2001P055

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

FINAL DRAINAGE REPORT
FOR
WIGWAM CREEK - PHASE I
MARICOPA COUNTY, ARIZONA

July 6, 2000
1st Revised: February 26, 2001
2nd Revision: March 26, 2001
3rd Revision: March 30, 2001
4th Revision: April 3, 2001

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014

CVL Project No. 98-0098-07-08

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

2801 West Durango Street, Phoenix, Arizona 85009 (602) 506-1501

PERMIT TO USE FLOOD CONTROL DISTRICT RIGHT-OF-WAY

Filing Fee	$25.00	Permit No.	2001P055
Inspection Fee	$240.00	Effective Date	11/2/01
Bond Amount	$10,000.00	Expiration Date	11/16/01
Easement Deposit		**Extended Expiration Date:**	6-21-02
Rent Fee		**Extension Fees:**	$830.00

Div Mgr 3/26

Received by 3/21

This Agreement made by and between the Flood Control District of Maricopa County, hereinafter referred to as DISTRICT, and CHI CONSTRUCTION COMPANY hereinafter referred to as PERMITEE. The DISTRICT hereby grants, pursuant to the terms and conditions appearing below upon the reverse side hereof, a revocable permit to enter upon, occupy and use, at PERMITEE's sole expense, right-of-way described as follows and as shown on Exhibit 'A':

NW CORNER OF COLTER CHANNEL AND CAMELBACK ROA

The right-of-way is to be used for the sole and express purpose of:

CONSTRUCT OUTFALL STRUCTURES TO THE COLTER CHANNEL

Stipulations:

Because the DISTRICT holds an easement interest only in the affected parcel(s), rent is not being charged. Therefore, PERMITEE is responsible for obtaining any necessary permits/approvals from the underlying fee owner. Furthermore, PERMITEE is also responsible for obtaining all necessary dust control permits.

The DISTRICT can accept stormwater runoff only. Therefore, no dry weather discharges or flows from other causes will be allowed.

This permit allows installation of one inlet on the north side of Colter Channel, immediately west of the box culvert installation, as depicted on Sheet 7 of the approved plans. All other uses of DISTRICT right-of-way must be authorized in writing by the DISTRICT.

The grouted rip-rap turndowns must be installed along the entire perimeter of the structure. The turndowns must be approved by the DISTRICT'S inspector prior to backfill. Furthermore, erosion protection must be placed between the DISTRICT'S maintenance road and the property line. An on-site meeting with the DISTRICT is required prior to installation of the erosion protection.

All DISTRICT right-of-way, including, but not limited to, the maintenance road, fencing, and landscaping shall be restored to original or better condition, to the satisfaction of the DISTRICT'S inspector.

All work shall be performed in a safe workman like manner to the satisfaction and approval of the Flood Control District. Notify Jonathon Hughes, Permits Inspector, at (602) 506-4727 or Shelby Brown at (602) 506-4583, 48 hours prior to any work and upon completion. The contractor is responsible for having a copy of this Permit onsite at all times while work is being performed in District rights of way. As-builts plans sealed by an Arizona registered engineer or land surveyor and District gate key, if provided, must be submitted to the District before release of any construction bond that is retained.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

By: Mike Wilson

Jim Schwartzmann
Manager, Land Management Division

Date: 11/01/01

FINAL INSPECTION:

By: Mike Chamberlain

Title: PW Inspector

Date: 11-03-04

PERMITEE:

Name: CHI CONSTRUCTION COMPANY

Address: 7001 N. SCOTTSDALE ROAD, SUITE 2050
SCOTTSDALE AZ 85253

Phone: 480-200-9875

By: [illegible]

Title: Land Development

Date: 11/2/01

ref:
Permit Number: 2001P055

Project:
DESCRIPTION:
Part of the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, parcels listed below:

ADDENDUM NO. 1

PERMIT 2001P055

The referenced permit is hereby modified to include the following terms and conditions:

1. Allow PERMITEE to install two (2) additional inlets as depicted in the plans approved by the DISTRICT.

2. The DISTRICT'S access to the structure may not be blocked under any circumstances.

3. All other terms and conditions in DISTRICT Permit 2001P055 remain in full force and effect.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

By: _____

Title: Division Manager of Land Division

Date: 3/26/02

CHI CONSTRUCTION COMPANY, PERMITEE

By: _____

Title: Land Development

Date: 3/26/02

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

2801 West Durango Street, Phoenix, Arizona 85009 (602) 506-1501

PERMIT TO USE FLOOD CONTROL DISTRICT RIGHT-OF-WAY

Filing Fee	$25.00	Permit No.	2001P055
Inspection Fee	$240.00	Effective Date	11/2/01
Bond Amount	$10,000.00	Expiration Date	11/16/01
Easement Deposit		**Extended Expiration Date:**	6-21-02
Rent Fee		**Extension Fee:**	$830.00

Div Mgr 1/26/02

Received by 3/21

This Agreement made by and between the Flood Control District of Maricopa County, hereinafter referred to as DISTRICT, and CHI CONSTRUCTION COMPANY hereinafter referred to as PERMITEE. The DISTRICT hereby grants, pursuant to the terms and conditions appearing below upon the reverse side hereof, a revocable permit to enter upon, occupy and use, at PERMITEE's sole expense, right-of-way described as follows and as shown on Exhibit 'A':

NW CORNER OF COLTER CHANNEL AND CAMELBACK ROA

The right-of-way is to be used for the sole and express purpose of:

CONSTRUCT OUTFALL STRUCTURES TO THE COLTER CHANNEL

Stipulations:

Because the DISTRICT holds an easement interest only in the affected parcel(s), rent is not being charged. Therefore, PERMITEE is responsible for obtaining any necessary permits/approvals from the underlying fee owner. Furthermore, PERMITEE is also responsible for obtaining all necessary dust control permits.

The DISTRICT can accept stormwater runoff only. Therefore, no dry weather discharges or flows from other causes will be allowed.

This permit allows installation of one inlet on the north side of Colter Channel, immediately west of the box culvert installation, as depicted on Sheet 7 of the approved plans. All other uses of DISTRICT right-of-way must be authorized in writing by the DISTRICT.

The grouted rip-rap turndowns must be installed along the entire perimeter of the structure. The turndowns must be approved by the DISTRICT'S inspector prior to backfill. Furthermore, erosion protection must be placed between the DISTRICT'S maintenance road and the property line. An on-site meeting with the DISTRICT is required prior to installation of the erosion protection.

All DISTRICT right-of-way, including, but not limited to, the maintenance road, fencing, and landscaping shall be restored to original or better condition, to the satisfaction of the DISTRICT'S inspector.

All work shall be performed in a safe workman like manner to the satisfaction and approval of the Flood Control District. Notify Jonathon Hughes, Permits Inspector, at (602) 506-4727 or Shelby Brown at (602) 506-4583, 48 hours prior to any work and upon completion. The contractor is responsible for having a copy of this Permit onsite at all times while work is being performed in District rights of way. As-builts plans sealed by an Arizona registered engineer or land surveyor and District gate key, if provided, must be submitted to the District before release of any construction bond that is retained.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

By: Mike Wilson

Jim Schwartzmann
Manager, Land Management Division

Date: 11/01/01

FINAL INSPECTION:

By: Mike Clemmer

Title: PW Inspector

Date: 11-03-04

PERMITEE:

Name: CHI CONSTRUCTION COMPANY

Address: 7001 N. SCOTTSDALE ROAD, SUITE 2050
SCOTTSDALE AZ 85253

Phone: 480-200-9875

By: [illegible]

Title: Land Development

Date: 11/2/01

CONDITIONS AND SPECIFICATIONS

1. Permitee warrants and represents that he and/or his Contractor(s) are qualified to perform the undertaking which is the subject of this Permit and agrees to obtain such other licenses, permits and agreements as may be required by other appropriate governmental agencies. This Permit is subject to all prior unexpired permits, agreements, easements, privileges or other rights, whether recorded or unrecorded, and Permitee shall make his own arrangements with holders of such prior rights.

2. Approved construction of improvements in District right-of-way shall be completed and maintained in conformity with all applicable safety standards and regulations and in a manner so as to avoid the creation of potentially dangerous conditions and harm to others. All work shall conform to the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments as amended. Inspection by the District is not intended nor understood to be more than a determination that any specifications set forth herein have been complied with by Permitee and is not to be considered as an approval or ratification by the District of the quality or fitness of Permitee's improvements.

3. Permitee shall be liable for any and all damages to the property of the District or of any other party by reason of the exercise of the privilege herein given. Permitee further agrees to indemnify and hold harmless the District, its agents, officers, employees, successors or assigns against any and all claims, actions, costs or expenses for property damages loss or expense that is attributable to bodily injury, sickness, disease, death, or personal injuries caused by or related to the rights herein granted, except those caused solely and exclusively by the negligence of the District.

4. Permitee shall not generate, manufacture, refine, transport, dispose, produce, process, handle, use, store or treat any Hazardous or Extremely Hazardous Substance, Hazardous Waste, Special Waste or Solid Waste on the property, or use the property in such a manner as to create an environmental or public health hazard or nuisance, as these terms are defined by any federal, state, or local laws, statutes or rules or regulations. Permitee shall defend, indemnify and hold District harmless from and against all claims, demands, actions, judgments, settlements, liens, penalties, damages, losses, injuries costs and expenses (including reasonable attorneys' fees) arising out of or in any way related to Permitee's failure to comply with the provisions of this paragraph.

5. In the event the use of the property does not comply with applicable plans, conditions, specifications, provisions and limitations stated herein, or upon revocation of this Permit, the Permitee, if required by the District, shall remove at its own cost, within ten (10) days after written notice, any improvements or installations placed on the right-of-way. In case of failure of the Permitee to so remove any improvements or installations, or to provide proper and continuous maintenance and repair, the District may thereupon remove the same or provide appropriate maintenance and Permitee agrees to promptly reimburse the District for actual cost thereof including all legal fees and costs, if any.

6. No assignment of this Permit or any interest therein and no subpermit for any purpose shall be made or granted by Permitee without the prior written consent of the District.

7. In the event any property belonging to, or the area occupied by the Permitee interferes with or is needed to construct, maintain or relocate any District structure, Permitee shall at his own expense, relocate, remove, lower or raise such property, within a reasonable time, when requested to do so by the District in writing.

8. Permitee shall advise the District in writing of the anticipated start of work covered by this Permit at least three (3) working days prior to the start of work. All work shall be done subject to the supervision of, and to the satisfaction of, the District. Activities and uses authorized under this Permit are subject to any instructions of the District, and all such instructions must be strictly observed.

9. Permitee shall file and maintain, during the term of occupancy with the District, a certificate of insurance indicating coverage for public liability including premises and contractual coverage with limits no less than $500,000 per person and $1,000,000 per occurrence for bodily injury and $500,000 for property damage. Said insurance shall name the Flood Control District of Maricopa County as additional insured and be primary. It shall be the sole responsibility of the Permitee to maintain coverage in force in compliance with the above provisions.

10. Notwithstanding the expiration date above, this Permit is revocable by the District upon 10 days written notice to the Permitee.

11. It is mutually understood and agreed that this permit shall be governed by the laws of the State of Arizona, both as to interpretation and performance. Any action at law, suit in equity, or judicial proceeding for the enforcement of this permit, or any provision thereof, shall be instituted only in the courts of the State of Arizona.

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

FINAL DRAINAGE REPORT
FOR
WIGWAM CREEK - PHASE I
MARICOPA COUNTY, ARIZONA

July 6, 2000
Revised: February 26, 2001
2nd Revision: March 26, 2001
3rd Revision: March 30, 2001
4th Revision: April 3, 2001

Prepared for:

Continental Homes, Inc.
7001 North Scottsdale Road, Suite 2050
Scottsdale, Arizona 85253
(602) 483-0006

Prepared by:

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, AZ 85014
(602) 264-6831

CVL Project No. 98-0098-07-08

CVL

Final Drainage Report
for
Wigwam Creek
Maricopa County, Arizona

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1
- 1.1 Scope 1
- 1.2 Site Description 1
- 1.3 Development 2
- 1.4 Regulatory Jurisdiction 2

2.0 HYDROLOGIC SETTING 3
- 2.1 Topography 3
- 2.2 Regional Hydrology 3

3.0 MANAGEMENT OF OFF-SITE STORMWATER RUNOFF 4

4.0 MANAGEMENT OF ON-SITE STORMWATER RUNOFF 5
- 4.1 On-Site Hydrology 5
- 4.2 On-Site Stormwater Runoff Management Plan 5
- 4.3 On-site Retention 5

5.0 FLOOD ZONE INFORMATION 6

6.0 SUMMARY AND CONCLUSIONS 7

7.0 REFERENCES 8

FIGURES

Figure 1 Location Map
Figure 2 Vicinity Map
Figure 3 Flood Insurance Rate Map

APPENDICES

Appendix A Hydrology and Street Hydraulics Calculations
Appendix B Catch Basin and Depressed Curb Calculations
Appendix C Storm Drain Calculations
Appendix D Retention Basin Calculations
Appendix E Greenbelt Channel Hydraulics
Appendix F Excerpt from Preliminary Drainage Report
Appendix G FCD Table
Appendix H Off-site Swale Calculations **& Drainage Exhibit**

PLATES

Plate 1 Drainage Map

1.0 INTRODUCTION

1.1 Scope

Coe & Van Loo Consultants, Inc. (CVL), has been contracted by the Continental Homes, Inc. to provide engineering services in support of a proposed residential development, on the northwest corner of Camelback Road and El Mirage Road. The purpose of this report is to provide hydrologic and hydraulic analyses of phase I of the site. In addition, this report addresses off-site drainage, on-site drainage and retention.

This report is focused on providing practical design information, evaluation, and calculations for statistical flood events up to and including the 100-year frequency flood. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation conforms to currently applicable ordinances, regulations and policies effected by the appropriate jurisdictional regulatory authorities for the referenced site.

The analysis presented herein focuses on evaluating stormwater runoff resulting from a statistical evaluation of storm events of particular duration and frequency up to and including a 100-year frequency event. A storm event exceeding the 100-year event may cause or create the risk of greater flood impact than is addressed and presented in this assessment. However, the scope of this assessment does not include, neither did CVL's client request that, evaluation of stormwater runoff resulting from storm events exceeding the 100-year frequency event. CVL assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development cost resulting from or related to any such events, nor shall CVL be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

1.2 Site Description

The site is located in the western part of the Phoenix metropolitan area on the northwest corner of Camelback Road and El Mirage Road, in Maricopa County, Arizona (Figures 1 and 2). The entire site is bounded by Camelback Road on the south, El Mirage Road on the east, Bethany Home Road on the north and a residential development on the west. The site's location can be further described as within the eastern portion of Section 14, Township 2 North, Range 1 West,

of the Gila and Salt River Meridian, Maricopa County, Arizona. Furthermore, the site has a United States Postal Zip Code of 85037.

The site is currently used for farmland (row crops) and encompasses approximately 320 acres. The Airline Canal, a concrete lined irrigation channel passes through the northwest portion of the site and along the west site boundary. The channel conveys irrigation water to the farm fields on the site and to users downstream. The man-made, east-west aligned Colter Channel passes through the site and intercepts sheet flow that moves downslope from the north. No buildings or other structures were observed to be on the site.

1.3 Development

The site will be developed as a single-family residential subdivision containing lots of varying sizes. Open space will be provided in locations throughout the site, positioned to reduce the need for storm drain systems. Camelback Road, El Mirage Road and 127th Avenue will provide ingress and egress to the site.

1.4 Regulatory Jurisdiction

The site is currently situated within the jurisdiction of Maricopa County. The site is designed to meet the Flood Control District of Maricopa County (FCDMC) standards as described in the *Drainage Design Manual for Maricopa County, Volumes I and II* (References 1 and 2).

2.0 HYDROLOGIC SETTING

2.1 Topography

The site is located in an alluvial basin that is typical of the central and southern Arizona basin and range physiographic provence. The site location can be found on the United States Geological Survey 7.5 minute quadrangle map entitled El Mirage (Reference 3). The elevations range from approximately 1065 feet to 1026 feet. Existing ground slopes downward generally to the southeast at approximately 0.7 percent.

2.2 Regional Hydrology

Regional drainage patterns direct stormwater runoff generally to the east and southeast toward the Agua Fria River located approximately 1 mile east of the site. The historical land use is agricultural but is currently undergoing a transformation to a mix of agricultural, residential, and commercial uses.

The Flood Control District of Maricopa County (FCDMC) has conducted watershed planning studies which address the hydrologic and hydraulic conditions of the area. The results of these studies are presented in the Reference 4, *White Tanks Drainage Master Study* (WTADMS). The WTADMS was later modified for the Colter Channel design and two reports were produced: *Hydrology of Colter Channel, Flood Control District of Maricopa County*, July 1992 (Reference 5) and *Recommendation Report, Colter Channel Project CRSS Civil Engineers, Inc. and Wood Patel & Associates, Inc.*, November 1992 (Reference 6).

3.0 MANAGEMENT OF OFF-SITE STORMWATER RUNOFF

Off-site flows were addressed in the Wigwam Creek Preliminary Drainage Report (Reference 8). Off-site flows entering the site from the north and west will be carried in the greenbelt to the Colter Channel to be conveyed to the Agua Fria River. Flows along 127th Avenue, south of the Colter Channel, are intercepted by an existing canal that directs these flows south to Camelback Road. See Appendix E for the greenbelt channel calculations and Appendix F for the off-site drainage plan.

Temporary drainage swales have been designed to intercept off-site flows at several locations. These swales will route the flows around the proposed Phase I design. North of Colter Channel these swales convey flow toward channel #12 & Colter Channel. South of Colter Channel a swale is designed to outfall into Retention Basin R2, which has been designed to handle a portion of the Phase II retention requirements.

