORM DRAIN BET. MCDOWELL & THOMAS RD. 3

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLETS @ STA 23+80 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30"ϕ R.C.P. |
| Slope..... | 0.0050 ft/ft | |
| Manning's n..... | 0.012 | SAME SIZE AS ϕ10 |
| Discharge..... | 20.10 cfs | Req'd @ DES PT. 30 |

(SEE Sheet 0)

Computed Results:

| | |
|---|---|
| Depth..... | 1.45 ft |
| Velocity..... | 6.79 fps |
| Flow Area..... | 2.96 sf |
| Critical Depth.... | 1.52 ft |
| Critical Slope.... | 0.0043 ft/ft |
| Percent Full..... | 58.13 % |
| Full Capacity..... | 31.42 cfs |
| QMAX @.94D..... | 33.80 cfs |
| Froude Number..... | 1.09 (flow is Supercritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA 23+80 N.B & S.B.

Open Channel Flow Module, Version 3.41 (c) 1991
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STORM DRAIN BETWEEN McDOWELL AND THOMAS.



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLET @ STA 24+33 S.B.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.50 ft |
| Slope..... | 0.0050 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 23.05 cfs |

30" ϕ R.C.P.
SAME SIZE AS Q10
Req'd @ DES. PT. 30
(SEE SHEET 0)

Computed Results:

| | |
|---|---|
| Depth..... | 1.59 ft |
| Velocity..... | 6.99 fps |
| Flow Area..... | 3.30 sf |
| Critical Depth.... | 1.63 ft |
| Critical Slope.... | 0.0046 ft/ft |
| Percent Full..... | 63.64 % |
| Full Capacity..... | 31.42 cfs |
| QMAX @.94D..... | 33.80 cfs |
| Froude Number..... | 1.05 (flow is Supercritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA 24+33 S.B.

STORM DRAIN BETWEEN McDOWELL & THOMAS



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLETS @ STA 25+30 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.50 ft |
| Slope..... | 0.0050 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 27.07 cfs |

30" ϕ R.C.P.
SAME SIZE AS Q10
Req'd. @ DES. Pt. 30
(SEE Sheet 6)

Computed Results:

| | |
|---|---|
| Depth..... | 1.79 ft |
| Velocity..... | 7.20 fps |
| Flow Area..... | 3.76 sf |
| Critical Depth.... | 1.77 ft |
| Critical Slope.... | 0.0051 ft/ft |
| Percent Full..... | 71.58 % |
| Full Capacity..... | 31.42 cfs |
| QMAX @.94D..... | 33.80 cfs |
| Froude Number..... | 0.98 (flow is Subcritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 25+30 N.B. & S.B.

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN McDOWELL & THOMAS



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLETS @ STA 33+50 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 2.50 ft |
| Slope..... | 0.0065 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 36.60 cfs |

30" ϕ R.C.P.
Same SIZE AS Q10
Req'd. @ DES. A. 30
(SEE Sheet 0)

Computed Results:

| | |
|---|---|
| Depth..... | 2.10 ft |
| Velocity..... | 8.31 fps |
| Flow Area..... | 4.40 sf |
| Critical Depth.... | 2.05 ft |
| Critical Slope.... | 0.0068 ft/ft |
| Percent Full..... | 84.06 % |
| Full Capacity..... | 35.82 cfs |
| QMAX @.94D..... | 38.54 cfs |
| Froude Number..... | 0.94 (flow is Subcritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA 33+50 N.B & S.B

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

STORM DRAIN BETWEEN McDOWELL & THOMAS



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET

Comment: COLLECTION TO INLETS @ STA 35+20 N.B.& S.B.

Solve For Actual Depth

Given Input Data:

| | | |
|---|---|---|
| Diameter..... | 2.50 ft | 30"ϕ R.C.P. |
| Slope..... | 0.0070 ft/ft | SAME SIZE AS Q10 Reg'd. |
| Manning's n..... | 0.012 | @ DES. Pt. 30, |
| Discharge..... | 39.93 cfs | (SEE Sheet 0) |

Computed Results:

| | |
|---|---|
| Depth..... | 2.31 ft |
| Velocity..... | 8.43 fps |
| Flow Area..... | 4.74 sf |
| Critical Depth.... | 2.13 ft |
| Critical Slope.... | 0.0076 ft/ft |
| Percent Full..... | 92.32 % |
| Full Capacity..... | 37.18 cfs |
| QMAX @.94D..... | 39.99 cfs |
| Froude Number..... | 0.79 (flow is Subcritical) |

TOTAL COLLECTION FROM ALL INLETS TO STA. 35+00 N.B + S.B

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

DOWNSTREAM OF DESIGN PT (50) 8.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET/SCOTTSDA

Comment: COLLECTION AT OFFSITE BASIN NO. 50

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 4.00 ft |
| Slope..... | 0.0040 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 84.00 cfs = Q10 |

Computed Results:

| | |
|---|---|
| Depth..... | 2.84 ft |
| Velocity..... | 8.80 fps |
| Flow Area..... | 9.55 sf |
| Critical Depth.... | 2.78 ft |
| Critical Slope.... | 0.0042 ft/ft |
| Percent Full..... | 71.05 % |
| Full Capacity..... | 98.42 cfs |
| QMAX @.94D..... | 105.87 cfs |
| Froude Number..... | 0.96 (flow is Subcritical) |

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

DOWNSTREAM OF DESIGN PT. (60) 7

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET/SCOTTSDA

Comment: COLLECTION AT DESIGN POINT 60/ 54" S. DRAIN

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 4.50 ft |
| Slope..... | 0.0065 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 184.00 cfs = Q10 |

Computed Results:

| | |
|---|---|
| Depth..... | 4.11 ft |
| Velocity..... | 12.08 fps |
| Flow Area..... | 15.23 sf |
| Critical Depth.... | 3.92 ft |
| Critical Slope.... | 0.0068 ft/ft |
| Percent Full..... | 91.33 % |
| Full Capacity..... | 171.76 cfs |
| QMAX @.94D..... | 184.76 cfs |
| Froude Number..... | 0.87 (flow is Subcritical) |

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

ALT. NO. 1 – THOMAS RD. OUTFALL 10.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET/SCOTTSDA

Comment: ALT NO 1 - 54" OUTFALL & EXIST 45" IN THOMAS

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 4.50 ft |
| Slope..... | 0.0065 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 169.00 cfs |

Computed Results:

| | |
|---|---|
| Depth..... | 3.62 ft |
| Velocity..... | 12.31 fps |
| Flow Area..... | 13.73 sf |
| Critical Depth.... | 3.79 ft |
| Critical Slope.... | 0.0060 ft/ft |
| Percent Full..... | 80.55 % |
| Full Capacity..... | 171.76 cfs |
| QMAX @.94D..... | 184.76 cfs |
| Froude Number..... | 1.11 (flow is Supercritical) |

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

ALT NO. 2 — THOMAS RD. OUTFALL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET/SCOTTSDA

Comment: ALT NO 2 - 66" OUTFALL WITHOUT 45" IN THOMAS

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 5.50 ft |
| Slope..... | 0.0065 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 269.00 cfs |

Computed Results:

| | |
|---|---|
| Depth..... | 4.15 ft |
| Velocity..... | 14.00 fps |
| Flow Area..... | 19.21 sf |
| Critical Depth.... | 4.56 ft |
| Critical Slope.... | 0.0054 ft/ft |
| Percent Full..... | 75.38 % |
| Full Capacity..... | 293.30 cfs |
| QMAX @.94D..... | 315.50 cfs |
| Froude Number..... | 1.23 (flow is Supercritical) |

Open Channel Flow Module, Version 3.41 (c) 1991
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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64TH STREET/SCOTTSDA 72"ϕ R.C.P.

Comment: COMBINE OSBORN AND THOMAS RD. OUTFALL SYSTEM

Solve For Actual Depth

Given Input Data:

| | |
|---|---|
| Diameter..... | 6.00 ft |
| Slope..... | 0.0065 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 330.00 cfs |

Computed Results:

| | |
|---|---|
| Depth..... | 4.42 ft |
| Velocity..... | 14.79 fps |
| Flow Area..... | 22.31 sf |
| Critical Depth.... | 4.94 ft |
| Critical Slope.... | 0.0051 ft/ft |
| Percent Full..... | 73.63 % |
| Full Capacity..... | 369.90 cfs |
| QMAX @.94D..... | 397.90 cfs |
| Froude Number..... | 1.27 (flow is Supercritical) |

Open Channel Flow Module, Version 3.41 (c) 1991
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OSBORN GRAVITY S. DRAIN OUTFALL (IN 64TH ST PORTION)



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64th. STRET S. DRAIN

Comment: 48" RCP OUTFALL IN OSBORN ROAD (PUMP ALT.)

