City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 7, 1991

PROJECT ACCEPTANCE LETTER

Gilbert Luna
Universal Construction Company
Station B, Box 6008
Albuquerque, NM 87197-6008

RE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AND WENONAH, PROJECT NO. 3340

Dear Mr. Luna:

The above referenced project has been completed according to the plans and specifications. The project consisted of the extension of Tramway south of Central Ave., S.E. and Wenonah Ave. to include earthwork, base course, asphalt paving, concrete curb and gutter, a concrete bridge crossing, trench and waterline, and storm drainage infrastructure.

The City of Albuquerque accepts the referenced project as a whole and the contractual correction period began July 3, 1990. The correction period on this project is for one (1) year.

Sincerely,

Brian L. Speicher, P.E.
Chief Construction Engineer
Design/Construction Division
Engineering Group
Public Works Department

BLS:tp

cc: Tierra Engineering
Jim Hicks, Engineering Group, PWD
Mike Fellman, CIP Office
Denise Wilcox, Engineering Group, PWD
Martin Barker, Engineering Group, PWD
Fred Aguirre, Engineering Group, PWD
Terri Martin, Engineering Group, PWD
Steve Gonzales, Special Assessments
A. N. Gaume, Operations Group, PWD
Sam Hall, Operations Group, PWD
Jim Fink, Operations Group, PWD
Ray Chavez, Engineering Group, PWD
Jon Ertsgaard, Water/Wastewater Group, PWD
Dave Parks, Engineering Group, PWD
Tom Kennerly, Engineering Group, PWD
Josie Gutierrez, New Meter Sales, Finance Group, PWD
Claudia Gallegos, Standby Clerk, Finance, PWD
Richard Zamora, Engineering Group, PWD
f/Project No. 3340
f/Readers
f/Warranty:Contract

TRANSPORTATION DESIGN ENGINEERING
P.O. BOX 1293
ALBUQUERQUE, NEW MEXICO 87103
PHONE NUMBER (505) 768-2760

CONFERMEMO

L22-D48

To: Roger Green
DRB Chairman

Date: 2/16/90

Project Number: 3340

Subject: Tramway Extension South of Four Hills and Wenonah Rd.

Remarks: Attached please find original Drainage Covenant for the referenced project for your use and filing

Copies to: (with enclosures)

Fred Aguirre, DRB ☑

Signed: Suzanne Dougharty

DRAINAGE COVENANT

This Drainage Covenant, between Smith's Food & Drug Centers, Inc. a Delaware Corporation, and the City of Albuquerque, a New Mexico municipal corporation ("City"), whose address is P.O. Box 1293, Albuquerque, New Mexico 87103, is made in Albuquerque, Bernalillo County, New Mexico and is entered into as of the date Owner signs this Easement.

1. Recital. Owner is the owner of certain real property located at the Tramway south of Central and Wenonah in Bernalillo County, New Mexico (the "Property") (Exhibit A).

Pursuant to City ordinances, regulations and other applicable laws, the City is required to construct and maintain certain temporary drainage facilities on the Property, and the parties wish to enter into this agreement to establish the obligations and responsibilities of the parties.

2. Description and Construction of Temporary Drainage Facilities. City shall construct the following "Drainage Facility" within the Property at City's sole expense in accordance with the standards, plans and specifications approved by the City: Project No. 3340, Temporary berm and swale to accommodae site flows to the Tramway Channel until the property is developed.

The temporary Drainage Facility is more particularly described in the attached Exhibit B.

3. Maintenance of Drainage Facility. The City will maintain the Drainage Facility at City's cost in accordance with the approved construction plans, Project No. 3340.

4. City's Right of Entry. The City has the right to enter upon the Property at any time and perform whatever inspection and maintenance of the Drainage Facility it deems appropriate, without liability to the Owner.

5. Site Development. Prior to approval of a Site Development Plan for the property, the Owner shall submit a drainage plan for review and approval conforming to the City Standards and the existing drainage plan for the Tramway Extension South of Central and Wenonah Avenue, File No. L-22/D48. The Owner will demolish the berm and swale upon development of the property.

6. Indemnification. As a part of the consideration for this grant, subject to the provisions of the New Mexico Tort Claims Act and all other applicable New Mexico laws, the City agrees to save Owner harmless from any and all liability arising from the City's negligent use of the temporary drainage facility. The City does not agree to save Owner harmless from any liability which may arise from Owner's use of the temporary drainage facility and the property.

7. Cancellation of Agreement and Release of Covenant. This agreement may be cancelled and covenants released by the City following by the City's mailing to the Owner notice of the City's intention to record a Cancellation and Release with the Bernalillo County Clerk. The Cancellation and Release will be effective thirty (30) days after the date of mailing the notice to the User unless a later date is stated in the notice or in the Cancellation and Release. After the effective date, the City will record the Cancellation and Release with the Bernalillo County Clerk.

8. Assessment. Nothing in this agreement shall be construed to relieve the Owner, his heirs, assigns and successors from an assessment against Owner's Property for improvements to the Property under a duly authorized and approved Special Assessment District. The parties specifically agree that the value of the drainage facility will not reduce the amount assessed by the City.

9. Notice. For purposes of giving formal written notice to the Owner, Owner's address is:

1550[redacted] Redwood Road
Salt Lake City, UT 84104

Notice may be given to the Owner either in person or by mailing the notice by regular U.S. mail, postage paid. Notice will be considered to have been received by the Owner within 6 days after the notice is mailed if there is no actual evidence of receipt. The Owner may change Owner's address by giving written notice of the change be certified mail, return receipt requested, to the City Public Works Department, P.O. Box 1293, Albuquerque, New Mexico 87103.

10. Term. This agreement shall continue until terminated by the City pursuant to Section 7. above, or until development of the "Property" in accordance with Section 5 above.

11. Binding on Owner's Property. The covenants and obligations of the Owner set forth herein shall be binding on Owner, his heirs, assigns and successors and on Owner's Property and constitute covenants running the Owner's Property until released by the City.

12. Entire Agreement. This agreement contains the entire agreement of the parties and supersedes any and all other agreements or understandings, oral or written, whether previous to the execution hereof or contemporaneous herewith.

13. Changes to Agreement. Changes to this agreement are not binding unless made in writing, signed by both parties.

14. Construction and Severability. If any part of this agreement is held to be invalid or unenforceable, the remainder of the agreement will remain valid and enforceable if the remainder is reasonably capable of completion.

15. Captions. The captions to the sections or paragraphs of this agreement are not part of this agreement and will not affect the meaning or construction of any of its provisions.

OWNER:

By: [signature]
Its: VICE PRESIDENT
Dated: 2-14-90

STATE OF UTAH)
) ss
COUNTY OF SALT LAKE)

The foregoing instrument was acknowledged before me this 14th day of February, 1990, by [name of person signing:] Larry McNeill, [title or capacity, for instance, "President" or "Owner":] of [name of the entity which owns the Property if other than the individual signing for instance, the name of the corporation, partnership, or joint venture:] Vice President, Smith's Food & Drug Centers, Inc.

NOTARY PUBLIC
My Commission Expires August 6, 1992
JO CHRISTENSEN
1550 So. Redwood Rd.
Salt Lake City, UT 84104
STATE OF UTAH

Jo Christensen
Notary Public

My Commission Expires:

August 6, 1992

CITY OF ALBUQUERQUE:

Approved:

By: Russell B. Smith
Title: City Engineer
Dated: 1-24-90

SD/tsl/WP+124458

Tract J of FOUR HILLS VILLAGE SHOPPING CENTER AND APARTMENT COMPLEX, City of Albuquerque, Bernalillo County, New Mexico, as the same is shown and designated on the Plat filed in the Office of the County Clerk of Bernalillo County on August 12, 1986, as Document Number 86-74533, recorded in Vol. C31, folio 63, (Sheets 1 through 4), records of Bernalillo County, New Mexico.

TOGETHER WITH:

A certain Tract of Land within the Northwest Quarter of Section 26 and the Northeast corner of Section 27, Township 10 North, Range 4 East, New Mexico Principal Meridian, City of Albuquerque, Bernalillo County, New Mexico, being Tract One as described in Exhibit A of Special Master's Deed, Tract One, filed August 13, 1982, in Book D167-A, pages 442 thru 444 of the Records of Bernalillo County, New Mexico, excepting from said Tract One, a Northerly 0.2191 Acre Portion thereof and an Easterly Portion thereof taken for right-of-way of Tramway East Drainage Improvements - Phase II and said certain Tract of Land being more particularly described as follows:

BEGINNING at the Quarter Corner between said Sections 26 and 27, Township 10 North, Range 4 East (a brass cap monument set in concrete), whence the Albuquerque City Survey Monument "TOM" bears N 88° 41' 50" E, 1824.54 feet distant, said Corner also being an angle point on the Northerly line of the Corrected Plat, Canada Village, Second Unit, filed on October 16, 1953, in the Records of Bernalillo County, New Mexico; Thence,

N 88° 42' 51" W, 191.53 feet along said Northerly line of Canada Village, Second Unit, to the Southwest corner of the Tract herein described, said corner also being the Southeast corner of Tract F, Four Hills Village Shopping Center and Apartment Complex, filed on April 26, 1985, in the Records of Bernalillo County, New Mexico; Thence,

N 00° 30' 25" E, 473.59 feet along the Easterly line of said Tract F, Four Hills Village Shopping Center and Apartment Complex to the Northwest corner of the Tract herein described, said corner also being the Southwest corner of Tract J, Four Hills Village Shopping Center and Apartment Complex; Thence Easterly along the Southerly line of said Tract J on the following thirteen (13) courses,

S 89° 29' 35" E, 306.24 feet to a point; Thence,

S 61° 12' 20" E, 26.59 feet to a point; Thence,

S 65° 29' 02" E, 25.05 feet to a point; Thence,

S 67° 34' 07" E, 25.10 feet to a point; Thence,

S 77° 52' 28" E, 25.63 feet to a point; Thence,

S 87° 13' 14" E, 28.49 feet to a point of curvature; Thence,

EXHIBIT A

Northeasterly , 47.81 feet on the arc of a curve to the left (said curve having a radius of 157.28 feet and a chord which bears N 84° 04' 14" E, 47.63 feet) to a point of tangency; Thence,

N 75° 21' 43" E, 49.16 feet to a point of curvature; Thence,

Southeasterly , 12.87 feet on the arc of a curve to the right (said curve having a radius of 13.16 feet and a chord which bears S 76° 37' 13" E, 12.36 feet) to a point of tangency; Thence,

S 48° 36' 08" E, 38.54 feet to a point; Thence,

N 68° 26' 08" E, 32,62 feet to a point of curvature; Thence,

Northeasterly , 54.97 feet on the arc of a curve to the left (said curve having a radius of 167.70 feet and a chord which bears N 49° 22' 22" E, 54.73 feet) to a point on curve; Thence,

S 89° 29' 35" E, 68.42 feet to the Southeast corner of said Tract J and the Northeast corner of the Tract herein described, a point on the Westerly right-of-way line of said Tramway East Drainage Channel; Thence Southerly along said Westerly right-of-way line of Tramway East Drainage Channel on the following three (3) courses,

S 06° 29' 09" W, 276.50 feet to a point; Thence,

N 83° 30' 51" W, 24.37 feet to a point on curve; Thence,

Southwesterly , 199.50 feet on the arc of a curve to the left (said curve having a radius of 2914.79 feet and a chord which bears S 04° 31' 30" W, 199.47 feet) to a point on curve and the Southeast corner of the Tract herein described, said corner also being on said Northerly line of Canada Village, Second Unit; Thence,

S 89° 53' 41" W, 446.73 feet along said Northerly line of Canada Village, Second Unit, to the Point of Beginning of the Tract herein described.

Said Tract contains 7.0849 acres, more or less.

LEGEND

EXISTING ASPHALT TO BE REMOVED

NEW ASPHALT PAVING (SEE TYPICAL SECTION FOR STREET REQUIREMENTS

EXISTING TREES TO BE REMOVED

EXISTING TREES TO REMAIN

NOTE: GRADING SWALES, BERMS & DESILATION PONDS SHALL BE INCIDENTAL TO THE COST OF THE EARTH WORK OPERATION

SCALE: 1"=50'

℄ CURVE DATA
Δ = 99°59'02"
R = 65.00'
L = 102.08'
T = 64.98'

THIS AREA DESIGNATED FOR EXCESS MATERIAL (COMPACTED TO 95%)
CONTRACTOR SHALL CLEAR & GRUB & SCARIFY AREA TO A DEPTH OF 6" PRIOR TO PLACING EXCESS MATERIAL

EXIST. CHAIN LINK FENCING TO BE REMOVED WITHIN CONSTRUCTION LIMITS

REMOVE 385' L.F. OF 6'± HIGH RETAINING WALL

LIMITS OF SAW CUT

PAVEMENT SECTION FOR PARKING LOT

FOUR HILLS ROAD

TRAMWAY CHANNEL

BUILT 181' CHANNEL CROSSING

EXIST FRONTAGE ROAD

CENTRAL AVE.

EAST CENTRAL BLVD.

TRAMWAY

EXISTING "CHEVRON" SIGN TO REMAIN

BUILDING

PARKING LOT

SEE SHEET 7

SEE SHEET 8

SEE SHEET 9

SEE SHEET 10

SEE SHEET 11

Exhibit B

DRAINAGE COVENANT

This Drainage Covenant, between Massachusetts General Life Insurance Company, a Massachusetts Life Insurance Corporation, successor is pursuant to a statutory merger with Bankers Union Life Insurance Company ("Bankers Union"), and the City of Albuquerque, a New Mexico municipal corporation ("City"), whose address is P.O. Box 1293, Albuquerque, New Mexico 87103, is made in Albuquerque, Bernalillo County, New Mexico and is entered into as of the date Owner signs this Easement.

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6. Indemnification. As a part of the consideration for this grant, subject to the provisions of the New Mexico Tort Claims Act and all other applicable New Mexico laws, the City agrees to save Owner harmless from any and all liability arising from the City's negligent use of the temporary drainage facility. The City does not agree to save Owner harmless from any liability which may arise from Owner's use of the temporary drainage facility and the property.

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9. Notice. For purposes of giving formal written notice to the Owner, Owner's address is:

_____

_____

_____

Notice may be given to the Owner either in person or by mailing the notice by regular U.S. mail, postage paid. Notice will be considered to have been received by the Owner within 6 days after the notice is mailed if there is no actual evidence of receipt. The Owner may change Owner's address by giving written notice of the change be certified mail, return receipt requested, to the City Public Works Department, P.O. Box 1293, Albuquerque, New Mexico 87103.

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15. Captions. The captions to the sections or paragraphs of this agreement are not part of this agreement and will not affect the meaning or construction of any of its provisions.

OWNER:

By: _____

Its: _____

Dated: _____

STATE OF _____)
) ss
COUNTY OF _____)

The foregoing instrument was acknowledged before me this ____ day of _____, 198___, by [name of person signing:] _____, [title or capacity, for instance, "President" or "Owner":] of [name of the entity which owns the Property if other than the individual signing, for instance, the name of the corporation, partnership, or joint venture:] _____.

_____
Notary Public

My Commission Expires:

_____

CITY OF ALBUQUERQUE:

Approved:

By:_____
Title: _____
Dated: _____

SD/tsl/WP+124458

Tract J of FOUR HILLS VILLAGE SHOPPING CENTER AND APARTMENT COMPLEX, City of Albuquerque, Bernalillo County, New Mexico, as the same is shown and designated on the Plat filed in the Office of the County Clerk of Bernalillo County on August 12, 1986, as Document Number 86-74533, recorded in Vol. C31, folio 63, (Sheets 1 through 4), records of Bernalillo County, New Mexico.

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N 88° 42' 51" W, 191.53 feet along said Northerly line of Canada Village, Second Unit, to the Southwest corner of the Tract herein described, said corner also being the Southeast corner of Tract F, Four Hills Village Shopping Center and Apartment Complex, filed on April 26, 1985, in the Records of Bernalillo County, New Mexico; Thence,

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S 89° 29' 35" E, 306.24 feet to a point; Thence,

S 61° 12' 20" E, 26.59 feet to a point; Thence,

S 65° 29' 02" E, 25.05 feet to a point; Thence,

S 67° 34' 07" E, 25.10 feet to a point; Thence,

S 77° 52' 28" E, 25.63 feet to a point; Thence,

S 87° 13' 14" E, 28.49 feet to a point of curvature; Thence,

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N 75° 21' 43" E, 49.16 feet to a point of curvature; Thence,

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N 68° 26' 08" E, 32.62 feet to a point of curvature; Thence,

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S 89° 53' 41" W, 446.73 feet along said Northerly line of Canada Village, Second Unit, to the Point of Beginning of the Tract herein described.

Said Tract contains 7.0849 acres, more or less.

PT ℄ STA 12+30.91, 4.06' LT
TC 5686; MATCH EXIST MED CB
END OF MED CB REMOVAL & SAW CUT OF PAVEMENT

PRC ℄ STA 11+91.50, 0.40' RT
TC 5684.37

PC STA 11+49.92, 3.95' RT
TC 5683.31

LIMITS OF SAW CUT

℄ STA 10+50.01, 7.94' RT
TC 5680.00', MATCH EXIST ℄ W/ EDGE OF PAVEMENT

℄ STA 10+49.97, 5.94' RT
TC 5680.00

PAVEMENT SECTION FOR PARKING LOT
ENTRANCE A, B, & C FROM R/W TO LIMIT OF CONSTRUCTION INSIDE OF PARKING LOT

PC ℄ STA 0+48.24

℄ STA 10+03.86 CENTRAL AVE.
℄ STA 0+00.00 TOUR RAMP

PCR STA STA 9+60.24, 1.78' RT
TC 7655;

PC STA 9+30.92, 8' LT
TC 5675.60;
BEGIN REMOVAL OF MED CB & SAW CUT OF PAVEMENT, MATCH EXIST MED CB

PTR ℄ STA 10+91.52, 40.78' RT
TC 7950

PT ℄ STA 1+59.92, 21.99' LT
TC 5672.90;

PT ℄ STA 1+50.32

STA 1+85
MATCH EXIST PAVEMENT, EL. 5672.00;
LIMITS OF SAW CUT

PT STA 1+50.70, 21.99' RT
TC 7210;

PCR ℄ STA 0+91.20, 26.11 LT.

PTR STA 0+57.66, 31.95' RT

PCR STA 9+48.86, 44' RT
TC 5678.45

PTR STA 9+57.86, 9' RT, TC 5676.86;
BEGIN MED CB REMOVAL & SAW CUT OF PAVEMENT, MATCH EXIST MED CB

℄ CURVE DATA
Δ = 89° 59' 02"
R = 65.00'
L = 102.08'
T = 64.98'

CURVE DATA AT FACE OF CURB

	DELTA	RADIUS	LENGTH	TANGENT
(1)				
(2)				
(3)				
(4)				
(5)				
(6)				
(7)				
(8)				
(9)				

LEGEND

EXISTING ASPHALT TO BE REMOVED

NEW ASPHALT PAVING (SEE TYPICAL SECTION FOR STREET REQUIREMENTS

EXISTING TREES TO BE REMOVED

EXISTING TREES TO REMAIN

NOTE GRADING SWALES, BERMS & DESILATION PONDS SHALL BE INCIDENTAL TO THE COST OF THE EARTH WORK OPERATION

SCALE: 1"=50'

FOUR HILLS ROAD

SEE SHEET 8

TRAMWAY CHANNEL

14' WIDE X 12' DEEP

BUILT 161' / 30 CHANNEL CROSSING

EXIST. CHAIN LINK FENCING TO BE REMOVED WITHIN CONSTRUCTION LIMITS

THIS AREA DESIGNATED FOR EXCESS MATERIAL (COMPACTED TO 95%)

CONTRACTOR SHALL CLEAR & GRUB & SCARIFY AREA TO A DEPTH OF 6" PRIOR TO PLACING EXCESS MATERIAL

SEE SHEET 6

SEE SHEET 10

TOE OF EROSION CONTROL BERM

Proposed R/W

EXISTING TREES TO REMAIN

SEE SHEET 4

TRAMWAY

AVE.

EXIST FRONTAGE ROAD

SEE SHEET 5

SEE SHEET 7

SEE SHEET 8

REMOVE 385' LF OF 8'± HIGH RETAINING WALL

BLVD.

EAST CENTRAL

EXISTING "CHEVRON" SIGN TO REMAIN

BUILDING

PARKING LOT

SEE SHEET 9

SAS

Exhibit B

FILE COPY

TY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

ENGINEERING GROUP

INTER-OFFICE CORRESPONDENCE October 5, 1989

TO: Suzanne Dougharty, Engineering PWD/Transportation Div.

FROM: Loren D. Meinz, Hydrology Division

SUBJECT: Project No. 3340 L22/D48
Drainage Report for Tramway Blvd. Extension,
Central to Wenonah, and Wenonah to Four Hills Rd.

The drainage report for the referenced project is approved, subject to completion of the following item.

1) Areas designated in the drainage report as A1 and B1 are indicated as areas to be regraded to drain to the East. Grading of these areas must be completed as part of the street construction, or assured by written agreement between the City and the property owner.

If you have any questions, don't hesitate to call.

cc: Rodger Green, Design Review Committee
Fred Aguirre, City Hydrologist

wp+1335

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

KEN SCHULTZ
MAYOR

DESIGN REVIEW COMMITTEE MEETING **9/8/89** **1:30**

PROJECT: **Tramway Boulevard Extension** **Project No. 3340**

CONSULTANT: **Tierra Engineering Consultants, Inc.**

PRESENT:
Roger Green, D.R.C. Chairman
Richard Dourte, Transportation
Suzanne Dougharty, Project Manager
Joe Luehring, Utility Coordinator
Carlos Montoya, Project Review
Gilbert Aldez, Hydrology
Loren Meinz, Hydrology
Robert Kane, Utilities
Carlos Castaneda, Consultant
Mike Yost, Consultant

COMMENTS:

1. Will need to have a written agreement with Landowner to the east that City can construct, and will maintain, berm on private property.

2. Will need approved Drainage Report prior to final signatures.

3. Marked up plans provided by Richard Dourte and Carlos Montoya.

4. Sidewalks are required on west side of Tramway, south of Central.

5. Utility Section needs more time to finalize any comments, Suzanne will follow-up.

6. Written comments provided by Joe Luehring.

7. Sewer line service must be provided under Wenonah Avenue.

Resubmit four (4) plan sets for a sign-off meeting after comments are addressed. Return all marked up plan sets.

WP+123469

Loren Meinz
for Tramway
Drainage file

Form No. A-110
Rev. 9-87

New Mexico
State Highway and Transportation Department

INTRA-DEPARTMENTAL CORRESPONDENCE

SUBJECT Drainage Report Review, Tramway Blvd. Ext., south of Central Ave. to Wenonah Ave.

DATE 8/31/89

FILE REFERENCE:

RECEIVED
SEP 13 1989
PMD/TRANS DEV

TO Wayne Preskar
Project Development Engineer

ATTENTION OF

FROM Ronald E. Gaines
Drainage Engineer

I have reviewed the subject project drainage report for the City of Albuquerque, submitted by Tierra Engineering.

The consultant proposed to build three curb inlets at Tramway Blvd. and Wenonah Ave. intersection and to drain into the existing 1-36" storm sewer line along the proposed Tramway Blvd. extension. The expected additional 100 year flow into the existing storm sewer system is 7 cfs. There are no as-builts available on the existing storm drain system, however, our evaluation showed that there is enough capacity to handle the additional flows.

I found that the recommendations contained therein are reasonable and therefore, it is hereby approved.

If I can be of futher assistance, please advise.

Sincerely,

Ronald E Gaines

Ronald E. Gaines

cc: L. D. Duffy
Gilbert Aldez, Tierra Engineering
Suzanne Dougharty, City of Albuquerque

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

ENGINEERING GROUP

INTER-OFFICE CORRESPONDENCE September 6, 1989

TO: Suzanne Dougharty, Transp. Div., Engineering - PWD

FROM: Loren Meinz, Engineer, Hydrology Division - PWD

SUBJECT: REVIEW OF DRAINAGE REPORT FOR TRAMWAY BLVD. EXT. SO. OF CENTRAL & WENONAH AVE. E. OF TRAMWAY

Per your request, I have reviewed the subject project. The following are review comments:

1) Furnish as-built information for existing 36" RCP, incl. letter from State Highway for approval to connect additional storm drainage systems. As-built information must include verification of length/slope data contained in report (pg. 8).

2) Since areas A1, & B1, are private property, City will need verification and/or construction must be completed to drain A1, & B1, to east to the channel. Rundown construction into channel will be necessary. Grading should be covered by written agreement between City & property owner.

3) Transportation Planning, COA, should review geometry and access for project.