4.0 MANAGEMENT OF ON-SITE STORMWATER RUNOFF

4.1 On-Site Hydrology

The on-site hydrology is based on the rational method criteria as recommended by the FCDMC Hydrology Manual (Reference 10). Drainage sub-basins have been delineated based on the parcel lot layouts and the final grading plans. Times of concentration have been based on FCDMC equation (Eqn. 3.2. Reference 2). For the on-site area, a C value of 0.52 was applied for the 10-year and 0.65 for the 100-year storm event. Refer to Plate 1 for on-site drainage patterns, and Appendix A for hydrology.

4.2 On-Site Stormwater Runoff Management Plan

Runoff from the site is from the lots to the adjacent interior streets. Phase 1 outfalls at several locations and is divided into different drainage areas as shown on Plate 1. Drainage Area 1 outfalls at CP-5 into retention basin R1 via depressed curb No. 1. Drainage Area 2 outfalls at CP-10 into retention basin R3 via SD# 1. Drainage Area 3 outfalls to the greenbelt channel at CP-17, CP-18, CP-19 and CP-12. The channel directs flow, southerly, to Colter Channel. Drainage Area 4 outfalls to Wigwam Creek Blvd. At CP-20, CP-21, CP-22 and CP-23. The combination of depressed curb No. 5 and Scupper No. 1 allows flows at CP-21 to outfall onto Wigwam Creek Blvd. where flows are intercepted at CP-26 via SD# 3 and discharged into the greenbelt channel.

The streets within the project have been designed to convey the 10-year strom below top of curb per Maricopa County requirements (Reference 2). Where the 10-year flow exceeds the capacity of the street, supplemental storm drain will be provided to intercept the excess flow. In addition, the 100-year flow will be less than 100 cfs in the street, with a maximum velocity of 12 feet per second. The 100-year flow depth will be at least 1 foot below finish floor elevations and no greater than 100 cfs within the roadway. Refer to Appendix A for street hydraulics calculations.

4.3 On-site Retention

For areas requiring on-site retention, basins will be designed to retain runoff from the 100-year, 2-hour storm. These basins shall be designed to drain in 36 hours as per Maricopa County design specifications. Discharge will occur through a bleed off system. See Appendix D for Retention Basin and bleed off Calculations.

5.0 FLOOD ZONE INFORMATION

The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (FIRM) panel number 04013C1615H, dated September 30, 1995 and revised per Letter of Map Revision dated August 5, 1977 (Reference 7), indicates (Figure 4) the subject site falls within Zones X and A. Zone A is a special flood hazard area inundated by the 100-year flood and is defined by FEMA as:

"No base flood elevations determined".

Zone X is defined by FEMA as:

"Areas of 500 year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from the 100-year flood."

The Zone A designated area is the ponding area behind the airline Canal and this zone will be removed through FEMA CLOMR/LOMR process. The ponding will be removed by relocating the canal in a storm drain (Figure 5). Therefore, no other measures of flood proofing other than those mentioned in the on-site stormwater runoff management plan (Section 4.2) will be required.

6.0 SUMMARY AND CONCLUSIONS

1. The site is protected from off-site flows by a channel along 127th Avenue, a greenbelt channel that discharges into Colter channel, and Colter channel.
2. For areas requiring on-site retention, basins have been designed to retain runoff from the 100-year, 2-hour storm.
3. The 10-year flow is to be conveyed within the street sections below the top of the sidewalk. The 100-year flow is contained at an elevation that is below the finish floor elevations and does not exceed an elevation of 0.5 foot above the crown of the road at any location.
4. The intent of this design includes utilizing streets for management of stormwater runoff. At numerous locations, the full street cross-section is needed for conveyance of the required design flow. Installation of speed bumps in these streets should be avoided at most locations as it will defeat the intent of the drainage design and may cause flooding.
5. The design of this project has been based on generally accepted engineering practices and in accordance with the Flood Control District of Maricopa County requirements.
6. The ponding area behind the Airline Canal, designated as Zone A, will be removed through the FEMA CLOMR/LOMR process.

7.0 REFERENCES

1. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology,* September 1992.

2. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics,* September 1992.

3. United States Geological Survey (U.S.G.S.) 7.5 minute quadrangle topographic map, *El Mirage, Arizona*, 1957 (photorevised 1982).

4. White Tanks/Agua Fria Area Drainage Master Study Technical Data Notebook: by The WLB Group, Inc., May 1992.

5. Hydrology of Colter Channel Contributory Drainage Area; Flood Control District of Maricopa County, July 1992.

6. Recommendation Report, Colter Channel Project CRSS Civil Engineers, Inc., and Wood Patel & Associates, Inc., November 1992.

7. Federal Emergency Management Agency Flood Insurance Rate Map (FIRM) Maricopa County, Arizona and Incorporated Areas, Panel Number 04013C1615H dated September 30, 1995.

8. Coe & Van Loo, Preliminary Drainage report for Wigwam Creek, August 17, 1999.

DOCUMENT QUALITY ASSURANCE

As part of CVL's policy to provide quality products to its clients, all reports are subject to review for technical accuracy, validity of conclusions and appropriateness of recommendations.

This document was prepared by: _____

Printed/Typed Name: *Brent Emmerton, E.I.T.*

Date: *April 3, 2001*

This document was prepared under the direction of: _____

Printed/Typed Name: *J. Doug Both, Project Manager*

Date: *April 3, 2001*

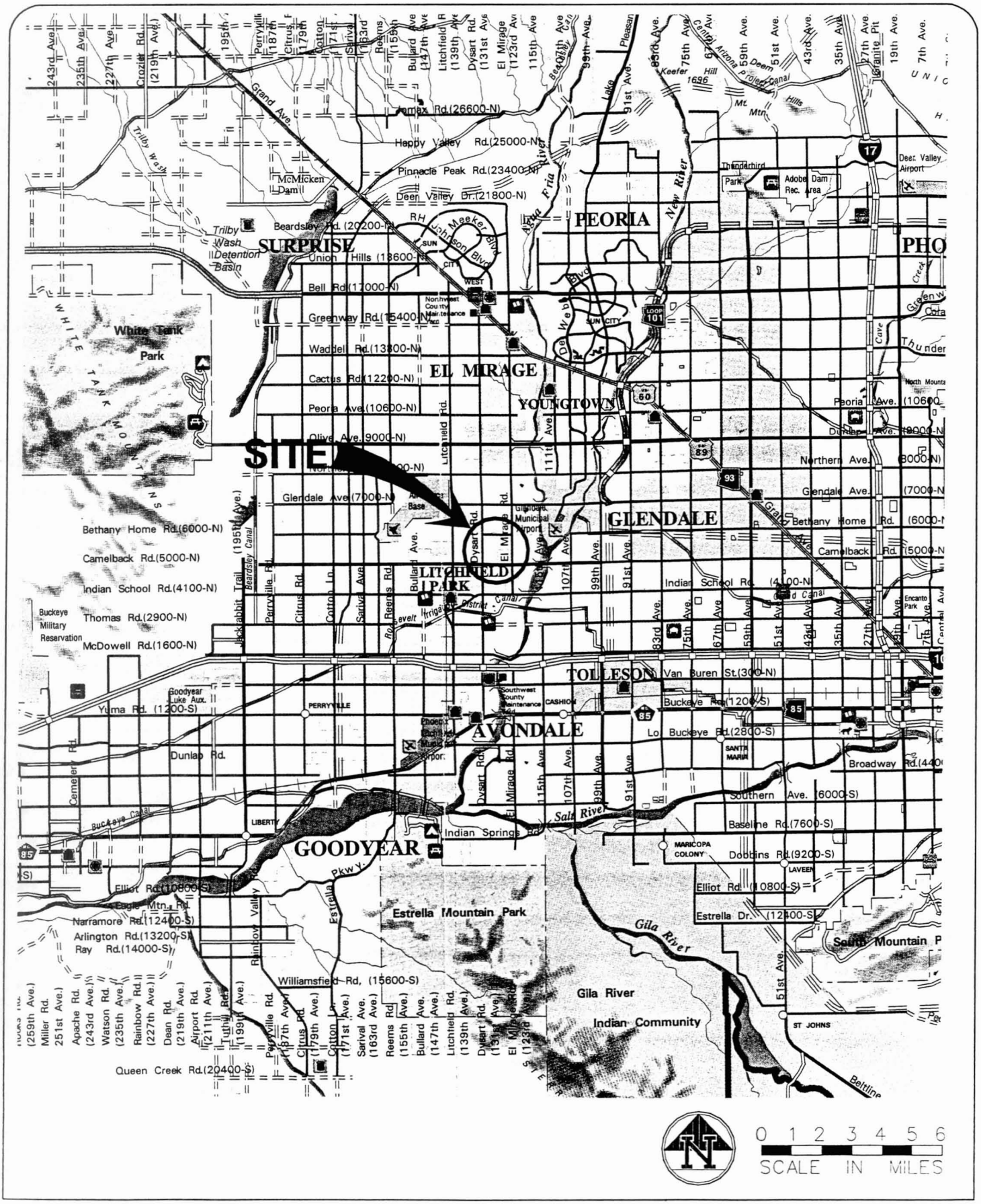
This document was peer reviewed by: _____

Printed/Typed Name: *Burke Lokey, P.E..*

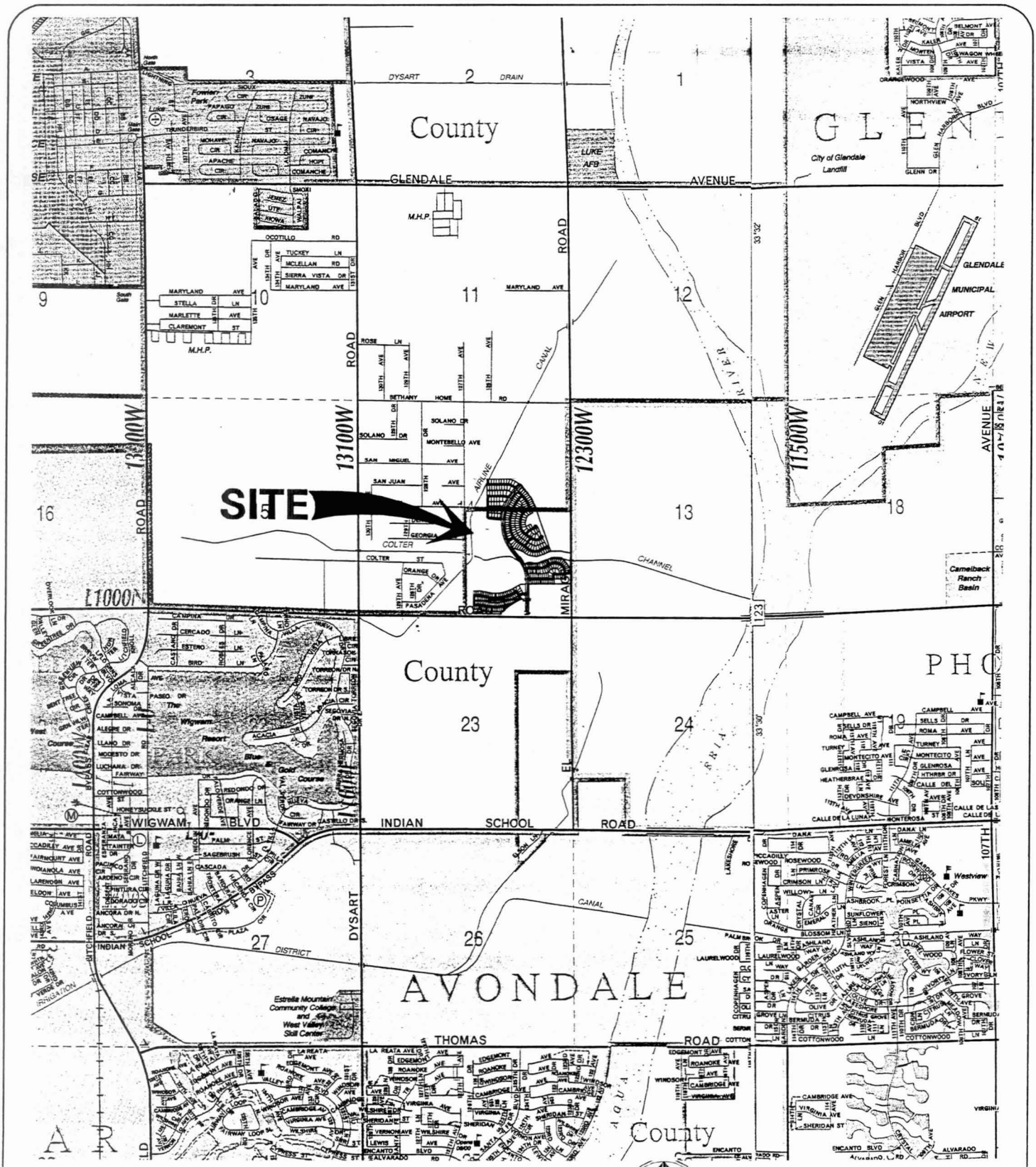
Date: *March 30, 2001*

CVL

FIGURES



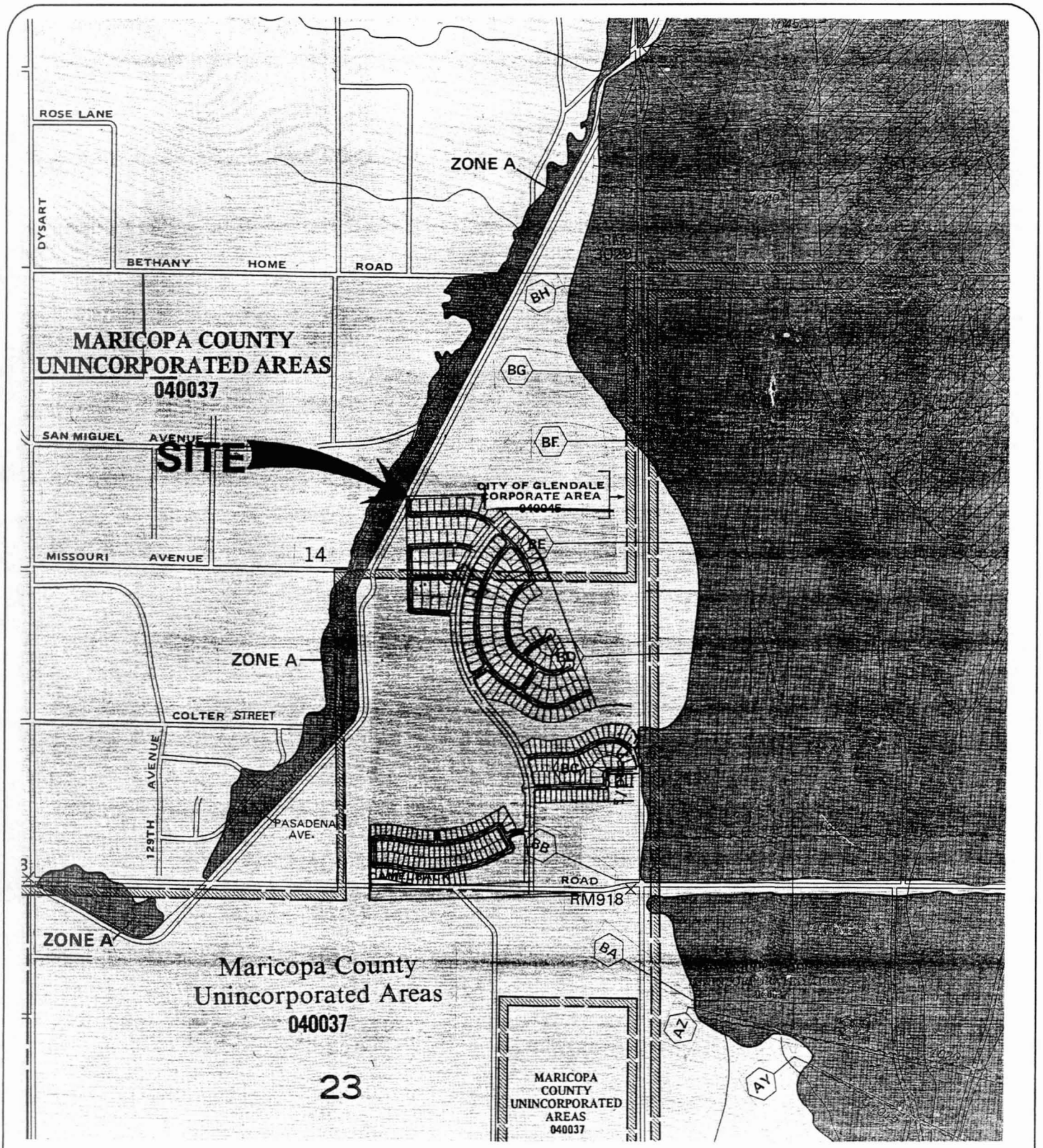
VICINITY MAP	WIGWAM CREEK	JOB NO 980098–07
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 1



© 1997 Wide World of Maps, Inc.
Reproduced With Permission No. 971013-A

0 .25 .5 1
SCALE IN MILES

LOCATION MAP	WIGWAM CREEK	JOB NO 980098-07
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 2



MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS
04013C1615 H REV. SEPT 30,1995