Solve For Full Flow Capacity

Given Input Data:

| | |
|---|---|
| Diameter..... | 4.00 ft |
| Slope..... | 0.0035 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 92.06 cfs |

Computed Results:

| | |
|---|---|
| Full Flow Capacity..... | 92.06 cfs |
| Full Flow Depth..... | 4.00 ft |
| Velocity..... | 7.33 fps |
| Flow Area..... | 12.57 sf |
| Critical Depth.... | 2.91 ft |
| Critical Slope.... | 0.0045 ft/ft |
| Percent Full..... | 100.00 % |
| Full Capacity..... | 92.06 cfs |
| QMAX @.94D..... | 99.03 cfs |
| Froude Number..... | FULL |

OSBORN RD. S. DRAIN OUTFALL IN OSBORN RD. TO SCOTTSDALE RD. 14.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 64th. STRET S. DRAIN

Comment: 54" RCP OUTFALL IN OSBORN ROAD (GRAVITY ALT)

Solve For Full Flow Capacity

Given Input Data:

| | |
|---|---|
| Diameter..... | 4.50 ft |
| Slope..... | 0.0020 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 95.27 cfs |

Computed Results:

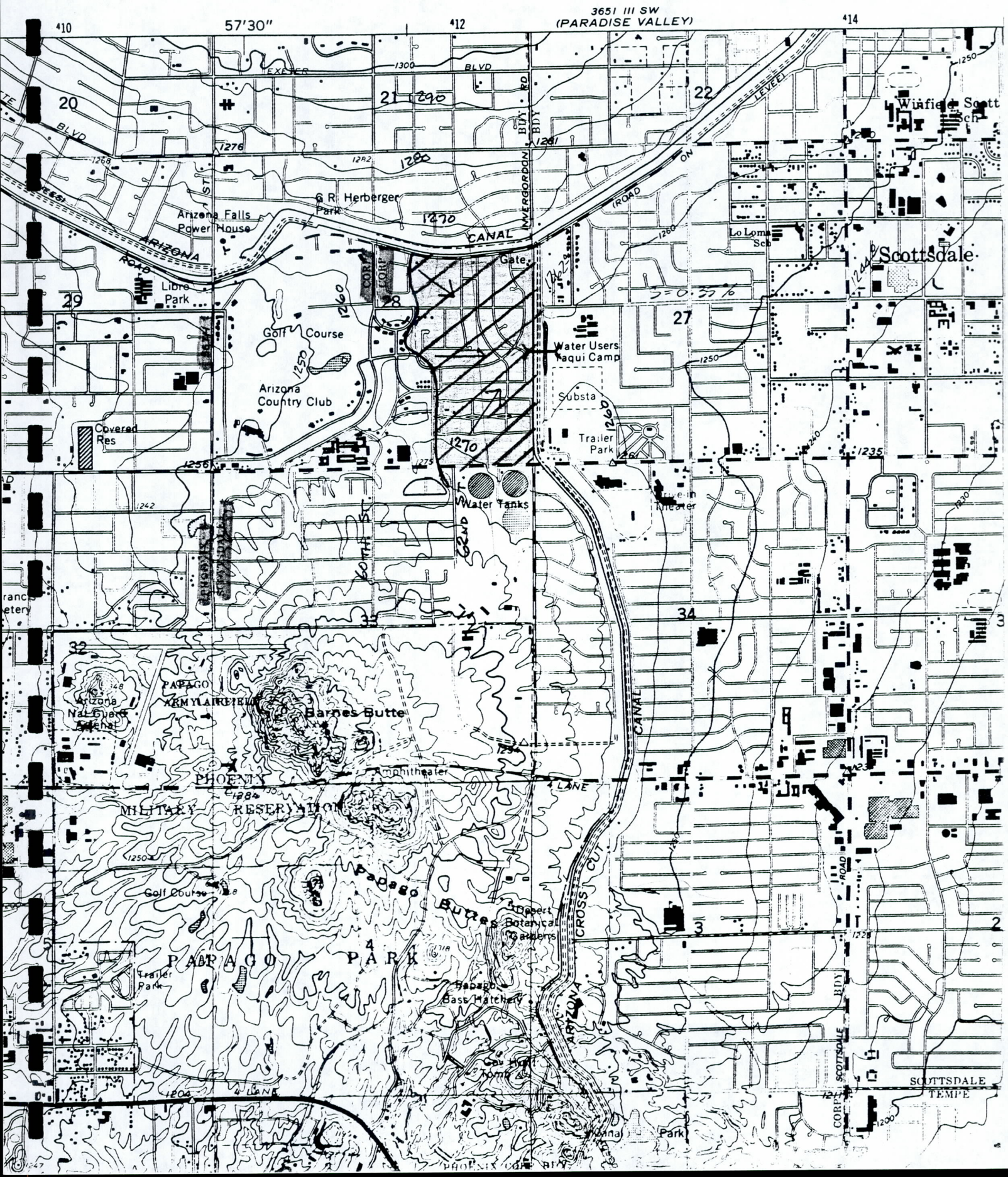
| | |
|---|---|
| Full Flow Capacity..... | 95.27 cfs |
| Full Flow Depth..... | 4.50 ft |
| Velocity..... | 5.99 fps |
| Flow Area..... | 15.90 sf |
| Critical Depth.... | 2.87 ft |
| Critical Slope.... | 0.0037 ft/ft |
| Percent Full..... | 100.00 % |
| Full Capacity..... | 95.27 cfs |
| QMAX @.94D..... | 102.49 cfs |
| Froude Number..... | FULL |

Open Channel Flow Module, Version 3.41 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

# Part G Non-Tributary Runoff Into Paiute Park (HEC-1/TR-55 Models)

AREA SHADED BELOW IS TRIBUTARY TO PAUTE PARK
BUBBLE-UP DRAIN. AREA = 148 ACRES = 0.23 MI²

PARAMETERS FOR HEC-1 MODEL → RAINFALL PER PH CARD
CN = 72-75 RANGE



# PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 1 of 4541P1-123

Made by BOB B.

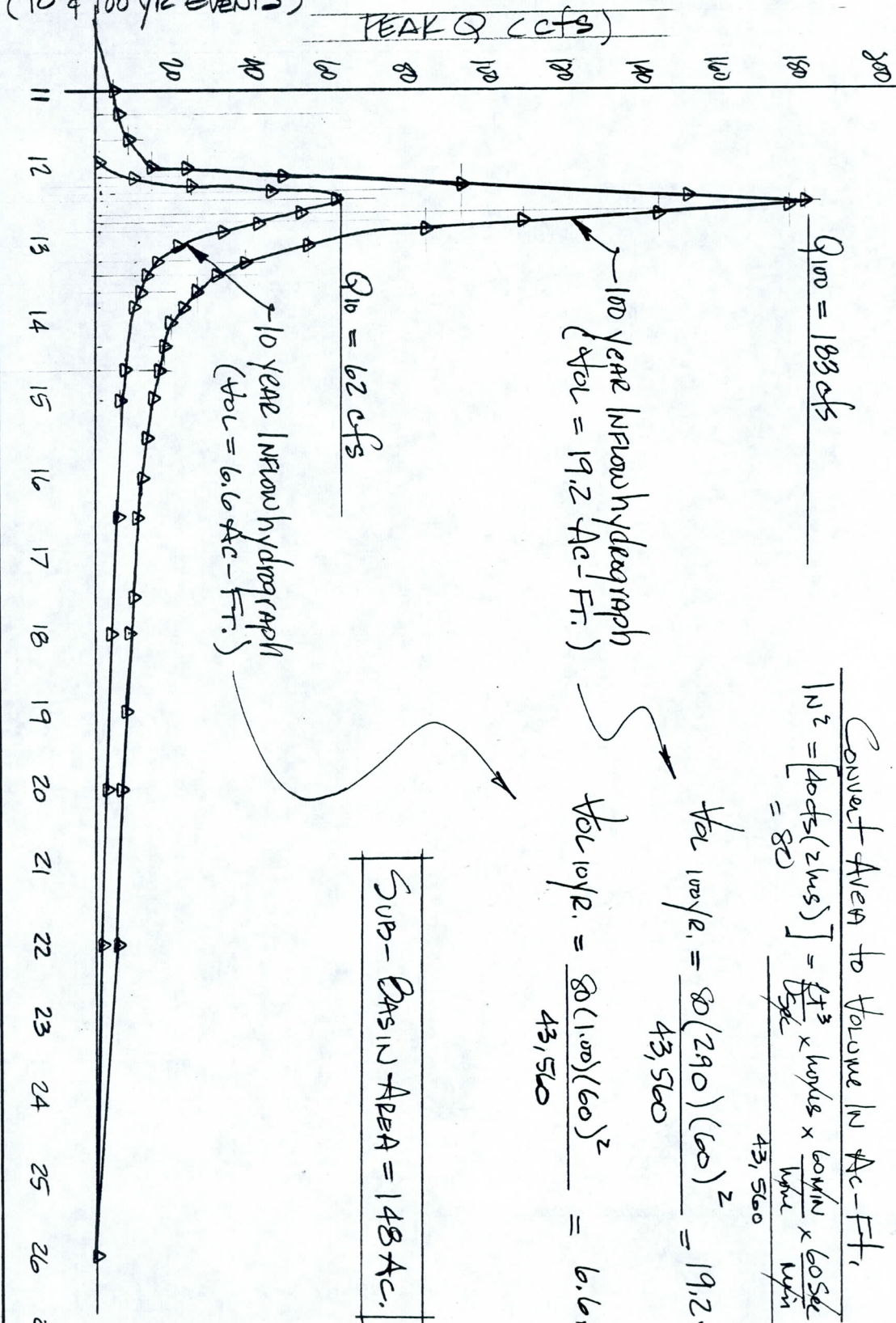
Date MAY 02, 1994

Checked by BV

Date 5-4-94

Subject 64TH STREET / SCOTTSDALE
HYDROGRAPH INTO PAIUTE PARK
— FROM TR-55 OUTPUT —

(10 & 100 YR EVENTS)




TYPE II RAINFALL DISTRIBUTION

AREA 100 YR = 2.90 IN²
AREA 10 YR = 1.00 IN²

PLANIMETER

CONVERT AREA TO VOLUME IN AC-FT.

$IN^2 = [40cfs(2hrs)] = 80$

$\frac{ft^3}{sec} \times hours \times \frac{60 min}{hour} \times \frac{60 sec}{min} = ft^3$ / 43,560

VOL 100 YR. $= \frac{80(2.90)(60)^2}{43,560} = 19.2$ AC-FT.