4) Install Type "A" inlet over proposed storm sewer pipe at face of median curb, southbound lines, near Sta. 12+50 Tramway Blvd., to prevent cross-flow due to superelevation.

cc: Fred Aguirre, City Hydrologist, Hydrology Section - PWD
Stuart Reeder, Civil Engineer, Hydrology Section - PWD

LM:jc
WP+1234

EXISTING TREES TO REMAIN

SCALE: 1"=50'

SHEET 7

PARKING LOT

REMOVE 385' LF OF
8'± HIGH RETAINING WALL

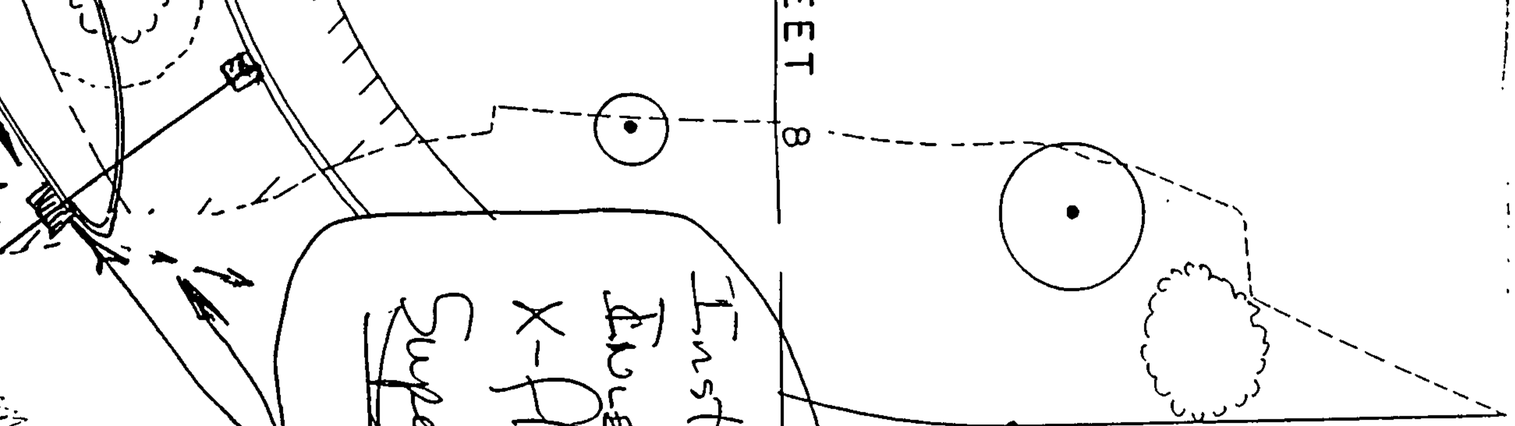
Install Type "A"
Inlet To prevent
X-flow due to
Super.

SEE SHEET 8

WENONAH

SEE SHEET 9

PARKING LOT



50

SCALE:

TITLE:

APPROVALS

D.R.C. Chairman

TRAMWAY / WENONAH STREET IMP'CMT.
DESIGN REV. COMM. 9-8-'89
1:30 pm

- Comments sent to Susanne Daugherty.
- Discussed additional plan modifications with comm't consultant.
- Redlined plan set given to consultant with instructions to return the plan set to Hydrology Division.

J. D. Thomas
9-8-89

FIGURE 6

CITY OF ALBUQUERQUE
DESIGN REVIEW COMMITTEE
NOTICE OF D.R.C. MEETING

9-1-89
(DATE)

PROJECT NO: 3340

PROJECT NAME: TRAMWAY BLVD EXT. - S. OF CENTRAL & WENONAH RD

TYPE OF PROJECT: CIP XX PWC ____ SAD ____ PRIVATE ____

Contact Person: S. DOUGHARTY Phone: 768-2767
Firm: C.O.A. - TRANSPORTATION

Scheduled with the D.R.C. on 09/08/89 at 1:30 in Conf. Room (302) / 303 on the 3rd Floor of the old City Hall Building.

The Project Is Scheduled For:
/ / Design Report Review
/ / Pre-Design Meeting
/ / Preliminary Plan Review
/X/ Final Plan Review (Appr. Infra. List)
/ / Signoff of Plans (Mylars Required)
/ / _____

The Project Relates To:
/ / Water / / San. Sewer /X/ Paving / / Storm Drainage / / _____

The Attached Package Includes:
/X/ Drawings / / Spec's / / Estimate / / Report /-/ Memo Only

Indicated below are the Departments/Divisions that have received project documents and are invited to attend. It will be the Project Managers responsiblity to notify consulting engineering firms of date and time of scheduled meetings on all CIP projects.

**** First 8 Receive Preliminary Plans--First 4 Receive Final Plans ****

/X/ Roger Green/Carlos Montoya	Project Review	All
/X/ Richard Dourte	Transportation Dev.	All
/X/ Robert Kane	Utility Design	All
/X/ Stuart Reeder	Hydrology	All
/X/ Russell Givler	Construction	All
/X/ Bill Coleman	Traffic Operations	All
/X/ Ray Chavez	Street Maint.	All
/ / Jim Olsen	Water Supply-Shutoff Plan: Yes/No	All
/-/ Diane Scena	Parks & Rec.	Memos
/ / Robert McArthur	Transit Dept.	Memos
/X/ Joe Luehring	Utility Coordinator	PWC & Masterplans
/ / Jim Fink	Line Maintenance	CIP/SAS
/ / Dan Hogan	Design Hydrology	CIP/S.D.
/ / Joe Dellalonga	City Architect	ARCHITECTURAL
/ / Lee Lunsford	SAD Engineer	SAD
/ / Greg Olson	Project Design	PWC
/ / Brett Locke	Transportation Dev.	CIP/TRANS.
/ / Billy Goolsby	Utility Design	CIP/WATER & SAS
/ / Glenn Coontz	General Services Dept.	BUILDINGS
/ / Mark Shoesmith	PWD/City Attorney	SPECIFICATIONS
/-/ Cynthia Bruce	Planning Department	CIP/Memos
/-/ CIP Manager	CIP	CIP/Memos
/ / _____	_____	_____

RG/tm (WP+123400)-Rev. 8/28/89

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

KEN SCHULTZ
MAYOR

DESIGN REVIEW COMMITTEE MEETING 6/23/89 1:30

PROJECT: Tramway Blvd. Extension, S. of Central Project No. 3340

CONSULTANT: Tierra Engineering Consultants, Inc.

PRESENT: Roger Green, D.R.C. Chairman
Richard Dourte, Transportation
Suzanne Dougharty, Project Manager
Joe Luehring, Utility Coordinator
Andre Houle, Construction Division
Gilbert Aldez, Consultant

COMMENTS:

1. Marked up plans provided by Andre Houle, Richard Dourte, Suzanne Dougharty and Roger Green.

2. Written comments provided by Joe Luehring.

3. Sewerline issue needs to be worked out with Water/Waste Water Section.

Resubmit for a final review session after comments have been addressed. Return all marked up plans.

RG/cl

wp+123469

PUBLIC WORKS DEPARTMENT

Walter H. Nickerson, Jr., P.E.
Assistant Director Public Works

ENGINEERING GROUP

Telephone (505) 768-2500

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Tramway Extension ZONE ATLAS/DRNG. FILE #: 1048 L-22 ~~L-23~~

LEGAL DESCRIPTION: See Vicinity Map

CITY ADDRESS: _____

ENGINEERING FIRM: Tierra Engineering CONTACT: Gilbert Aldaz

ADDRESS: _____ PHONE: _____

OWNER: City of Albuquerque CONTACT: Suzanne Dougharty

ADDRESS: _____ PHONE: 768-2767

ARCHITECT: _____ CONTACT: _____

ADDRESS: _____ PHONE: _____

SURVEYOR: _____ CONTACT: _____

ADDRESS: _____ PHONE: _____

CONTRACTOR: _____ CONTACT: _____

ADDRESS: _____ PHONE: _____

PRE-DESIGN MEETING:

✓ YES

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED
AUG 15 1989
HYDROLOGY SECTION

DRB NO. _____

EPC NO. _____

PROJ. NO. 3340

TYPE OF SUBMITTAL:

✓ DRAINAGE REPORT

✓ DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

___ GRADING PLAN

___ EROSION CONTROL PLAN

___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL

___ PRELIMINARY PLAT APPROVAL

___ SITE DEVELOPMENT PLAN APPROVAL

___ FINAL PLAT APPROVAL

___ BUILDING PERMIT APPROVAL

___ FOUNDATION PERMIT APPROVAL

___ CERTIFICATE OF OCCUPANCY APPROVAL

___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

X OTHER CIP Project (SPECIFY)

DATE SUBMITTED: August 15, 1989

BY: Suzanne Dougharty

DRAINAGE INFORMATION SHEET

L22/048

PROJECT TITLE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD ZONE ATLAS/DRNG. FILE #: L-22 & L-23

LEGAL DESCRIPTION: See Vicinity Map (Sheet)

CITY ADDRESS:

ENGINEERING FIRM: Tierra Engineering Consultants CONTACT: Gilbert Aldaz

ADDRESS: 105 6th Street S.W., Suite 202 Albuquerque, New Mexico 87102 PHONE: 242-2270

OWNER: City of Albuquerque CONTACT: Suzanne Dougharty

ADDRESS: 400 Marquette N.W., Albuquerque, New Mexico 87103 PHONE: 768-2760

ARCHITECT: N/A CONTACT:

ADDRESS: PHONE:

SURVEYOR: N/A CONTACT:

ADDRESS: PHONE:

CONTRACTOR: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

X YES

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED
JUN 0 1 1989
HYDROLOGY SECTION

DRB NO.

EPC NO.

PROJ. NO. 3340

TYPE OF SUBMITTAL:

X DRAINAGE REPORT

X DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

___ GRADING PLAN

___ EROSION CONTROL PLAN

___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

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___ FOUNDATION PERMIT APPROVAL

___ CERTIFICATE OF OCCUPANCY APPROVAL

___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

X OTHER Street Design (SPECIFY)

DATE SUBMITTED: May 19, 1989

BY: GILBERT ALDAZ

CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO

INTER-OFFICE CORRESPONDENCE July 11, 1989 REF. NO. 2077

TO: Suzanne Dougharty, Transp. Div., Engineering - PWD

FROM: Loren Meinz, Engineer, Hydrology Division - PWD

SUBJECT: REVIEW OF DRAINAGE REPORT FOR TRAMWAY BLVD. EXT. SO. OF CENTRAL & WENONAH AVE. E. OF TRAMWAY

Per your request, I have reviewed the subject project. The following are review comments:

1) Need to include drainage map of upstream contrib. areas showing existing drain systems and classification of contribution areas.

2) Need as-built information for existing 36" RCP, incl. letter from State Highway for approval to connect additional storm drainage systems.
As-built information must include verification of length/slope data contained in report (pg. 8).

3) Since areas A1, & B1, are private property, City will need verification and/or construction must be completed to drain A1, & B1, to east to the channel. Rundown construction into channel will be necessary.
Grading should be covered by written agreement between City & property owner.

4) Street profile grade shown in calc's (p.10) for Tramway is S=0.83%
Contours indicate an overall slope of approx. 2.5%. Report should include approx. street profiles to verify calculations.

5) Recommend constructing two (2) type "A" inlets at NW quad of Tramway/Wenonah intersection, to eliminate valley gutter across Wenonah.
Recommend constructing two (2) type "A" inlets on north side of Wenonah prior to start of super elevation, to prevent cross-drainage across Wenonah. This will also reduce flows on the south side of Wenonah that will "pass" to exist. 4-Hills Drive.

6) Report indicates min. pipe size of 24" (p.1), but plan show several 18" pipes. Verify & correct.

7) Information on exist. 36" pipe should be available from NM State Highway Department, Ron Gaines, ph 827-5323.
Some maps indicate easement for pipe to be State Highway easement # misc. 48, pg 123.

8) Transportation Planning, COA, should review geometry and access for project.

LM:jc

cc: Brett Locke, Engineer, Engineering Division - PWD
Fred Aguirre, Engineer III, Engineering Division - PWD
Stuart Reeder, Engineer Associate, Engineering Division - PWD
Kapil Goyal, Engineer, Hydrology Division - PWD

DRAINAGE INFORMATION SHEET

PROJECT TITLE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD ZONE ATLAS/DRNG. FILE #: L-22 & L-23

LEGAL DESCRIPTION: See Vicinity Map (Sheet)

CITY ADDRESS:

ENGINEERING FIRM: Tierra Engineering Consultants CONTACT: Gilbert Aldaz

ADDRESS: 105 6th Street S.W., Suite 202 Albuquerque, New Mexico 87102 PHONE: 242-2270

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ARCHITECT: N/A CONTACT:

ADDRESS: PHONE:

SURVEYOR: N/A CONTACT:

ADDRESS: PHONE:

CONTRACTOR: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

X YES

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO.

EPC NO.

PROJ. NO.

TYPE OF SUBMITTAL:

X DRAINAGE REPORT

X DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

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___ FOUNDATION PERMIT APPROVAL

___ CERTIFICATE OF OCCUPANCY APPROVAL

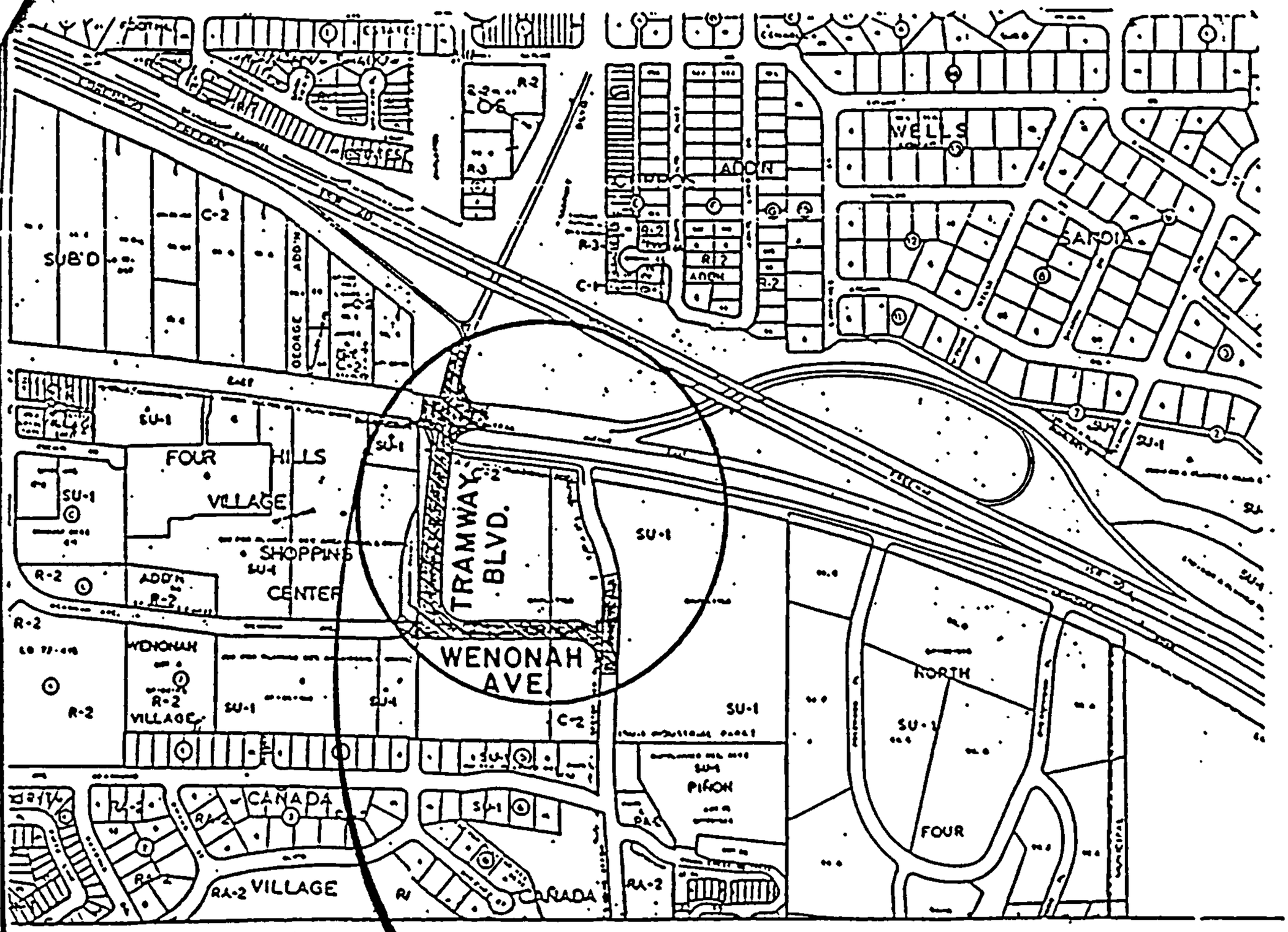
___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

X OTHER Street Design (SPECIFY)

DATE SUBMITTED: MAY 19, 1989

BY: GILBERT ALDAZ



ZONE ATLAS L-22, L-23

VICINITY MAP

REVIEW OF PLANS FOR TRAMWAY BLVD. EXT. SO. OF CENTRAL & WENONAH AVE E. OF TRAMWAY.

1) NEED DRAINAGE MAP OF UPSTREAM CONTRIB. AREAS SHOWING EXIST. DRAIN SYSTEMS & CLASSIFICATION OF CONTRIB. AREAS.

2) AS-BUILT INFORMATION FOR EXIST. 36" RCP INCL. LETTER FROM STATE HWY. FOR APPROVAL TO CONNECT ADDITIONAL STORM DRAWAGE SYSTEMS.
AS-BUILT INFORMATION MUST INCLUDE VERIFICATION OF LENGTH/SLOPE DATA CONTAINED IN REPORT (pg. 8).

3) SINCE AREAS A_1 & B_1 ARE PRIVATE PROPERTY, CITY WILL NEED VERIFICATION AND/OR CONSTRUCTION MUST BE COMPLETED TO DRAIN A_1 & B_1 to EAST TO THE CHANNEL. RUNDOWN CONSTRUCTION INTO CHANNEL WILL BE NECESSARY.
GRADING SHOULD BE COVERED BY WRITTEN AGREEMENT BETWEEN CITY & PROPERTY OWNER.

(cont'd.)

4) PROFILE GRADE SHOWN IN CALC's (P. 10) FOR TRAMWAY IS S = 0.83%. CONTOURS INDICATE AN OVERALL SLOPE OF APPROX. 2.5%. REPORT SHOULD INCLUDE APPROX. STREET PROFILES TO VERIFY CALCULATIONS.

5) RECOMMEND CONSTRUCTING TWO (2) TYPE "A" INLETS AT NW QUAD OF TRAMWAY/WENONAH, TO ELIMINATE VALLEY GUTTER ACROSS WENONAH.

RECOMMEND CONSTRUCTING TWO (2) TYPE "A" INLETS ON NORTH SIDE OF WENONAH PRIOR TO START OF SUPERELEVATION, TO PREVENT CROSS-DRAINAGE ACROSS WENONAH. THIS WILL ALSO REDUCE FLOWS ON THE SOUTH SIDE OF WENONAH THAT WILL "PASS" TO EXIST. 4-HILLS DRIVE.

6) REPORT INDICATES MIN. PIPE SIZE OF 24" (P. 1), [redacted] BUT PLAN SHOWS SEVERAL 18" PIPES. VERIFY & CORRECT.

7) INFORMATION ON EXIST. 36" PIPE SHOULD BE AVAILABLE FROM NM STATE Hwy. DEPT RON GAINES, ph 827-5323.

SOME MAPS INDICATE EASEMENT FOR PIPE TO BE STATE Hwy. EASEMENT # MISC 48, Pg 123.

8) TRANSPORTATION PLANNING, COA, SHOULD REVIEW GEOMETRY AND ACCESS FOR PROJECT.

LOREN MEINZ
PWD / ENGR / HYDROLOGY
7/6/89

TOTAL UPSTREAM AREA
TRAMWAY / WENONAH
7/6/89

700' x 300'
500' x 150'
700 x 250
500 x 100
300 x 150

AREAS TAKEN FROM CITY CONTOUR MAPS.

TOTAL AREA 555,000 SF.

$\frac{1}{1}$ 43560 = 12.74 ac.

REPORT INDICATES 13.1 ac } close enough.

TOTAL UPSTREAM AREA
TRAMWAY / WENONAH
7/6/89

700' x 300'
500' x 150'
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AREAS TAKEN FROM CITY CONTOUR MAPS.

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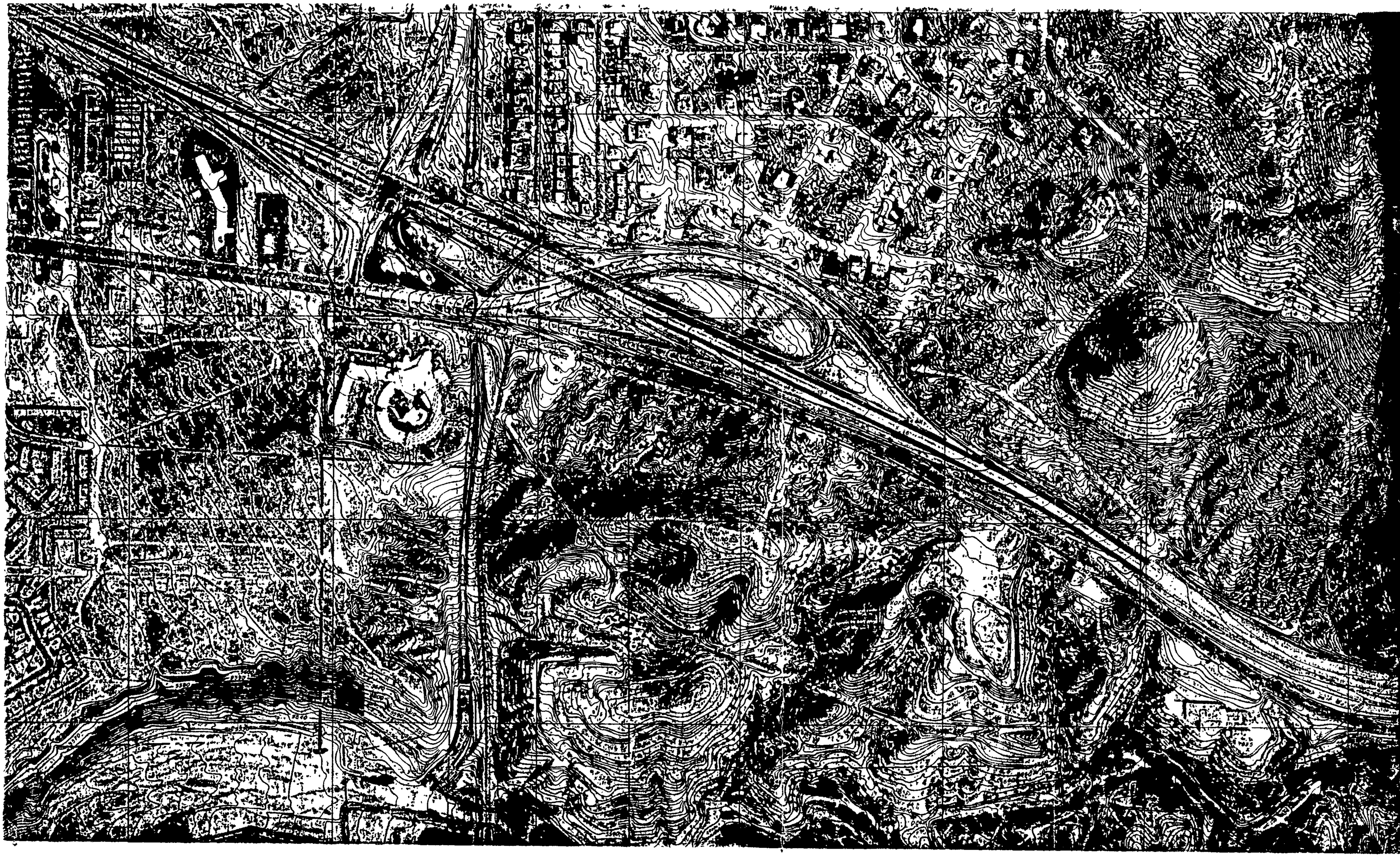
$\frac{1}{1}$ 43560 = 12.74 ac.

REPORT INDICATES 13.1 ac } close enough.



DRAINAGE INFORMATION SHEET

PROJECT TITLE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD ZONE ATLAS/DRNG. FILE #: L-22 & L-23

LEGAL DESCRIPTION: See Vicinity Map (Sheet)

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ADDRESS: _____ PHONE: _____

SURVEYOR: N/A CONTACT: _____

ADDRESS: _____ PHONE: _____

CONTRACTOR: N/A CONTACT: _____

ADDRESS: _____ PHONE: _____

PRE-DESIGN MEETING:

X YES

____ NO

____ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. _____

EPC NO. _____

PROJ. NO. _____

TYPE OF SUBMITTAL:

X DRAINAGE REPORT

X DRAINAGE PLAN

____ CONCEPTUAL GRADING & DRAINAGE PLAN

____ GRADING PLAN

____ EROSION CONTROL PLAN

____ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

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____ PRELIMINARY PLAT APPROVAL

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____ FOUNDATION PERMIT APPROVAL

____ CERTIFICATE OF OCCUPANCY APPROVAL

____ ROUGH GRADING PERMIT APPROVAL

____ GRADING/PAVING PERMIT APPROVAL

X OTHER Street Design (SPECIFY)

DATE SUBMITTED: MAY 19, 1989

BY: GILBERT ALDAZ

TABLE OF CONTENTS

A) INTRODUCTION

The City of Albuquerque is currently planning development of Tramway Boulevard Extension south of Central Avenue S.E. and Wenonah Road (See Vicinity Map Sheet ____). The roadway right-of-way for Tramway Blvd and Wenonah Road will consist of approximately 3.5 acres. The purpose of this report is to present an overall drainage management plan for the project which is acceptable to the City of Albuquerque.

B) SITE DESCRIPTION

Tramway Boulevard Extension begins at Central Avenue and continues south for 800 feet. Tramway is bounded on the west by Four Hills Village Shopping Center and on the east by Unplatted Lands (formerly old Western Skies Motel). Wenonah Road begins at Tramway Boulevard terminus and continues east to Four Hills Road for approximately 700 feet. Wenonah Road is bounded on the north and south by unplatted properties.