1000' 500' 0 1000'
SCALE IN FEET

FLOOD INSURANCE RATE MAP	WIGWAM CREEK	JOB NO 980098-07
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 3

APPENDIX A

Hydrology and Street Hydraulics Calculations

SUMMARY OF RATIONAL METHOD PEAK FLOW HYDROLOGY
Wigwam Creek

CP Concentration Point	Sub-basin Area (ac)	A Cum. Area (ac)	C Weighted Runoff Coefficient			i Intensity (in/hr)			Q Peak Flow Rate (cfs)			S Street Slope (%)	Flow Capacity (cfs)		Depth (ft) 100-year
			Return Period			Return Period			Return Period				4" Type 6"		
			10-Year	50-Year	100-Year	10-Year	50-Year	100-Year	10-Year	50-Year	100-Year		10-Year	10-Year	
1	4.99	4.99	0.52	0.62	0.65	4.4	6.4	7.4	11	20	24	0.46	11.0	35.5	0.44
2	2.16	7.15	0.52	0.62	0.65	4.0	5.9	6.8	15	26	32	0.25	8.0	25.6	0.53
3	4.11	4.11	0.52	0.62	0.65	4.2	6.1	7.1	9	16	19	0.36	9.7	31.4	0.42
4	2.06	6.17	0.52	0.62	0.65	3.6	5.4	6.2	12	21	25	0.36	9.7	31.4	0.46
5		13.32	0.52	0.62	0.65	3.9	5.8	6.8	27	49	59				
6	4.62	4.62	0.52	0.62	0.65	4.6	6.7	7.7	11	19	23	0.52	11.7	37.7	0.42
7	2.97	7.59	0.52	0.62	0.65	4.1	6.0	7.0	16	29	34	1.11	17.0	54.9	0.43
8	3.22	3.22	0.52	0.62	0.65	4.6	6.7	7.8	8	14	16	0.30	8.9	28.7	0.41
9	2.57	5.79	0.52	0.62	0.65	4.1	6.0	6.9	12	22	26	0.84	14.9	48.0	0.41
10		13.38	0.52	0.62	0.65	4.1	6.1	7.1	29	51	61				
11	4.17	4.17	0.52	0.62	0.65	4.2	6.2	7.2	9	16	19	0.33	9.3	30.0	0.43
12	3.98	7.80	0.52	0.62	0.65	3.5	5.2	6.1	14	26	31	0.33	9.3	30.0	0.50
13	3.27	3.27	0.52	0.62	0.65	4.6	6.7	7.7	8	14	16	0.25	8.0	25.6	0.42
14	2.58	5.85	0.52	0.62	0.65	3.9	5.8	6.7	12	21	25	0.25	8.0	25.6	0.49
15	3.00	8.85	0.52	0.62	0.65	3.6	5.3	6.2	16	29	36	0.25	8.0	25.6	0.56
16	3.48	3.48	0.52	0.62	0.65	4.5	6.6	7.6	8	14	17	0.25	8.0	25.6	0.43
17		12.33	0.52	0.62	0.65	3.6	5.4	6.2	23	41	50				
18	1.78	1.78	0.52	0.62	0.65	5.7	7.7	8.7	5	9	10	0.30	8.9	28.7	0.35
19	4.05	4.05	0.52	0.62	0.65	4.3	6.3	7.2	9	16	16	0.30	8.9	28.7	0.41
20	1.89	1.89	0.52	0.62	0.65	4.2	6.1	7.1	4	7	9	0.77	14.2	45.9	0.28
21	2.69	2.69	0.52	0.62	0.65	4.8	7.0	8.1	7	12	14	1.00	16.2	52.3	0.31

CVL

SUMMARY OF RATIONAL METHOD PEAK FLOW HYDROLOGY
Wigwam Creek

CP Concentration Point	Sub-basin Area (ac)	A Cum. Area (ac)	C Weighted Runoff Coefficient			i Intensity (in/hr)			Q Peak Flow Rate (cfs)			S Street Slope (%)	Flow Capacity (cfs)		Depth (ft)
			Return Period			Return Period			Return Period				4" Type 6"		100-year
			10-Year	50-Year	100-Year	10-Year	50-Year	100-Year	10-Year	50-Year	100-Year		10-Year	10-Year	
22	3.17	3.17	0.52	0.62	0.65	5.3	7.5	8.7	9	15	18	1.18	21.8	56.9	0.34
23	4.80	4.80	0.52	0.62	0.65	4.9	7.0	8.1	12	21	25	1.10	17.0	54.9	0.38
24	1.83	1.83	0.52	0.62	0.65	3.7	5.5	6.4	6	10	11	0.25		24.4	0.37
25	0.10	3.82	0.52	0.62	0.65	3.7	5.6	6.5	10	18	22	0.25		24.4	0.47
26	1.62	8.13	0.52	0.62	0.65	3.3	5.0	5.8	19	34	41	0.25		24.4	0.58
27	0.15	11.45	0.52	0.62	0.65	3.3	5.0	5.8	29	44	53	0.25		24.4	0.65
28	0.68	12.13	0.52	0.62	0.65	3.1	4.7	5.5	24	44	54	0.25		24.4	0.65
29	0.15	17.08	0.52	0.62	0.65	3.2	4.8	5.6	34	61	74	0.25		24.4	0.74*
30	0.40	17.98	0.52	0.62	0.65	3.1	4.7	5.5	34	61	75	0.25		24.4	0.75*
31	3.19	3.19	0.52	0.62	0.65	3.5	5.3	6.1	10	16	19	0.25		24.4	0.45
32	1.57	1.57	0.52	0.62	0.65	3.5	5.3	6.2	5	8	9	0.26		24.9	0.34

*Note: SD #3, SD #4 and SD #5 reduce the 100-year flow in the street to 45 cfs. Therefore, the depth of flow during the 100-year storm event is 0.60 ft.

CVL

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 1

Location: On-Site

Drainage Basin Data

Water Course Length: 1020.00 ft

Basin Area: 4.990 acres

High Elevation: 42.70 ft

Low Elevation: 35.01 ft

Average Slope: 0.0075 ft/ft

Roughness, Kb: 0.0356 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	10	11	16	20	24
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	11.7	10.3	9.7	8.8	8.4	7.9
i (in/hr)	2.6	3.7	4.4	5.6	6.4	7.4

Computed by: , CVL
Monday, June 12, 2000 1:13:40 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 2

Location: On-Site

Drainage Basin Data

Water Course Length: 1432.00 ft

Basin Area: 7.150 acres

High Elevation: 42.70 ft

Low Elevation: 33.23 ft

Average Slope: 0.0066 ft/ft

Roughness, Kb: 0.0347 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	9	12	15	21	26	32
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	14.9	13.1	12.2	11.1	10.5	10.0
i (in/hr)	2.3	3.3	4.0	5.1	5.9	6.8

Computed by: , CVL
Monday, June 12, 2000 1:13:41 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 3

Location: On-Site

Drainage Basin Data

Water Course Length: 892.00 ft

Basin Area: 4.110 acres

High Elevation: 39.40 ft

Low Elevation: 35.40 ft

Average Slope: 0.0045 ft/ft

Roughness, Kb: 0.0362 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	7	9	13	16	19
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	13.3	11.7	10.9	9.9	9.4	8.9
i (in/hr)	2.5	3.5	4.2	5.3	6.1	7.1

Computed by: , CVL
Monday, June 12, 2000 1:13:42 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 4

Location: On-Site

Drainage Basin Data

Water Course Length: 1500.00 ft

Basin Area: 6.170 acres

High Elevation: 39.50 ft

Low Elevation: 33.23 ft

Average Slope: 0.0042 ft/ft

Roughness, Kb: 0.0351 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	10	12	16	21	25
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	18.4	16.2	15.1	13.7	12.9	12.2
i (in/hr)	2.1	3.0	3.6	4.6	5.4	6.2

Computed by: , CVL
Monday, June 12, 2000 1:13:43 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 5

Location: On-Site

Drainage Basin Data

Water Course Length: 1500.00 ft

Basin Area: 13.320 acres

High Elevation: 42.70 ft

Low Elevation: 33.13 ft

Average Slope: 0.0064 ft/ft

Roughness, Kb: 0.0330 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	16	23	27	39	49	59
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	15.1	13.2	12.3	11.2	10.6	10.1
i (in/hr)	2.3	3.3	3.9	5.1	5.8	6.8

Computed by: , CVL
Monday, June 12, 2000 1:13:43 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 6

Location: On-Site

Drainage Basin Data

Water Course Length: 832.00 ft

Basin Area: 4.620 acres

High Elevation: 39.60 ft

Low Elevation: 33.59 ft

Average Slope: 0.0072 ft/ft

Roughness, Kb: 0.0358 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	9	11	15	19	23
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	10.6	9.3	8.7	8.0	7.6	7.2
i (in/hr)	2.8	3.8	4.6	5.8	6.7	7.7

Computed by: , CVL
Monday, June 12, 2000 1:13:44 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 7

Location: On-Site

Drainage Basin Data

Water Course Length: 1287.00 ft

Basin Area: 7.590 acres

High Elevation: 39.60 ft

Low Elevation: 30.96 ft

Average Slope: 0.0067 ft/ft

Roughness, Kb: 0.0345 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	10	13	16	23	29	34
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	13.8	12.2	11.4	10.3	9.8	9.3
i (in/hr)	2.4	3.4	4.1	5.2	6.0	7.0

Computed by: , CVL
Monday, June 12, 2000 1:16:18 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 8

Location: On-Site

Drainage Basin Data

Water Course Length: 632.00 ft

Basin Area: 3.220 acres

High Elevation: 37.40 ft

Low Elevation: 34.16 ft

Average Slope: 0.0051 ft/ft

Roughness, Kb: 0.0368 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	6	8	11	14	16
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	10.4	9.1	8.5	7.8	7.4	7.0
i (in/hr)	2.8	3.9	4.6	5.9	6.7	7.8

Computed by: , CVL
Monday, June 12, 2000 1:16:19 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 9

Location: On-Site

Drainage Basin Data

Water Course Length: 1153.00 ft

Basin Area: 5.790 acres

High Elevation: 37.40 ft

Low Elevation: 30.96 ft

Average Slope: 0.0056 ft/ft

Roughness, Kb: 0.0352 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	10	12	17	22	26
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	14.1	12.4	11.5	10.5	10.0	9.4
i (in/hr)	2.4	3.4	4.1	5.2	6.0	6.9

Computed by: , CVL
Monday, June 12, 2000 1:16:20 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 10

Location: On-Site

Drainage Basin Data

Water Course Length: 1287.00 ft

Basin Area: 13.380 acres

High Elevation: 39.60 ft

Low Elevation: 30.96 ft

Average Slope: 0.0067 ft/ft

Roughness, Kb: 0.0330 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	17	24	29	41	51	61
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	13.4	11.8	11.0	10.0	9.5	9.0
i (in/hr)	2.5	3.5	4.1	5.3	6.1	7.1

Computed by: , CVL
Monday, June 12, 2000 1:16:20 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 11

Location: On-Site

Drainage Basin Data

Water Course Length: 850.00 ft

Basin Area: 4.170 acres

High Elevation: 40.23 ft

Low Elevation: 36.36 ft

Average Slope: 0.0046 ft/ft

Roughness, Kb: 0.0361 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	8	9	13	16	19
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	12.8	11.3	10.5	9.6	9.1	8.6
i (in/hr)	2.5	3.5	4.2	5.4	6.2	7.2

Computed by: , CVL
Tuesday, March 06, 2001 3:01:44 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 12

Location: On-Site

Drainage Basin Data

Water Course Length: 1531.00 ft

Basin Area: 7.800 acres

High Elevation: 40.00 ft

Low Elevation: 34.44 ft

Average Slope: 0.0036 ft/ft

Roughness, Kb: 0.0344 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	8	12	14	20	26	31
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	19.5	17.1	15.9	14.4	13.6	12.9
i (in/hr)	2.0	2.9	3.5	4.5	5.2	6.1

Computed by: , CVL
Monday, June 12, 2000 1:16:22 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 13

Location: On-Site

Drainage Basin Data

Water Course Length: 635.00 ft

Basin Area: 3.270 acres

High Elevation: 40.10 ft

Low Elevation: 37.06 ft

Average Slope: 0.0048 ft/ft

Roughness, Kb: 0.0368 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	7	8	11	14	16
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	10.7	9.4	8.8	8.0	7.6	7.2
i (in/hr)	2.7	3.8	4.6	5.8	6.7	7.7

Computed by: , CVL
Monday, June 12, 2000 1:16:22 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 14

Location: On-Site

Drainage Basin Data

Water Course Length: 1075.00 ft

Basin Area: 5.850 acres

High Elevation: 40.10 ft

Low Elevation: 35.99 ft

Average Slope: 0.0038 ft/ft

Roughness, Kb: 0.0352 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	10	12	17	21	25
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	15.6	13.7	12.7	11.6	11.0	10.4
i (in/hr)	2.3	3.2	3.9	5.0	5.8	6.7

Computed by: , CVL
Monday, June 12, 2000 1:16:23 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 15

Location: On-Site

Drainage Basin Data

Water Course Length: 1497.00 ft

Basin Area: 8.850 acres

High Elevation: 40.10 ft

Low Elevation: 34.35 ft

Average Slope: 0.0038 ft/ft

Roughness, Kb: 0.0341 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	10	14	16	23	29	36
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	18.7	16.4	15.2	13.9	13.1	12.4
i (in/hr)	2.1	2.9	3.6	4.6	5.3	6.2

Computed by: , CVL
Monday, June 12, 2000 1:16:24 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 16

Location: On-Site

Drainage Basin Data

Water Course Length: 699.00 ft

Basin Area: 3.480 acres

High Elevation: 37.80 ft

Low Elevation: 34.35 ft

Average Slope: 0.0049 ft/ft

Roughness, Kb: 0.0366 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	7	8	11	14	17
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	11.1	9.8	9.2	8.4	7.9	7.5
i (in/hr)	2.7	3.8	4.5	5.7	6.6	7.6

Computed by: , CVL
Monday, June 12, 2000 1:16:25 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 17

Location: On-Site

Drainage Basin Data

Water Course Length: 1497.00 ft

Basin Area: 12.330 acres

High Elevation: 40.10 ft

Low Elevation: 34.35 ft

Average Slope: 0.0038 ft/ft

Roughness, Kb: 0.0332 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	14	19	23	33	41	50
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	18.4	16.1	15.0	13.6	12.9	12.2
i (in/hr)	2.1	3.0	3.6	4.6	5.4	6.2

Computed by: , CVL
Monday, June 12, 2000 1:16:25 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 18

Location: On-Site

Drainage Basin Data

Water Course Length: 80.00 ft

Basin Area: 1.780 acres

High Elevation: 37.70 ft

Low Elevation: 34.06 ft

Average Slope: 0.0455 ft/ft

Roughness, Kb: 0.0384 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	3	5	5	7	9	10
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	4.9	5.7	6.7	7.7	8.7

Computed by: , CVL
Monday, June 12, 2000 1:16:26 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 19

Location: On-Site

Drainage Basin Data

Water Course Length: 855.00 ft

Basin Area: 4.050 acres

High Elevation: 37.90 ft

Low Elevation: 33.80 ft

Average Slope: 0.0048 ft/ft

Roughness, Kb: 0.0362 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	7	9	13	16	19
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	12.6	11.1	10.4	9.5	9.0	8.5
i (in/hr)	2.5	3.6	4.3	5.4	6.3	7.2

Computed by: , CVL
Monday, June 12, 2000 1:16:27 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 20

Location: On-Site

Drainage Basin Data

Water Course Length: 1072.00 ft

Basin Area: 1.890 acres

High Elevation: 45.20 ft

Low Elevation: 38.25 ft

Average Slope: 0.0065 ft/ft

Roughness, Kb: 0.0383 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	2	3	4	6	7	9
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	13.4	11.8	11.0	10.0	9.5	9.0
i (in/hr)	2.5	3.5	4.2	5.3	6.1	7.1

Computed by: , CVL
Monday, June 12, 2000 1:16:27 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 21

Location: On-Site

Drainage Basin Data

Water Course Length: 640.00 ft

Basin Area: 2.690 acres

High Elevation: 42.72 ft

Low Elevation: 38.09 ft

Average Slope: 0.0072 ft/ft

Roughness, Kb: 0.0373 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	4	6	7	9	12	14
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	9.3	8.2	7.6	7.0	6.6	6.3
i (in/hr)	2.9	4.1	4.8	6.1	7.0	8.1

Computed by: , CVL
Monday, June 12, 2000 1:16:28 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 22

Location: On-Site

Drainage Basin Data

Water Course Length: 602.00 ft

Basin Area: 3.170 acres

High Elevation: 44.00 ft

Low Elevation: 36.95 ft

Average Slope: 0.0117 ft/ft

Roughness, Kb: 0.0369 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	5	7	9	12	15	18
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	7.4	6.6	6.1	5.7	5.4	5.1
i (in/hr)	3.2	4.4	5.3	6.5	7.5	8.7

Computed by: , CVL
Monday, June 12, 2000 1:16:29 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 23

Location: On-Site

Drainage Basin Data

Water Course Length: 850.00 ft

Basin Area: 4.800 acres

High Elevation: 45.70 ft

Low Elevation: 36.33 ft

Average Slope: 0.0110 ft/ft

Roughness, Kb: 0.0357 (A)

10-Year Runoff Coefficient: 0.520

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	7	10	12	17	21	25
C	0.520	0.520	0.520	0.572	0.624	0.650
Tc (min)	9.1	8.1	7.5	6.9	6.6	6.2
i (in/hr)	2.9	4.1	4.9	6.1	7.0	8.1

Computed by: , CVL
Monday, June 12, 2000 1:16:30 p

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 24

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 884.00 ft

Basin Area: 1.830 acres

High Elevation: 40.23 ft

Low Elevation: 37.99 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0384 (A)

10-Year Runoff Coefficient: 0.900

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	4	5	6	8	10	11
C	0.900	0.900	0.900	0.950	0.950	0.950
Tc (min)	17.1	15.0	13.9	12.7	12.0	11.3
i (in/hr)	2.2	3.1	3.7	4.8	5.5	6.4

Computed by: , CVL
Tuesday, June 27, 2000 9:06:33 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 25

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 925.00 ft

Basin Area: 3.820 acres

High Elevation: 40.23 ft

Low Elevation: 37.89 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0364 (A)