VOL 10 YR. $= \frac{80(1.00)(60)^2}{43,560} = 6.6$ AC-FT.

SUB-BASIN AREA = 148 AC.

REFERENCE

Use TR-55 GRAPHICAL PEAK DISCH & TABULAR Hydrograph Method

SEE Computer RUNS.

$T_C = 0.5$ hr.
$C_N = 75$
$A = 148$ AC
$RAIN_{10} = 2.4$ (24 hrs)
$RAIN_{100} = 3.9$ (24 hrs)

→ Using The Kirpich Equation.

TR-55 GRAPHICAL DISCHARGE METHOD

VERSION 1.11

Project : 64TH STREET - SCOTTSDALE
County : MARICOPA
Subtitle: PIUTE PARK TRIB AREA

User: B.B
State: AZ
Checked: BV

Date: 05-02-94
Date: 5-4-94

Data: Drainage Area : 148 Acres
Runoff Curve Number : 75
Time of Concentration: 0.50 Hours
Rainfall Type : II
Pond and Swamp Area : NONE

| Storm Number | 1 | 2 |
|---|---|---|
| Frequency (yrs) | 100 | 10 |
| 24-Hr Rainfall (in) | 3.9 | 2.4 |
| Ia/P Ratio | 0.17 | 0.28 |
| Runoff (in) | 1.59 | 0.59 |
| Unit Peak Discharge (cfs/acre/in) | 0.777 | 0.701 |
| Pond and Swamp Factor 0.0% Ponds Used | 1.00 | 1.00 |
| Peak Discharge (cfs) | 183 | 62 |

TR-55 TABULAR DISCHARGE METHOD VERSION 1.11

Project : 64TH STREET - SCOTTSDALE User: B.B Date: 05-02-94
County : MARICOPA State: AZ Checked: BV Date: 5-4-94
Subtitle: PAIUTE PARK TRIB AREA

Total watershed area: 0.230 sq mi Rainfall type: II Frequency: 10 years

---------- Subareas ----------

| | A |
|---|---|
| Area(sq mi) | 0.23 |
| Rainfall(in) | 2.4 |
| Curve number | 75 |
| Runoff(in) | 0.59 |
| Tc (hrs) | 0.50 |
| TimeToOutlet | 0.00 |
| Ia/P | 0.28 |

| Time (hr) | Total Flow | Subarea Contribution to Total Flow (cfs) A |
|---|---|---|
| 11.0 | 0 | 0 |
| 11.3 | 0 | 0 |
| 11.6 | 1 | 1 |
| 11.9 | 1 | 1 |
| 12.0 | 2 | 2 |
| 12.1 | 9 | 9 |
| 12.2 | 24 | 24 |
| 12.3 | 45 | 45 |
| 12.4 | 61P | 61P |
| 12.5 | 61 | 61 |
| 12.6 | 52 | 52 |
| 12.7 | 41 | 41 |
| 12.8 | 32 | 32 |
| 13.0 | 21 | 21 |
| 13.2 | 16 | 16 |
| 13.4 | 13 | 13 |
| 13.6 | 11 | 11 |
| 13.8 | 9 | 9 |
| 14.0 | 9 | 9 |
| 14.3 | 7 | 7 |
| 14.6 | 7 | 7 |
| 15.0 | 6 | 6 |
| 15.5 | 6 | 6 |
| 16.0 | 5 | 5 |
| 16.5 | 5 | 5 |
| 17.0 | 4 | 4 |
| 17.5 | 4 | 4 |
| 18.0 | 4 | 4 |
| 19.0 | 3 | 3 |
| 20.0 | 3 | 3 |
| 22.0 | 2 | 2 |
| 26.0 | 0 | 0 |

P - Peak Flow

TR-55 TABULAR DISCHARGE METHOD

VERSION 1.11

Project : 64TH STREET - SCOTTSDALE
County : MARICIPA
Subtitle: PAIUTE PARK

User: B.B
State: AZ
Checked: BV

Date: 05-02-94
Date: 5-4-94

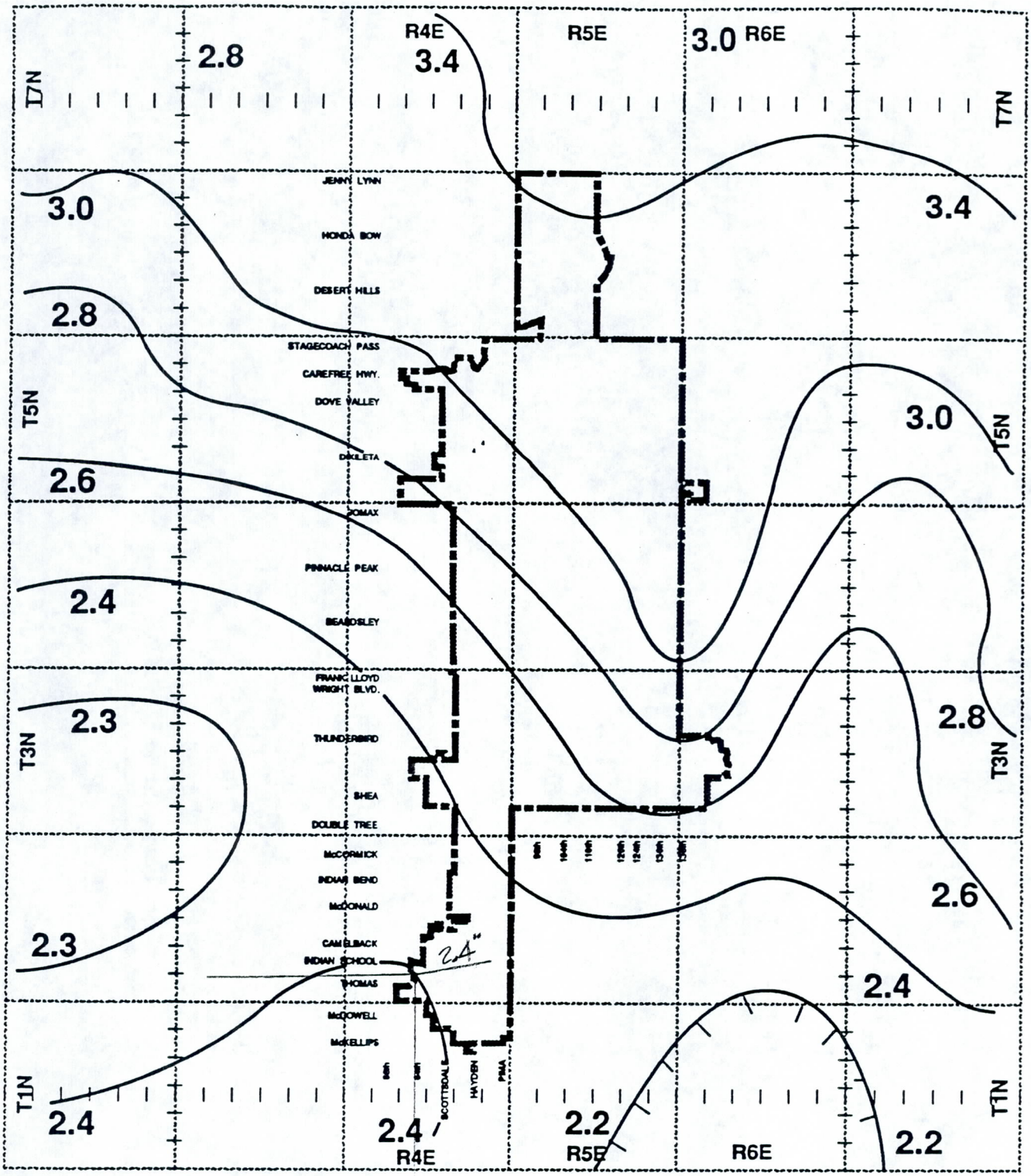
Total watershed area: 0.230 sq mi Rainfall type: II Frequency: 100 years

---------- Subareas ----------

| | A |
|---|---|
| Area(sq mi) | 0.23 |
| Rainfall(in) | 3.9 |
| Curve number | 75 |
| Runoff(in) | 1.59 |
| Tc (hrs) | 0.50 |
| TimeToOutlet | 0.00 |
| Ia/P | 0.17 |

| Time (hr) | Total Flow | Subarea Contribution to Total Flow (cfs) A |
|---|---|---|
| 11.0 | 4 | 4 |
| 11.3 | 5 | 5 |
| 11.6 | 8 | 8 |
| 11.9 | 14 | 14 |
| 12.0 | 23 | 23 |
| 12.1 | 47 | 47 |
| 12.2 | 93 | 93 |
| 12.3 | 151 | 151 |
| 12.4 | 181P | 181P |
| 12.5 | 177 | 177 |
| 12.6 | 144 | 144 |
| 12.7 | 109 | 109 |
| 12.8 | 84 | 84 |
| 13.0 | 54 | 54 |
| 13.2 | 38 | 38 |
| 13.4 | 30 | 30 |
| 13.6 | 25 | 25 |
| 13.8 | 22 | 22 |
| 14.0 | 19 | 19 |
| 14.3 | 17 | 17 |
| 14.6 | 15 | 15 |
| 15.0 | 14 | 14 |
| 15.5 | 12 | 12 |
| 16.0 | 11 | 11 |
| 16.5 | 10 | 10 |
| 17.0 | 9 | 9 |
| 17.5 | 9 | 9 |
| 18.0 | 8 | 8 |
| 19.0 | 7 | 7 |
| 20.0 | 6 | 6 |
| 22.0 | 5 | 5 |
| 26.0 | 0 | 0 |