C) COMPUTATIONAL PROCEDURES

The rational method was used to determine the peak flow for drainage basins. Basins were divided into sub-basins to provide a better resolution of developed flows at critical locations. The runoff coefficient was based on developed conditions using the following criteria:

Surface Type	Coefficient
Street R.O.W. to include paving, medians, sidewalks and curb and gutter	C = 0.95
Undeveloped (Offsite Drainage Basin)	C = 0.40

The time of concentration will be calculated by the Kirpich Formula as follows:

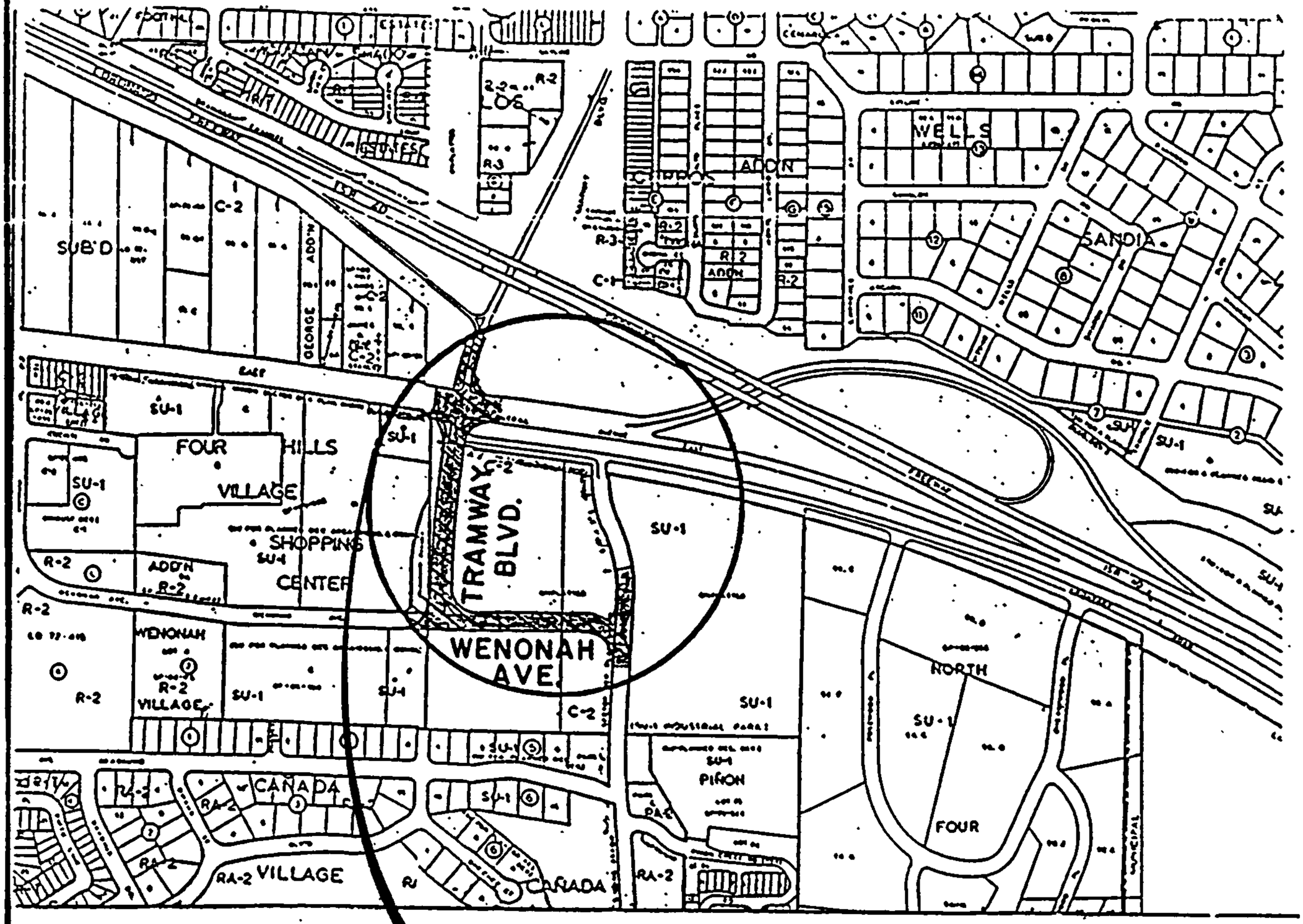
$$Tc = 0.0078 \frac{(L)^{0.77}}{(S)^{0.385}}$$

A minimum of 10 minutes will be utilized.

Depth of flow in composite gutter sections will be determined from Chart 5 (See Appendix A and C) per "Drainage of Highway Pavements" by Federal Highway Administration

Capacities for catch basins will be determined from grating capacities (See Appendix B and D) per the city DPM.

The storm sewer is size based on a analysis of manning's equation for maximum capacity for non-pressurized pipe systems. A minimum of 24" RCP pipe diameter will be used to minimize clogging.

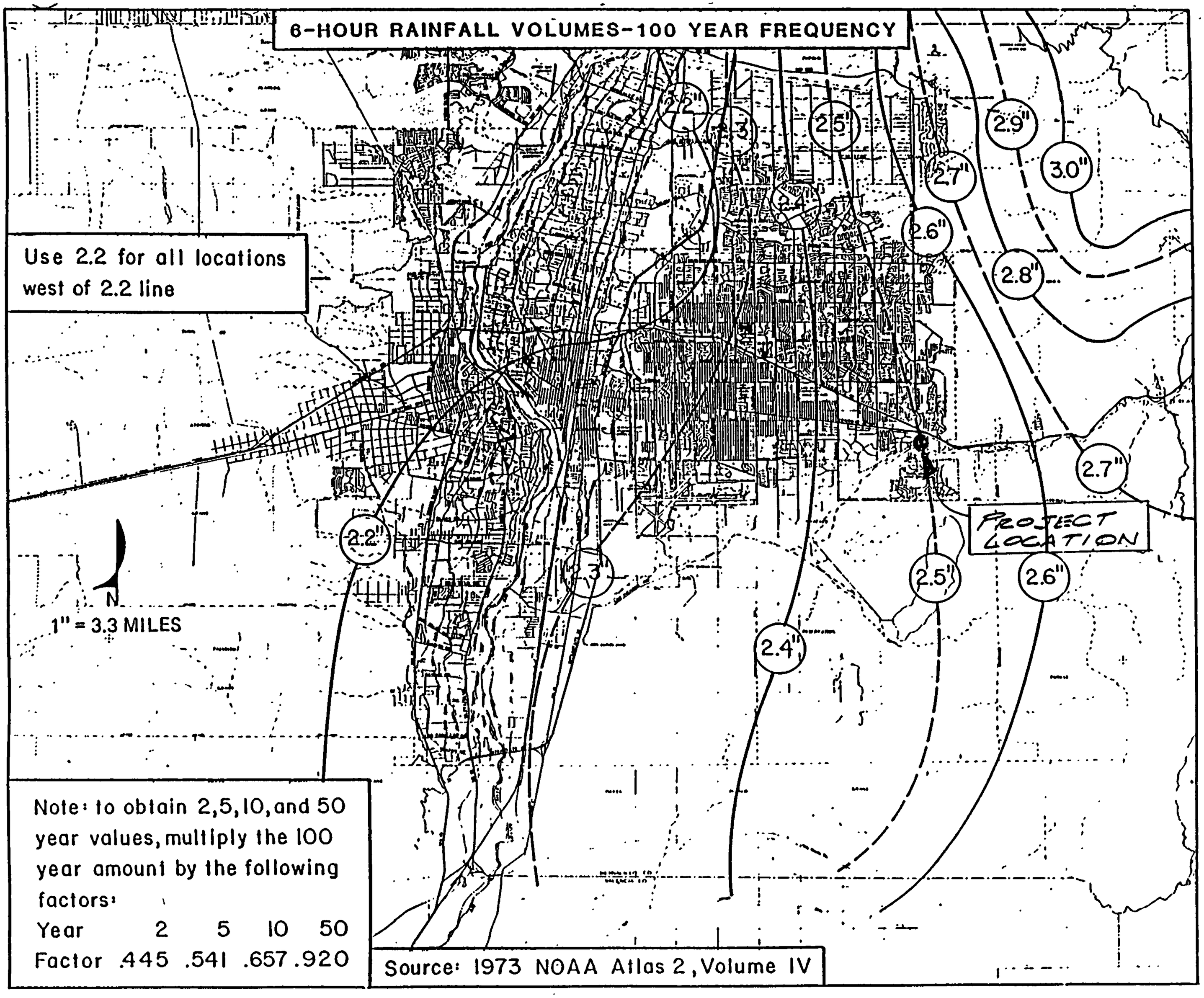


ZONE ATLAS L-22, L-23

VICINITY MAP

4-82

6-HOUR RAINFALL VOLUMES-100 YEAR FREQUENCY



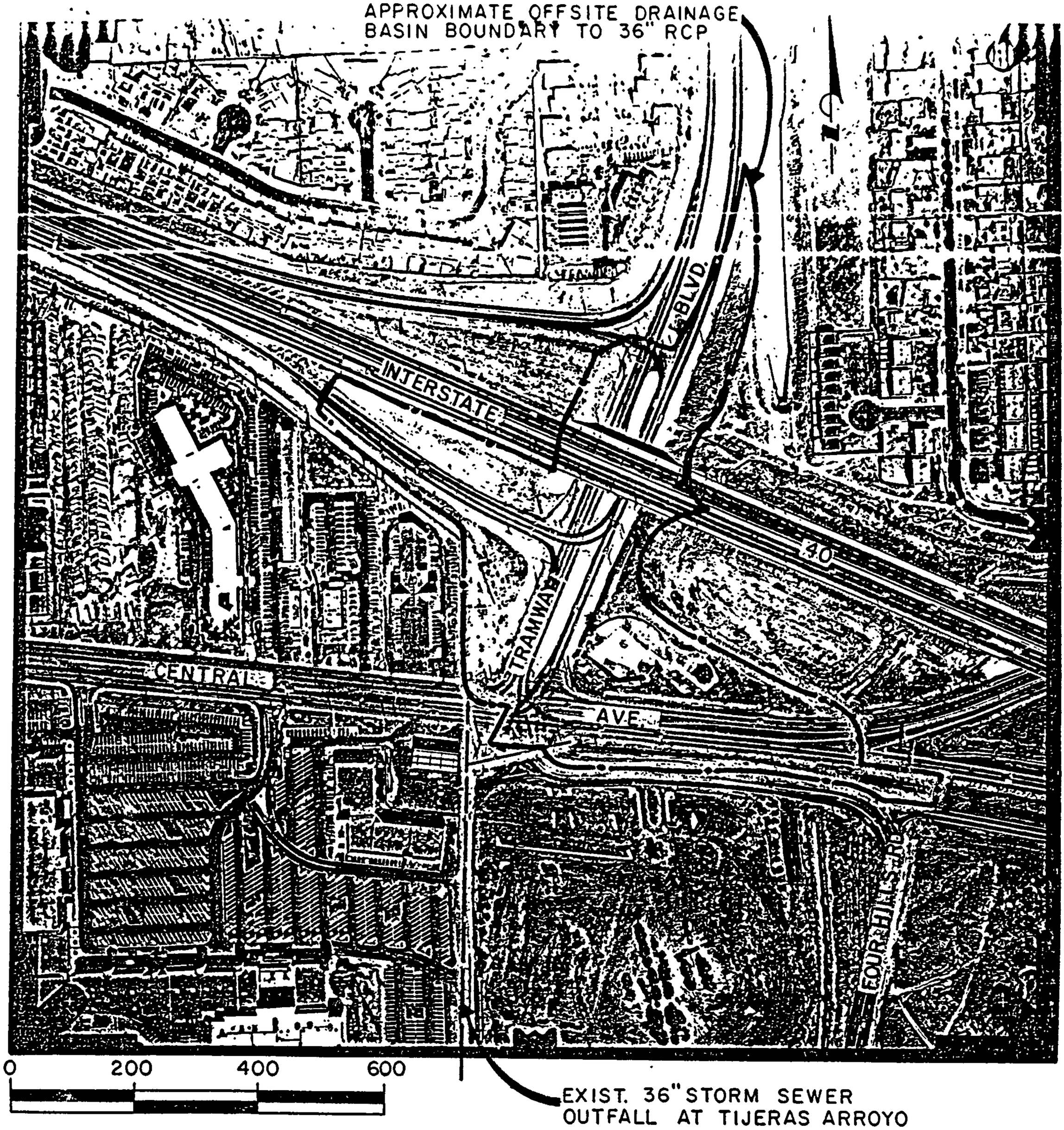
Note: to obtain 2,5,10,and 50 year values, multiply the 100 year amount by the following factors:

Year	2	5	10	50
Factor	.445	.541	.657	.920

Source: 1973 NOAA Atlas 2, Volume IV

PLATE 22.2 D-1

22.2



SCALE: 1" = 238'

OFFSITE DRAINAGE BASIN - BOUNDARY FOR EXIST. 36" RCP

ESTIMATED OFFSITE DRAINAGE BASIN FOR EXISTING 36" RCP STORM SEWER

High Elev = 5712
Low Elev = 5671
} Length = 825'

High Elev = 5671
Low Elev = 5660
} Length = 750'

MAP SHOWING ASSUMED FLOW PATH & ELEV'S.

TIME OF CONCENTRATION

OVERLAND FLOW VELOCITY

$V = KY^{0.5}$

$K = 2.00$ Paved Area

$S_1 = \frac{5712 - 5671}{825} = 0.0497$ $\quad Y = 4.97\%$

$S_2 = \frac{5671 - 5660}{750} = 0.0146$ $\quad Y = 1.46\%$

$V_1 = KY^{0.5} = 2.0(4.97)^{0.5} = 4.6$ fps

$V_2 = KY^{0.5} = 2.0(1.46)^{0.5} = 2.4$ fps

$$t_c = \left[\left(\frac{825\text{ ft}}{4.6\frac{\text{ft}}{\text{sec}}}\right) + \left(\frac{750\text{ ft}}{2.4\text{ ft/sec}}\right)\right]\frac{\text{min}}{60\text{sec}} = 8.2\text{ min}$$

use $t_c = 10$ minute minimum

Intensity

$$I = (6\text{ hr. rain})\, 6.84\, t_c^{-0.51}$$

$$I = (2.5\text{in})\, 6.84\, (10)^{-0.51} = 5.28'$$

MAP SHOWING AREAS ?

Runoff Coefficient

Total Area = 13.1 acres

Streets, Drives & Medians

C = 0.95 , A = 7.1 acres

Lawns & Landscaping

C = 0.25 , A = 3.2 acres

Undeveloped

C = 0.40 , A = 2.8 acres

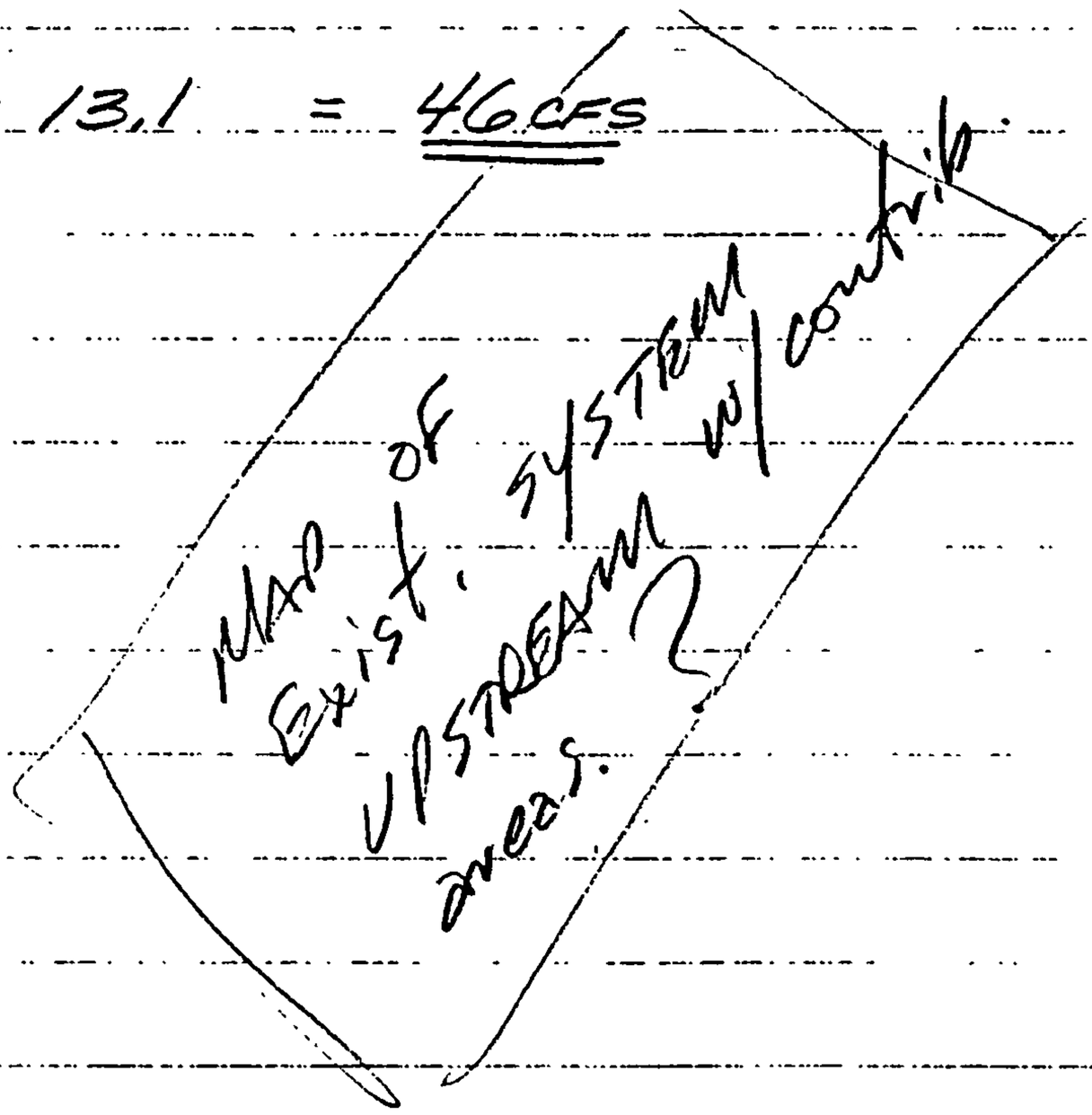
Composite C

$$C = \frac{0.95(7.1) + 0.25(3.2) + 0.40(2.8)}{13.1} = 0.66$$

* Flow Into 36" RCP From Offsite Drainage Basin

$$Q = C \times I \times A$$

$$Q = 0.66 \times 5.28 \times 13.1 = \underline{\underline{46 \text{ CFS}}}$$



CAPACITY OF EXISTING 36" RCP

Inv. Inlet = 54.10 source

Inv MH = 41.54 where?

LENGTH = 580'

Location drawing of pipe sized?

Source of INVERT ELEV's?

$$S = \frac{54.10 - 41.54}{580'} = 2.17\%$$

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}, \quad n = 0.015$$

$$Q = \frac{1.49}{0.015}\left(\pi\frac{(36/12)^2}{4}\right)\left(\frac{\frac{\pi(36/12)^2}{4}}{\pi(36/12)}\right)^{2/3}(0.0217)^{1/2} = 85 cfs$$

$Q_{CAPACITY\ FULL\ FLOW} = 85 CFS > 46 CFS$ OK

Project Name _____ Sheet ___ Of ___

Project No. _____

By _____ Date _____

ONSITE DRAINAGE BASINS

Basin	Area (ac.)	Length (Ft.)	Top Elev. (Ft.)	Bottom Elev (Ft.)	Slope (Ft/Ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr. Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac.ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac. Ft.)
A	2.3 1.90	950	68	46	.023	10	B	100	0.95	2.5	5.28	9.5		1.64	3.47	6.3	
A1	4.15	850	74	54	.023	10	B	0	0.40	2.5	5.28	8.8		1.64	3.47	5.8	
B	1.55 1.62	750	46	40	.008	10	B	100	0.95	2.5	5.28	8.1		1.64	3.47	5.4	
B1	2.28	375	61	47	.037	10	B	0	0.40	2.5	5.28	4.8		1.64	3.47	3.2	
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1, 2, 3, 4, 5 Basin Areas, Lengths, Top & Bottom Elevations & Slopes from Plate 3.

6. T_c by Kirpich Formula $T_c = 0.0078 \frac{(L)^{0.77}}{(S)^{0.385}}$

7. See Soils Map Plate ___ and Text

8. By Area Computation

9. DPM Plate 22.2 C-1

10, 14 DPM Plate 22.2 D-1

11, 15 DPM Plate 22.2 D-2

12, 16 Rational Formula $Q = CIA$

13, 17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

SEE APPENDIX "A"

STREET CAPACITY CALCULATIONS

1) TRAMWAY BLVD (ARTERIAL STREET)

BASIN A (TRAMWAY BLVD, DOES NOT INCLUDE ADJACENT TRACT)

$Q_{100} = 9.5$ CFS

$Q_{10} = 6.3$ CFS

STREET CRITERIA (ARTERIAL)

0.87' Deep - 100 YR.

ONE DRY LANE - 10 YR.

CHECK MAX Q FOR ONE DRY LANE 10 YR

$S = 0.83\%$ (Profile slope)

$S_x = 2.0\%$

$S_w = 6.25\%$

$T = 12'$

$W = 2'$

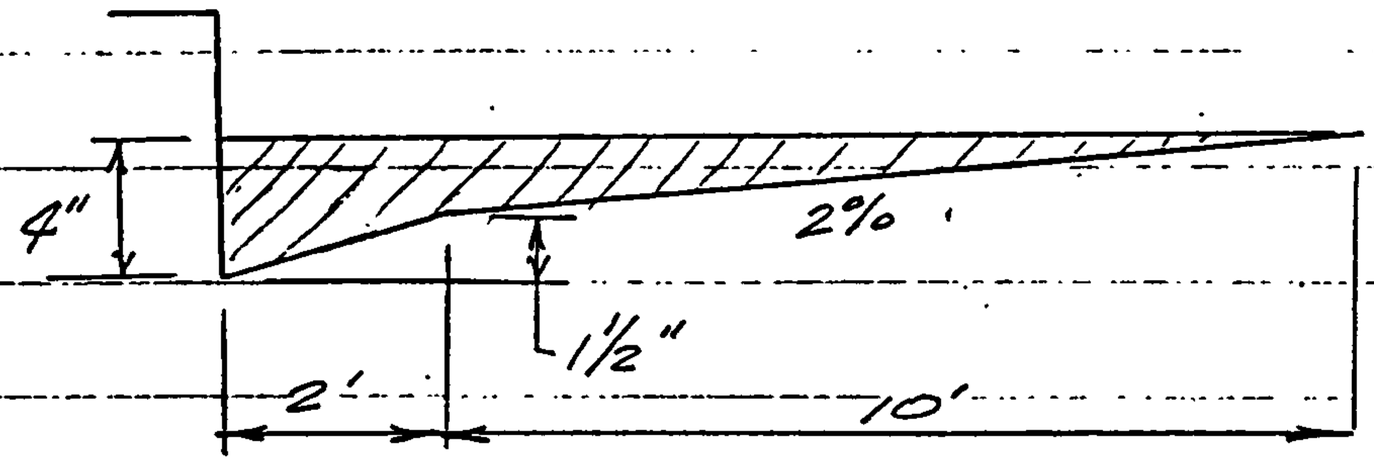
$\frac{T}{W} = \frac{12'}{2'} = 6$

$\frac{S_w}{S_x} = \frac{6.25}{2.00} = 3.125$

Chart 5 $\rightarrow Q_n = 0.062$

$Q_{max} = \frac{0.062}{0.017} = 3.6$ CFS - FOR ONE DRY LANE

SEE APPENDIX "A"



$Q_{10} = \frac{6.3 \text{ CFS}}{2 \text{ CURBS}} = 3.15 \frac{\text{CFS}}{\text{CURB}} < 3.6 \text{ CFS FOR ONE DRY LANE} - \text{OK}$

Check Depth of Flow For $Q_n = 3.15(0.017) = 0.054$

CHART 5 $\longrightarrow$ $T/W = 5.5$

$T = 5.5(2') = 11'$

$d = \left(\frac{1.5''}{12''/ft}\right) + (11-2)0.02 = \underline{\underline{0.30'}}$

CHECK GRATE CAPACITY FOR TYPE "A" SEE APPENDIX "B"

PLATE 22.3 D-5

$Q_{INTERCEPT} = 1.7 \text{ CFS } 10YR$

$Q_{PASS\ 10YR} = 3.15 \text{ CFS} - 1.7 \text{ CFS} = 1.45 \text{ CFS}$ to WENONAH w/ Valley Gutter

CHECK 100 YR

$Q_{100} = \frac{9.5 CFS}{2 CURBS} = 4.75 CFS$

FIND DEPTH @ CURB

$Q_n = 4.75 (0.017) = 0.0808$

$S = 0.83\%$

$S_x = 2.0\%$, $S_W = 6.25\%$, $\frac{S_W}{S_x} = 3.125$

$W = 2$

CHART 5 $\longrightarrow \frac{T}{W} = 6.5$

$T = 6.5 W = 6.5 (2') = 13'$

$d_{100} = \left(\frac{1.5"}{12"/ft}\right) + (13 - 2) 0.02 = 0.35'$

CHECK GRATE CAPACITY FOR TYPE "A"

PLATE 22.3, D-5

$Q_{INTERCEPT} = 2.3 CFS - 100 YR$

$Q_{PASS\ 100 YR} = 4.75 - 2.3 = 2.45 CFS$ to WENONAH w/ VALLEY GUTTER

3 - 2 WEST SIDE, 1 EAST SIDE.

USE # - TYPE "A" CATCH BASINS ON TRAMWAY BLVD., BOTH SIDES OF STREET, JUST NORTH OF WENONAH ROAD

FLOW ADDED TO 36" $= 3(2.3) = 6.9 CFS$

correct designation?

2) WENONAH ROAD - (COLLECTOR STREET)

will S. side drain to east or to west?

BASIN B

$Q_{100} = 8.1\,cfs + 2.45\,cfs\,(2) = 13.0\,cfs$

TRAMWAY S 4.05 cfs
N 6.50 cfs.

$Q_{10} = 5.4\,cfs + 1.45\,(2) = 8.3\,cfs$

STREET CRITERIA

0.87' DEEP - 100YR

0.50' DEEP - 10YR

CHECK DEPTH OF FLOW

48' WIDE STREET. (most of street shows 60' wide) ?