10-Year Runoff Coefficient: 0.710

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	6	8	10	14	18	22
C	0.710	0.710	0.710	0.781	0.852	0.888
Tc (min)	17.0	14.9	13.9	12.6	11.9	11.3
i (in/hr)	2.2	3.1	3.7	4.8	5.6	6.5

Computed by: , CVL
Friday, June 23, 2000 9:44:19 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 26

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1455.00 ft

Basin Area: 8.130 acres

High Elevation: 40.23 ft

Low Elevation: 36.56 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0343 (A)

10-Year Runoff Coefficient: 0.690

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	11	15	19	26	34	41
C	0.690	0.690	0.690	0.759	0.828	0.862
Tc (min)	21.7	19.0	17.7	16.1	15.1	14.3
i (in/hr)	1.9	2.7	3.3	4.3	5.0	5.8

Computed by: . CVL
Friday, June 23, 2000 9:44:20 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 27

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1502.00 ft

Basin Area: 11.450 acres

High Elevation: 40.23 ft

Low Elevation: 36.43 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0334 (A)

10-Year Runoff Coefficient: 0.640

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	14	20	24	34	44	53
C	0.640	0.640	0.640	0.704	0.768	0.800
Tc (min)	21.7	19.0	17.7	16.1	15.1	14.3
i (in/hr)	1.9	2.7	3.3	4.3	5.0	5.8

Computed by : CVL
Friday, June 23, 2000 9:44:20 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author : Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 28

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1717.00 ft

Basin Area: 12.130 acres

High Elevation: 40.23 ft

Low Elevation: 36.43 ft

Average Slope: 0.0022 ft/ft

Roughness, Kb: 0.0332 (A)

10-Year Runoff Coefficient: 0.650

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	14	20	24	34	44	54
C	0.650	0.650	0.650	0.715	0.780	0.813
Tc (min)	24.8	21.8	20.2	18.4	17.2	16.2
i (in/hr)	1.8	2.5	3.1	4.0	4.7	5.5

Computed by: CVL
Friday, June 23, 2000 9:44:21 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 29

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1762.00 ft

Basin Area: 17.080 acres

High Elevation: 40.23 ft

Low Elevation: 35.75 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0323 (A)

10-Year Runoff Coefficient: 0.620

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	20	28	34	48	61	74
C	0.620	0.620	0.620	0.682	0.744	0.775
Tc (min)	23.5	20.6	19.1	17.4	16.3	15.4
i (in/hr)	1.8	2.6	3.2	4.1	4.8	5.6

Computed by: , CVL
Friday, June 23, 2000 9:44:22 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 30

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1890.00 ft

Basin Area: 17.480 acres

High Elevation: 40.23 ft

Low Elevation: 35.50 ft

Average Slope: 0.0025 ft/ft

Roughness, Kb: 0.0322 (A)

10-Year Runoff Coefficient: 0.620

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	19	28	34	48	61	75
C	0.620	0.620	0.620	0.682	0.744	0.775
Tc (min)	24.7	21.6	20.0	18.2	17.1	16.1
i (in/hr)	1.8	2.5	3.1	4.0	4.7	5.5

Computed by : CVL
Friday, June 23, 2000 9:44:23 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 31

Location: Wigwam Creek Parkway

Drainage Basin Data

Water Course Length: 1582.00 ft

Basin Area: 3.190 acres

High Elevation: 40.23 ft

Low Elevation: 33.05 ft

Average Slope: 0.0045 ft/ft

Roughness, Kb: 0.0369 (A)

10-Year Runoff Coefficient: 0.900

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	6	8	10	14	16	19
C	0.900	0.900	0.900	0.950	0.950	0.950
Tc (min)	19.1	16.7	15.6	14.1	13.3	12.6
i (in/hr)	2.1	2.9	3.5	4.5	5.3	6.1

Computed by: , CVL
Tuesday, June 27, 2000 9:06:47 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

RATIONAL FOR WINDOWS

Flood Control District of Maricopa County Rational Method

Project Information

Project Name: Wigwam

Project Description: On-Site Peak Flows

Drainage Point: 32

Location: Camelback Road

Drainage Basin Data

Water Course Length: 1432.00 ft

Basin Area: 1.570 acres

High Elevation: 38.50 ft

Low Elevation: 32.34 ft

Average Slope: 0.0043 ft/ft

Roughness, Kb: 0.0388 (A)

10-Year Runoff Coefficient: 0.900

10-Year 6 Hour Rainfall Depth: 2.00 inches

Hydrological Summary Table

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Q (cfs)	3	4	5	7	8	9
C	0.900	0.900	0.900	0.950	0.950	0.950
Tc (min)	18.9	16.6	15.4	14.0	13.2	12.5
i (in/hr)	2.1	2.9	3.5	4.6	5.3	6.2

Computed by: , CVL
Tuesday, June 27, 2000 9:06:54 a

File: N:\980098\HYDRO\RATIONAL\PHASE1.RAT

Author: Frank M. Gu, P.E.
Email: frank@netcom.com
URL: http://www.he.net/~esc/rational.html

RATIONAL FOR WINDOWS -- Version 1.0 Registered to Coe & Van Loo Consultants, Inc.
4550 North 12th Street, Phoenix, AZ 85014

Table
Rating Table for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\local st.fm2
Worksheet	Wigwam Local St 4" Roll Curb
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Water Surface Elevation	0.33 ft

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.002000	0.020000	0.000200 ft/ft

Rating Table

Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.002000	0.015	7.25	1.32
0.002200	0.015	7.60	1.38
0.002400	0.015	7.94	1.44
0.002600	0.015	8.27	1.50
0.002800	0.015	8.58	1.56
0.003000	0.015	8.88	1.62
0.003200	0.015	9.17	1.67
0.003400	0.015	9.45	1.72
0.003600	0.015	9.73	1.77
0.003800	0.015	9.99	1.82
0.004000	0.015	10.25	1.87
0.004200	0.015	10.51	1.91
0.004400	0.015	10.75	1.96
0.004600	0.015	11.00	2.00
0.004800	0.015	11.23	2.04
0.005000	0.015	11.46	2.09
0.005200	0.015	11.69	2.13
0.005400	0.015	11.91	2.17
0.005600	0.015	12.13	2.21
0.005800	0.015	12.35	2.25
0.006000	0.015	12.56	2.28
0.006200	0.015	12.77	2.32
0.006400	0.015	12.97	2.36
0.006600	0.015	13.17	2.40
0.006800	0.015	13.37	2.43
0.007000	0.015	13.57	2.47
0.007200	0.015	13.76	2.50

Table
Rating Table for Irregular Channel

Rating Table			
Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.007400	0.015	13.95	2.54
0.007600	0.015	14.13	2.57
0.007800	0.015	14.32	2.60
0.008000	0.015	14.50	2.64
0.008200	0.015	14.68	2.67
0.008400	0.015	14.86	2.70
0.008600	0.015	15.04	2.73
0.008800	0.015	15.21	2.77
0.009000	0.015	15.38	2.80
0.009200	0.015	15.55	2.83
0.009400	0.015	15.72	2.86
0.009600	0.015	15.89	2.89
0.009800	0.015	16.05	2.92
0.010000	0.015	16.21	2.95
0.010200	0.015	16.38	2.98
0.010400	0.015	16.53	3.01
0.010600	0.015	16.69	3.04
0.010800	0.015	16.85	3.06
0.011000	0.015	17.01	3.09
0.011200	0.015	17.16	3.12
0.011400	0.015	17.31	3.15
0.011600	0.015	17.46	3.18
0.011800	0.015	17.61	3.20
0.012000	0.015	17.76	3.23
0.012200	0.015	17.91	3.26
0.012400	0.015	18.05	3.28
0.012600	0.015	18.20	3.31
0.012800	0.015	18.34	3.34
0.013000	0.015	18.49	3.36
0.013200	0.015	18.63	3.39
0.013400	0.015	18.77	3.41
0.013600	0.015	18.91	3.44
0.013800	0.015	19.05	3.46
0.014000	0.015	19.18	3.49
0.014200	0.015	19.32	3.51
0.014400	0.015	19.46	3.54
0.014600	0.015	19.59	3.56
0.014800	0.015	19.72	3.59
0.015000	0.015	19.86	3.61
0.015200	0.015	19.99	3.64
0.015400	0.015	20.12	3.66
0.015600	0.015	20.25	3.68
0.015800	0.015	20.38	3.71
0.016000	0.015	20.51	3.73
0.016200	0.015	20.64	3.75

Table
Rating Table for Irregular Channel

Rating Table			
Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.016400	0.015	20.76	3.78
0.016600	0.015	20.89	3.80
0.016800	0.015	21.02	3.82
0.017000	0.015	21.14	3.85
0.017200	0.015	21.26	3.87
0.017400	0.015	21.39	3.89
0.017600	0.015	21.51	3.91
0.017800	0.015	21.63	3.93
0.018000	0.015	21.75	3.96
0.018200	0.015	21.87	3.98
0.018400	0.015	21.99	4.00
0.018600	0.015	22.11	4.02
0.018800	0.015	22.23	4.04
0.019000	0.015	22.35	4.07
0.019200	0.015	22.47	4.09
0.019400	0.015	22.58	4.11
0.019600	0.015	22.70	4.13
0.019800	0.015	22.81	4.15
0.020000	0.015	22.93	4.17

Table
Rating Table for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\local st.fm2
Worksheet	Wigwam Local St 6" Curb
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Water Surface Elevation	0.50 ft

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.002000	0.020000	0.000200 ft/ft

Rating Table

Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.002000	0.015	23.40	2.10
0.002200	0.015	24.55	2.20
0.002400	0.015	25.64	2.30
0.002600	0.015	26.68	2.39
0.002800	0.015	27.69	2.48
0.003000	0.015	28.66	2.57
0.003200	0.015	29.60	2.66
0.003400	0.015	30.51	2.74
0.003600	0.015	31.40	2.82
0.003800	0.015	32.26	2.89
0.004000	0.015	33.10	2.97
0.004200	0.015	33.91	3.04
0.004400	0.015	34.71	3.11
0.004600	0.015	35.49	3.18
0.004800	0.015	36.26	3.25
0.005000	0.015	37.00	3.32
0.005200	0.015	37.74	3.38
0.005400	0.015	38.46	3.45
0.005600	0.015	39.16	3.51
0.005800	0.015	39.85	3.57
0.006000	0.015	40.54	3.64
0.006200	0.015	41.21	3.70
0.006400	0.015	41.87	3.76
0.006600	0.015	42.51	3.81
0.006800	0.015	43.15	3.87
0.007000	0.015	43.78	3.93
0.007200	0.015	44.40	3.98

Table
Rating Table for Irregular Channel

Rating Table			
Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.007400	0.015	45.02	4.04
0.007600	0.015	45.62	4.09
0.007800	0.015	46.22	4.15
0.008000	0.015	46.81	4.20
0.008200	0.015	47.39	4.25
0.008400	0.015	47.96	4.30
0.008600	0.015	48.53	4.35
0.008800	0.015	49.09	4.40
0.009000	0.015	49.65	4.45
0.009200	0.015	50.19	4.50
0.009400	0.015	50.74	4.55
0.009600	0.015	51.27	4.60
0.009800	0.015	51.81	4.65
0.010000	0.015	52.33	4.69
0.010200	0.015	52.85	4.74
0.010400	0.015	53.37	4.79
0.010600	0.015	53.88	4.83
0.010800	0.015	54.38	4.88
0.011000	0.015	54.89	4.92
0.011200	0.015	55.38	4.97
0.011400	0.015	55.87	5.01
0.011600	0.015	56.36	5.06
0.011800	0.015	56.85	5.10
0.012000	0.015	57.33	5.14
0.012200	0.015	57.80	5.18
0.012400	0.015	58.27	5.23
0.012600	0.015	58.74	5.27
0.012800	0.015	59.21	5.31
0.013000	0.015	59.67	5.35
0.013200	0.015	60.12	5.39
0.013400	0.015	60.58	5.43
0.013600	0.015	61.03	5.47
0.013800	0.015	61.48	5.51
0.014000	0.015	61.92	5.55
0.014200	0.015	62.36	5.59
0.014400	0.015	62.80	5.63
0.014600	0.015	63.23	5.67
0.014800	0.015	63.66	5.71
0.015000	0.015	64.09	5.75
0.015200	0.015	64.52	5.79
0.015400	0.015	64.94	5.83
0.015600	0.015	65.36	5.86
0.015800	0.015	65.78	5.90
0.016000	0.015	66.19	5.94
0.016200	0.015	66.61	5.97

Table
Rating Table for Irregular Channel

Rating Table			
Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.016400	0.015	67.02	6.01
0.016600	0.015	67.42	6.05
0.016800	0.015	67.83	6.08
0.017000	0.015	68.23	6.12
0.017200	0.015	68.63	6.16
0.017400	0.015	69.03	6.19
0.017600	0.015	69.43	6.23
0.017800	0.015	69.82	6.26
0.018000	0.015	70.21	6.30
0.018200	0.015	70.60	6.33
0.018400	0.015	70.99	6.37
0.018600	0.015	71.37	6.40
0.018800	0.015	71.75	6.44
0.019000	0.015	72.13	6.47
0.019200	0.015	72.51	6.50
0.019400	0.015	72.89	6.54
0.019600	0.015	73.26	6.57
0.019800	0.015	73.64	6.61
0.020000	0.015	74.01	6.64

Table
Rating Table for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\local st.fm2
Worksheet	Wigwam Creek Parkway
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Water Surface Elevation	0.50 ft

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.002000	0.010000	0.000200 ft/ft

Rating Table

Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.002000	0.015	21.80	1.74
0.002200	0.015	22.86	1.82
0.002400	0.015	23.88	1.90
0.002600	0.015	24.85	1.98
0.002800	0.015	25.79	2.06
0.003000	0.015	26.70	2.13
0.003200	0.015	27.57	2.20
0.003400	0.015	28.42	2.27
0.003600	0.015	29.24	2.33
0.003800	0.015	30.05	2.40
0.004000	0.015	30.83	2.46
0.004200	0.015	31.59	2.52
0.004400	0.015	32.33	2.58
0.004600	0.015	33.06	2.64
0.004800	0.015	33.77	2.69
0.005000	0.015	34.46	2.75
0.005200	0.015	35.15	2.80
0.005400	0.015	35.82	2.86
0.005600	0.015	36.47	2.91
0.005800	0.015	37.12	2.96
0.006000	0.015	37.75	3.01
0.006200	0.015	38.38	3.06
0.006400	0.015	38.99	3.11
0.006600	0.015	39.60	3.16
0.006800	0.015	40.19	3.21
0.007000	0.015	40.78	3.25
0.007200	0.015	41.36	3.30

Table
Rating Table for Irregular Channel

Rating Table			
Channel Slope (ft/ft)	Wtd. Mannings Coefficient	Discharge (cfs)	Velocity (ft/s)
0.007400	0.015	41.93	3.34
0.007600	0.015	42.49	3.39
0.007800	0.015	43.05	3.43
0.008000	0.015	43.59	3.48
0.008200	0.015	44.14	3.52
0.008400	0.015	44.67	3.56
0.008600	0.015	45.20	3.60
0.008800	0.015	45.72	3.65
0.009000	0.015	46.24	3.69
0.009200	0.015	46.75	3.73
0.009400	0.015	47.26	3.77
0.009600	0.015	47.76	3.81
0.009800	0.015	48.25	3.85
0.010000	0.015	48.74	3.89

APPENDIX B

Catch Basin and Depressed Curb Calculation

WIGWAM CREEK (98-0098-07)
STORM DRAIN #1
CATCH BASIN CALCULATIONS

CP - 10 - CATCH BASIN NO.(s) 1-1-1

Using combination curb inlet/grated inlet - sump condition calculation of total interception capacity is based on the combined grate inlet and curb inlet interception capacity.

Design 1

Compute "sump" condition interception capacity for grated inlet portion; weir flow:

Q10 @ CP- 10 = 29 cfs

So: Qig = CwPd^1.5 * Cg (Weir Flow Eqn, Eqn. 3.17) ♦

Where:
Qig = Amount of Street Flow Intercepted (cfs)
Cwg = Weir Coefficient for Grate = 3.0
P = Perimeter of Grate (Minus side along curb) = 1.65 + 1.65 + 2.02 = 5.32 ft
d = Ponding Depth at Curb = 0.67 ft
Cg = Clogging Factor Applied to Qi (per Table 3.2) ♦ = 0.65

Qig = (3.0) * (5.32) * (0.67)^1.5*(0.65) = 5.69 ≅ 5.7 cfs

Design 2

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qic = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Qic = Amount of street flow caught by an inlet (cfs)
Cwc = Weir Coefficient for Curb Inlet = 2.3
L = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.65
d = Ponding depth at curb = 0.67 ft

Calculate flow to be picked up = (29.0) - (5.7) = 23.3 cfs

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qic}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{23.3 \text{ cfs}}{0.65 * 2.3 * 0.67^{1.5}}\right] - (1.8)*(1.42) = 25.9 \text{ ft}$$

For Design: For catch basins(s) use double wing MAG Std Detail No. 533-1, total curb opening, L1 = 17 ft
L2 = 10 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP - 10

So: Total flow intercepted = (29 cfs) 1 = 29 cfs @ CP - 10

♦ MCFCD Volume II Hydraulics, Reference 2

WIGWAM CREEK (980098-07)
STORM DRAIN #2
CATCH BASIN CALCULATIONS

CP - 31 - CATCH BASIN NO.(s) 1-2-1,1-2-2

Using combination curb inlet/grated inlet - sump condition calculation of total interception capacity is based on the combined grate inlet and curb inlet interception capacity.