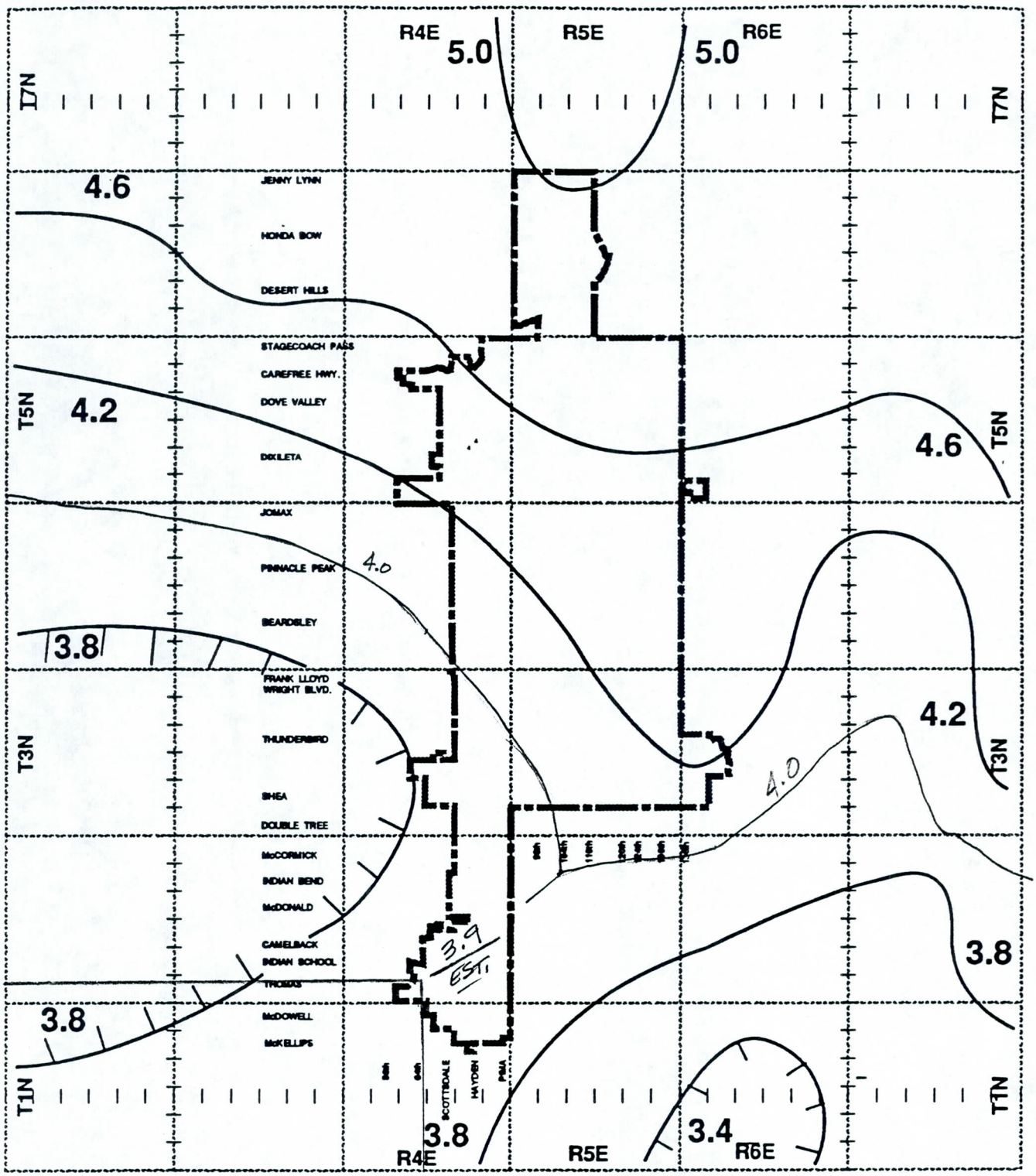
P - Peak Flow




# FIGURE 2.2-9

Isopluvials 10 Year 24 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol. VIII




# FIGURE 2.2-12

Isopluvials 100 Year 24 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol. VIII

**PARSONS BRINCKERHOFF COMPUTATION SHEET**

Page 1 of 4541P-123

Made by BOB B.

Date MAY 03, 94

Checked by BV

Date 5-4-94

Subject 64TH Street/SCOTTSDALE
PIUTE PARK TRIB. Hydrology
— HEC-1 MODEL —

I USE CLARK UNIT Hydrograph Method; (ADOT CONCURS W/ THIS FOR ALL PARTS OF ARIZONA)

1. Area = 148 Ac = 0.23 $Mi^2$
2. L = 3150' = 0.60 Mi
3. $L_{CA}$ = 2300' = 0.44 Mi
4. S = 8.5'/Mile  4'/2500 = 0.16 %

5. WATERSHED Is URBAN

6. $T_{c_{100}} = 3.2 A^{0.1} L^{0.25} L_{CA}^{0.25} S^{-0.14} (RTIMP)^{-0.36}$ → Is Effective Impervious Area In % (Say = 30 %)

$T_{c_{100}} = 3.2(0.23)^{0.1}(0.60)^{0.25}(0.44)^{0.25}(8.5)^{-0.14}(30)^{-0.36}$

$T_{c_{100}} = 0.43$ (Round Off to ½ hr. = 30 Min.)

Say $T_{c_{100}} = 0.50$ hr. (Same as Kirpich)

7. Now $R = 0.37 T_c^{1.11} L^{0.80} A^{-0.57}$

$R = 0.37(0.5)^{1.11}(0.60)^{0.80}(0.23)^{-0.57}$

$R = 0.26$

∴ Enter ON UC Card 0.50 & 0.26 for Tc & R Respectively.

& Compute $Q_{100}$ peak & $Volume_{100}$ (IN AC-FT.)