$S = 0.50\%$

$S_x = 2.0\%$, $S_w = 6.25\%$, $\frac{S_w}{S_x} = 3.125$

$W = 2'$

$Q_{100} = \frac{13.0\,cfs}{2\ curbs} = 6.5\,cfs$ CURB

$T_{MAX} = \frac{48'}{2} = 24'$ for CHART 5

$Q_n = 6.5\,(0.017) = 0.11$

Equv. $4.2\,(0.017) = 0.071$

CHART 5 → $\frac{T}{W} = 8.5$ S 6.9 N 8.5

$T = 8.5\,(2') = 17' < 24'$ OK

S: $Q_n = 4.05\,(0.017) = 0.069 \cong 0.07$
N: $Q_n = 6.05\,(0.017) = 0.11$

APPENDIX C

" "

$T_W = 6.9$

$T = 13.8$

$d_{100} = \left(\frac{1.5''}{12''/Ft}\right) + (17' - 2')0.02 = \underline{0.43'} < 0.50'$

14-2

N 0.36.
= 0.36

NO NEED TO ANALYZE 10 YR STORM

CHECK GRATE CAPACITY FOR TYPE "A"

PLATE 22.3, D-5

$S\ d_{100} = 0.36'$ (100 yr.)

$N\ d_{100} = 0.43'$

$d_{10} = 0.36$

S = 2.2 cfs

N = 3.4 cfs $Q_{INTERCEPT} = 3.4\ CFS\ (6.8)$ $Q_I = 2.2$ cfs

$Q_{PASS\ 100\ YR} = 6.5\ CFS - 3.4\ CFS\ (6.8) = 3.1\ CFS\ (0)$ $Q_p = 4.2 - 2.2 = 2.0$

use 2 N, $N = 6.5 - 6.8 \cong 0$

use 1 S, $S = 4.05 - 2.2 =$ ~~1.85~~ cfs

WENONAH ROAD SUPERELEVATES TO

SOUTH CURB @ FOUR HILLS ROAD

3 - 2 N side
1 S side

USE #- TYPE "A" CATCH BASINS

ON WENONAH BEFORE SUPERELEVATION,

ASSUME FLOWS ON NORTH CURB PASSING

CATCH BASIN FLOW TO SOUTH CURB

DUE TO SUPERELEVATION, PICK UP

REMAINING FLOW ON SOUTH CURB.

$Q_{PASS\ TOTAL\ SOUTH\ CURB} = 2 \times 3.1 = 6.2\ CFS$ ~~1.85~~ (3.1)

$Q_U = 1.85(0.017) = 0.03$

$d_{100} = \frac{6.2}{6.5}(0.43') = 0.41'$

CHECK GRATE CAPACITY FOR SINGLE "C"

PLATE 22.3, D-5

$Q_{INTERCEPT} =$ ~~3.0 CFS~~ 1.5 cfs

$Q_{PASS} = 6.2\ CFS - 3.0\ CFS = 3.2\ CFS$ DOWN FOUR HILLS ROAD

$1.85 - 1.5 = 0.35$ cfs.

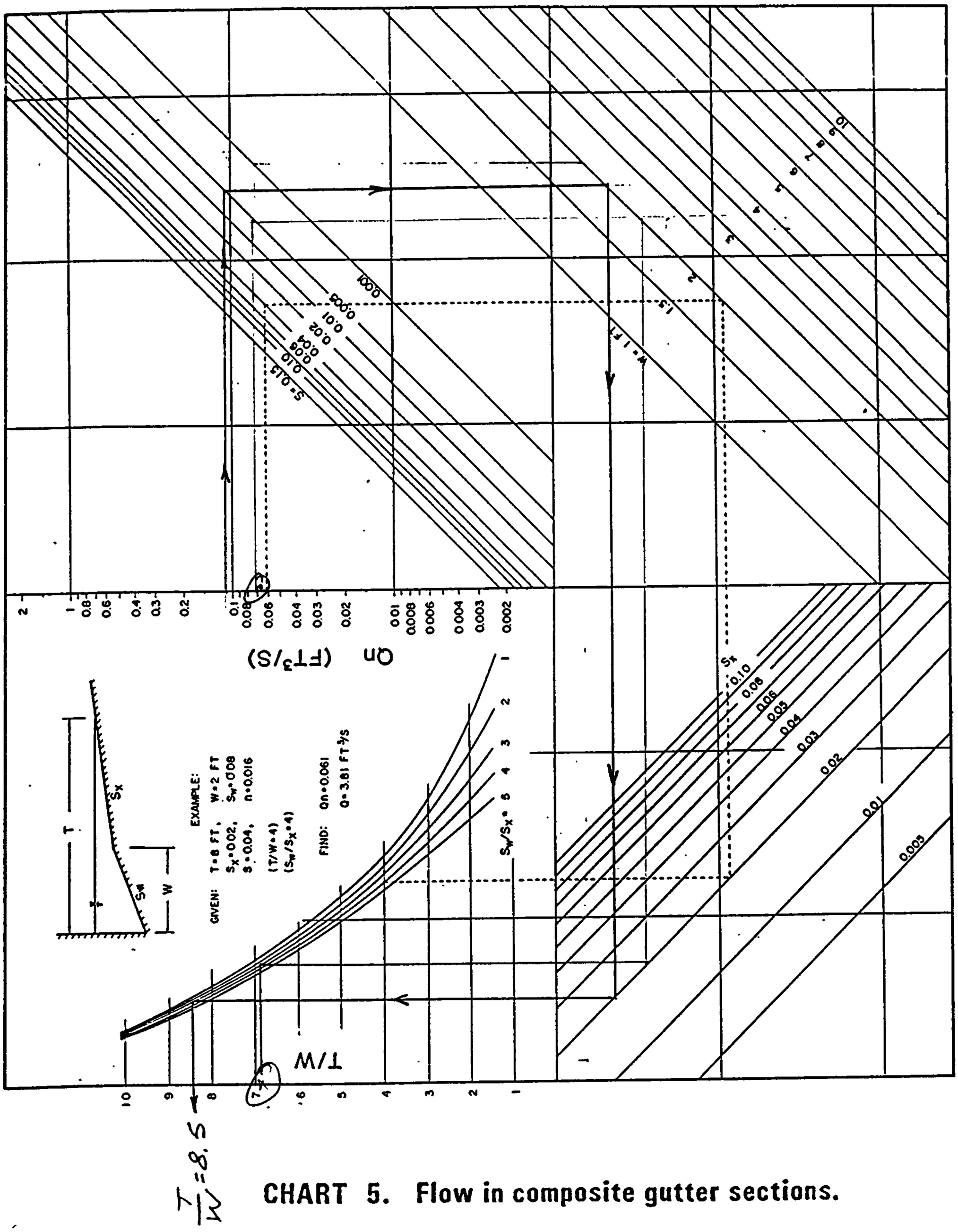
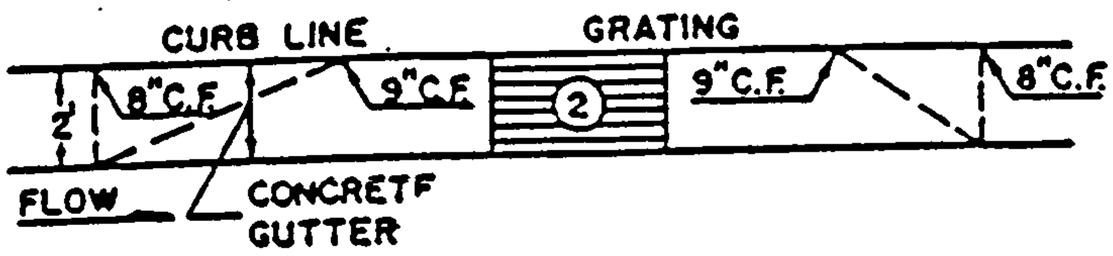
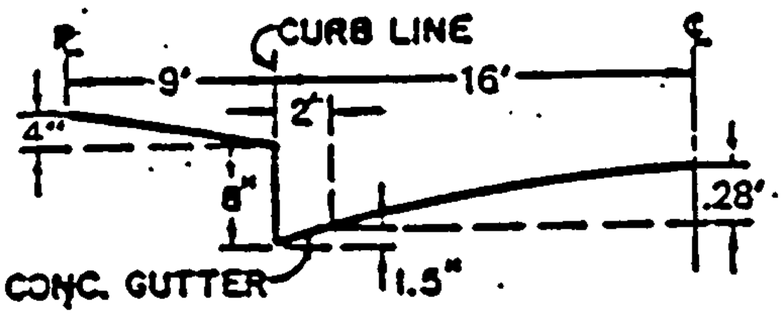


CHART 5. Flow in composite gutter sections.

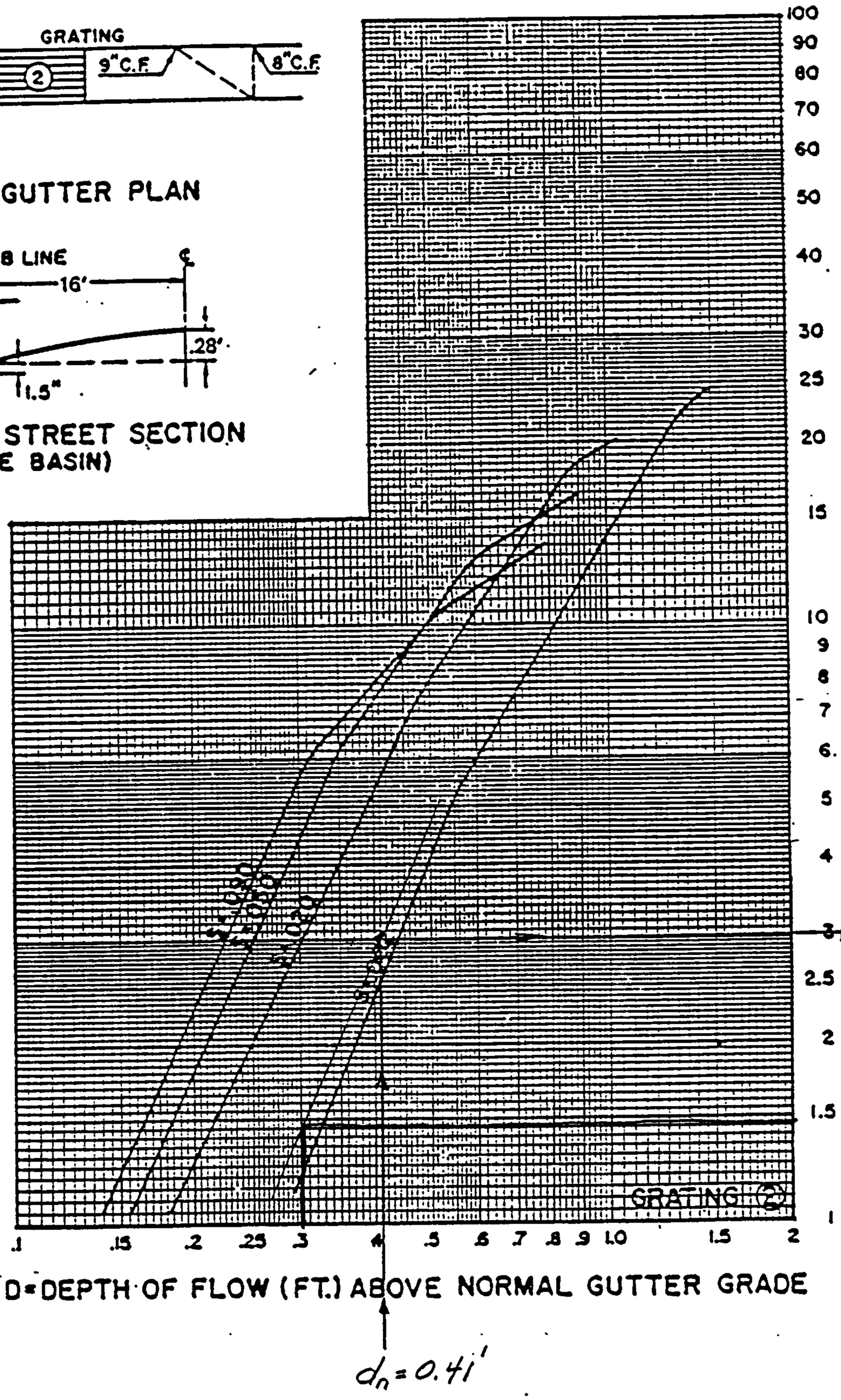
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



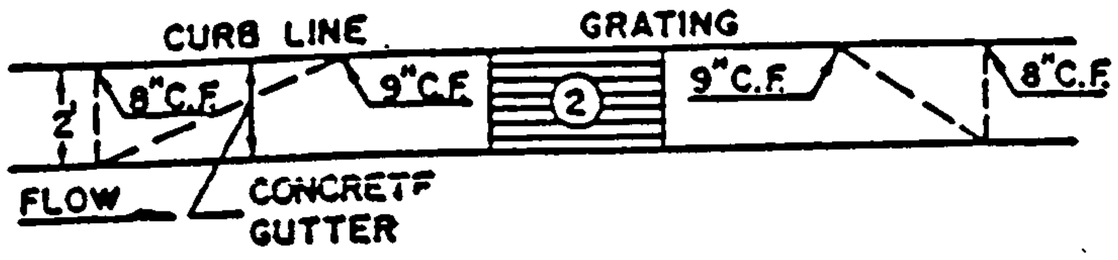
GRATING & GUTTER PLAN



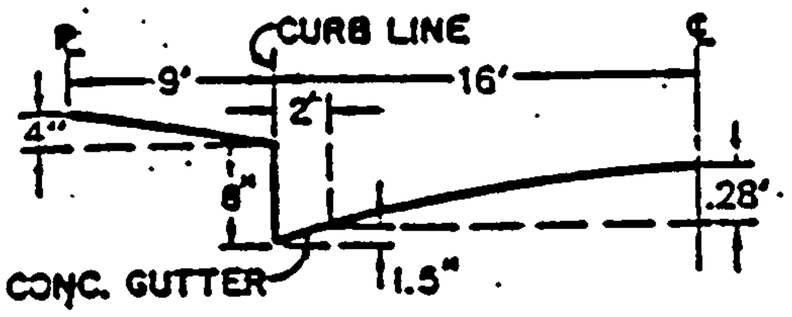
TYPICAL HALF STREET SECTION
(ABOVE BASIN)



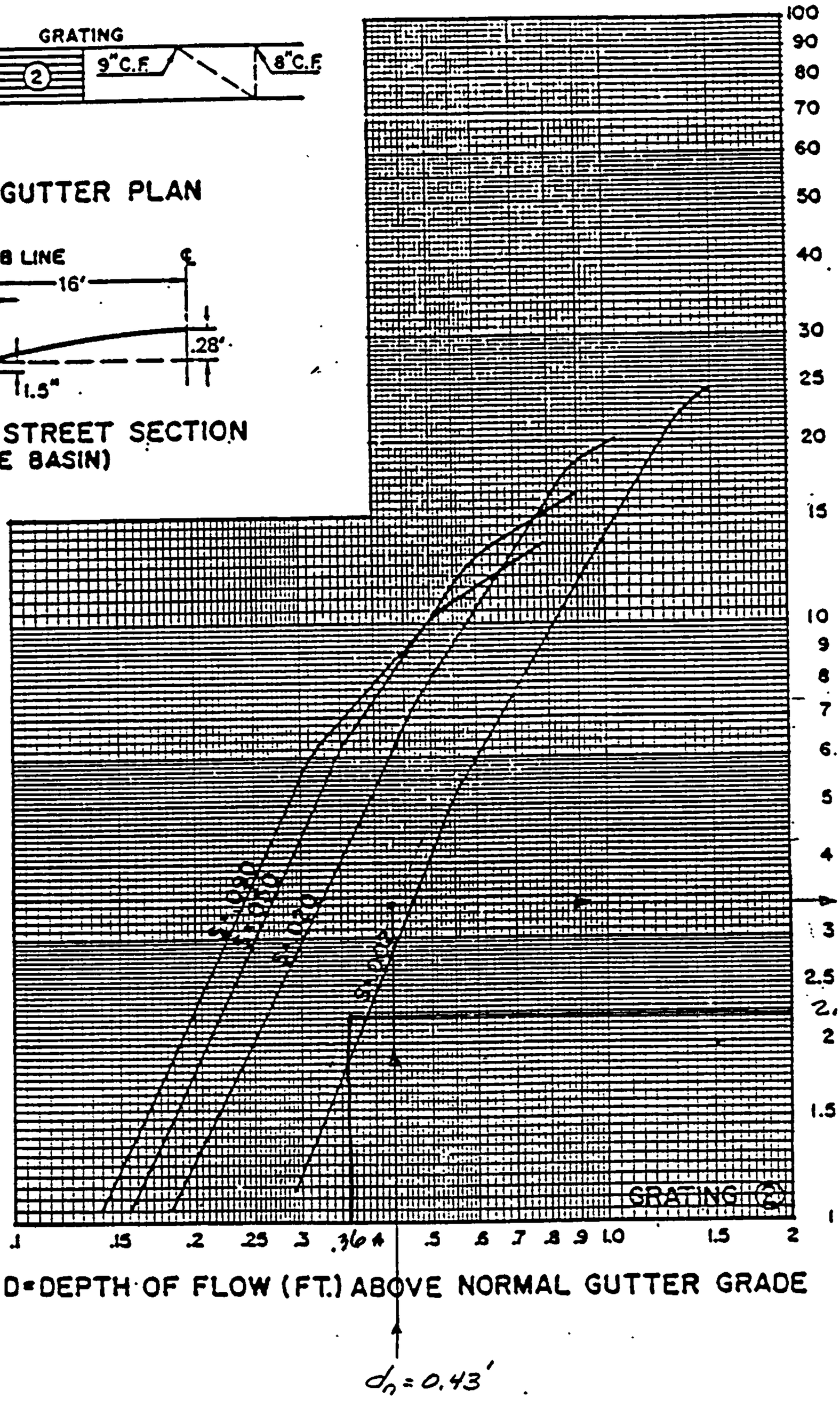
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



CAPACITY OF PROPOSED 24" RCP

* CHECK MAIN STORM SEWER LINE

$$Q_{100} = 6.5 + 2.2 \overset{+1.5}{=} \cancel{9.8} \; 10.2 \text{ cfs}$$

$Q_{MAX\ 100YR} = \cancel{9.8}$ CFS STORM SEWER AT MENONAH AVENUE / CHANNEL

SLOPE = 3.71 % (steep slope??)

MANNING'S EQ.

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}$$

$$Q_{CAP.} = \frac{1.49}{0.015}\left(\frac{\pi(2)^2}{4}\right)\left(\frac{\frac{\pi(2)^2}{4}}{2\pi}\right)^{2/3}(0.0371)^{1/2}$$

$Q_{CAPACITY} = 37.7$ CFS $> \cancel{9.8}\ 10.2$ CFS REQUIRED OK

CAPACITY OF PROPOSED 18" RCP CONNECTOR PIPES TO CATCH BASINS

$Q_{max} = \frac{6.5}{3/4}$ CFS

SLOPE = 2.0 %

MANNING'S EQUATION

$$Q_{CAP.} = \frac{1.49}{0.015}\left(\frac{\pi(1.5)^2}{4}\right)\left(\frac{\frac{\pi(1.5)^2}{4}}{1.5\pi}\right)^{2/3}(0.02)^{1/2}$$

$Q_{CAP} = \frac{9.3}{12.9}$ CFS $>$ $\frac{6.5}{3/4}$ CFS REQUIRED OK

TRAMWAY BLVD

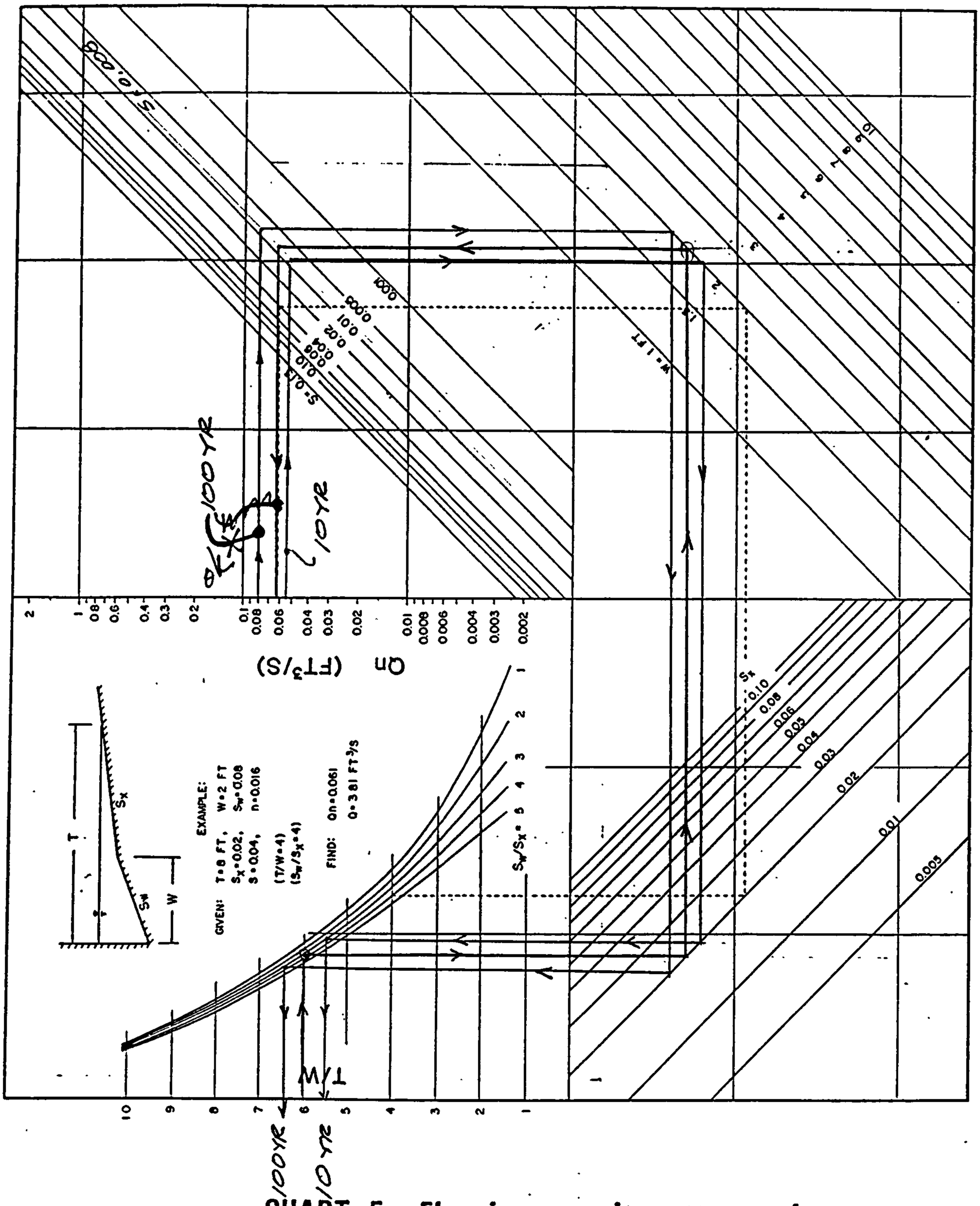
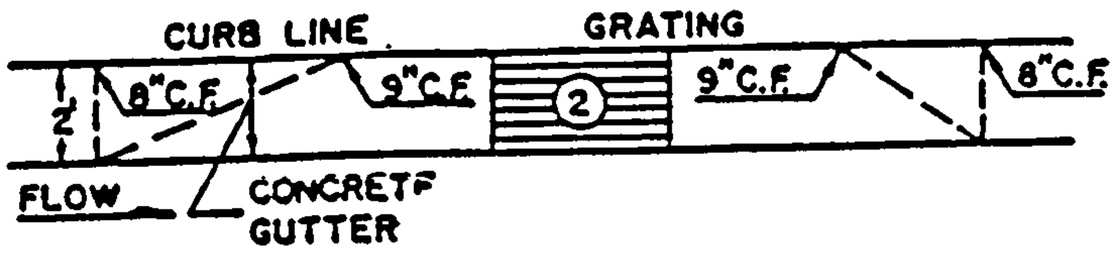


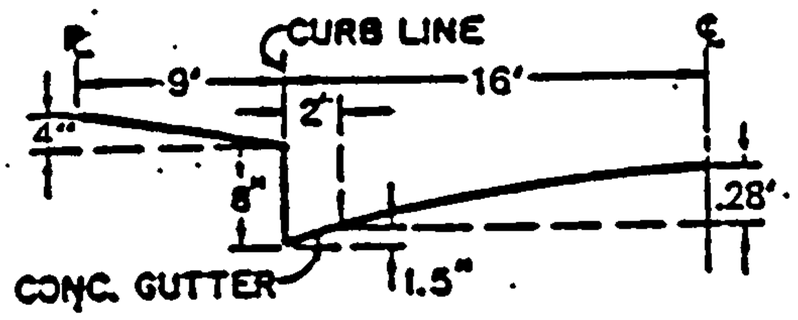
CHART 5. Flow in composite gutter sections.