Design 1

Compute "sump" condition interception capacity for grated inlet portion; weir flow:

Q10 @ CP- 31 = (10 cfs) /2 = 5.0 cfs (per half street)

So: Qig = CwPd^1.5 * Cg (Weir Flow Eqn, Eqn. 3.17) ♦

Where:
Qig = Amount of Street Flow Intercepted (cfs)
Cwg = Weir Coefficient for Grate = 3.0
P = Perimeter of Grate (Minus side along curb) = 1.65 + 1.65 + 2.02 = 5.32 ft
d = Ponding Depth at Curb = 0.67 ft
Cg = Clogging Factor Applied to Qi (per Table 3.2) ♦ = 0.65

Qig = (3.0) * (5.32) * (0.67)^1.5*(0.65) = 5.69 ≅ 5.7 cfs

Design 2

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qic = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Qic = Amount of street flow caught by an inlet (cfs)
Cwc = Weir Coefficient for Curb Inlet = 2.3
L = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.65
d = Ponding depth at curb = 0.67 ft

Calculate flow to be picked up = (5.0) - (5.7) = -0.7 cfs

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qic}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{-0.7}{0.65 * 2.3 * 0.67^{1.5}}\right] - (1.8)*(1.42) = 0.0 \text{ ft}$$

For Design: For catch basins(s) use single wing MAG Std Detail No. 533-1, total curb opening, L = 3 ft

Design scupper interception capacity >= required capacity of the Q10 in the half street at CP - 31

So: Total flow intercepted = (5 cfs) 2 = 10 cfs @ CP - 31

♦ MCFCD Volume II Hydraulics, Reference 2

WIGWAM CREEK (98-0098-07)
STORM DRAIN #3
CATCH BASIN CALCULATIONS

CP - 26 - CATCH BASIN NO.(s) 1-3-1,1-3-2

"Flow-by" Catch Basin Interception Capacity

Q10 @ CP- 26 = (19 cfs) /2 = 9.5 cfs (per half street)

Qd = Qdesign = 9.5 cfs, street slope = 0.25 %
D = Depth of flow = 0.47 ft

a) W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
T = Spread = 23.8 ft
W/T = 1.42 / 23.8 = 0.059

b) Sw' = Cross-slope of gutter section = 2 inch (depression)/ 17 inch ≅ 0.118 ft/ft
Sx = Pavement cross-slope = 0.020 ft/ft
Sw = Sw' + Sx = 0.138
Sw/Sx = 0.138 / 0.020 = 6.90

c) Eo = 0.15 (Fig. 3.23) ♦

d) Se = Sx + Sw'*Eo
=0 0.020 + (0.118)*(0.15)
=0 0.038

e) Qd = 9.5 cfs
Lt = 22.7 ft (Fig. 3.20) ♦
Adjust for clogging = 22.7 ft * 1.25 = 28.4 ft

For Design
Use single wing MAG Std Detail No. 533-1,
Lt = 10 ft
Total Opening Length = 13 ft

f) E = Efficiency of Inlet
= 1-(1-L/Lt)^1.8 (Eqn 3.5) ♦
= 1 - (1 - 13 / 28.4)^1.8
= 1 - (1 - 0.46)^1.8
= 1 - (0.54)^1.8
= 1 - (0.33)
= 0.67

g) Flow intercepted = Q*E = 9.5 cfs * 0.67 = 6.37 cfs = 6.40 cfs

h) Flow-by = Qd - Qintercepted = (9.5 cfs - 6.4 cfs) * 2 = 6.3 cfs

So: Total flow-by @ CP - 26 = 6.3 cfs

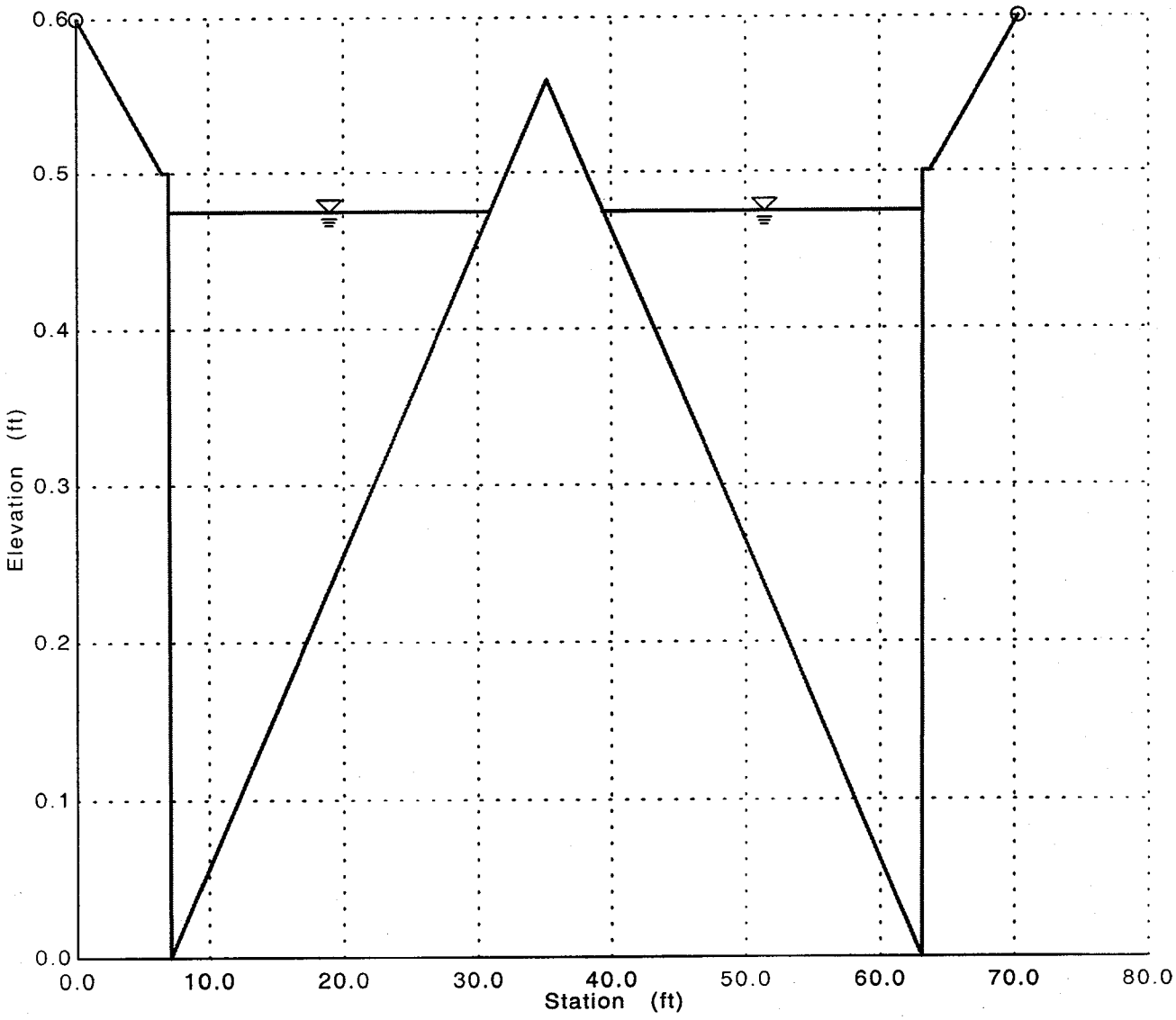
Total flow intercepted = (6.4 cfs) * 2 = 12.8 cfs @ CP - 26 (for the 10-year flow)

♦ MCFCD Volume II Hydraulics, Reference 2

Cross Section at CP-26
Cross Section for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\local st.fm2
Worksheet	Wigwam Creek Parkway
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	0.47	ft
Discharge	19.00	cfs



WIGWAM CREEK (98-0098-07)
STORM DRAIN #4
CATCH BASIN CALCULATIONS

CP - 30 - CATCH BASIN NO.(s) 1-4-1,1-5-1

Using combination curb inlet/grated inlet - sump condition calculation of total interception capacity is based on the combined grate inlet and curb inlet interception capacity.

Design 1

Compute "sump" condition interception capacity for grated inlet portion; weir flow:

Q10 @ CP- 30 = (21.2 cfs) /2 = 10.6 cfs (per half street)

So: Qig = CwPd^1.5 * Cg (Weir Flow Eqn, Eqn. 3.17) ♦

Where:
Qig = Amount of Street Flow Intercepted (cfs)
Cwg = Weir Coefficient for Grate = 3.0
P = Perimeter of Grate (Minus side along curb) = 1.65 + 1.65 + 2.02 = 5.32 ft
d = Ponding Depth at Curb = 0.67 ft
Cg = Clogging Factor Applied to Qi (per Table 3.2) ♦ = 0.65

Qig = (3.0) * (5.32) * (0.67)^1.5*(0.65) = 5.69 ≅ 5.7 cfs

Design 2

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qic = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Qic = Amount of street flow caught by an inlet (cfs)
Cwc = Weir Coefficient for Curb Inlet = 2.3
L = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.65
d = Ponding depth at curb = 0.67 ft

Calculate flow to be picked up = (10.6) - (5.7) = 4.9 cfs

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qic}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{4.9 \text{ cfs}}{0.65 * 2.3 * 0.67^{1.5}}\right] - (1.8)*(1.42) = 3.4 \text{ ft}$$

For Design: For catch basins(s) use no wing MAG Std Detail No. 533-1, total curb opening, L = 6 ft

Design scupper interception capacity >= required capacity of the Q10 in the half street at CP - 30

So: Total flow intercepted = (10.6 cfs) 2 = 21.2 cfs @ CP - 30

♦ MCFCD Volume II Hydraulics, Reference 2

WIGWAM CREEK (98-0098-07)
STORM DRAIN #6
CATCH BASIN CALCULATIONS

CP - 17 - CATCH BASIN NO.(s) 1-6-1

Using combination curb inlet/grated inlet - sump condition calculation of total interception capacity is based on the combined grate inlet and curb inlet interception capacity.

Design 1

Compute "sump" condition interception capacity for grated inlet portion; weir flow:

Q10 @ CP- 17 = 23 cfs

So: Qig = CwPd^1.5 * Cg (Weir Flow Eqn, Eqn. 3.17) ♦

Where:
Qig = Amount of Street Flow Intercepted (cfs)
Cwg = Weir Coefficient for Grate = 3.0
P = Perimeter of Grate (Minus side along curb) = 1.65 + 1.65 + 2.02 = 5.32 ft
d = Ponding Depth at Curb = 0.50 ft
Cg = Clogging Factor Applied to Qi (per Table 3.2) ♦ = 0.65

Qig = (3.0) * (5.32) * (0.50)^1.5*(0.65) = 3.67 ≅ 3.7 cfs

Design 2

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qic = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Qic = Amount of street flow caught by an inlet (cfs)
Cwc = Weir Coefficient for Curb Inlet = 2.3
L = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.65
d = Ponding depth at curb = 0.50 ft

Calculate flow to be picked up = (23.0) - (3.7) = 19.3 cfs

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qic}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{19.3 \text{ cfs}}{0.65 * 2.3 * 0.50^{1.5}}\right] - (1.8)*(1.42) = 34.0 \text{ ft}$$

For Design: For catch basins(s) use double wing MAG Std Detail No. 533-1, total curb opening, L1 = 17 ft
L2 = 17 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP - 17

So: Total flow intercepted = (23 cfs) 1 = 23 cfs @ CP - 17

♦ MCFCD Volume II Hydraulics, Reference 2

Wigwam (980098-02)
SCUPPER CALCULATIONS

CP - 5 - SCUPPER NO.(s) 1

Using inlet - sump condition calculation of total interception capacity.

Q10 @ CP- 5 = 27 cfs

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qi = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Cw = Weir Coefficient for Curb Inlet = 2.3
Lt = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.80
d = Ponding depth at curb = 0.50 ft
Qi = Amount of street flow caught by an inlet (cfs)

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qi}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{27.0 \text{ cfs}}{0.80 * 2.3 * 0.50^{1.5}}\right] - (1.8)*(1.42) = 39.0 \text{ ft}$$

For Design: For scupper(s) use MAG Std Detail No. 206.2 - total curb opening, Lt = 40 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP - 5

♦ MCFCD Volume II Hydraulics, Reference 2

Wigwam (980098-02)
SCUPPER CALCULATIONS

CP - 19 - SCUPPER NO.(s) 2

Using inlet - sump condition calculation of total interception capacity.

Q10 @ CP- 19 = 9 cfs

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qi = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Cw = Weir Coefficient for Curb Inlet = 2.3
Lt = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.80
d = Ponding depth at curb = 0.50 ft
Qi = Amount of street flow caught by an inlet (cfs)

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qi}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{9.0 \text{ cfs}}{0.80 * 2.3 * 0.50^{1.5}}\right] - (1.8)*(1.42) = 11.3 \text{ ft}$$

For Design: For scupper(s) use MAG Std Detail No. 206.2 - total curb opening, Lt = 12 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP - 19

♦ MCFCD Volume II Hydraulics, Reference 2

Wigwam (980098-02)
SCUPPER CALCULATIONS

CP - 18 - SCUPPER NO.(s) 3

Using inlet - sump condition calculation of total interception capacity.

Q10 @ CP- 18 = 5 cfs

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qi = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Cw = Weir Coefficient for Curb Inlet = 2.3
Lt = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.80
d = Ponding depth at curb = 0.50 ft
Qi = Amount of street flow caught by an inlet (cfs)

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qi}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{5.0 \text{ cfs}}{0.80 * 2.3 * 0.50^{1.5}}\right] - (1.8)*(1.42) = 5.1 \text{ ft}$$

For Design: For scupper(s) use MAG Std Detail No. 206.2 - total curb opening, Lt = 6 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP - 18

♦ MCFCD Volume II Hydraulics, Reference 2

Wigwam (980098-02)
SCUPPER CALCULATIONS

CP - 21 - SCUPPER NO.(s) 4

Using inlet - sump condition calculation of total interception capacity.

Q10 @ CP- 21 = 7 cfs

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qi = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Cw = Weir Coefficient for Curb Inlet = 2.3
Lt = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.80
d = Ponding depth at curb = 0.50 ft
Qi = Amount of street flow caught by an inlet (cfs)

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qi}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{7.0 \text{ cfs}}{0.80 * 2.3 * 0.50^{1.5}}\right] - (1.8)*(1.42) = 8.2 \text{ ft}$$

For Design: For scupper(s) use MAG Std Detail No. 206.2 - total curb opening, Lt = 10 ft

Design scupper interception capacity >= required capacity of the Q10 in the street at CP -21

♦ MCFCD Volume II Hydraulics, Reference 2

Wigwam (980098-02)
SCUPPER CALCULATIONS

CP - 12 - SCUPPER NO.(s) 5

Using inlet - sump condition calculation of total interception capacity.

Q10 @ CP- 12 = (14 cfs) /2 = 7.0 cfs (pe

Compute "sump" condition interception capacity for curb inlet; weir flow:

So: Qi = Cw (L + 1.8w)d^1.5 * Cc (Weir Flow Eqn, Eqn. 3.8) ♦

Where:
Cw = Weir Coefficient for Curb Inlet = 2.3
Lt = Length of Curb Opening (ft)
W = Width of Depressed Gutter [inch] , [ft] = 17 = 1.42
Cc = Clogging Factor (per Table 3.2) ♦ = 0.80
d = Ponding depth at curb = 0.67 ft
Qi = Amount of street flow caught by an inlet (cfs)

Estimate Required Length of Curb Opening

$$L = \left[\frac{Qi}{Cc * Cw * d^{1.5}}\right] - 1.8 * W = \left[\frac{7.0 \text{ cfs}}{0.80 * 2.3 * 0.67^{1.5}}\right] - (1.8)*(1.42) = 4.4 \text{ ft}$$

For Design: For scupper(s) use MAG Std Detail No. 206.2 - total curb opening, Lt = 10 ft

Design scupper interception capacity >= required capacity of the Q10 in the half street at CP - 12

♦ MCFCD Volume II Hydraulics, Reference 2

APPENDIX C

Storm Drain Calculations

CVL

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #1
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#1-1-1	P-1	25.00	25.50	55	0.0091	18	29.0	10.0	16.41	16.42	4.200	1.2	5.02	30.69	30.96	5.69	5.46	30.96
O-1												1.2		26.49	26.49	26.49	26.49	28.50

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #2
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#1-2-2	P-2	30.10	30.30	56	0.0036	18	5.0	6.3	2.83	2.83	0.130	1.2	0.15	32.26	32.41	2.16	2.11	33.05
CB#1-2-1	P-1	29.90	30.00	25	0.0040	18	10.0	6.6	5.66	5.83	0.240	1.2	0.60	31.54	32.14	1.64	2.14	33.05
O-1												1.2		31.30	31.30	31.30	31.30	32.90

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #3
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#3	P-6	33.34	33.44	25	0.0040	18	5.0	6.6	2.83	2.83	0.060	1.2	0.15	35.70	35.84	2.36	2.40	36.56
CB#4	P-5	33.34	33.44	35	0.0029	18	5.0	5.6	2.83	2.83	0.080	1.2	0.15	35.72	35.87	2.38	2.43	36.60
J-1	P-4	32.58	33.24	330	0.0020	24	10.0	10.1	3.18	3.18	0.640	1.2	0.22	35.42	35.64	2.84	2.40	37.12
MH#1	P-7	32.20	32.48	140	0.0020	24	10.0	10.1	3.18	3.18	0.270	1.2	0.00	34.77	34.77	2.57	2.29	36.49
O-1												1.2		34.50	34.50	34.50	34.50	35.90

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #4
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#1-4-1	P-1	32.40	32.50	40	0.0025	18	10.6	5.3	6.00	6.00	0.410	1.2	0.67	35.20	35.50	2.80	3.00	35.50
O-1												1.2		34.79	34.79	34.79	34.79	35.40

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #5
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#1-5-1	P-1	32.40	32.50	35	0.0029	18	10.6	5.6	6.00	6.00	0.360	1.2	0.67	34.58	35.25	2.18	2.75	35.50
O-1												1.2		34.22	34.22	34.22	34.22	35.40

Wigwam Creek - Parcel & Job # (98-0098-07) - Analysis for Proposed Storm Drain #6
Storm Drain Capacity Calculation Record

Head Loss Variables

Bend Loss, Kb (90 degrees) =	1.04
Expansion Loss, Ke =	0.35
Shape Adjustment, Cs =	0.50

ID		STORM DRAIN DESIGN DATA							HEAD LOSS CALCULATION					HYDRAULIC GRADE LINE				
Inlet	Pipe ID	Outlet Invert	Inlet Invert	Length (ft)	S (ft/ft)	D (in)	Q pipe (cfs)	Q full (cfs)	V pipe in (ft/s)	V pipe out (ft/s)	hf (ft)	km	hm (ft)	Elev. @ Outlet	Elev. @ Inlet	Depth @ Outlet	Depth @ Inlet	Ground Elev.
CB#1-6-1	P-1	28.60	30.35	54	0.0324	24	23.0	40.7	7.32	7.32	0.560	1.2	1.00	33.06	33.85	4.46	3.50	33.85
O-1												1.2		32.50	32.50	32.50	32.50	32.10

Wigwam Creek - Phase 1 Job # (98-0098-07) - Analysis for Proposed Storm Drain #1

D-Load Calculations

Pavement thickness [ft] = 0.80

Storm Drain System #	Pipe Segment ID	Pipe Size, RGRCP [in]	Cover From Top of Pipe to Pavement Surface or Ground Elevation [ft] *	Pavement Section [ft]	Cover From Subgrade [ft]	D-Load	Class **	Comments
SD # 1	P-1	18	2.00	--	1.79	1250	CL. III	****

Notes:

* Minimum cover for pipe.