→ SEE HEC-1 OUTPUT

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  05/03/1994  TIME  17:33:32 *
*                                      *
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```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL  LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM



```
        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
           1          ID  ****************************************************************************
           2          ID  64 TH STREET - SCOTTSDALE
           3          ID  FILE: 64PIUTE1.DAT
           4          ID
           5          ID     100 YEAR MODEL USING:
           6          ID             - SCS CURVE NUMBER METHOD
           7          ID             - TIME OF CONCENTRATION - EQU 4.2 (URBAN CONDITIONS)
           8          ID             - FOR RAINFALL DISTRIBUTION SEE PH CARD
           9          ID             - USE CURVE NO = 72 FOR RESIDENTIAL DEVELOPMENT
          10          ID             - NMIN = 5 MINUTES
          11          IT     05      0      0     300
          12          IO      3      2

          13          KK    100
          14          KM  ****************************************************************************
          15          KM  ************* 100 YEAR FREQUENCY WITH SPECIFIED RAINFALL *******************
          16          KM  ****************************************************************************
          17          BA   0.23
          18          PH      0      0   0.74   1.44   2.51   2.82   3.05   3.30   3.60   3.90
          19          LS      0     72
          20          UC   0.50   0.26
```

```
          21          ZZ
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  05/03/1994  TIME  17:33:32 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    ************************************************************************
                    64 TH STREET - SCOTTSDALE
                    FILE: 64PIUTE1.DAT

                       100 YEAR MODEL USING:
                              - SCS CURVE NUMBER METHOD
                              - TIME OF CONCENTRATION - EQU 4.2 (URBAN CONDITIONS)
                              - FOR RAINFALL DISTRIBUTION SEE PH CARD
                              - USE CURVE NO = 72 FOR RESIDENTIAL DEVELOPMENT
                              - NMIN = 5 MINUTES

 12 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          3  PRINT CONTROL
                   IPLOT          2  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN          5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2    0  ENDING DATE
                  NDTIME        0055  ENDING TIME
                   ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 13 KK    *       100  *
```

```
*           *
**************
                ****************************************************************************
                ************* 100 YEAR FREQUENCY WITH SPECIFIED RAINFALL *******************
                ****************************************************************************

          SUBBASIN RUNOFF DATA

17 BA          SUBBASIN CHARACTERISTICS
                    TAREA          .23  SUBBASIN AREA

               PRECIPITATION DATA

18 PH                                 DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
               ..... HYDRO-35 ......  ............... TP-40 ...............  ........... TP-49 ...........
               5-MIN  15-MIN  60-MIN   2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                 .74    1.44    2.51   2.82    3.05    3.30    3.60    3.90     .00     .00     .00     .00

                                                STORM AREA =      .23

19 LS          SCS LOSS RATE
                    STRTL          .78  INITIAL ABSTRACTION
                   CRVNBR        72.00  CURVE NUMBER
                    RTIMP          .00  PERCENT IMPERVIOUS AREA

20 UC          CLARK UNITGRAPH
                      TC          .50  TIME OF CONCENTRATION
                       R          .26  STORAGE COEFFICIENT

               SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

                                                      ***

                                                UNIT HYDROGRAPH PARAMETERS
                                          CLARK   TC=   .50 HR,      R=   .26 HR
                                         SNYDER   TP=   .41 HR,     CP=   .73

                                                UNIT HYDROGRAPH
                                           20 END-OF-PERIOD ORDINATES
               24.      84.     160.     228.     264.     258.     211.     152.     110.      80.
               58.      42.      30.      22.      16.      11.       8.       6.       4.       3.

     ***            ***            ***            ***            ***

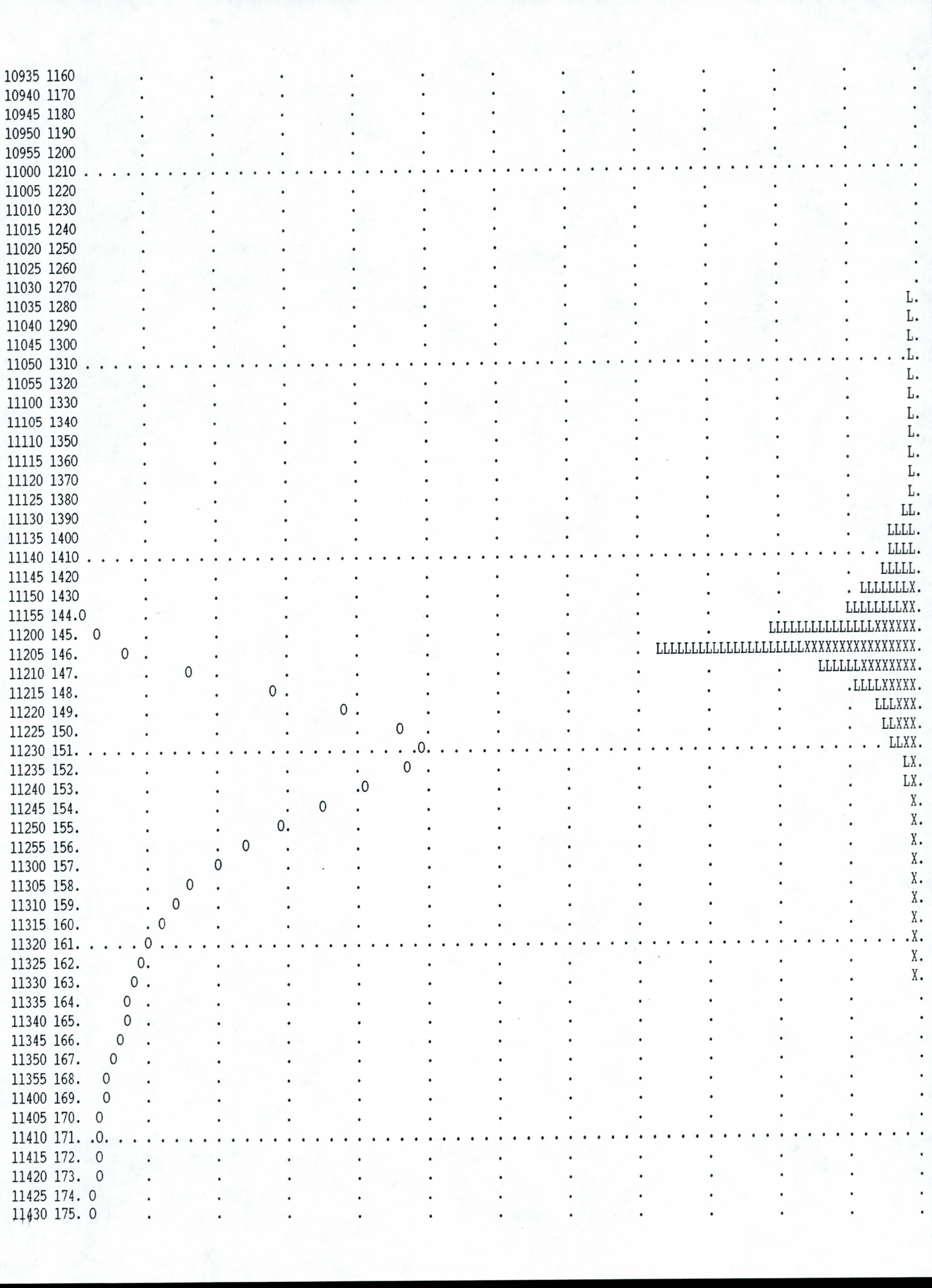
                         HYDROGRAPH AT STATION      100

     TOTAL RAINFALL =    3.90, TOTAL LOSS =    2.51, TOTAL EXCESS =    1.39

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     24.92-HR
+   (CFS)       (HR)
                          (CFS)
+     196.     12.50                    31.         9.          8.          8.
                        (INCHES)      1.263       1.383       1.383       1.383
                        (AC-FT)        15.         17.         17.         17.

                         CUMULATIVE AREA =     .23 SQ MI

1                                                   STATION      100
```