APPENDIX A

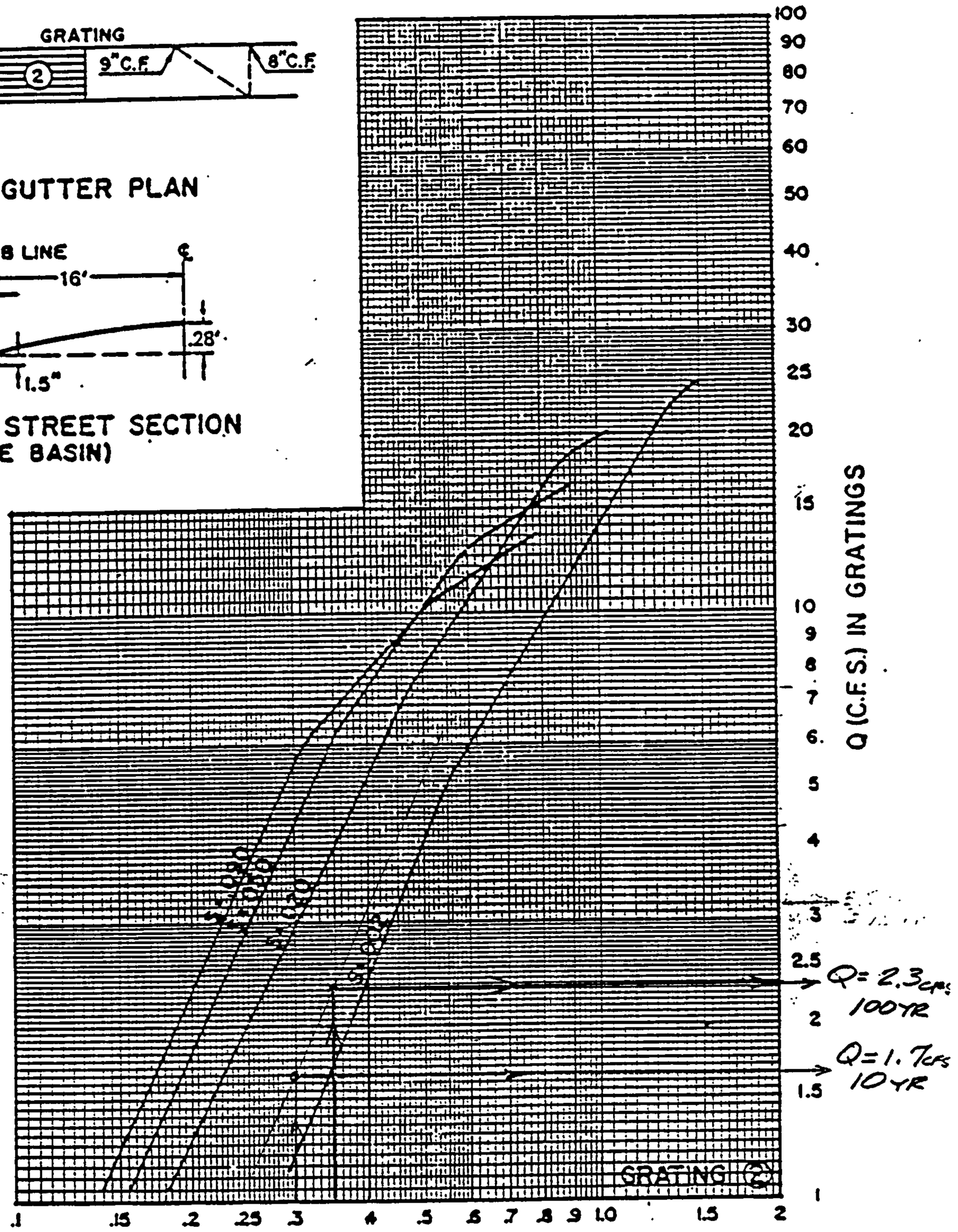
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

TIERRA
ENGINEERING
CONSULTANTS,
INC.

CIVIL AND SOILS
ENGINEERING
LAND SURVEYS AND
DEVELOPMENTS

DRAINAGE MANAGEMENT PLAN

FOR

TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD

PREPARED FOR

CITY OF ALBUQUERQUE
PUBLIC WORKS/STREET DEPARTMENT
JOB NO. 0184-01

FINAL SUBMITTAL

PREPARED BY:

TIERRA ENGINEERING CONSULTANTS, INC.

REVISED JULY 24, 1989

RICHARD CATANACH
NEW MEXICO
4457
REGISTERED PROFESSIONAL ENGINEER

Richard Catanach, P.E.
No. 4457

632 PASEO DE PERALTA SANTA FE, NEW MEXICO 87501 505/982-2845

105 6TH STREET SW ALBUQUERQUE, NEW MEXICO 87102 505/242-2270

DRAINAGE INFORMATION SHEET

PROJECT TITLE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD ZONE ATLAS/DRNG. FILE #: L-22 & L-23

LEGAL DESCRIPTION: See Vicinity Map (Sheet)

CITY ADDRESS: _____

ENGINEERING FIRM: Tierra Engineering Consultants CONTACT: Gilbert Aldaz

ADDRESS: 105 6th Street S.W., Suite 202, Albuquerque, New Mexico 87102 PHONE: 242-2270

OWNER: City of Albuquerque CONTACT: Suzanne Dougharty

ADDRESS: 400 Marquette N.W., Albuquerque, New Mexico 87103 PHONE: 768-2760

ARCHITECT: N/A CONTACT: _____

ADDRESS: _____ PHONE: _____

SURVEYOR: N/A CONTACT: _____

ADDRESS: _____ PHONE: _____

CONTRACTOR: N/A CONTACT: _____

ADDRESS: _____ PHONE: _____

PRE-DESIGN MEETING:

X YES

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED
AUG 15 1989
HYDROLOGY SECTION

DRB NO. _____

EPC NO. _____

PROJ. NO. _____

TYPE OF SUBMITTAL:

X DRAINAGE REPORT

X DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

___ GRADING PLAN

___ EROSION CONTROL PLAN

___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL

___ PRELIMINARY PLAT APPROVAL

___ SITE DEVELOPMENT PLAN APPROVAL

___ FINAL PLAT APPROVAL

___ BUILDING PERMIT APPROVAL

___ FOUNDATION PERMIT APPROVAL

___ CERTIFICATE OF OCCUPANCY APPROVAL

___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

X OTHER Street Design (SPECIFY)

DATE SUBMITTED: May 19, 1989

BY: GILBERT ALDAZ

TABLE OF CONTENTS

A) **INTRODUCTION**

The City of Albuquerque is currently planning development of Tramway Boulevard Extension south of Central Avenue S.E. and Wenonah Road (See Vicinity Map Sheet 2). The roadway right-of-way for Tramway Blvd and Wenonah Road will consist of approximately 3.5 acres. The purpose of this report is to present an overall drainage management plan for the project which is acceptable to the City of Albuquerque.

B) **SITE DESCRIPTION**

Tramway Boulevard Extension begins at Central Avenue and continues south for 800 feet. Tramway is bounded on the west by Four Hills Village Shopping Center and on the east by Unplatted Lands (formerly old Western Skies Motel). Wenonah Road begins at Tramway Boulevard terminus and continues east to Four Hills Road for approximately 700 feet. Wenonah Road is bounded on the north and south by unplatted properties.

C) **COMPUTATIONAL PROCEDURES**

The rational method was used to determine the peak flow for drainage basins. Basins were divided into sub-basins to provide a better resolution of developed flows at critical locations. The runoff coefficient was based on developed conditions using the following criteria:

Surface Type	Coefficient
Street R.O.W. to include paving, medians, sidewalks and curb and gutter	C = 0.95
Undeveloped (Offsite Drainage Basin)	C = 0.40

The time of concentration will be calculated by the Kirpich Formula as follows:

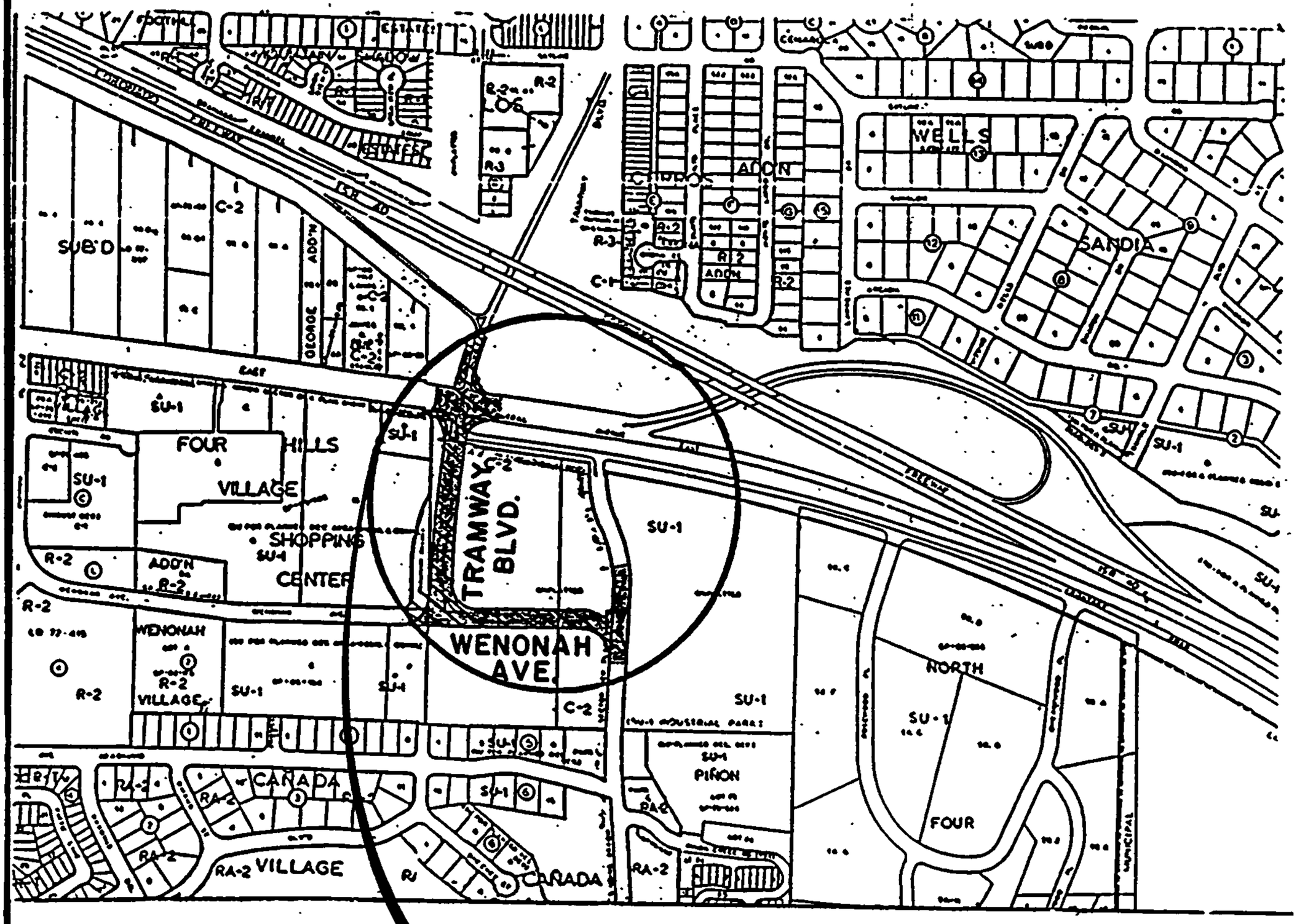
$$Tc = 0.0078 \frac{(L)^{0.77}}{(S)^{0.385}}$$

A minimum of 10 minutes will be utilized.

Depth of flow in composite gutter sections will be determined from Chart 5 (See Appendix A and C) per "Drainage of Highway Pavements" by Federal Highway Administration

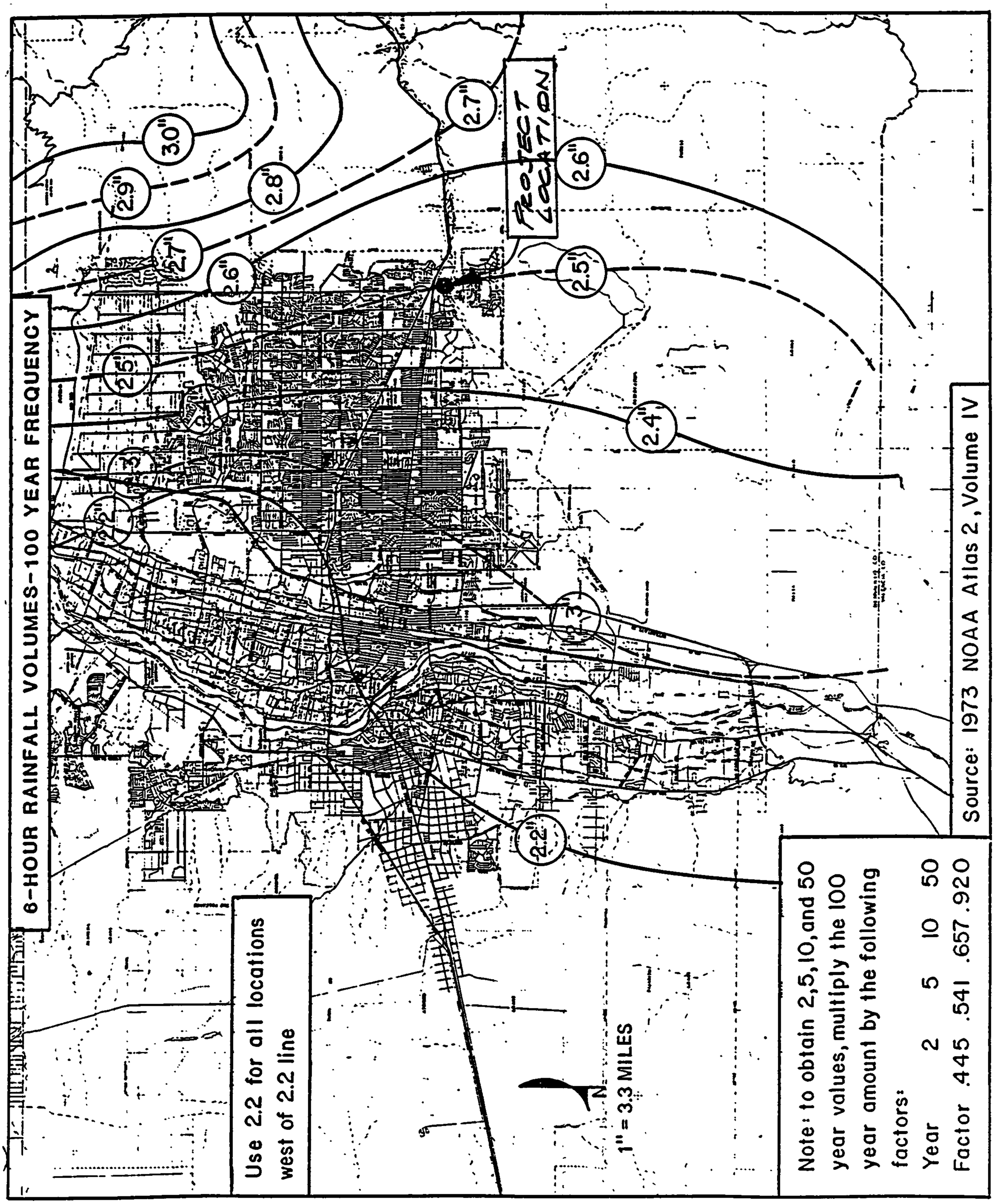
Capacities for catch basins will be determined from grating capacities (See Appendix B and D) per the city DPM.

The storm sewer is size based on a analysis of manning's equation for maximum capacity for non-pressurized pipe systems. A minimum of 18" RCP pipe diameter will be used to minimize clogging.



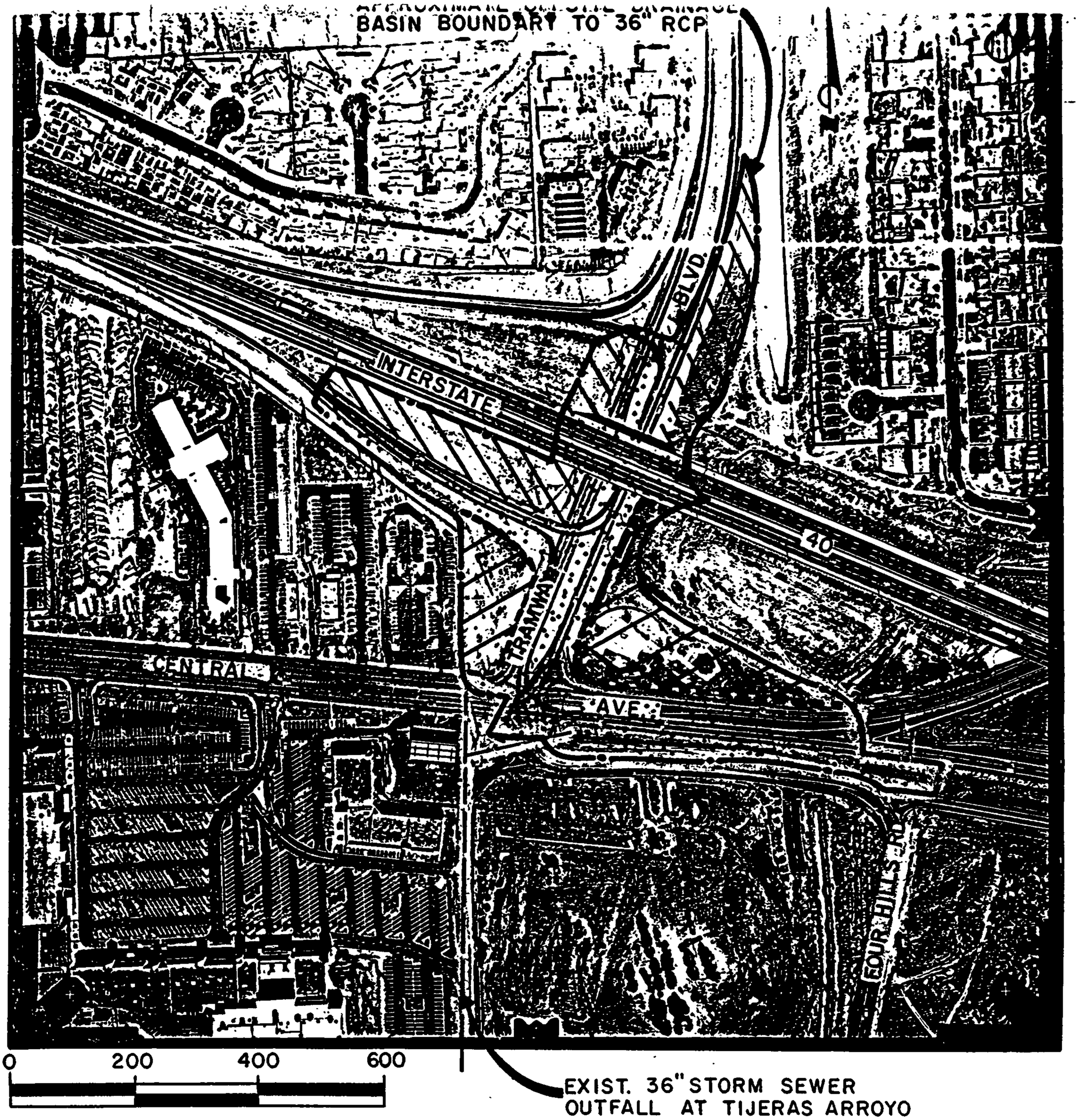
ZONE ATLAS L-22, L-23

VICINITY MAP



13

PLATE 22.2 D-1



SCALE: 1" = 238'

Paved Area .....

Landscaped Area ...

Undeveloped .....

OFFSITE DRAINAGE BASIN -
BOUNDARY FOR EXIST. 36" RCP

ESTIMATED OFFSITE DRAINAGE BASIN FOR EXISTING 36" RCP STORM SEWER

High Elev = 5712
Low Elev = 5671
} Length = 825'

High Elev = 5671
Low Elev = 5660
} Length = 750'

TIME OF CONCENTRATION

OVERLAND FLOW VELOCITY

$V = KY^{0.5}$

$K = 2.00$ Paved Area

$S_1 = \frac{5712 - 5671}{825} = 0.0497$ $\quad Y = 4.97\%$

$S_2 = \frac{5671 - 5660}{750} = 0.0146$ $\quad Y = 1.46\%$

$V_1 = KY^{0.5} = 2.0(4.97)^{0.5} = 4.6$ fps

$V_2 = KY^{0.5} = 2.0(1.46)^{0.5} = 2.4$ fps

$$t_c = \left[\left(\frac{825\text{ ft}}{4.6\frac{\text{ft}}{\text{sec}}}\right) + \left(\frac{750\text{ ft}}{2.4\text{ ft/sec}}\right)\right]\frac{\text{min}}{60\text{sec}} = 8.2\text{ min}$$

use $t_c = 10$ minute minimum

Intensity

$$I = (6\text{ hr. rain})\, 6.84\, t_c^{-0.51}$$

$$I = (2.5\text{in})\, 6.84\, (10)^{-0.51} = 5.28$$

Runoff Coefficient

Total Area = 13.1 acres

Streets, Drives & Medians

$C = 0.95$, $A = 7.1$ acres

Lawns & Landscaping

$C = 0.25$, $A = 3.2$ acres

Undeveloped

$C = 0.40$, $A = 2.8$ acres

Composite C

$$C = \frac{0.95(7.1) + 0.25(3.2) + 0.40(2.8)}{13.1} = 0.66$$

* FLOW INTO 36" RCP FROM OFFSITE PRAINAGE BASIN

$$Q = C \times I \times A$$

$$Q = 0.66 \times 5.28 \times 13.1 = \underline{\underline{46 \text{ CFS}}}$$

CAPACITY OF EXISTING 36" RCP

Inv. Inlet = 54.10
Inv MH = 41.54
LENGTH = 580'

} Survey Information ✓

$$S = \frac{54.10 - 41.54}{580'} = 2.17\%$$

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2} \quad , \quad n = 0.015$$

$$Q = \frac{1.49}{0.015} \left(\pi \frac{(36/12)^2}{4} \right) \left(\frac{\frac{\pi (36/12)^2}{4}}{\pi (36/12)} \right)^{2/3} (0.0217)^{1/2} = 85 cfs$$

$Q_{CAPACITY\ FULL\ FLOW} = 85 CFS > 46 CFS$ OK

Project Name _____

Project No. _____

ONSITE DRAINAGE BASINS

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev (ft.)	Slope (ft/ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR				10 YEAR			
										6 Hr. Rain Volume (in.)	I/6 Hr. Rain (in./hr.)	Peak Flow Rate Q (cfs)	Runoff Volume (ac.ft.)	6 Hr. Rain Volume (in.)	I/6 Hr. Rain (in./hr.)	Peak Flow Rate Q(cfs)	Runoff Volume (ac. ft.)
A	3.00	950	68	46	.023	10	B	100	0.76	2.5	5.28	12.0		1.64	3.47	7.9	
A1	3.05	850	74	54	.023	10	B	0	0.40	2.5	5.28	6.4		1.64	3.47	4.2	
B	3.00	750	46	40	.008	10	B	100	0.71	2.5	5.28	11.2		1.64	3.47	7.4	
B1	0.90	375	61	47	.037	10	B	0	0.40	2.5	5.28	1.9		1.64	3.47	1.2	
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

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7. See Soils Map Plate ___ and Text

8. By Area Computation

9. DPM Plate 22.2 C-1

10,14 DPM Plate 22.2 D-1

11,15 DPM Plate 22.2 D-2

12,16 Rational Formula $Q = CIA$

13,17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

Sheet ___ Of ___

By ___ Date ___

STREET CAPACITY CALCULATIONS

1) TRAMWAY BLVD (ARTERIAL STREET)

BASIN A (TRAMWAY BLVD, DOES NOT INCLUDE ADJACENT TRACT)

$Q_{100} = 12.0$ CFS

$Q_{10} = 7.9$ CFS

STREET CRITERIA (ARTERIAL)

0.87' Deep - 100 YR.

ONE DRY LANE - 10 YR.