** Minimum class for pipes under roadways is Class III.

*** If minimum cover is < 1.0', then use Class V pipe.

Wigwam Creek - Phase 1 Job # (98-0098-07) - Analysis for Proposed Storm Drain #2

D-Load Calculations

Pavement thickness [ft] = 0.80

Storm Drain System #	Pipe Segment ID	Pipe Size, RGRCP [in]	Cover From Top of Pipe to Pavement Surface or Ground Elevation [ft] *	Pavement Section [ft]	Cover From Subgrade [ft]	D-Load	Class **	Comments
SD # 2	P-2	18	1.25	0.80	0.24	D-load > 3000	CL. V	***
	P-1	18	1.50	--	1.29	1750	CL. IV	****

Notes:

* Minimum cover for pipe.

** Minimum class for pipes under roadways is Class III.

*** If minimum cover is < 1.0', then use Class V pipe.

Wigwam Creek - Phase 1 Job # (98-0098-07) - Analysis for Proposed Storm Drain #3
D-Load Calculations

Pavement thickness [ft] = 0.80

Storm Drain System #	Pipe Segment ID	Pipe Size, RGRCP [in]	Cover From Top of Pipe to Pavement Surface or Ground Elevation [ft] *	Pavement Section [ft]	Cover From Subgrade [ft]	D-Load	Class **	Comments
SD # 3	P-4	18	1.62	0.80	0.61	D-load > 3000	CL. V	***
	P-3	18	1.66	0.80	0.65	D-load > 3000	CL. V	***
	P-2	24	1.88	0.80	0.87	D-load > 3000	CL. V	***
	P-1	24	1.70	--	1.49	1500	CL. IV	****

Notes:

* Minimum cover for pipe.

** Minimum class for pipes under roadways is Class III. Also, see Required "D" Load For RGRCP table in Appendix D.

*** If minimum cover is < 1.0', then use Class V pipe.

Wigwam Creek - Phase 1 Job # (98-0098-07) - Analysis for Proposed Storm Drain #4,5

D-Load Calculations

Pavement thickness [ft] = 0.80

Storm Drain System #	Pipe Segment ID	Pipe Size, RGRCP [in]	Cover From Top of Pipe to Pavement Surface or Ground Elevation [ft] *	Pavement Section [ft]	Cover From Subgrade [ft]	D-Load	Class **	Comments
SD # 4,5	P-1	18	1.50	--	1.29	1750	CL. IV	****

Notes:

* Minimum cover for pipe.

** Minimum class for pipes under roadways is Class III.

*** If minimum cover is < 1.0', then use Class V pipe.

APPENDIX D

Retention Basin Calculations

Wigwam Creek
(98-0098-02)
Retention Basin Volume Calculations

Area ID	Area (acres) A	Weighted (1) C value C	Precip. 100-yr, 2-hr (inches) P	**Volume Required (2)** (acre · ft)		**Volume Provided (3)** (acre · ft)				
				Volume Vreq	Cum. Vcum	Ret. Basin ID	Depth d (ft)	Bot. Area Ab (ac)	Top Area At (ac)	Volume Vp
Area 1	13.32	0.69	2.60	1.97		R1	3.0	1.75	2.77	**6.78**
Area 2	13.38	0.69	2.60	1.98		R2	3.0	0.31	0.68	**1.49**
Phase 2	25.42	0.69	2.60	3.77	**7.72**	R3	3.0	0.67	1.64	**3.47**
						R4	3.0	0.08	0.51	**0.89**
Totals	**52.12**			**7.72**	**7.72**					**11.73**

Note:

(1) C value = 0.69 residential areas
(2) Vreq = A x C x P/12 per Reference 2.
(3) Vp = (Ab + At)/2 x d

Wigwam Creek
(98-0098-02)
Equilizer Pipe Calculations (Renention Basins R-1 and R-2)

1) Retention Volume Required for Retention Basin R-2

Vreq = 3.55 acre-ft (Appendix D)

2) Retention Basin R-2 Volume Required;

Vp = 1.49 acre-ft (Appendix D)

3) Excess Volume from Retention Basin R-2

V = Vreq - Vp = 3.55-1.49 = 2.06 acre-ft

4) Area contributed to Retention (Excess Volume)

A= V/CP = 2.06/0.65*2.6 = 14.6 acres

5) Assume i100 = 5 inches per hour

Q = CiA = 0.65*5*14.6 = 47.5 cfs

Culvert Designer/Analyzer Report
Equilizer Pipe for R1 and R2

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	32.81 ft	Discharge	47.50 cfs
Inlet Control HW Elev	32.60 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	32.81 ft	Control Type	Outlet Control
Headwater Depth/ Height	0.84		

Grades			
Upstream Invert	30.30 ft	Downstream Invert	29.80 ft
Length	80.00 ft	Constructed Slope	0.006250 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.41 ft
Slope Type	Steep	Normal Depth	1.41 ft
Flow Regime	Supercritical	Critical Depth	1.57 ft
Velocity Downstream	7.25 ft/s	Critical Slope	0.004347 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	32.81 ft	Upstream Velocity Head	0.62 ft
Ke	0.50	Entrance Loss	0.31 ft

Inlet Control Properties			
Inlet Control HW Elev	32.60 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	14.1 ft^2
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Wigwam Creek
Job # (98-0098-07)
Retention Basin Drain Time and Bleedoff Pipe Calculations

Retention Basin ID	Bottom Area (ft^2)	Volume Required (ft^3)	Percolation Rate (1) (ft^3/hr/ft^2)	Drain Time (2) (hr)	Need Bleed-off Pipe (3)	Volume Required to Drain By Bleed-off Pipe (4) (ft^3)	Slope of Bleed-off Pipe (ft/ft)	Flowrate Required to Drain Within 36 hrs (5) (cfs)	Size of Bleed-off Pipe (in)	Bleed-off Pipe Flowrate Capacity (cfs)
R-1	76,230	235,660	0.010	618.3	Yes	221,939	0.010	1.71	10	2.37
R-3,R-4	32,670	81,457	0.010	498.7	Yes	75,576	0.010	0.58	10	2.37

Notes:

(1)Conservative percolation value

(2) Drain Time= (Volume Required)/[0.5X(Percolation Rate)]/(Bottom Area of Basin).

(3) Bleed-off is required if the drain time by basin itself exceeds 36 hours.

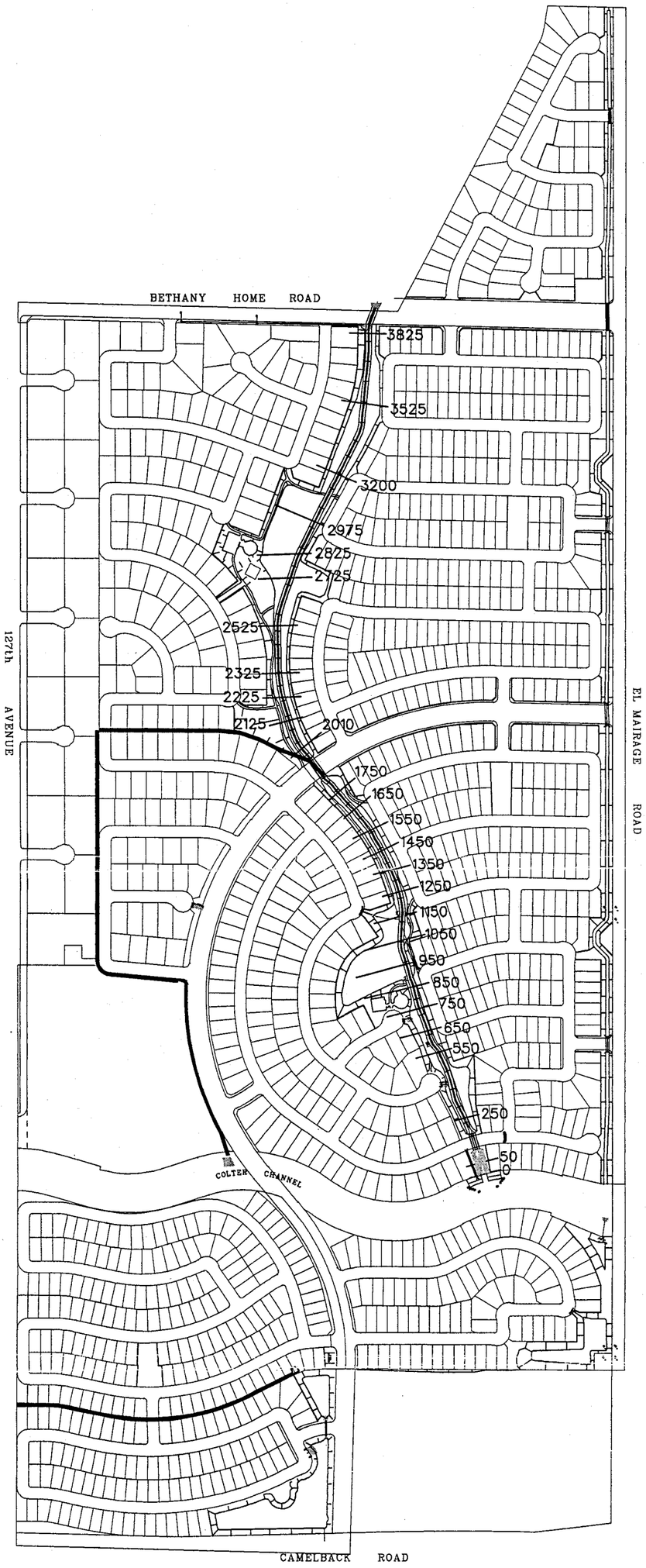
(4) (Volume To Be Drained By Bleed-off)= (Retention Volume Required)-(Volume To Be Drained By Basin Itself)
= (Retention Volume Required)-[0.5X(Percolation Rate)X36X(Bottom Area Of Basin)].

(5) Flowrate Required to Drain Basin Within 36 hrs = (Volume To Be Drained By Bleed-off)/(36X3600).

APPENDIX E

Greenbelt Channel Hydraulics

TIME [redacted]
FILE:- n:\980098\hydro\clomr\hecras.dgn



500' 250' 0 500'

SCALE IN FEET

FIGURE 4

JOB NO. 000046-04

HEC-RAS CROSS SECTIONS

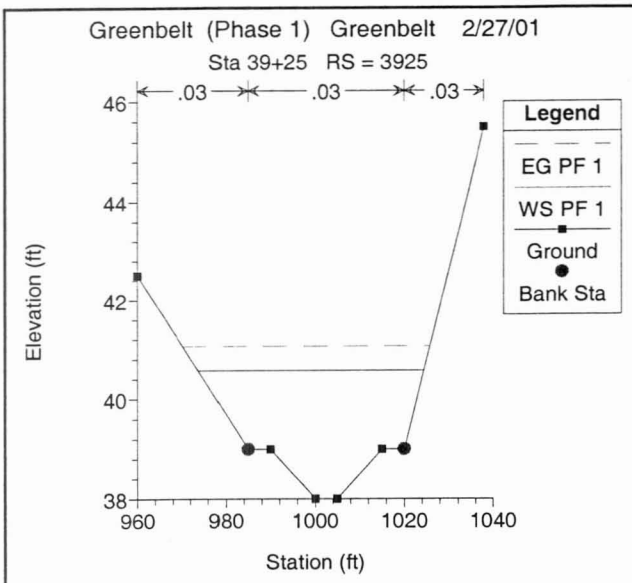
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

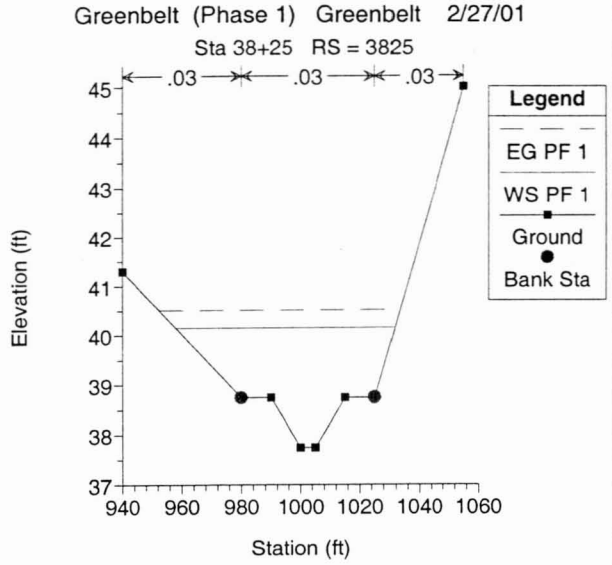
WIGWAM CREEK

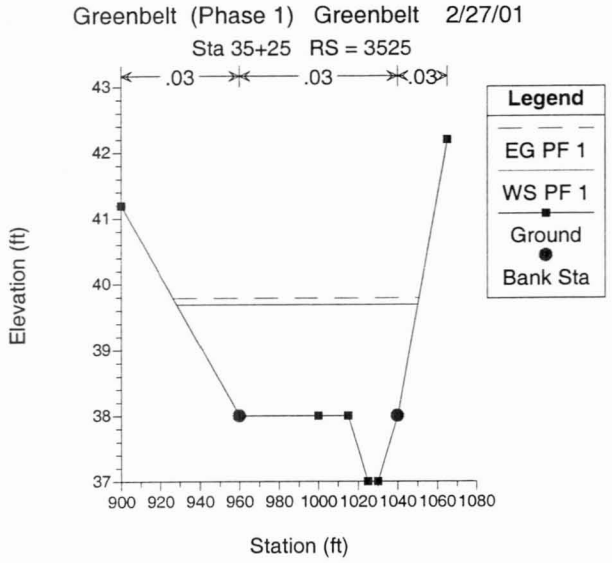
COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

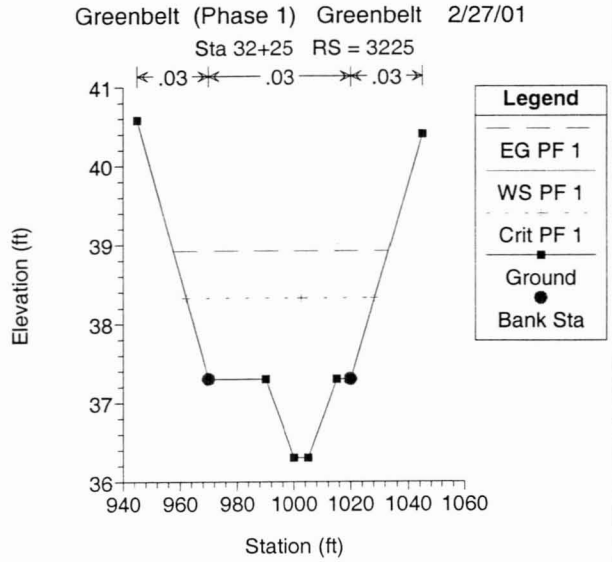
HEC-RAS Plan: gb River: Greenbelt Reach: 1