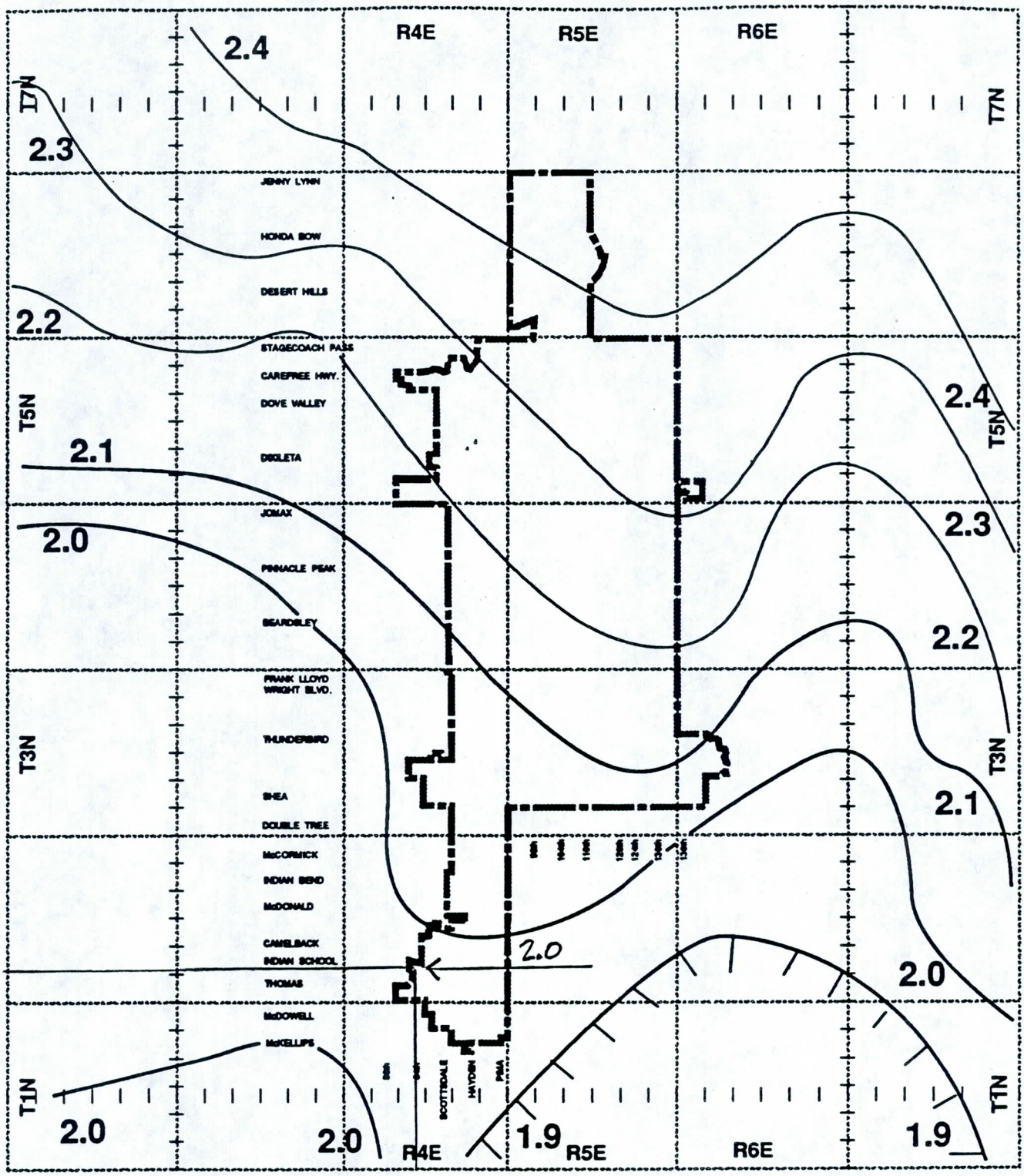


```
20035 2960        .         .         .         .         .         .         .         .         .         .         .         .
20040 2970        .         .         .         .         .         .         .         .         .         .         .         .
20045 2980        .         .         .         .         .         .         .         .         .         .         .         .
20050 2990        .         .         .         .         .         .         .         .         .         .         .         .
20055 3000---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
1
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

| | OPERATION | STATION | PEAK FLOW | TIME OF PEAK | AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR | 24-HOUR | 72-HOUR | BASIN AREA | MAXIMUM STAGE | TIME OF MAX STAGE |
|---|---|---|---|---|---|---|---|---|---|---|
| + | HYDROGRAPH AT | 100 | 196. | 12.50 | 31. | 9. | 8. | .23 | | |

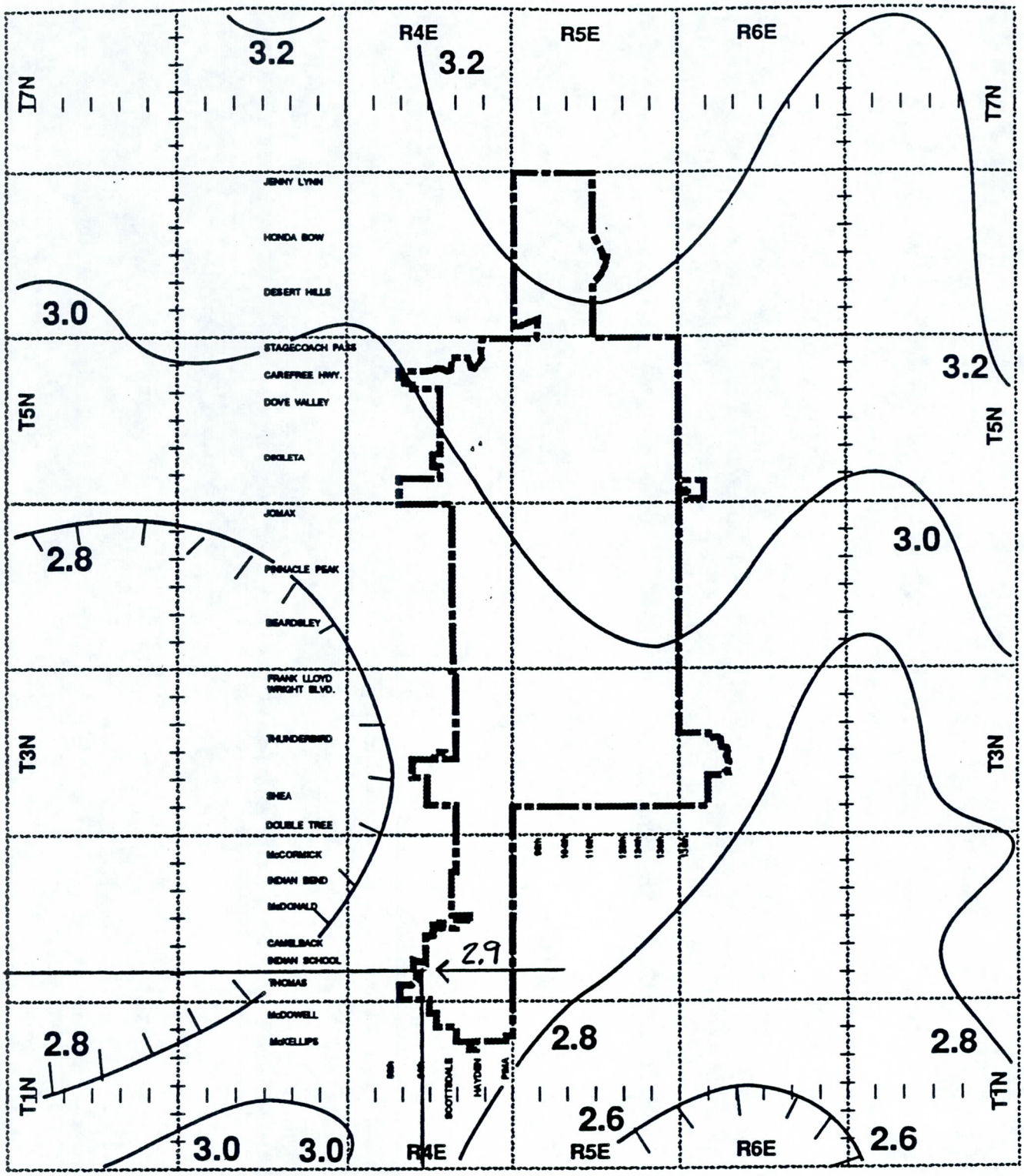
*** NORMAL END OF HEC-1 ***




# FIGURE 2.2-3

Isopluvials 10 Year 6 Hour Precipitation in Inches

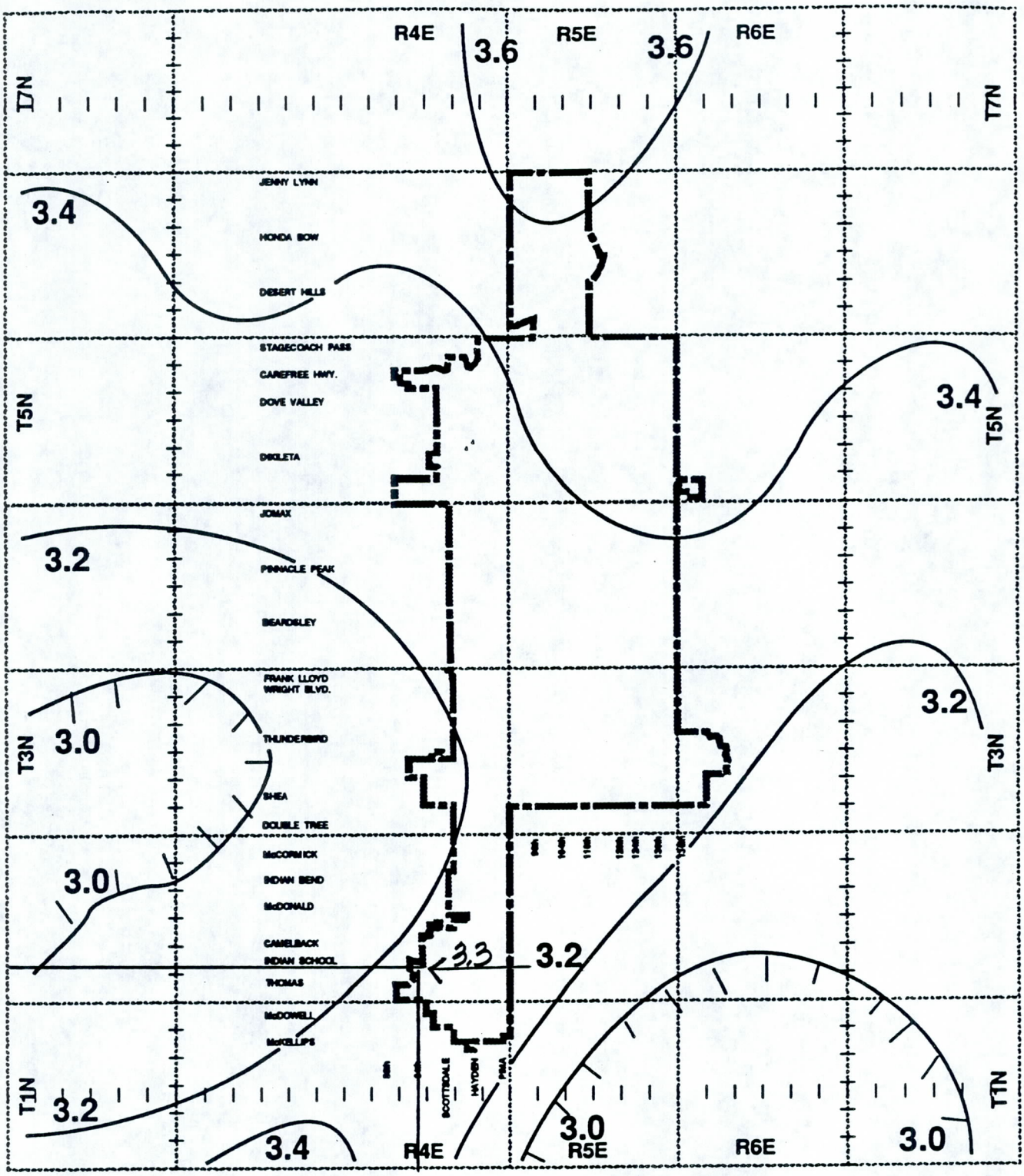
Rainfall Data From NOAA Atlas 2, Vol. VIII




# FIGURE 2.2-5

Isopluvials [redacted] Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol. VIII




# FIGURE 2.2-6

Isopluvials 100 Year 6 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol. VIII

# Part H Osborn/Thomas Road Storm Drain Outfall Economic Analysis

# OSBORN/THOMAS ROAD
# STORM DRAIN OUTFALL ECONOMIC ANALYSIS

## Alternative 1

Involves no Osborn Road outfall system. Storm runoff between Thomas Road and Indian school Road is pumped south to Thomas Road thereby necessitating an increase in size to the Thomas Road storm drain outfall system. This alternative also requires a pump station.

As requested by the City of Scottsdale, PB contacted the Water/Wastewater Department to obtain costs of pumping facilities and operation and maintenance costs over the 20 year design life of the project.

Mr. Bob Berlese and Gary Covert responded (see attached correspondences). They were not able to provide cost for pump stations and said that it would be difficult to even provide O & M costs. Finally Mr. Covert said somewhere in the $20,000/year range is what he thought it would take to maintain, repair and replace the pumps after a 20 year design period. Since these alternatives are to compare cost to a gravity drain system, for which cost are relatively straight forward, PB will use $15,000/year as conservative in the economic analysis utilizing a compounded annual rate (of return) of 8.0% for the time value of money.

With regard to the cost of pump house facilities, PB called several sources to make inquiry. Those sources are shown herein.

1. Thomas Road 72-Inch Storm Drain Outfall - 5,300 L.F. X $45/L.F. = $238,500
   (Unit Cost represents increase from 66-inch to 72-inch required for this scenario)
2. 36-Inch Force Main from 64th Street - 1700 L.F. X $55/L.F. = $93,500
3. Pump Lift Station - Includes 2-430 H.P.
   Submersible pumps, housing facility complete in place - 1 EA. = $500,000
4. Emergency Electrical Generator Backup - 1 EA. = $150,000
5. Electric Motor Controller - 1 EA. = 75,000
6. Operation, Maintenance And Replacement = $686,430
   Compute the future value of an annuity
   compounded annually @ 8.0% for 20 years Lump Sum
   = $15,000 x 45.762 (See Attached Table) (Ignore Inflation)

TOTAL COST ALTERNATIVE NO. 1 = $1,743,430

## Alternative 2

Involves pumping storm drainage between Thomas Road and Indian School Roads into the Osborn Road storm drain outfall system to be able to obtain more grade on the outfall conduit thereby reducing the pipe size in Osborn Road.

1. Osborn Road 48-Inch Storm Drain Outfall - 5150 L.F. x $100/L.F. = $515,000
2. 36-Inch Force Main from 64th Street - 950 L.F. X $55/L.F. = $52,250
3. Pump Lift Station - Includes 1-370 H.P.
   Submersible pump, housing facility complete in place - 1 EA. = $400,000
4. Emergency Electrical Generator Backup - 1 EA. = $150,000
5. Electric Motor Controller - 1 EA. = 75,000
6. Operation, Maintenance And Replacement - Lump Sum = $457,620
   F/A @ 8.0% interest, 20 years
   = $10,000 x 45.762 (Smaller Pump) (Ignore Inflation)

TOTAL COST ALTERNATIVE NO. 2 = $1,649,870

## Source of Pump Cost Information

1. Glen Harris at James, Cooke and Hobson in Phoenix
   Phone: (602) 243-0585