CHECK MAX Q FOR ONE DRY LANE 10 YR

$S = 0.50\%$ ✓

$S_x = 2.0\%$

$S_w = 6.25\%$

$T = 13'$

$W = 2'$

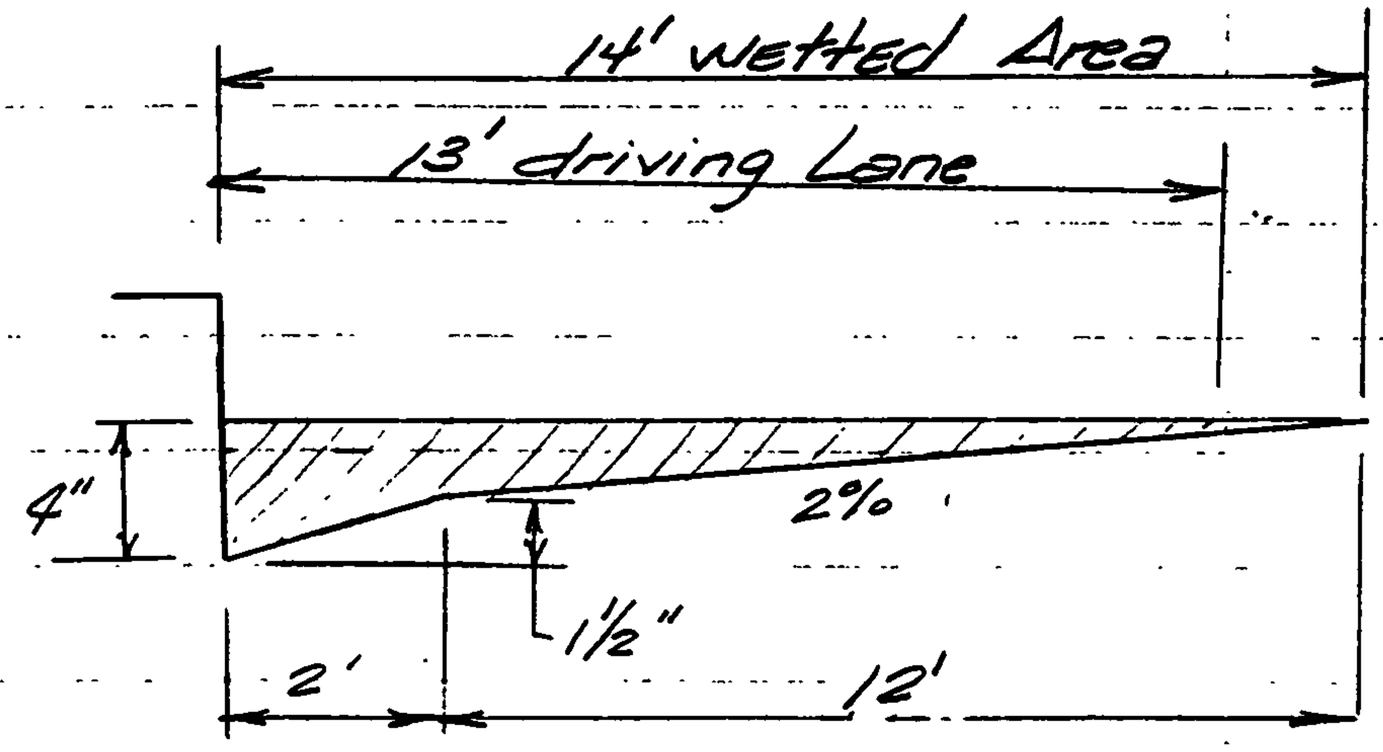
$\frac{T}{W} = \frac{13}{2'} = 6.5$

$\frac{S_w}{S_x} = \frac{6.25}{2.00} = 3.125$

Chart 5 → $Q_n = 0.06$

Appendix A

$Q_{max} = \frac{0.060}{0.017} = 3.5$ CFS - FOR ONE DRY LANE



$Q_{10} = \frac{7.9 \text{ CFS}}{2 \text{ CURBS}} = 3.9 \frac{\text{CFS}}{\text{CURB}} > 3.5$ CFS EXCEEDS 10YR

CRITERIA Encroaches One Foot into 2nd Lane (Minimal)

Check Depth of Flow For $Q_n = 3.9(0.017) = 0.066$

APPENDIX A
CHART 5 $\longrightarrow$ $T/W = 7.0$

$T = 7.0(2') = 14'$

$d = \left(\frac{1.5"}{12"/ft}\right) + (14'-2')0.02 = \underline{\underline{0.37'}}$

CHECK GRATE CAPACITY FOR TYPE "A"
PLATE 22.3 D-5 (APPENDIX B)

$Q_{INTERCEPT} = 2.6$ CFS 10YR

$Q_{PASS\ 10YR} = 3.9$ CFS $- 2.6$ CFS $= 1.3$ CFS to NEXT CATCH BASIN

CHECK 100 YR - TRAMWAY BLVD

$$Q_{100} = \frac{12\ CFS}{2\ CURBS} = 6.0\ CFS$$

FIND DEPTH @ CURB

$$Q_n = 6.0\ (0.017) = 0.102$$

$S = 0.50\%$ ✓

$S_x = 2.0\%$, $S_w = 6.25\%$, $\frac{S_w}{S_x} = 3.125$

$W = 2$

(Apperdix A)
(CHART 5) → $\frac{T}{W} = 8.4$

$T = 8.4\ W = 8.4\ (2') = 16.8'$

$$d_{100} = \left(\frac{1.5"}{12"/Ft}\right) + (16.8-2)0.02 = 0.42'$$

CHECK GRATE CAPACITY FOR TYPE "A"
PLATE 22.3, D-5

$Q_{INTERCEPT} = 3.5\ CFS \approx 100\ YR$

$Q_{PASS\ 100\ YR} = 6.0 - 3.5 = 2.5\ CFS$ to WENONAH

Add 1 Additional Type "C" Single Catch Basin at NW Quadrant Tramway / Wenonah intersection to eliminate valley gutter across Wenonah

CHECK 100 YR - TRAMWAY BLVD

Find Depth @ Curb, NW Quadrant

$Q_n = 2.5\,(0.017) = 0.0425$

$S = 0.50\%$

$S_x = 2.0\%$, $S_w = 6.25\%$, $\frac{S_w}{S_x} = 3.125$

$W = 2'$

CHART 5, APPENDIX A $\longrightarrow \frac{T}{W} = 5.8$

$T = 5.8W = 5.8\,(2') = 11.6'$

$d_{.00} = \left(\frac{1.5''}{12''/ft}\right) + (11.6 - 2.0)\,0.02 = 0.32'$

Check Grate Capacity for Single "C"
Plate 22.3, D-5, Appendix B

$Q_{INTERCEPT} = 1.95\,CFS \approx 100\,YR$

ok. 9ra de Wenonah to drain this to west.

$Q_{PASS\ 100\,YR} = 2.5 - 1.95\,CFS = 0.55\,CFS$ to Wenonah @ NW Quadrant

$Q_{PASS\ 100\,YR} = 2.5\,CFS$ to Wenonah @ NE Quadrant

2) WENONAH ROAD (COLLECTOR STREET)

BASIN B

$Q_{100} = 11.2\,cfs + \underbrace{0.6\,cfs}_{\text{SOUTH CURB TRAMWAY}} + \underbrace{2.5\,cfs}_{\text{NORTH CURB TRAMWAY}} = 13.7 = 14.3\,cfs$

NORTH CURB @ Wenonah

$Q_{100} = \underbrace{7.2\,cfs}_{\text{PRORATE AREA}} + 2.5\,cfs = 9.7\,cfs$ ✓

SOUTH CURB @ Wenonah

$Q_{100} = \underbrace{4\,cfs}_{\text{PRORATE AREA}} + 0.6\,cfs = 4.0 = 4.6\,cfs$

Check Depth of Flow North Curb

$Q_n = 9.7\,(0.017) = 0.165$

$S = 0.50\%$

$S_x = 2.0\%$, $S_w = 6.25\%$, $S_x' = 3.125$

$W = 2'$

CHART 5, APPENDIX C $\rightarrow \frac{T}{W} = 9.8$

$T = 9.8(2') = 19.6'$

$d_{100} = \left(\frac{1.5''}{12''/Ft}\right) + (19.6 - 2')0.02 = 0.48' < 0.50'$

NO NEED TO ANALYZE 10YR STORM

Wenonah Road North Curb

Check Grate Capacity For ~~Single~~ "A" ok as is.
~~Double "C"~~

North Curb

Plate 22.3, D-5, Appendix D

5.0 cfs (~~1" 2"~~)

$d_{100} = 0.48' \rightarrow Q_{INTERCEPT} = 4.4 cfs$

$Q_{PASS\ 100\ YR} = 9.7 - 4.4 cfs = 5.3 cfs$ (5.0, 4.7 cfs)

Add 1 Additional Type "C" Double Catch Basin at North Curb of Wenonah to Prevent Cross Street Drainage Before Superelevation

Find Depth of Flow North Curb @ 2nd Inlet

$Qn = 5.3\ (0.017) = 0.090$ (4.7, .080)

$S = 0.50\%$ ✓

$S_x = 2.0\%$, $S_w = 6.25\%$, $\frac{S_w}{S_x} = 3.125$

$W = 2'$

Chart 5, Appendix C → $\frac{T}{W} = 7.8$ (7.5)

$T = 7.8\ (2') = 15.6'$ (15.0)

$d_{100} = \left(\frac{1.5"}{12"/Ft}\right) + (15.6' - 2')\ 0.02 = 0.40'$ (15.0, 0.38)

WENONAH ROAD NORTH CURB ~~SWALE~~ "A"

CHECK GRATE CAPACITY FOR ~~DOUBLE~~ "C" OK AS IS.

PLATE 22.3, D-5, APPENDIX E

$d_{100} = 0.40' \rightarrow Q_{INTERCEPT} = 2.6$ ~~2.8~~ CFS

$Q_{PASS} = 4.7$ ~~5.3~~ CFS $- 2.6$ ~~2.4~~ CFS $= 2.1$ ~~2.9~~ CFS

100 YR

SHEETFLOWS ACROSS WENONAH TO SOUTH CURB AND TO 2nd INLET BEFORE CHANNEL

WENONAH ROAD SOUTH CURB

FIND DEPTH OF FLOW AT SOUTH CURB FOR 1st INLET

$Q_{100} = 4.0$ ~~4.6~~ CFS

$Q_n = 4.0$ ~~4.6~~ $(0.017) = .068$ ~~0.078~~

$S = 0.50\%$, $S_x = 2.0\%$, $S_w = 6.25\%$

$\frac{S_w}{S_x} = 3.125$, $W = 2'$

CHART 5 APPENDIX C $\rightarrow \frac{T}{W} = 7.2$ ~~7.5~~

$T = 7.2$ ~~7.5~~ $(2') = 15.0'$

$d_{100} = \left(\frac{1.5"}{12"/Ft}\right) + (15.0' - 2')(0.02) = .37$ ~~0.39'~~ ok.

WENONAH ROAD SOUTH CURB

CHECK GRATE CAPACITY FOR SINGLE "A"
PLATE 22.3, D-5, APPENDIX D

$d_{100} = 0.39' \rightarrow Q_{INTERCEPT} = 2.6 CFS$

$Q_{PASS\ 100\ YR} = 4.6 CFS - 2.6 CFS = 2.0 CFS$

FIND DEPTH OF FLOW SOUTH CURB @ 2ND INLET

$Q = 2.0 CFS + \underbrace{2.2 CFS}_{\text{SHEETFLOW FROM NORTH CURB}} = 4.4 CFS$ (2.1 → 4.1)

$Q_n = 4.4 (0.017) = 0.075$ (4.1 → .070)

$S = 0.50\%$, $S_x = 2.0\%$, $S_W = 6.25\%$

$\frac{S_W}{S_x} = 3.125$, $W = 2'$

CHART 5, APPENDIX C → $T/W = 7.2$ ✓

$T = 7.2 (2') = 14.4'$ ✓

$d_{100} = \left(\frac{1.5''}{12''/Ft}\right) + (14.4 - 2')0.02 = 0.37'$ ✓

WENONAH ROAD SOUTH CURB

CHECK GRATE CAPACITY FOR SINGLE "C"

PLATE 22.3, D-5, APPENDIX D

$d_{100} = 0.37'$ → $Q_{INTERCEPT} = 2.4 CFS$

$Q_{PASS} = \overset{4.1}{4.4} - 2.4 = \overset{1.7}{2.0} CFS$

100 YR

FLOWS TO FOUR HILLS ROAD / TIJERAS BRIDGE CROSSING

CAPACITY OF PROPOSED 24" RCP

* CHECK MAIN STORM SEWER LINE

Q_{MAX} = 9.8 CFS STORM SEWER AT 100YR V. VENONAH AVENUE / CHANNEL

SLOPE = 3.71 %

MANNING'S EQ.

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}$$

$$Q_{CAP.} = \frac{1.49}{0.015}\left(\frac{\pi(2)^2}{4}\right)\left(\frac{\frac{\pi(2)^2}{4}}{2\pi}\right)^{2/3}(0.0371)^{1/2}$$

$Q_{CAPACITY}$ = 37.7 CFS > 9.8 CFS REQUIRED OK

CAPACITY OF PROPOSED 18" RCP CONNECTOR PIPES TO CATCH BASINS

Q_{max} = 7.2 cfs @ North Curb Wenonah Avenue

Slope = 3.0 %

Manning's Equation

$$Q_{cap} = \frac{1.49}{0.015}\left(\frac{\pi(1.5)^2}{4}\right)\left(\frac{\frac{\pi(1.5)^2}{4}}{1.5\pi}\right)^{2/3}(0.03)^{1/2}$$

Q_{cap} = 15.8 cfs > 7.2 cfs Required **OK**

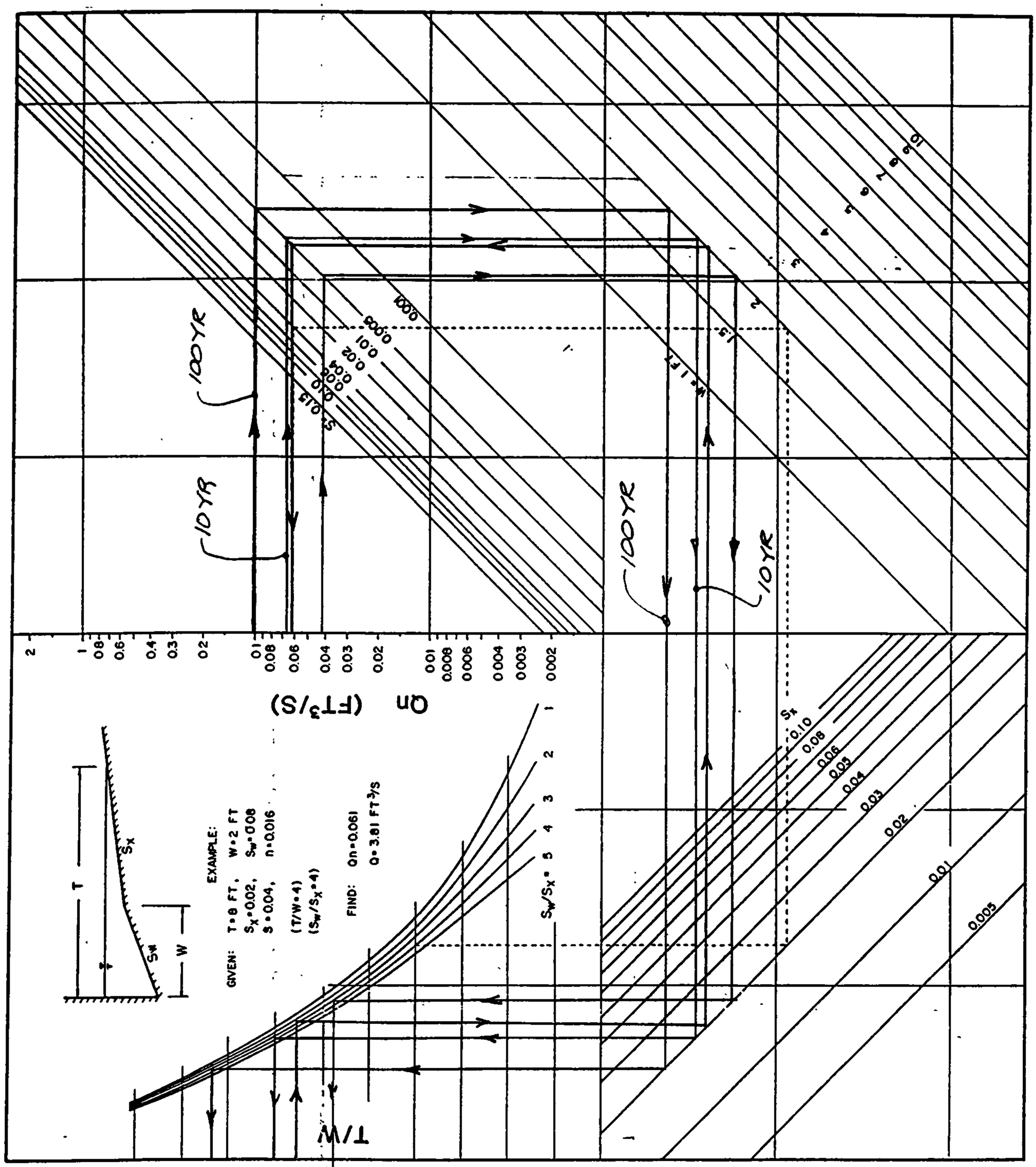
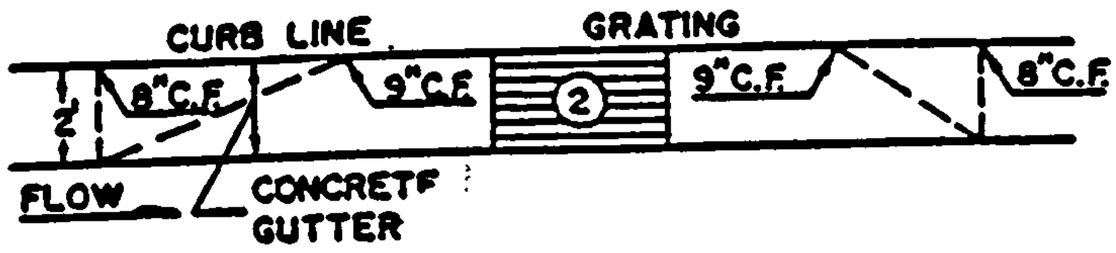
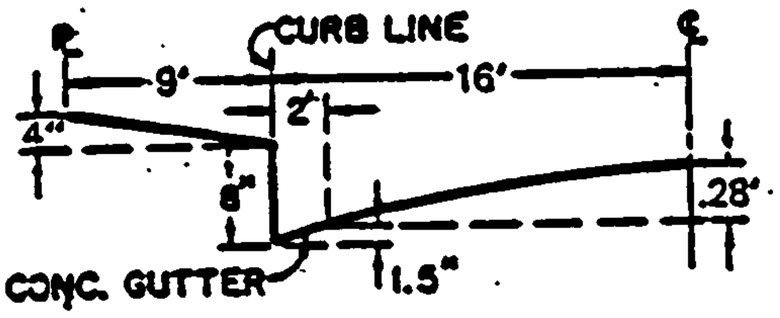


CHART 5. Flow in composite gutter sections.

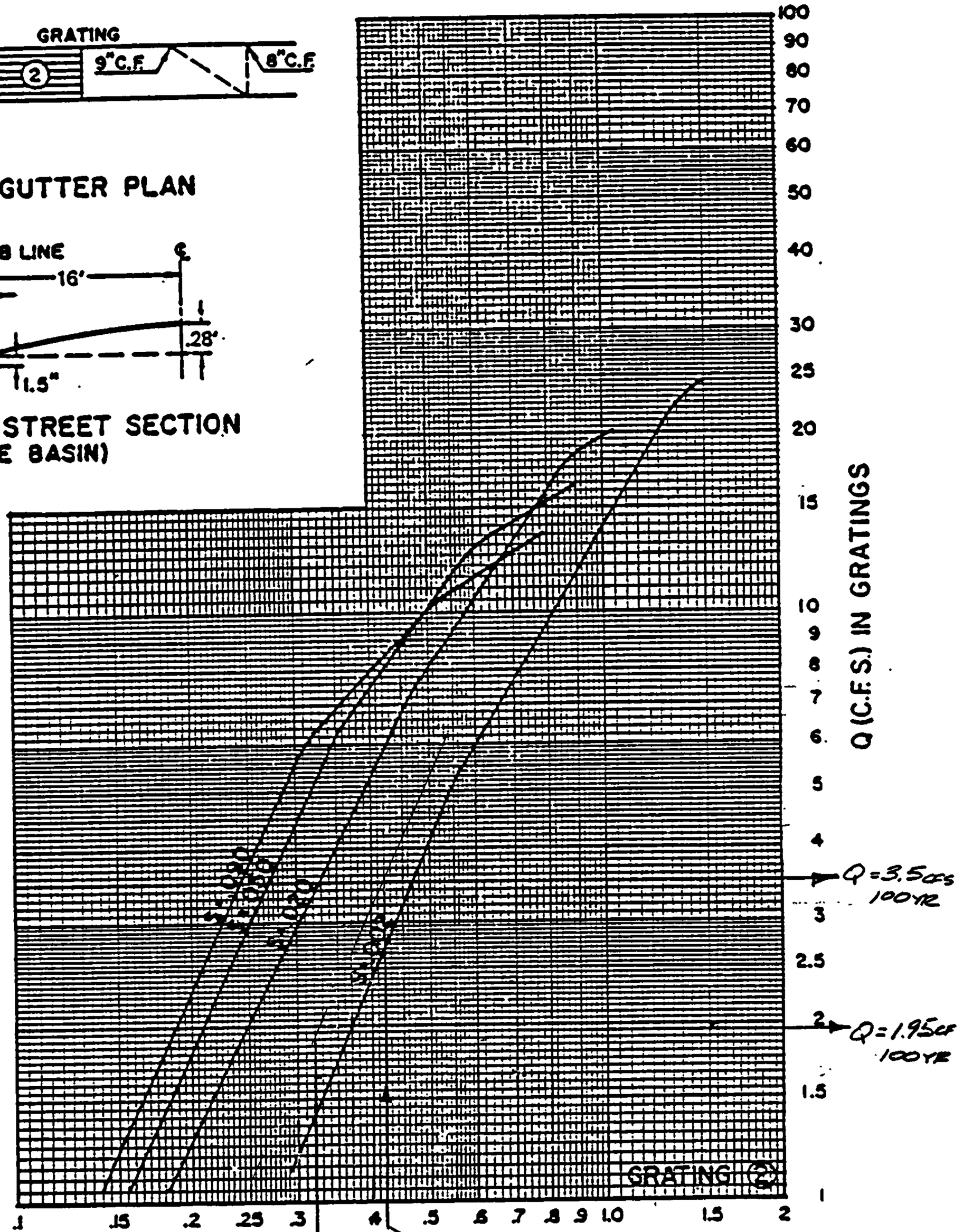
GRATING CAPACITIES FOR TYPE "A" , "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



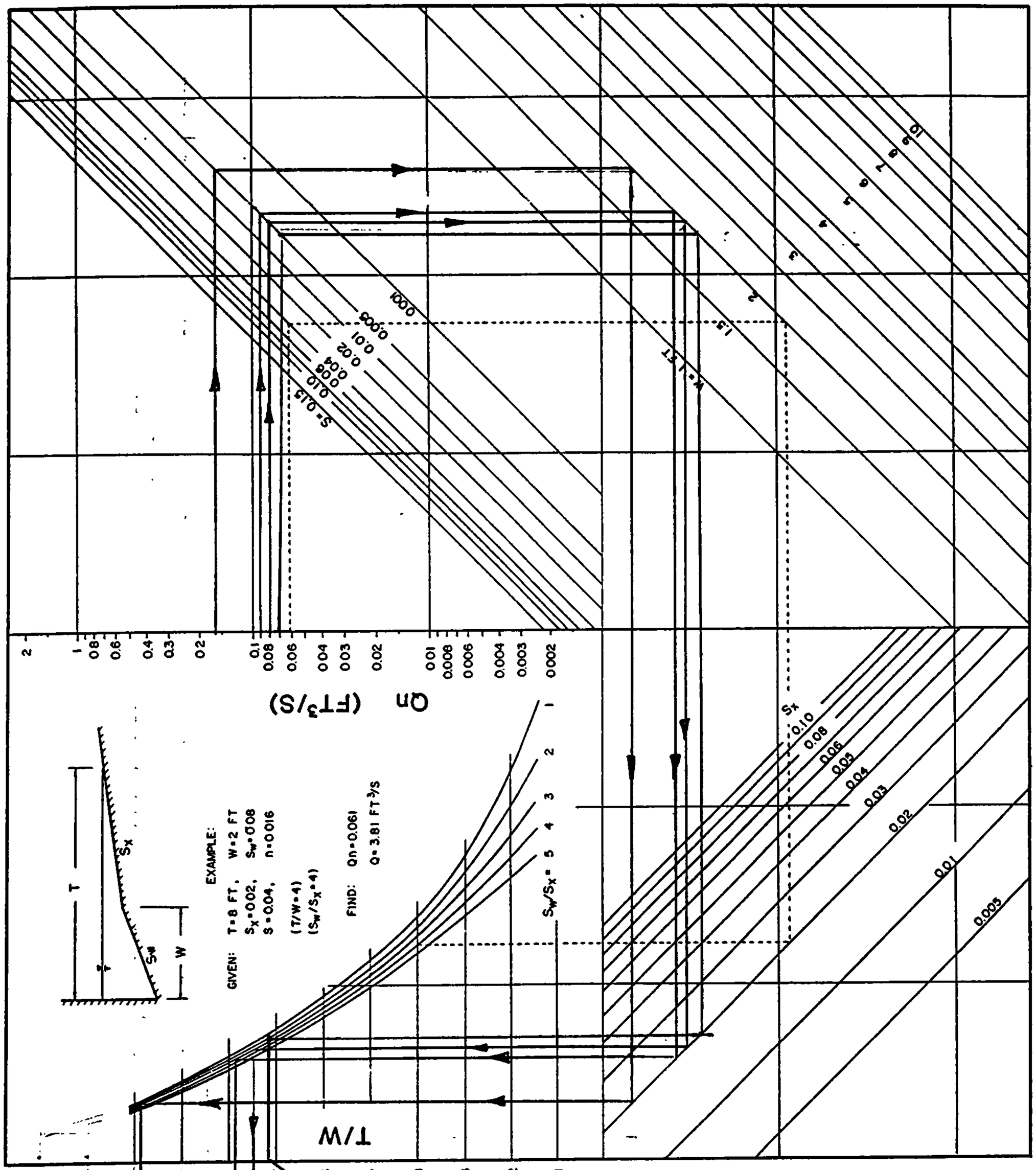
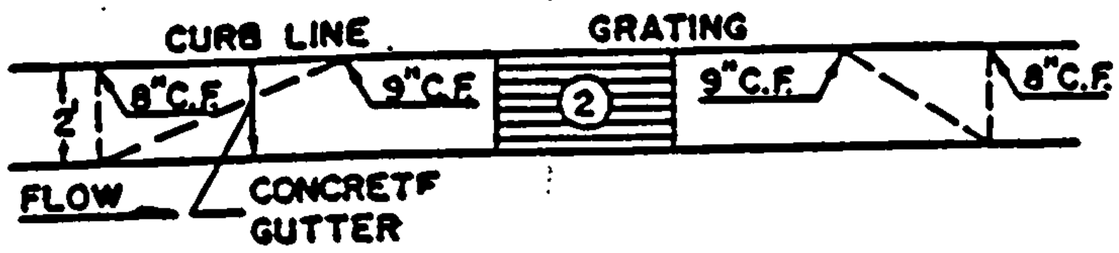


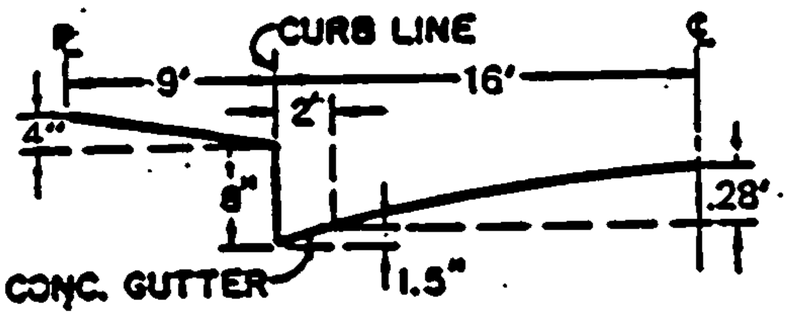
CHART 5. Flow in composite gutter sections.