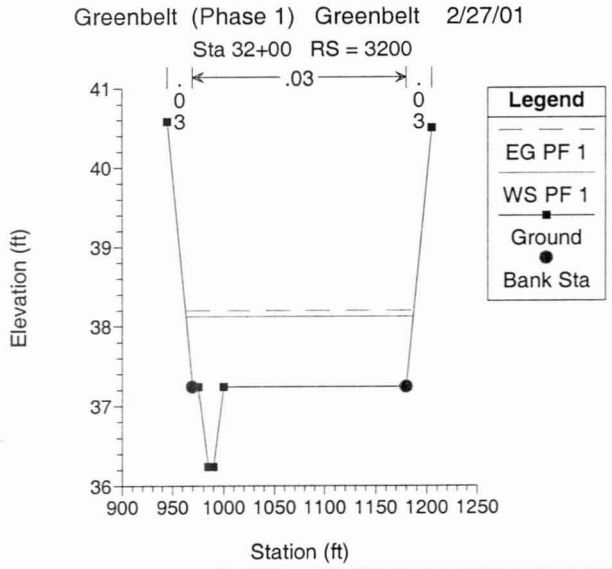
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3925	446.00	38.00	40.57		41.07	0.005493	5.82	82.39	50.61	0.72
1	3825	446.00	37.75	40.16		40.51	0.004881	5.00	98.47	73.79	0.67
1	3525	446.00	37.00	39.69		39.79	0.001203	2.61	185.35	121.72	0.34
1	3225	446.00	36.30	38.32	38.32	38.92	0.011252	6.32	74.39	66.05	0.97
1	3200	446.00	36.24	38.12		38.20	0.002072	2.19	206.44	223.39	0.39
1	2975	446.00	35.63	37.54		37.65	0.002863	2.65	170.18	175.72	0.47
1	2925	446.00	35.50	37.55		37.57	0.000490	1.16	386.13	360.65	0.20
1	2825	446.00	35.25	37.51		37.53	0.000406	1.19	377.60	297.35	0.18
1	2725	446.00	35.00	37.42		37.47	0.000791	1.84	248.06	173.64	0.26
1	2525	446.00	34.25	36.58		37.08	0.006857	5.85	83.16	62.26	0.79
1	2325	446.00	33.50	36.16		36.32	0.001924	3.32	143.24	89.75	0.43
1	2225	446.00	33.14	36.21		36.23	0.000203	1.18	392.43	200.13	0.14
1	2125	446.00	32.77	36.16		36.20	0.000330	1.68	282.12	128.58	0.19
1	2025	446.00	32.40	36.09	34.37	36.16	0.000489	2.26	222.14	99.11	0.23
1	2010	Culvert									
1	1850	446.00	32.00	34.87		34.96	0.000976	2.50	185.71	100.48	0.31
1	1650	446.00	31.70	34.58		34.72	0.001494	3.16	151.02	85.05	0.38
1	1250	446.00	31.10	33.79		33.99	0.002272	3.70	130.34	81.51	0.46
1	1150	446.00	30.95	33.80		33.85	0.000525	1.78	258.78	143.90	0.22
1	1050	446.00	30.80	33.81		33.81	0.000095	0.78	579.92	293.45	0.10
1	950	446.00	30.65	33.80		33.81	0.000055	0.62	730.70	345.61	0.07
1	850	446.00	30.50	33.75		33.79	0.000367	1.70	277.63	133.60	0.19
1	750	446.00	30.35	33.67		33.74	0.000615	2.28	208.76	97.38	0.25
1	650	446.00	30.20	33.62		33.68	0.000474	2.05	232.22	104.40	0.22
1	550	446.00	30.00	33.59		33.64	0.000374	1.89	248.60	102.31	0.20
1	250	446.00	29.40	33.40	31.57	33.50	0.000578	2.68	189.90	76.65	0.26
1	248	Culvert									
1	150	446.00	29.20	32.39		32.61	0.002483	3.90	125.06	62.56	0.43
1	50	446.00	29.00	32.09		32.36	0.002464	4.47	113.71	48.56	0.45
1	15	446.00	28.90	32.05		32.27	0.002013	4.09	127.38	55.88	0.41
1	0	446.00	28.80	32.00	30.75	32.23	0.002082	4.21	122.10	51.31	0.41

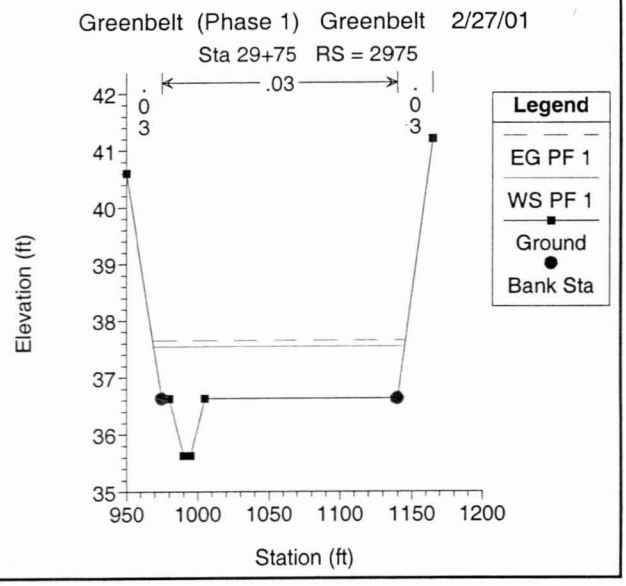

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 39+25 RS = 3925
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

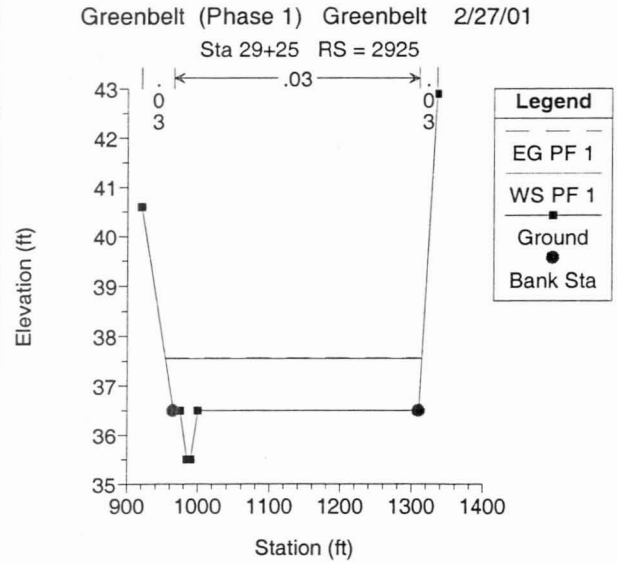

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 38+25 RS = 3825
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

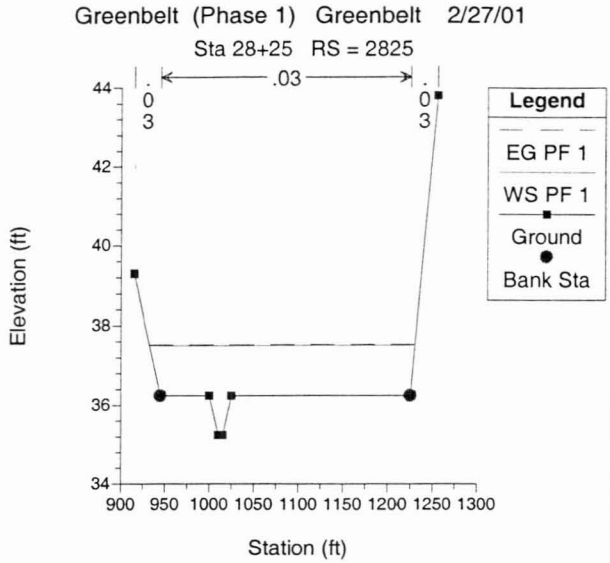

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 35+25 RS = 3525
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

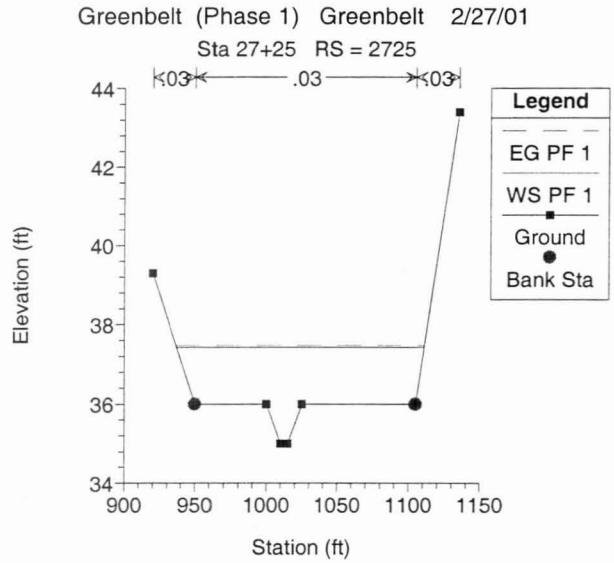

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 32+25 RS = 3225
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

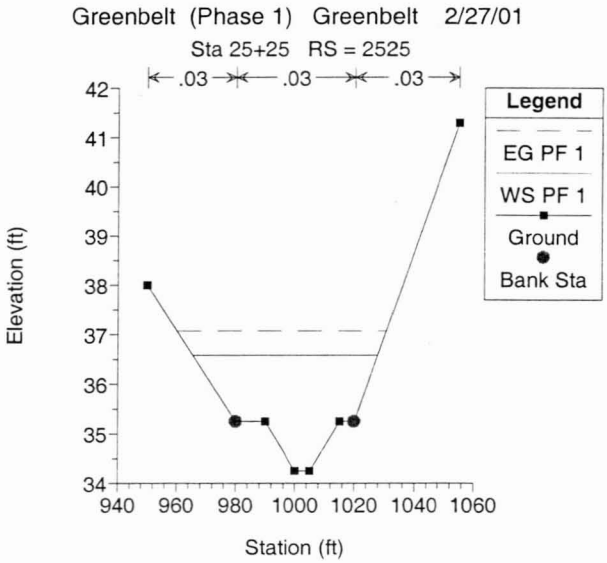

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 32+00 RS = 3200
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

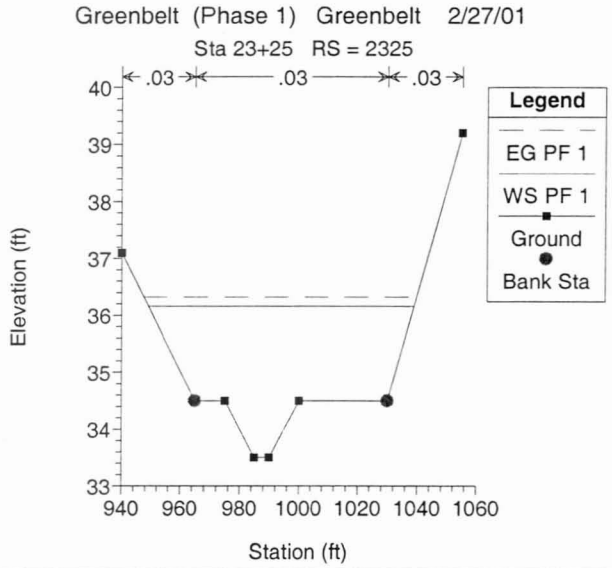

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 29+75 RS = 2975
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

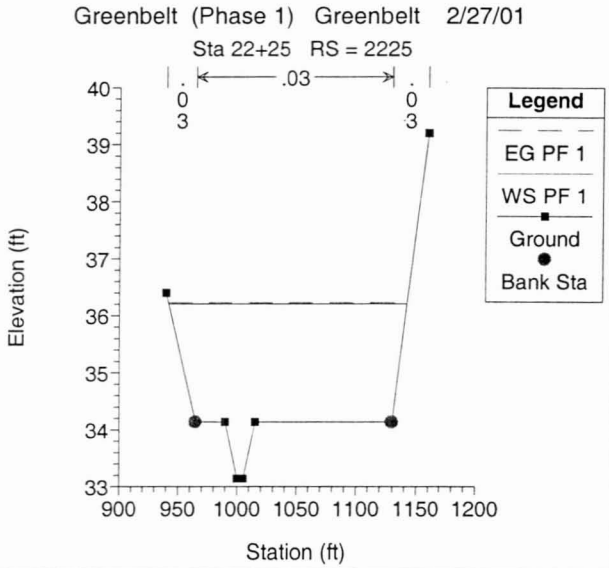

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 29+25 RS = 2925
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

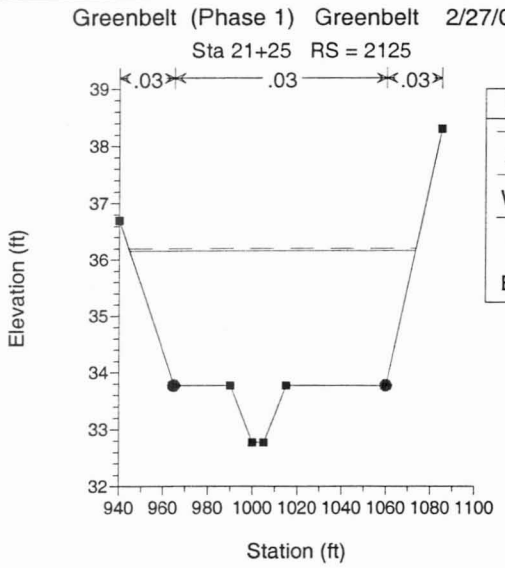

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 28+25 RS = 2825
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

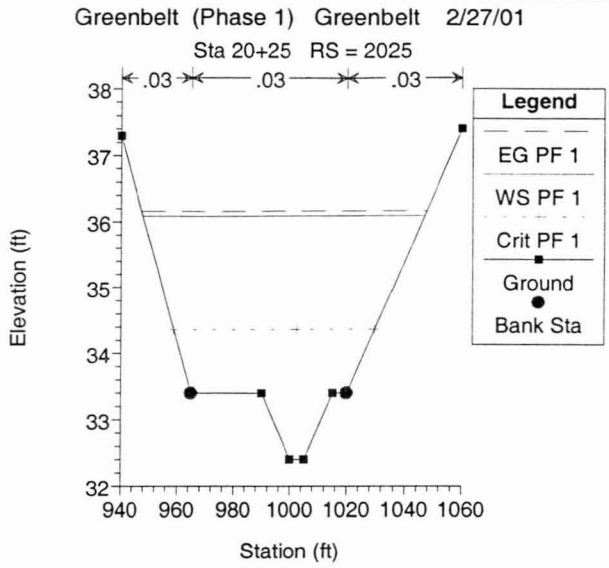

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 27+25 RS = 2725
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

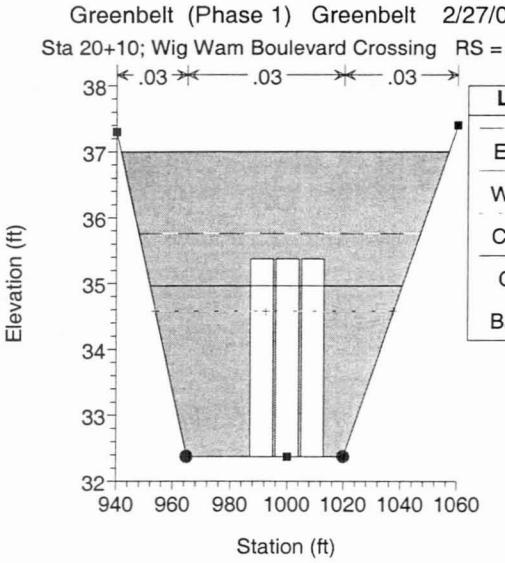

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 25+25 RS = 2525
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

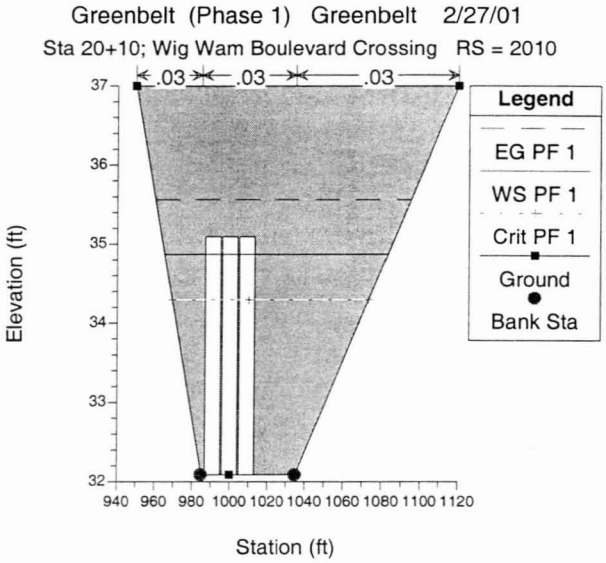

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 23+25 RS = 2325
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

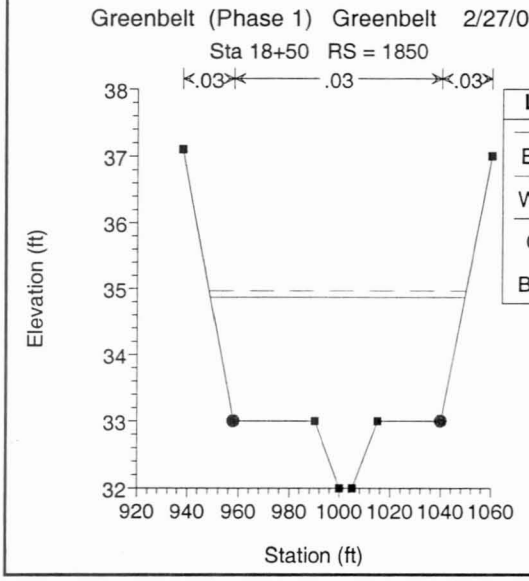

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 22+25 RS = 2225
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

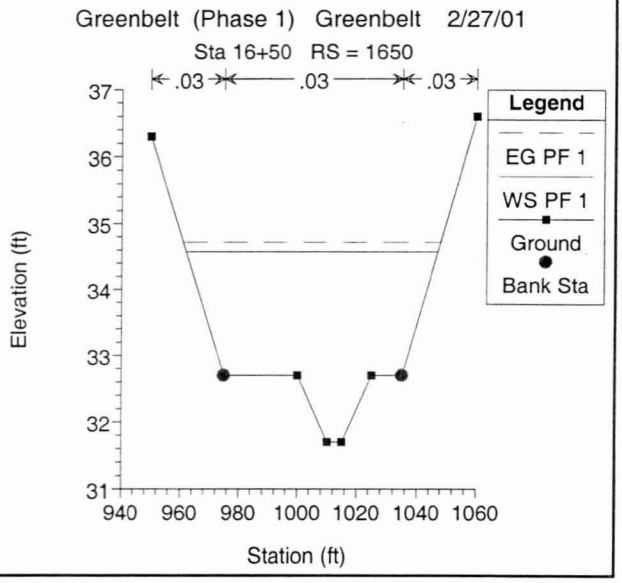

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 21+25 RS = 2125
.03 .03 .03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