   - For Alternative No. 1 - use 2-430 H.P. submersible pumps to start at different times..... $275,000
   - For Alternative No. 2 - use 1-370 H.P. submersible pump ..... $165,000

2. Don Felix at Felix Construction in Phoenix
   Phone: (602) 464-0011
   - For Alternative No. 1 - Lump Sum cost of pump station including vault, manifold, hook-ups, rails, pumps, etc. ..... $500,00
   - For Alternative No. 2 - Lump Sum cost of pump station including vault, manifold, hook-ups, rails, pumps, etc. ..... $400,000
   - Cost of Electric Motor Control System..... $75,000

3. Jack Frost at Cummins Southwest in Phoenix
   Phone: (602) 250-8253
   - Cost of Emergency Backup Generator in case there is a loss of locally supplied power..... $150,000

TEXT SOURCE – ENGINEERING ECONOMY – 6TH EDITION
BY GRANT, IRESON AND LEAVENWORTH – WILEY PUB., 1976



# TABLE D–13

## 8% Compound Interest Factors

| | Single Payment | | Uniform Series | | | | |
|---|---|---|---|---|---|---|---|
| n | Compound Amount Factor F/P | Present Worth Factor P/F | Sinking Fund Factor A/F | Capital Recovery Factor A/P | Compound Amount Factor F/A | Present Worth Factor P/A | n |
| 1 | 1.0800 | 0.9259 | 1.000 00 | 1.080 00 | 1.000 | 0.926 | 1 |
| 2 | 1.1664 | 0.8573 | 0.480 77 | 0.560 77 | 2.080 | 1.783 | 2 |
| 3 | 1.2597 | 0.7938 | 0.308 03 | 0.388 03 | 3.246 | 2.577 | 3 |
| 4 | 1.3605 | 0.7350 | 0.221 92 | 0.301 92 | 4.506 | 3.312 | 4 |
| 5 | 1.4693 | 0.6806 | 0.170 46 | 0.250 46 | 5.867 | 3.993 | 5 |
| 6 | 1.5869 | 0.6302 | 0.136 32 | 0.216 32 | 7.336 | 4.623 | 6 |
| 7 | 1.7138 | 0.5835 | 0.112 07 | 0.192 07 | 8.923 | 5.206 | 7 |
| 8 | 1.8509 | 0.5403 | 0.094 01 | 0.174 01 | 10.637 | 5.747 | 8 |
| 9 | 1.9990 | 0.5002 | 0.080 08 | 0.160 08 | 12.488 | 6.247 | 9 |
| 10 | 2.1589 | 0.4632 | 0.069 03 | 0.149 03 | 14.487 | 6.710 | 10 |
| 11 | 2.3316 | 0.4289 | 0.060 08 | 0.140 08 | 16.645 | 7.139 | 11 |
| 12 | 2.5182 | 0.3971 | 0.052 70 | 0.132 70 | 18.977 | 7.536 | 12 |
| 13 | 2.7196 | 0.3677 | 0.046 52 | 0.126 52 | 21.495 | 7.904 | 13 |
| 14 | 2.9372 | 0.3405 | 0.041 30 | 0.121 30 | 24.215 | 8.244 | 14 |
| 15 | 3.1722 | 0.3152 | 0.036 83 | 0.116 83 | 27.152 | 8.559 | 15 |
| 16 | 3.4259 | 0.2919 | 0.032 98 | 0.112 98 | 30.324 | 8.851 | 16 |
| 17 | 3.7000 | 0.2703 | 0.029 63 | 0.109 63 | 33.750 | 9.122 | 17 |
| 18 | 3.9960 | 0.2502 | 0.026 70 | 0.106 70 | 37.450 | 9.372 | 18 |
| 19 | 4.3157 | 0.2317 | 0.024 13 | 0.104 13 | 41.446 | 9.604 | 19 |
| 20 | 4.6610 | 0.2145 | 0.021 85 | 0.101 85 | 45.762 | 9.818 | 20 |
| 21 | 5.0338 | 0.1987 | 0.019 83 | 0.099 83 | 50.423 | 10.017 | 21 |
| 22 | 5.4365 | 0.1839 | 0.018 03 | 0.098 03 | 55.457 | 10.201 | 22 |
| 23 | 5.8715 | 0.1703 | 0.016 42 | 0.096 42 | 60.893 | 10.371 | 23 |
| 24 | 6.3412 | 0.1577 | 0.014 98 | 0.094 98 | 66.765 | 10.529 | 24 |
| 25 | 6.8485 | 0.1460 | 0.013 68 | 0.093 68 | 73.106 | 10.675 | 25 |
| 26 | 7.3964 | 0.1352 | 0.012 51 | 0.092 51 | 79.954 | 10.810 | 26 |
| 27 | 7.9881 | 0.1252 | 0.011 45 | 0.091 45 | 87.351 | 10.935 | 27 |
| 28 | 8.6271 | 0.1159 | 0.010 49 | 0.090 49 | 95.339 | 11.051 | 28 |
| 29 | 9.3173 | 0.1073 | 0.009 62 | 0.089 62 | 103.966 | 11.158 | 29 |
| 30 | 10.0627 | 0.0994 | 0.008 83 | 0.088 83 | 113.283 | 11.258 | 30 |
| 31 | 10.8677 | 0.0920 | 0.008 11 | 0.088 11 | 123.346 | 11.350 | 31 |
| 32 | 11.7371 | 0.0852 | 0.007 45 | 0.087 45 | 134.214 | 11.435 | 32 |
| 33 | 12.6760 | 0.0789 | 0.006 85 | 0.086 85 | 145.951 | 11.514 | 33 |
| 34 | 13.6901 | 0.0730 | 0.006 30 | 0.086 30 | 158.627 | 11.587 | 34 |
| 35 | 14.7853 | 0.0676 | 0.005 80 | 0.085 80 | 172.317 | 11.655 | 35 |
| 40 | 21.7245 | 0.0460 | 0.003 86 | 0.083 86 | 259.057 | 11.925 | 40 |
| 45 | 31.9204 | 0.0313 | 0.002 59 | 0.082 59 | 386.506 | 12.108 | 45 |
| 50 | 46.9016 | 0.0213 | 0.001 74 | 0.081 74 | 573.770 | 12.233 | 50 |
| 55 | 68.9139 | 0.0145 | 0.001 18 | 0.081 18 | 848.923 | 12.319 | 55 |
| 60 | 101.2571 | 0.0099 | 0.000 80 | 0.080 80 | 1 253.213 | 12.377 | 60 |
| 65 | 148.7798 | 0.0067 | 0.000 54 | 0.080 54 | 1 847.248 | 12.416 | 65 |
| 70 | 218.6064 | 0.0046 | 0.000 37 | 0.080 37 | 2 720.080 | 12.443 | 70 |
| 75 | 321.2045 | 0.0031 | 0.000 25 | 0.080 25 | 4 002.557 | 12.461 | 75 |
| 80 | 471.9548 | 0.0021 | 0.000 17 | 0.080 17 | 5 886.935 | 12.474 | 80 |
| 85 | 693.4565 | 0.0014 | 0.000 12 | 0.080 12 | 8 655.706 | 12.482 | 85 |
| 90 | 1 018.9151 | 0.0010 | 0.000 08 | 0.080 08 | 12 723.939 | 12.488 | 90 |
| 95 | 1 497.1205 | 0.0007 | 0.000 05 | 0.080 05 | 18 701.507 | 12.492 | 95 |
| 100 | 2 199.7613 | 0.0005 | 0.000 04 | 0.080 04 | 27 484.516 | 12.494 | 100 |