WENONAH ROAD

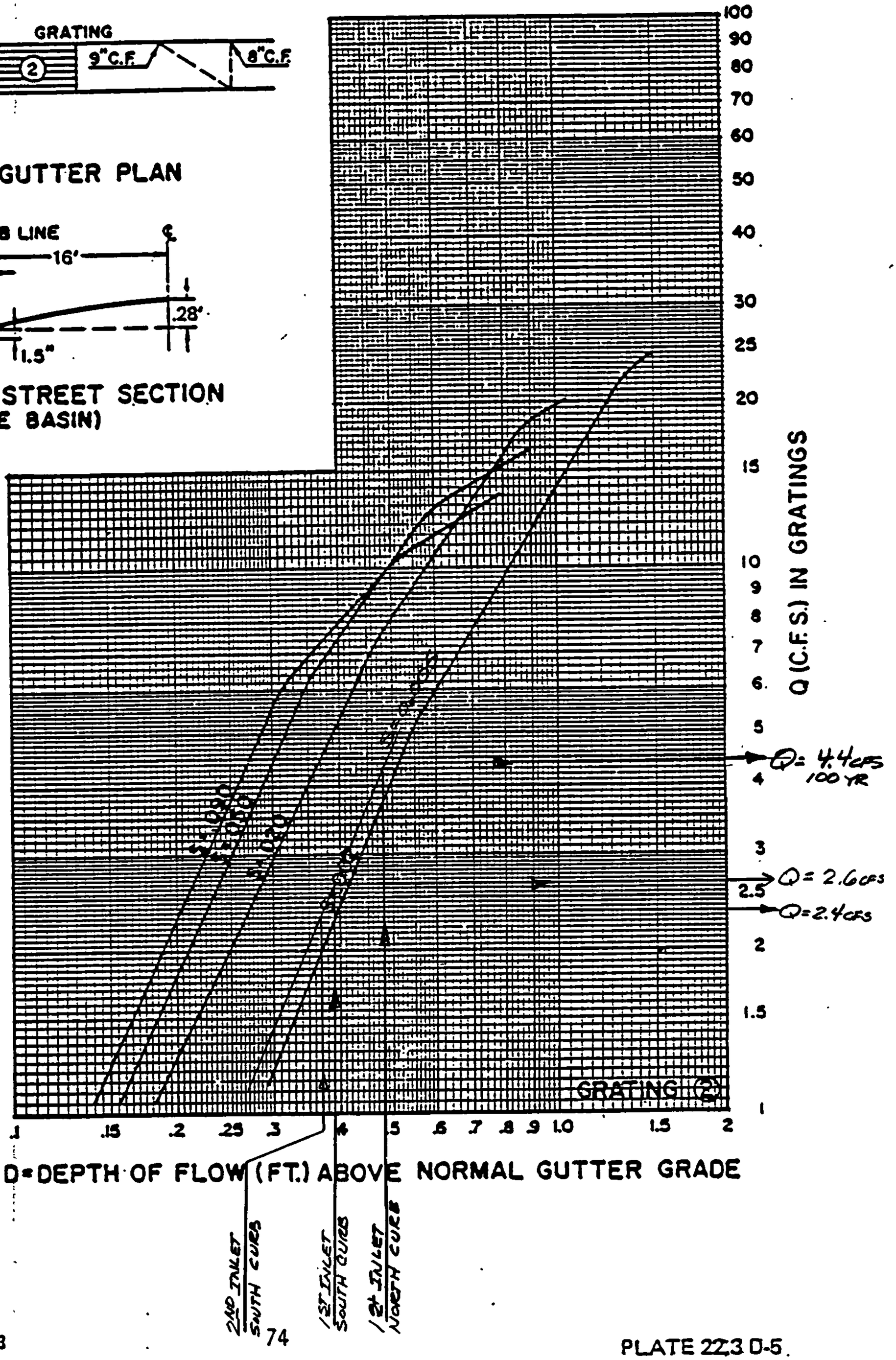
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



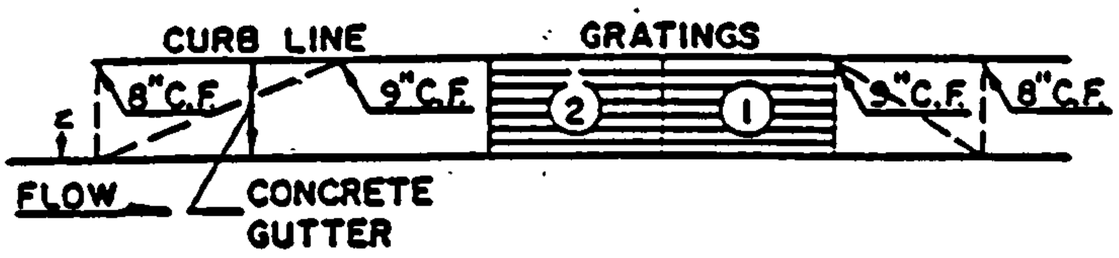
TYPICAL HALF STREET SECTION
(ABOVE BASIN)



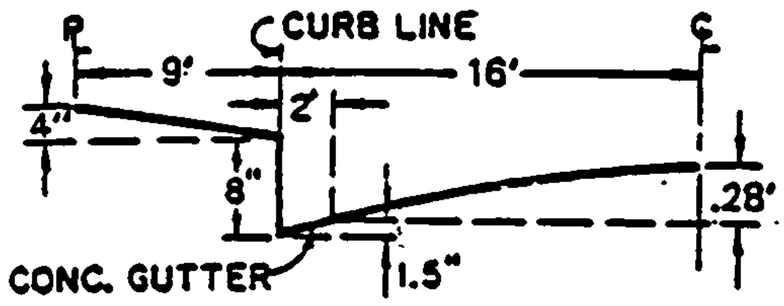
WENONAH ROAD

22.3

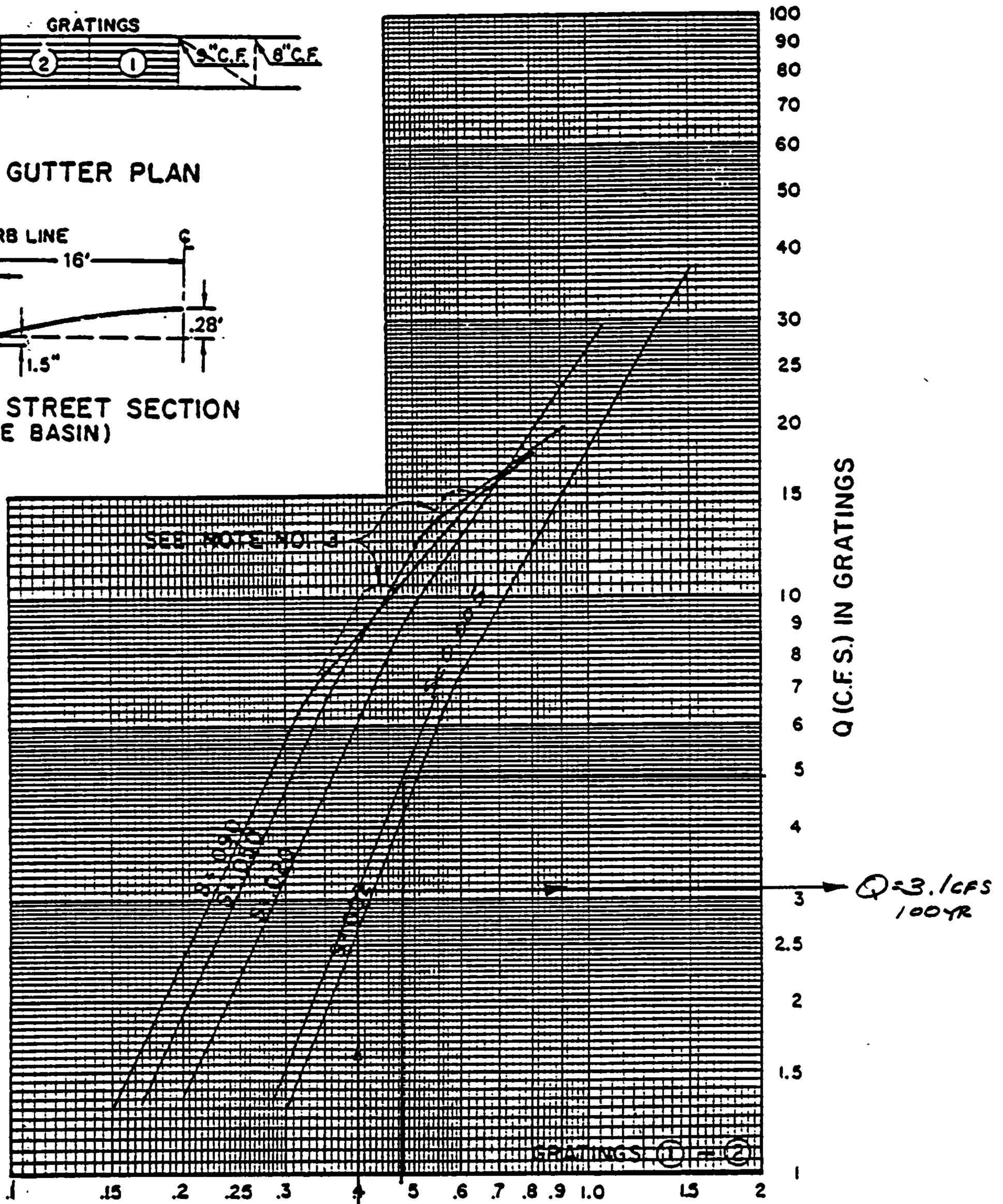
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



TIERRA
ENGINEERING
CONSULTANTS,
INC.

CIVIL AND SOILS
ENGINEERING
LAND SURVEYS AND
DEVELOPMENTS

DRAINAGE MANAGEMENT PLAN

FOR

TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD

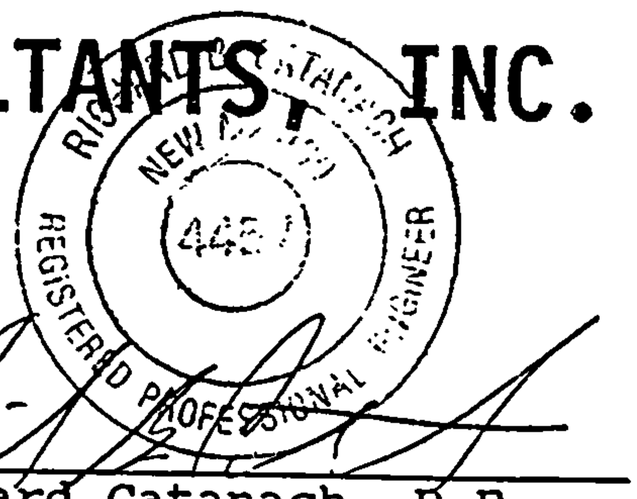
PREPARED FOR

CITY OF ALBUQUERQUE
PUBLIC WORKS/STREET DEPARTMENT
JOB NO. 0184-01

Initial Submittal

PREPARED BY:

TIERRA ENGINEERING CONSULTANTS, INC.



Richard Catanach, P.E.
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105 6TH STREET SW ALBUQUERQUE, NEW MEXICO 87102 505/242-2270

DRAINAGE INFORMATION SHEET

PROJECT TITLE: TRAMWAY BLVD. EXTENSION SOUTH OF CENTRAL AVENUE S.E. AND WENONAH ROAD ZONE ATLAS/DRNG. FILE #: L-22 & L-23

LEGAL DESCRIPTION: See Vicinity Map (Sheet)

CITY ADDRESS:

ENGINEERING FIRM: Tierra Engineering Consultants CONTACT: Gilbert Aldaz

ADDRESS: 105 6th Street S.W., Suite 202 Albuquerque, New Mexico 87102 PHONE: 242-2270

OWNER: City of Albuquerque CONTACT: Suzanne Dougharty

ADDRESS: 400 Marquette N.W., Albuquerque, New Mexico 87103 PHONE: 768-2760

ARCHITECT: N/A CONTACT:

ADDRESS: PHONE:

SURVEYOR: N/A CONTACT:

ADDRESS: PHONE:

CONTRACTOR: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

X YES

____ NO

____ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO.

EPC NO.

PROJ. NO. 3340

TYPE OF SUBMITTAL:

X DRAINAGE REPORT

X DRAINAGE PLAN

____ CONCEPTUAL GRADING & DRAINAGE PLAN

____ GRADING PLAN

____ EROSION CONTROL PLAN

____ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

____ SKETCH PLAT APPROVAL

____ PRELIMINARY PLAT APPROVAL

____ SITE DEVELOPMENT PLAN APPROVAL

____ FINAL PLAT APPROVAL

____ BUILDING PERMIT APPROVAL

____ FOUNDATION PERMIT APPROVAL

____ CERTIFICATE OF OCCUPANCY APPROVAL

____ ROUGH GRADING PERMIT APPROVAL

____ GRADING/PAVING PERMIT APPROVAL

X OTHER Street Design (SPECIFY)

DATE SUBMITTED: May 19, 1989

BY: Gilbert Aldaz

TABLE OF CONTENTS

A) **INTRODUCTION**

The City of Albuquerque is currently planning development of Tramway Boulevard Extension south of Central Avenue S.E. and Wenonah Road (See Vicinity Map Sheet ____). The roadway right-of-way for Tramway Blvd and Wenonah Road will consist of approximately 3.5 acres. The purpose of this report is to present an overall drainage management plan for the project which is acceptable to the City of Albuquerque.

B) **SITE DESCRIPTION**

Tramway Boulevard Extension begins at Central Avenue and continues south for 800 feet. Tramway is bounded on the west by Four Hills Village Shopping Center and on the east by Unplatted Lands (formerly old Western Skies Motel). Wenonah Road begins at Tramway Boulevard terminus and continues east to Four Hills Road for approximately 700 feet. Wenonah Road is bounded on the north and south by unplatted properties.

C) **COMPUTATIONAL PROCEDURES**

The rational method was used to determine the peak flow for drainage basins. Basins were divided into sub-basins to provide a better resolution of developed flows at critical locations. The runoff coefficient was based on developed conditions using the following criteria:

Surface Type	Coefficient
Street R.O.W. to include paving, medians, sidewalks and curb and gutter	C = 0.95
Undeveloped (Offsite Drainage Basin)	C = 0.40

The time of concentration will be calculated by the Kirpich Formula as follows:

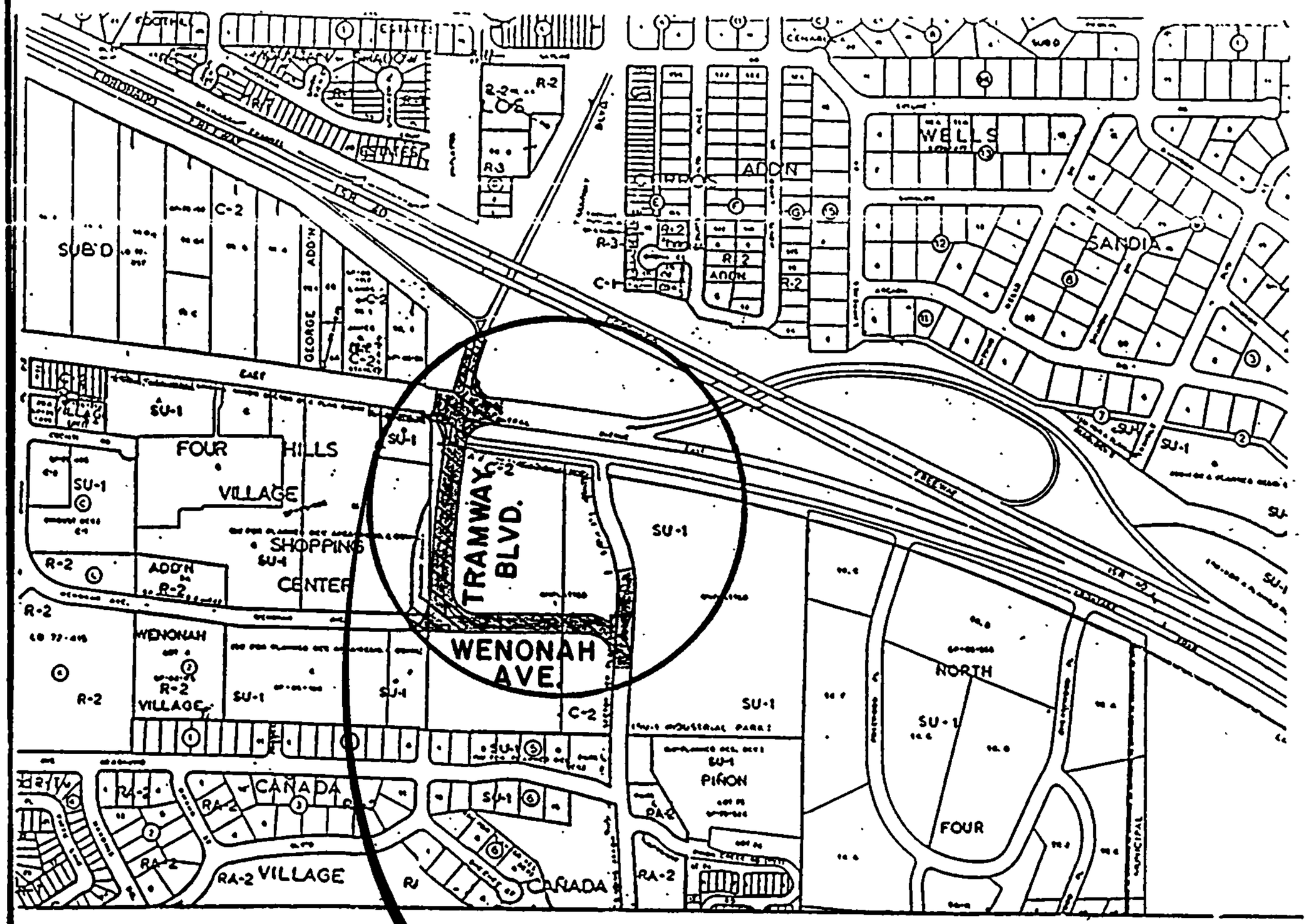
$$Tc = 0.0078 \frac{(L)^{0.77}}{(S)^{0.385}}$$

A minimum of 10 minutes will be utilized.

Depth of flow in composite gutter sections will be determined from Chart 5 (See Appendix A and C) per "Drainage of Highway Pavements" by Federal Highway Administration

Capacities for catch basins will be determined from grating capacities (See Appendix B and D) per the city DPM.

The storm sewer is size based on a analysis of manning's equation for maximum capacity for non-pressurized pipe systems. A minimum of 24" RCP pipe diameter will be used to minimize clogging.



ZONE ATLAS L-22,L-23

VICINITY MAP

6-HOUR RAINFALL VOLUMES-100 YEAR FREQUENCY

Use 2.2 for all locations west of 2.2 line

2.2" 2.3" 2.4" 2.5" 2.6" 2.7" 2.8" 2.9" 3.0"

PROJECT LOCATION

N

1" = 3.3 MILES

Note: to obtain 2,5,10,and 50 year values, multiply the 100 year amount by the following factors:

Year	2	5	10	50
Factor	.445	.541	.657	.920

Source: 1973 NOAA Atlas 2, Volume IV

SCALE: 1" = 238'

OFFSITE DRAINAGE BASIN - BOUNDARY FOR EXIST. 36" RCP

ESTIMATED OFFSITE DRAINAGE BASIN FOR EXISTING 36" RCP STORM SEWER

High Elev = 5712
Low Elev = 5671
} Length = 825'

High Elev = 5671
Low Elev = 5660
} Length = 750'

TIME OF CONCENTRATION

OVERLAND FLOW VELOCITY

$V = KY^{0.5}$

$K = 2.00$ Paved Area

$S_1 = \frac{5712 - 5671}{825} = 0.0497$ $Y = 4.97\%$

$S_2 = \frac{5671 - 5660}{750} = 0.0146$ $Y = 1.46\%$

$V_1 = KY^{0.5} = 2.0(4.97)^{0.5} = 4.6$ fps

$V_2 = KY^{0.5} = 2.0(1.46)^{0.5} = 2.4$ fps

$t_c = \left[\left(\frac{825\text{ ft}}{4.6\frac{\text{ft}}{\text{sec}}}\right) + \left(\frac{750\text{ ft}}{2.4\text{ ft/sec}}\right)\right]\frac{\text{min}}{60\text{sec}} = 8.2$ min

use $t_c = 10$ minute minimum

Intensity

$$I = (6\text{ hr. rain})\ 6.84\ t_c^{-0.51}$$

$$I = (2.5\text{in})\ 6.84\ (10)^{-0.51} = 5.28$$

Runoff Coefficient

Total Area = 13.1 acres

Streets, Drives & Medians

$C = 0.95$, $A = 7.1$ acres

Lawns & Landscaping

$C = 0.25$, $A = 3.2$ acres

Undeveloped

$C = 0.40$, $A = 2.8$ acres

Composite C

$$C = \frac{0.95(7.1) + 0.25(3.2) + 0.40(2.8)}{13.1} = 0.66$$

* FLOW INTO 36" RCP FROM OFFSITE DRAINAGE BASIN

$$Q = C \times I \times A$$

$$Q = 0.66 \times 5.28 \times 13.1 = \underline{\underline{46 \text{ CFS}}}$$

CAPACITY OF EXISTING 36" RCP

Inv. Inlet = 54.10

Inv MH = 41.54

LENGTH = 580'

$$S = \frac{54.10 - 41.54}{580'} = 2.17\%$$

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}, \quad n = 0.015$$

$$Q = \frac{1.49}{0.015}\left(\frac{\pi(36/12)^2}{4}\right)\left(\frac{\frac{\pi(36/12)^2}{4}}{\pi(36/12)}\right)^{2/3}(0.0217)^{1/2} = 85 cfs$$

$Q_{CAPACITY\ FULL\ FLOW} = 85 CFS > 46 CFS$ OK

Project Name _____

Project No. _____

ONSITE DRAINAGE BASINS

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev (ft.)	Slope (ft/ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr. Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac.ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac. ft.)
A	1.90	950	68	46	.023	10	B	100	0.95	2.5	5.28	9.5		1.64	3.47	6.3	
A1	4.15	850	74	54	.023	10	B	0	0.40	2.5	5.28	8.8		1.64	3.47	5.8	
B	1.62	750	46	40	.008	10	B	100	0.95	2.5	5.28	8.1		1.64	3.47	5.4	
B1	2.28	375	61	47	.037	10	B	0	0.40	2.5	5.28	4.8		1.64	3.47	3.2	
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1, 2, 3, 4, 5 Basin Areas, Lengths, Top & Bottom Elevations & Slopes FROM Plate 3.

6. T_c by Kirpich Formula $T_c = 0.0078 \frac{(L)^{0.77}}{(S)^{0.385}}$

7. See Soils Map Plate ___ and Text

8. By Area Computation

9. DPM Plate 22.2 C-1

10,14 DPM Plate 22.2 D-1

11,15 DPM Plate 22.2 D-2

12,16 Rational Formula $Q = CIA$

13,17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

Sheet ___ Of ___

By ___ Date ___

STREET CAPACITY CALCULATIONS

1) TRAMWAY BLVD (ARTERIAL STREET)

BASIN A (TRAMWAY BLVD, DOES NOT INCLUDE ADJACENT TRACT)

$Q_{100} = 9.5$ CFS

$Q_{10} = 6.3$ CFS

STREET CRITERIA (ARTERIAL)

0.87' Deep - 100 YR.

ONE DRY LANE - 10 YR.

CHECK MAX Q FOR ONE DRY LANE 10 YR

$S = 0.83\%$

$S_x = 2.0\%$

$S_w = 6.25\%$

$T = 12'$

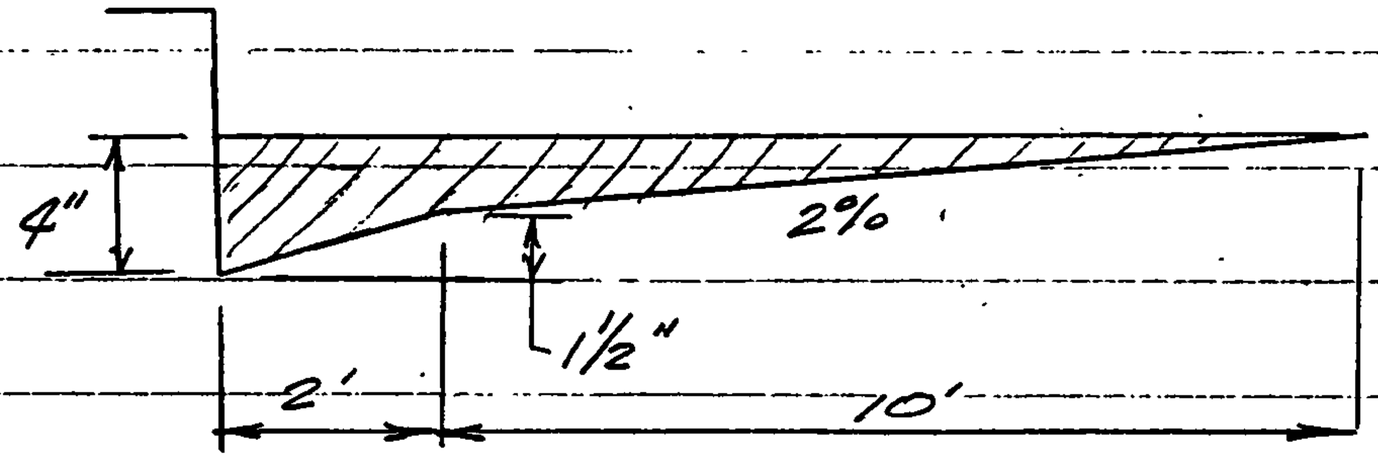
$W = 2'$

$\frac{T}{W} = \frac{12'}{2'} = 6$

$\frac{S_w}{S_x} = \frac{6.25}{2.00} = 3.125$

Chart 5 $\rightarrow Qn = 0.062$

$Q_{max} = \frac{0.062}{0.017} = 3.6$ CFS - FOR ONE DRY LANE



$Q_{10} = \frac{6.3 \text{ CFS}}{2 \text{ CURBS}} = 3.15 \frac{\text{CFS}}{\text{CURB}} < 3.6 \text{ CFS FOR ONE DRY LANE} - \text{OK}$

Check Depth of Flow For $Q_n = 3.15(0.017) = 0.054$

CHART 5 $\longrightarrow$ $T/W = 5.5$

$T = 5.5(2') = 11'$

$d = \left(\frac{1.5"}{12"/ft}\right) + (11-2)\,0.02 = \underline{\underline{0.30'}}$

CHECK GRATE CAPACITY FOR TYPE "A"

PLATE 22.3 D-5

$Q_{INTERCEPT} = 1.7 \text{ CFS}$ 10YR

$Q_{PASS\ 10YR} = 3.15 \text{ CFS} - 1.7 \text{ CFS} = 1.45 \text{ CFS}$ to WENONAH w/ Valley Gutter

CHECK 100 YR

$Q_{100} = \frac{9.5 CFS}{2 CURBS} = 4.75 CFS$

FIND DEPTH @ CURB

$Q_n = 4.75\ (0.017) = 0.0808$

$S = 0.83\%$

$S_x = 2.0\%$, $S_W = 6.25\%$, $\frac{S_W}{S_x} = 3.125$

$W = 2$

CHART 5 $\longrightarrow \frac{T}{W} = 6.5$

$T = 6.5\ W = 6.5\ (2') = 13'$

$d_{100} = \left(\frac{1.5"}{12"/ft}\right) + (13 - 2)\,0.02 = 0.35'$

CHECK GRATE CAPACITY FOR TYPE "A"

PLATE 22.3, D-5

$Q_{INTERCEPT} = 2.3 CFS - 100 YR$

$Q_{PASS\ 100\ YR} = 4.75 - 2.3 = 2.45 CFS$ to WENONAH w/ VALLEY GUTTER

USE 2- TYPE "A" CATCH BASINS ON TRAMWAY BLVD., BOTH SIDES OF STREET, JUST NORTH OF WENONAH ROAD

2) WENONAH ROAD - (COLLECTOR STREET)

BASIN B

$Q_{100} = 8.1\,cfs + \underbrace{2.45cfs\,(2)}_{\text{TRAMWAY}} = 13.0cfs$

$Q_{10} = 5.4\,cfs + 1.45\,(2) = 8.3\,cfs$

STREET CRITERIA

0.87' DEEP - 100YR

0.50' DEEP - 10YR

CHECK DEPTH OF FLOW

48' WIDE STREET

$S = 0.50\%$

$S_x = 2.0\%$, $S_w = 6.25\%$, $\frac{S_w}{S_x} = 3.125$

$W = 2'$

$Q_{100} = \frac{13.0cfs}{2\ CURBS} = \frac{6.5cfs}{CURB}$

$T_{MAX} = \frac{48'}{2} = 24'$ for CHART 5

$Q_n = 6.5\,(0.017) = 0.11$

CHART 5 $\rightarrow \frac{T}{W} = 8.5$

$T = 8.5\,(2') = 17' < 24'$ OK

$d_{100} = \left(\frac{1.5''}{12''/Ft}\right) + (17' - 2')0.02 = 0.43' < 0.50'$

NO NEED TO ANALYZE 10 YR STORM

CHECK GRATE CAPACITY FOR TYPE "A"

PLATE 22.3, D-5

$d_{100} = 0.43'$

$Q_{INTERCEPT} = 3.4 CFS$

$Q_{BYPASS} = 6.5 CFS - 3.4 CFS = 3.1 CFS$

100 YR

WENONAH ROAD SUPERELEVATES TO SOUTH CURB @ FOUR HILLS ROAD

USE 2- TYPE "A" CATCH BASINS ON WENONAH BEFORE SUPERELEVATION, ASSUME FLOWS ON NORTH CURB PASSING CATCH BASIN FLOW TO SOUTH CURB DUE TO SUPERELEVATION, PICK UP REMAINING FLOW ON SOUTH CURB.

$Q_{PASS\ TOTAL\ SOUTH\ CURB} = 2 \times 3.1 = 6.2 CFS$

$d_{100} = \frac{6.2}{6.5}(0.43') = 0.41'$

CHECK GRATE CAPACITY FOR SINGLE "C"

PLATE 22.3, D-5

$Q_{INTERCEPT} = 3.0 CFS$

$Q_{PASS} = 6.2 CFS - 3.0 CFS = 3.2 CFS$ DOWN FOUR HILLS ROAD

CAPACITY OF PROPOSED 24" RCP

* CHECK MAIN STORM SEWER LINE

Q_{MAX} = 9.8 CFS STORM SEWER AT 100 YR

WENONAH AVENUE / CHANNEL

SLOPE = 3.71 %

MANNING'S EQ.

$$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}$$

$$Q_{CAP.} = \frac{1.49}{0.015}\left(\frac{\pi(2)^2}{4}\right)\left(\frac{\frac{\pi(2)^2}{4}}{2\pi}\right)^{2/3}(0.0371)^{1/2}$$

$Q_{CAPACITY}$ = 37.7 CFS > 9.8 CFS REQUIRED OK

CAPACITY OF PROPOSED 18" RCP CONNECTOR PIPES TO CATCH BASINS

$Q_{max} = 3.4$ cfs

SLOPE = 2.0 %

MANNING'S EQUATION

$$Q_{CAP.} = \frac{1.49}{0.015}\left(\frac{\pi(1.5)^2}{4}\right)\left(\frac{\frac{\pi(1.5)^2}{4}}{1.5\pi}\right)(0.02)^{1/2}$$

$Q_{CAP} = 9.3$ cfs $>$ 3.4 cfs REQUIRED OK

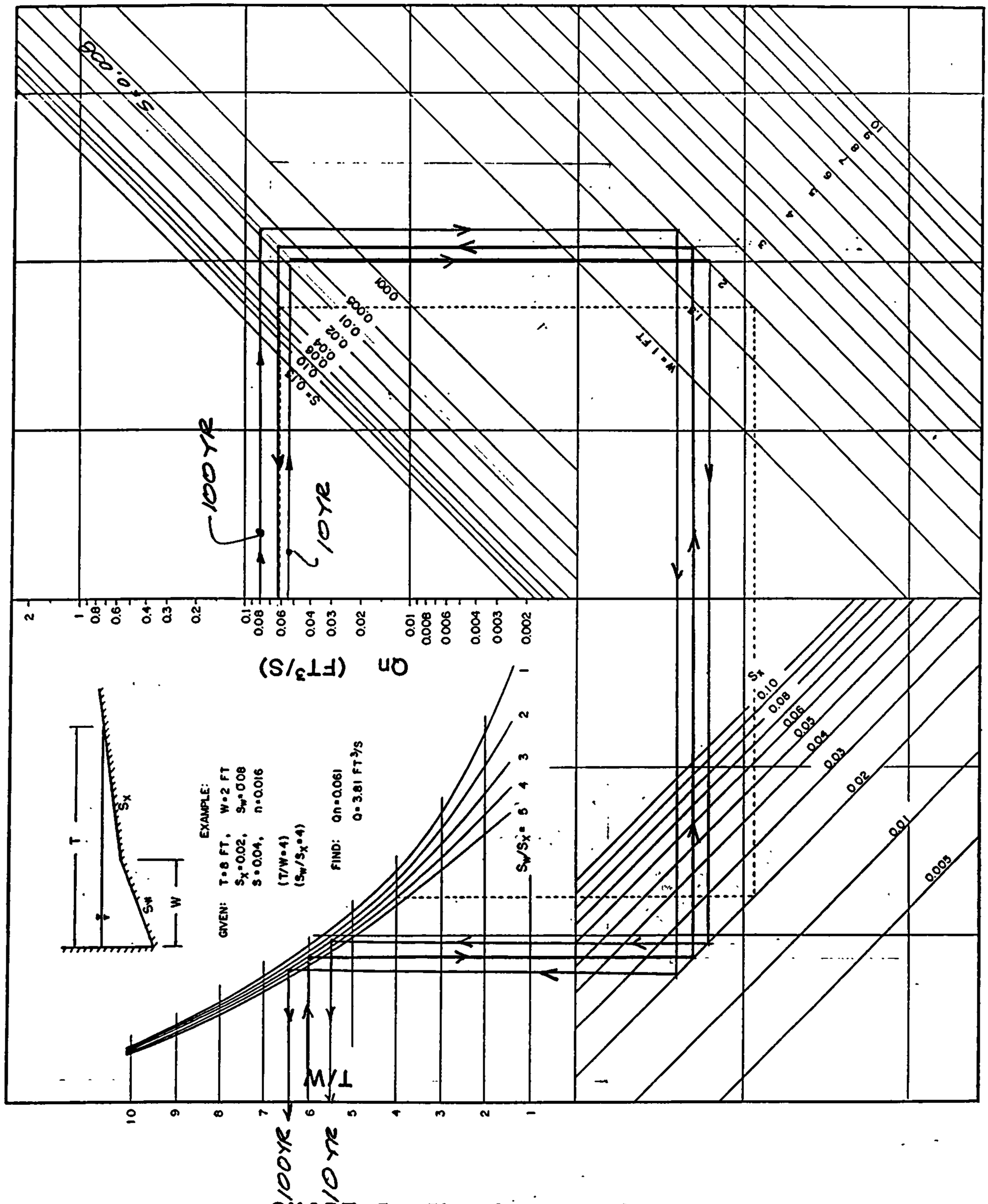
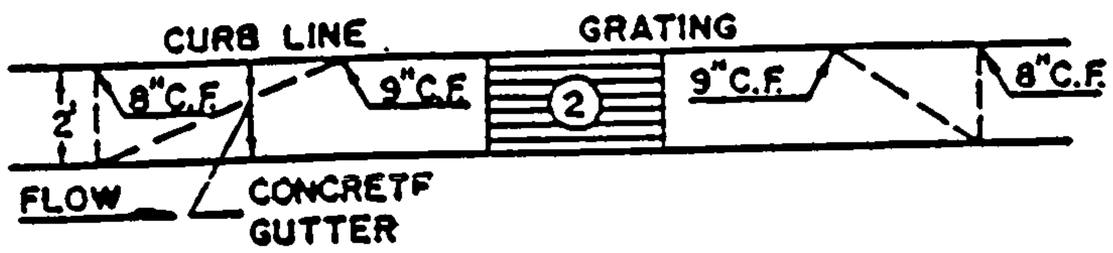
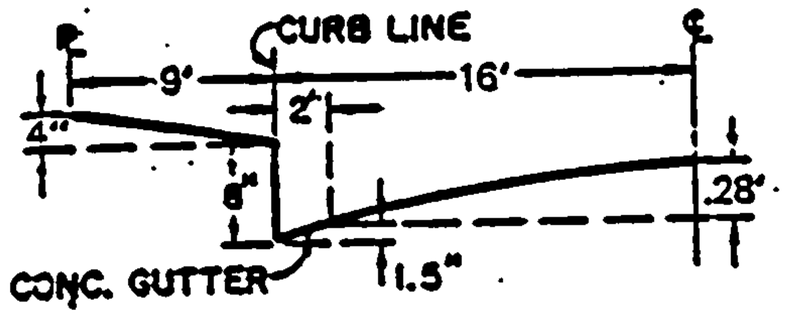


CHART 5. Flow in composite gutter sections.

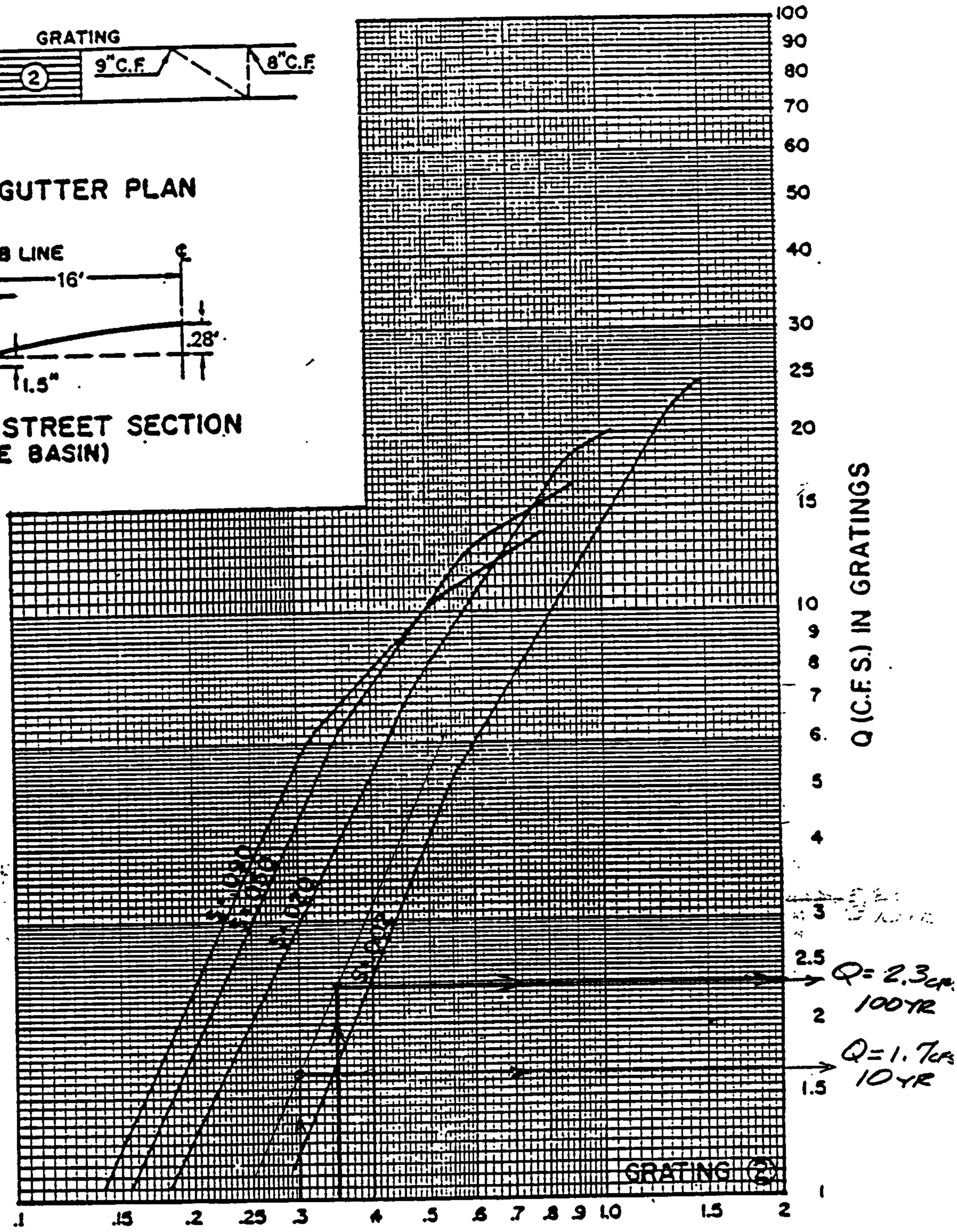
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION (ABOVE BASIN)



D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

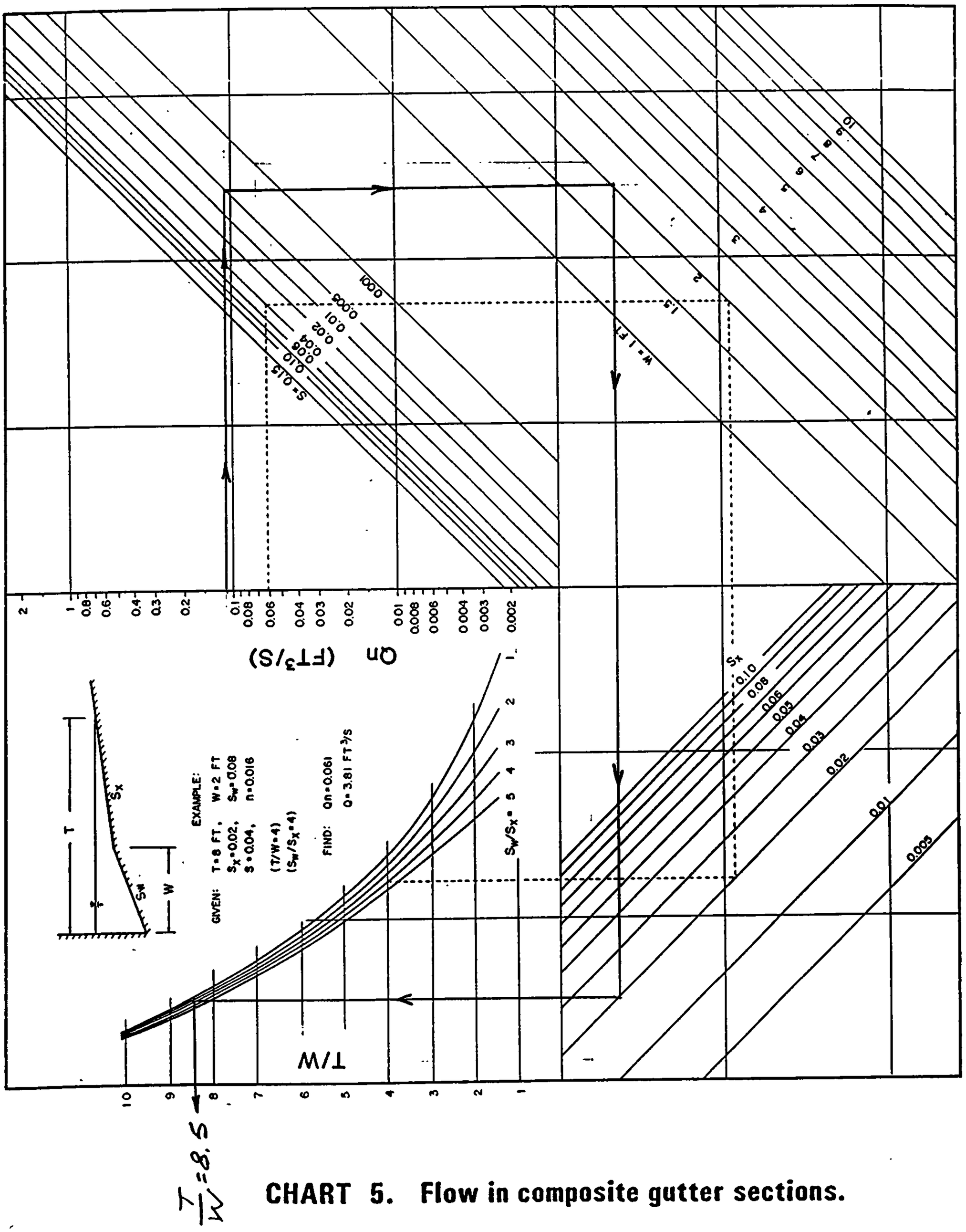
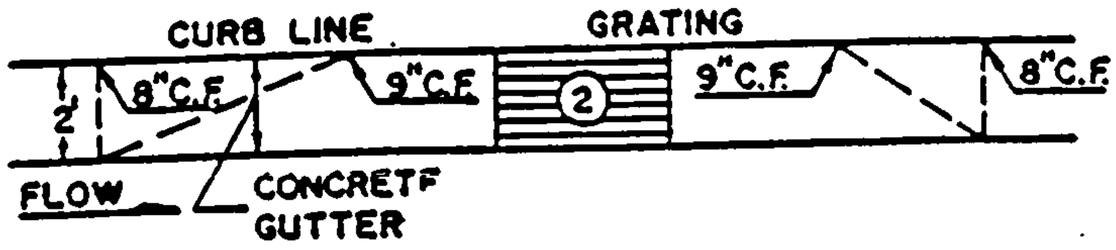
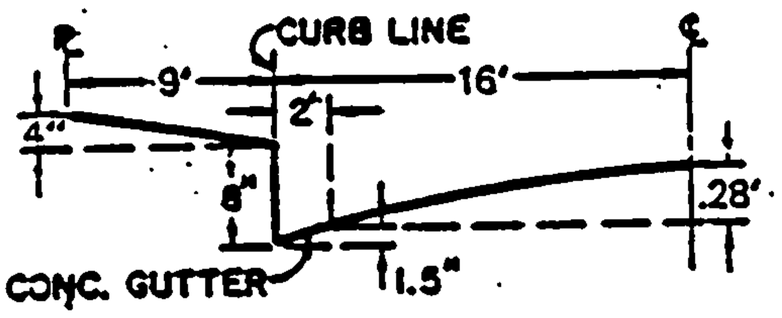


CHART 5. Flow in composite gutter sections.

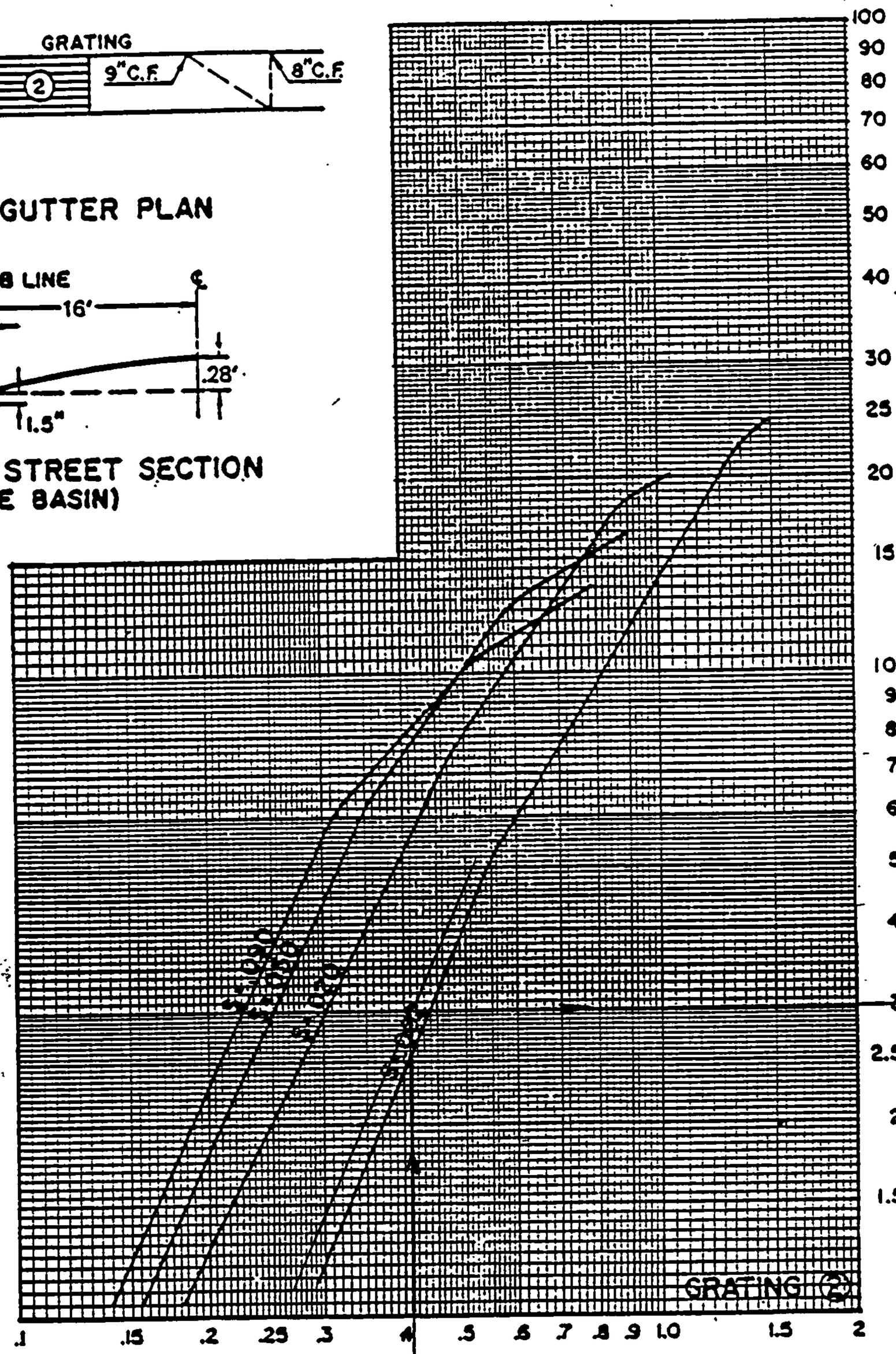
GRATING CAPACITIES FOR TYPE "A", "C" and "D"



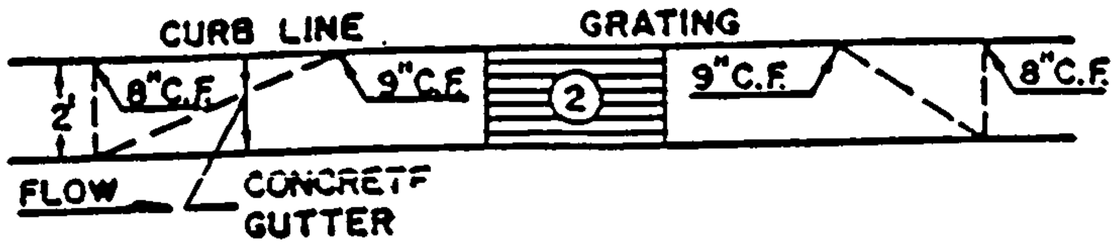
GRATING & GUTTER PLAN



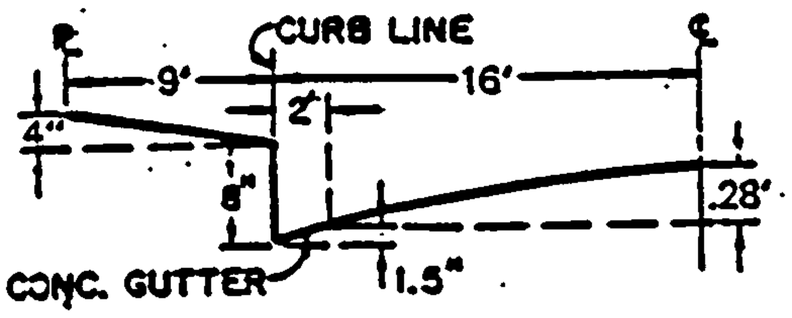
TYPICAL HALF STREET SECTION
(ABOVE BASIN)



GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)