20 YEAR LIFE
COMPOUNDED ANNUALLY

**FAX**

PB 100 YEARS

**Parsons Brinckerhoff**
1501 W. Fountainhead Parkway
Suite 400
Tempe, AZ 85282-1853
602-966-8295
Fax: 602-966-9234

to: MR. BOB BERLESE
CITY OF SCOTTSDALE
WATER/WASTEWATER dept.
SCOTTSDALE, ARIZONA.

fax no. 391-5650 PHONE
→ 391-5701 FAX

from: BOB BATTISTELLO

date: MAY 06, 1994

operator: B.B

job no. 4541P1-123

no. of pages (including this page) 9

comments THANK YOU FOR TAKING SOME TIME TO HELP US OUT. ANY INFO YOU CAN SUPPLY REGARDING THE COST OF PUMP STATION FACILITIES (2 ALT'S GIVEN IN TEXT) + O&M COSTS WOULD BE APPRECIATED. IT'S STORM DRAINAGE FACILITIES - SO THE FLOWRATE IS LARGE (108 cfs = 48,500 gpm) - THE TEXT SUPPLIES THE H.P. REQUIREMENTS OF THE 2 DIFFERENT PUMP ALT'S

AGAIN THANKS,

BOB BATTISTELLO

PLEASE FEEL FREE TO CALL ME IF YOU SHOULD HAVE ANY QUESTIONS.

PARSONS, BRINCKERHOFF, QUADE & DOUGLAS, INC.

# TELEPHONE CONVERSATION MEMORANDUM

Project 64TH STREET / SCOTTSDALE Job No. 4541P1-123 (Use Complete Number) Date MAY 18, 94

From BOB BATTISTELLO Talked to GARY COVERT - CITY OF SCOTTSDALE WATER & SEWER Dept. 391-5678

Indicate Department, Field Office, etc. for "In House" calls.
Indicate agency or firm for other than "In House" calls.

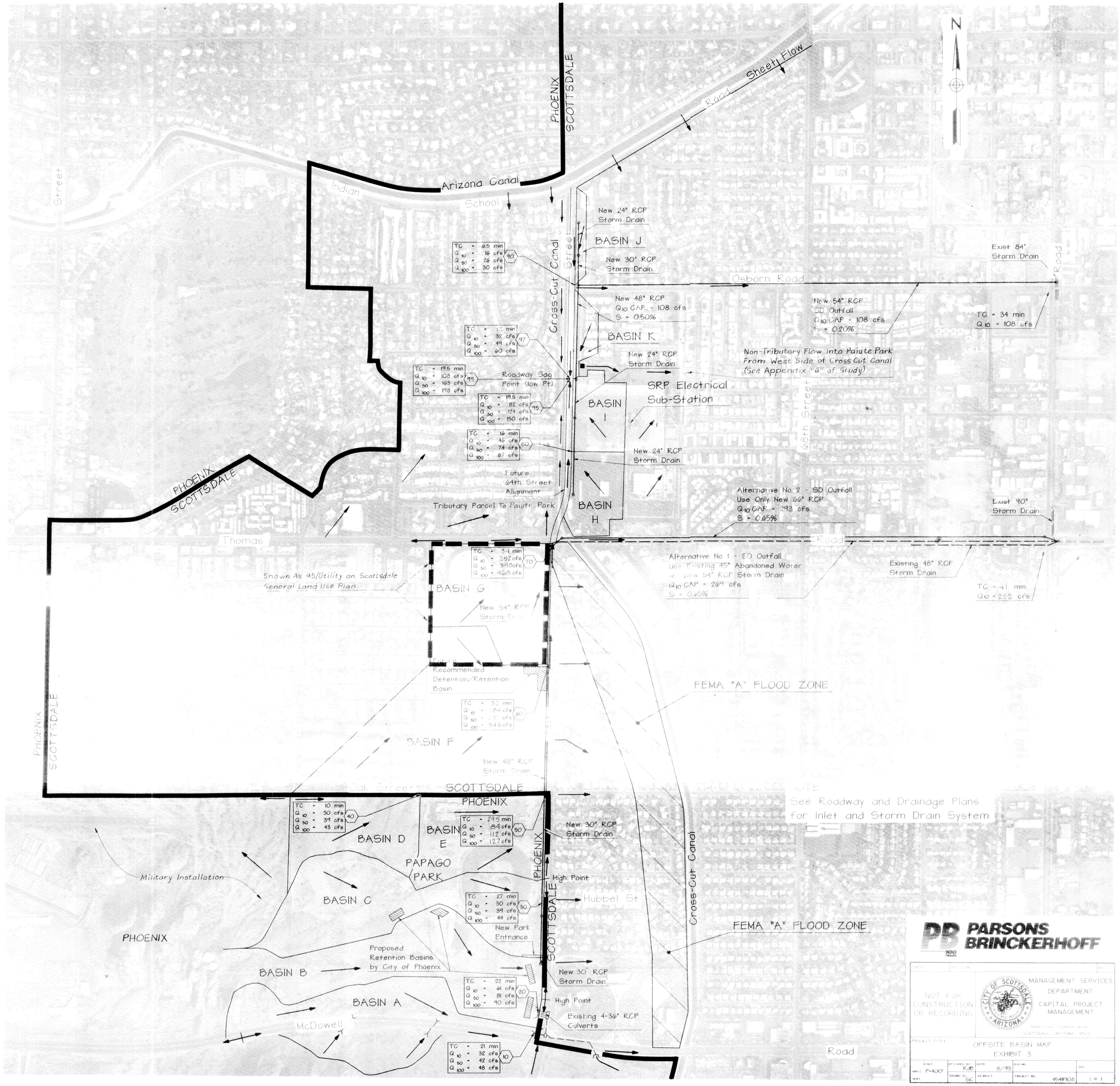
Item Discussed Cost of Pumpstation + O & M Costs for Storm DRAIN alt. 1 & 2 for Master DRAINAGE STUDY

Information Obtained GARY SAID to use $20,000/YR. for operation & MAINTENANCE of the Pump stations described in the Drainage Study. He was not able to supply a cost for the actual Pump stations (or even the pumps themselves)

He said to call the following for that info.
Bruce Loring @
JAMES, COOKE & HOBBS, Located @
S. 36th. Street - Phoenix
Ph: 243-0585

Action Required Call to price out a cost for the Pump stations for alt 1 & 2,

Distribution: B.V. | DJH | FILE | | | | By: BDB.


N
Sheet Flow
Road
PHOENIX
SCOTTSDALE
Arizona Canal
Indian
School
Street
New 24" RCP
Storm Drain
BASIN J
New 30" RCP
Storm Drain
TC = 6.5 min
Q 10 = 16 cfs
Q 50 = 26 cfs
Q 100 = 30 cfs
90
Cross-Cut Canal
Street
Osborn Road
Exist 84"
Storm Drain
Road
New 48" RCP
Q10 CAP = 108 cfs
S = 0.50%
New 54" RCP
SD Outfall
Q10 CAP = 108 cfs
S = 0.20%
TC = 34 min
Q 10 = 108 cfs
TC = 12 min
Q 10 = 32 cfs
Q 50 = 49 cfs
Q 100 = 60 cfs
97
BASIN K
New 24" RCP
Storm Drain
Non-Tributary Flow Into Paiute Park
From West Side of Cross Cut Canal
(See Appendix "G" of Study)
TC = 19.5 min
Q 10 = 108 cfs
Q 50 = 163 cfs
Q 100 = 198 cfs
99
Roadway Sag
Point (low Pt)
SRP Electrical
Sub-Station
TC = 19.5 min
Q 10 = 82 cfs
Q 50 = 124 cfs
Q 100 = 150 cfs
95
BASIN
I
68th Street
TC = 16 min
Q 10 = 46 cfs
Q 50 = 74 cfs
Q 100 = 87 cfs
60
New 24" RCP
Storm Drain
Future
64th Street
Alignment
Tributary Parcel To Paiute Park
BASIN
H
Alternative No 2 - SD Outfall
Use Only New 66" RCP
Q10 CAP = 293 cfs
S = 0.65%
Exist 90"
Storm Drain
PHOENIX
SCOTTSDALE
Thomas
Road
TC = 34 min
Q 10 = 252 cfs
Q 50 = 390 cfs
Q 100 = 468 cfs
70
Alternative No 1 - SD Outfall
Use Existing 45" Abandoned Water
w. New 54" RCP Storm Drain
Q10 CAP = 209 cfs
S = 0.45%
Existing 48" RCP
Storm Drain
TC = 41 min
Q10 = 252 cfs
Shown As 45/Utility on Scottsdale
General Land Use Plan
BASIN G
New 54" RCP
Storm Drain
Future
Recommended
Detention/Retention
Basin
FEMA "A" FLOOD ZONE
TC = 32 min
Q 10 = 184 cfs
Q 50 = 241 cfs
Q 100 = 346 cfs
60
BASIN F
New 48" RCP
Storm Drain
PHOENIX
SCOTTSDALE
Oak Street
SCOTTSDALE
PHOENIX
NOTE
See Roadway and Drainage Plans
for Inlet and Storm Drain System.
TC = 10 min
Q 10 = 30 cfs
Q 50 = 39 cfs
Q 100 = 43 cfs
40
BASIN D
BASIN
E
TC = 29.5 min
Q 10 = 84 cfs
Q 50 = 112 cfs
Q 100 = 127 cfs
50
New 30" RCP
Storm Drain
PAPAGO
PARK
PHOENIX
Military Installation
High Point
Hubbel St
BASIN C
TC = 27 min
Q 10 = 30 cfs
Q 50 = 39 cfs
Q 100 = 44 cfs
30
New Park
Entrance
SCOTTSDALE
Cross-Cut Canal
FEMA "A" FLOOD ZONE
PHOENIX
Proposed
Retention Basins
by City of Phoenix
BASIN B
New 30" RCP
Storm Drain
TC = 22 min
Q 10 = 61 cfs
Q 50 = 81 cfs
Q 100 = 90 cfs
20
BASIN A
High Point
Existing 4-36" RCP
Culverts
McDowell
TC = 21 min
Q 10 = 32 cfs
Q 50 = 42 cfs
Q 100 = 48 cfs
10
Road
PARSONS
BRINCKERHOFF
DATE
REVISION
BY
NOT FOR
CONSTRUCTION
OR RECORDING
CITY OF SCOTTSDALE
ARIZONA
MANAGEMENT SERVICES
DEPARTMENT
CAPITAL PROJECT
MANAGEMENT
PROJECT TITLE
OFFSITE BASIN MAP
EXHIBIT 3
SCALE
HORIZ. 1"=400'
VERT.
DESIGNED BY
RJB
DRAWN BY
SC
DATE
8/93
AS-BUILT
BID NO.
PROJECT NO.
4541P108
SHT.
1 OF 1