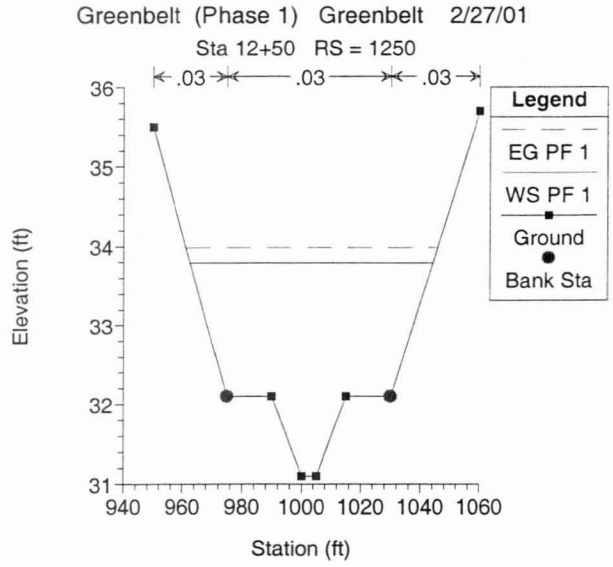

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 20+25 RS = 2025
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

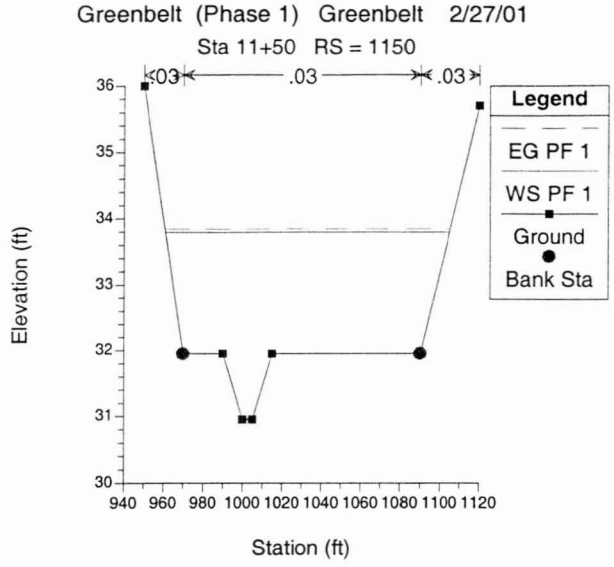

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 20+10; Wig Wam Boulevard Crossing RS = 2010
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

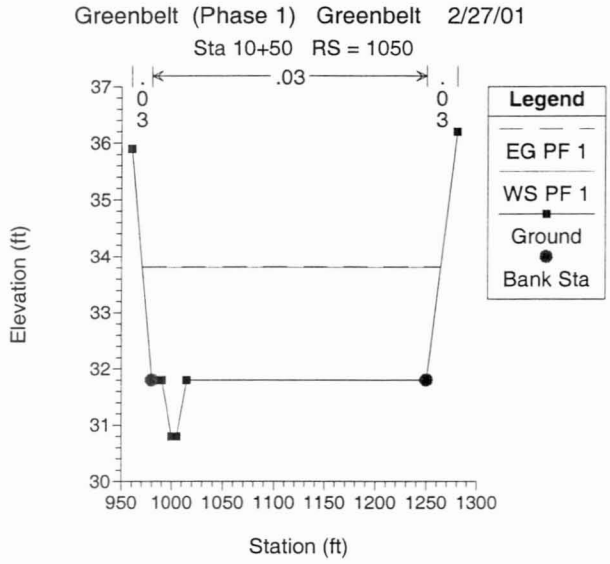

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 20+10; Wig Wam Boulevard Crossing RS = 2010
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

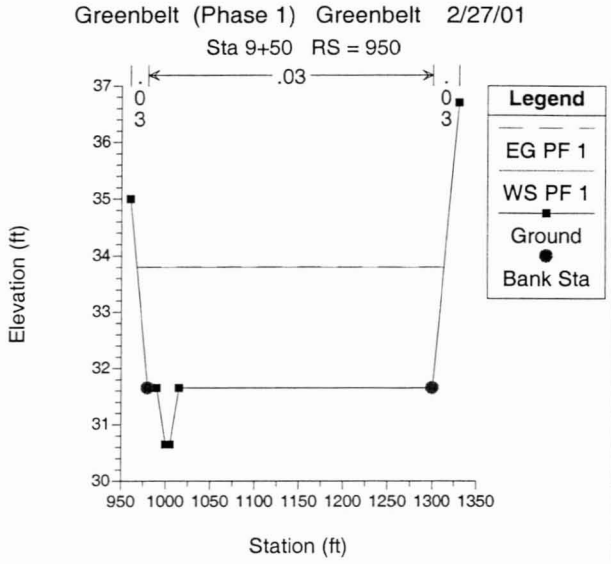

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 18+50 RS = 1850
.03 .03 .03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

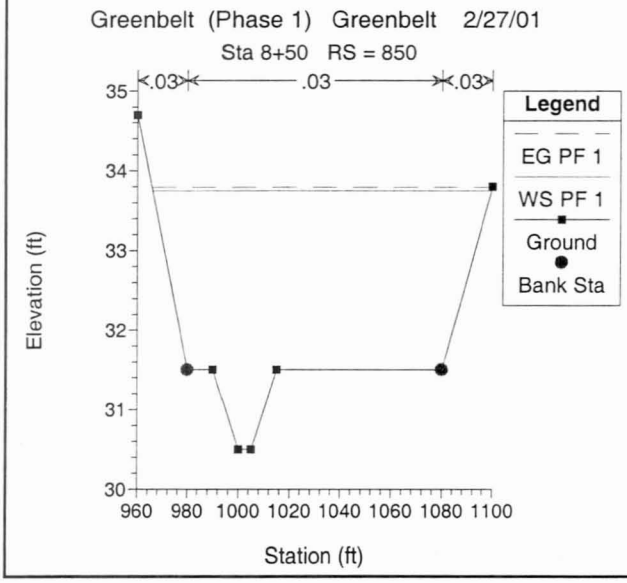

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 16+50 RS = 1650
.03 .03 .03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

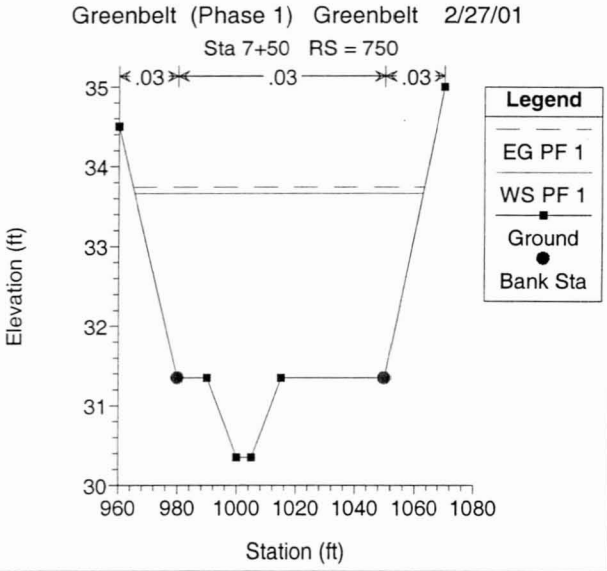

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 12+50 RS = 1250
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

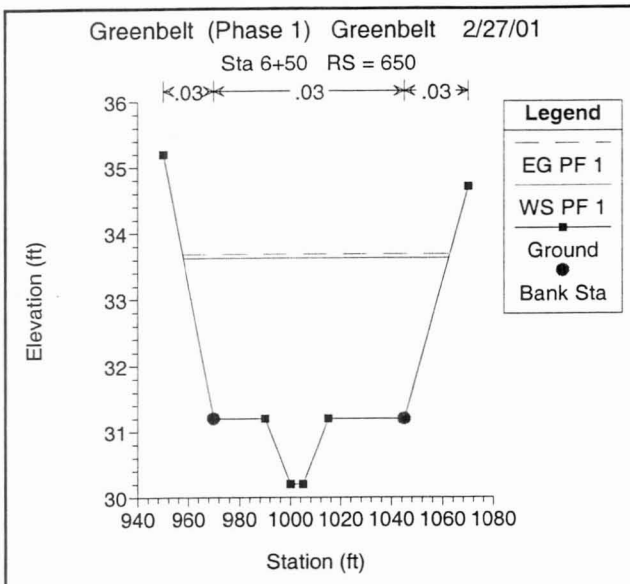

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 11+50 RS = 1150
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

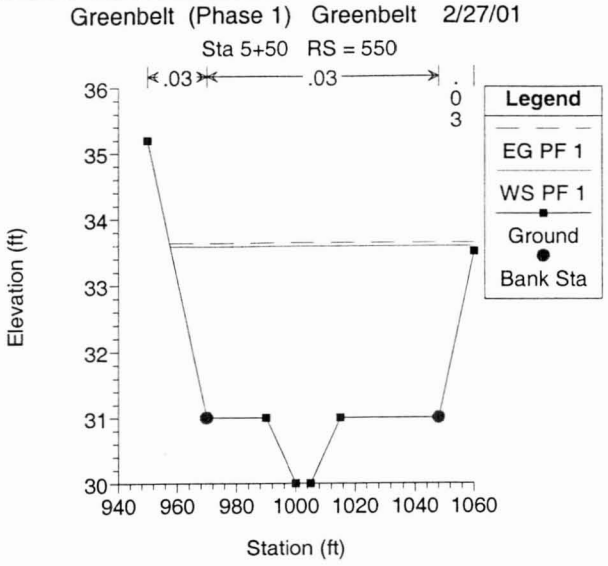

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 10+50 RS = 1050
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

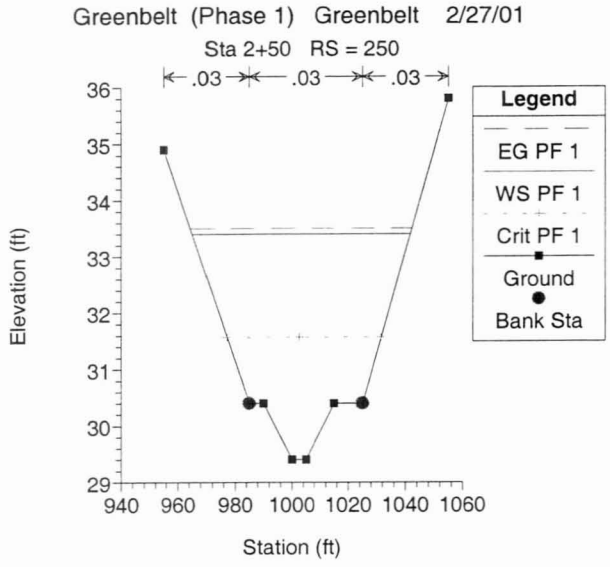

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 9+50 RS = 950
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

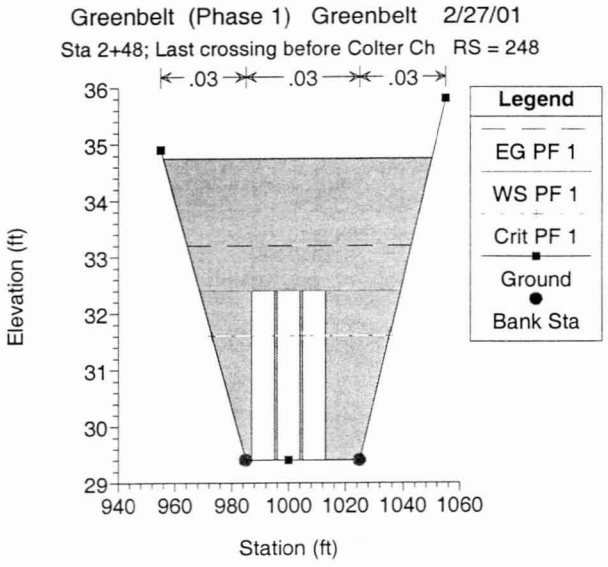

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 8+50 RS = 850
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

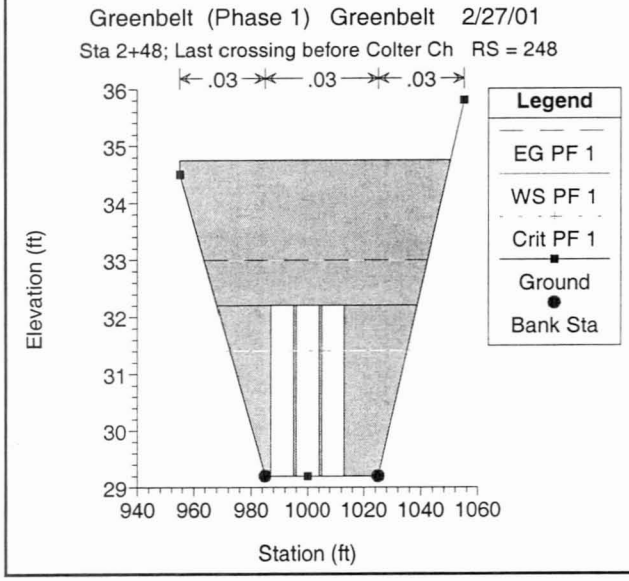

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 7+50 RS = 750
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

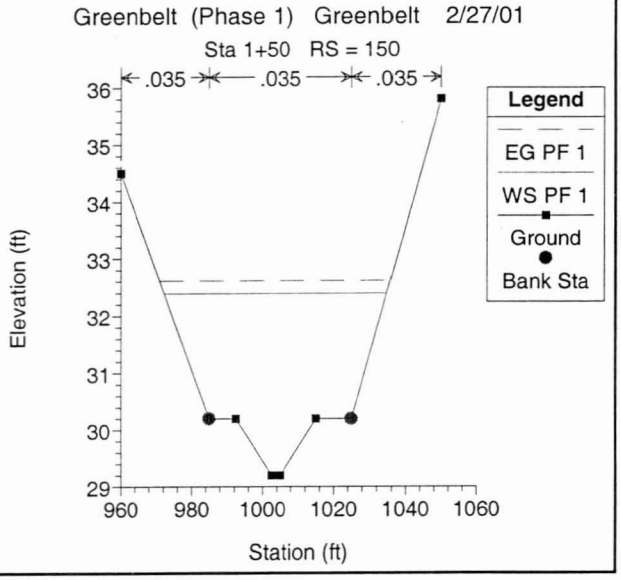

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 6+50 RS = 650
.03 .03 .03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

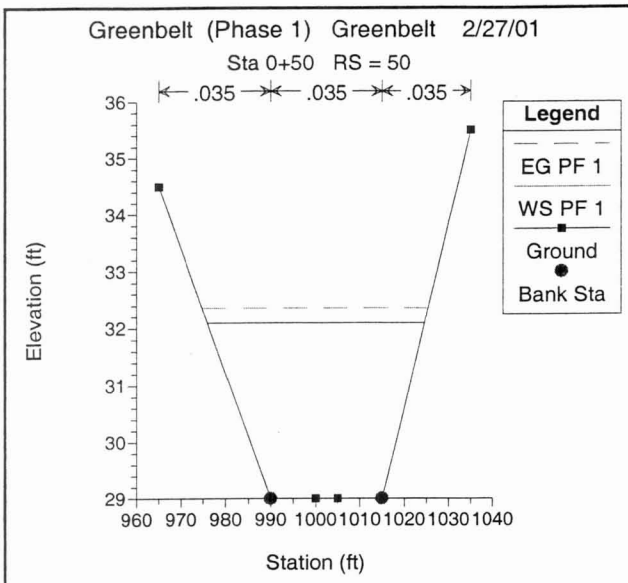

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 5+50 RS = 550
.03 .03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

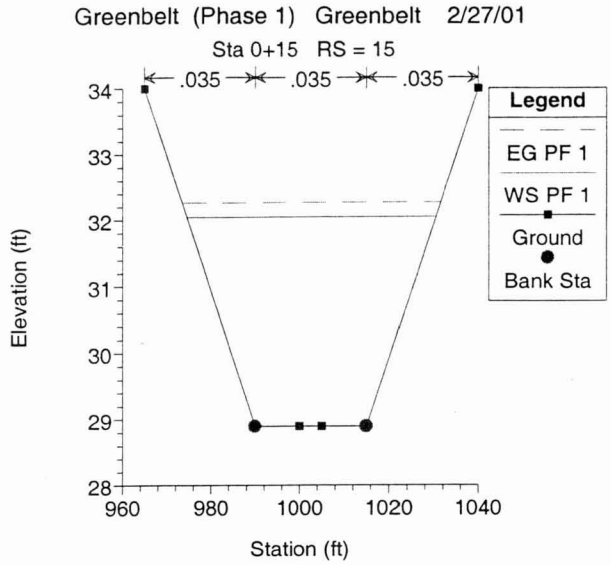

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 2+50 RS = 250
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

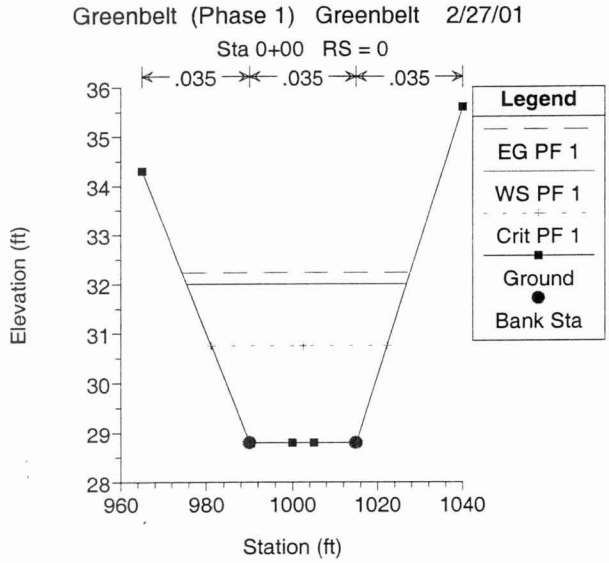

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 2+48; Last crossing before Colter Ch RS = 248
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

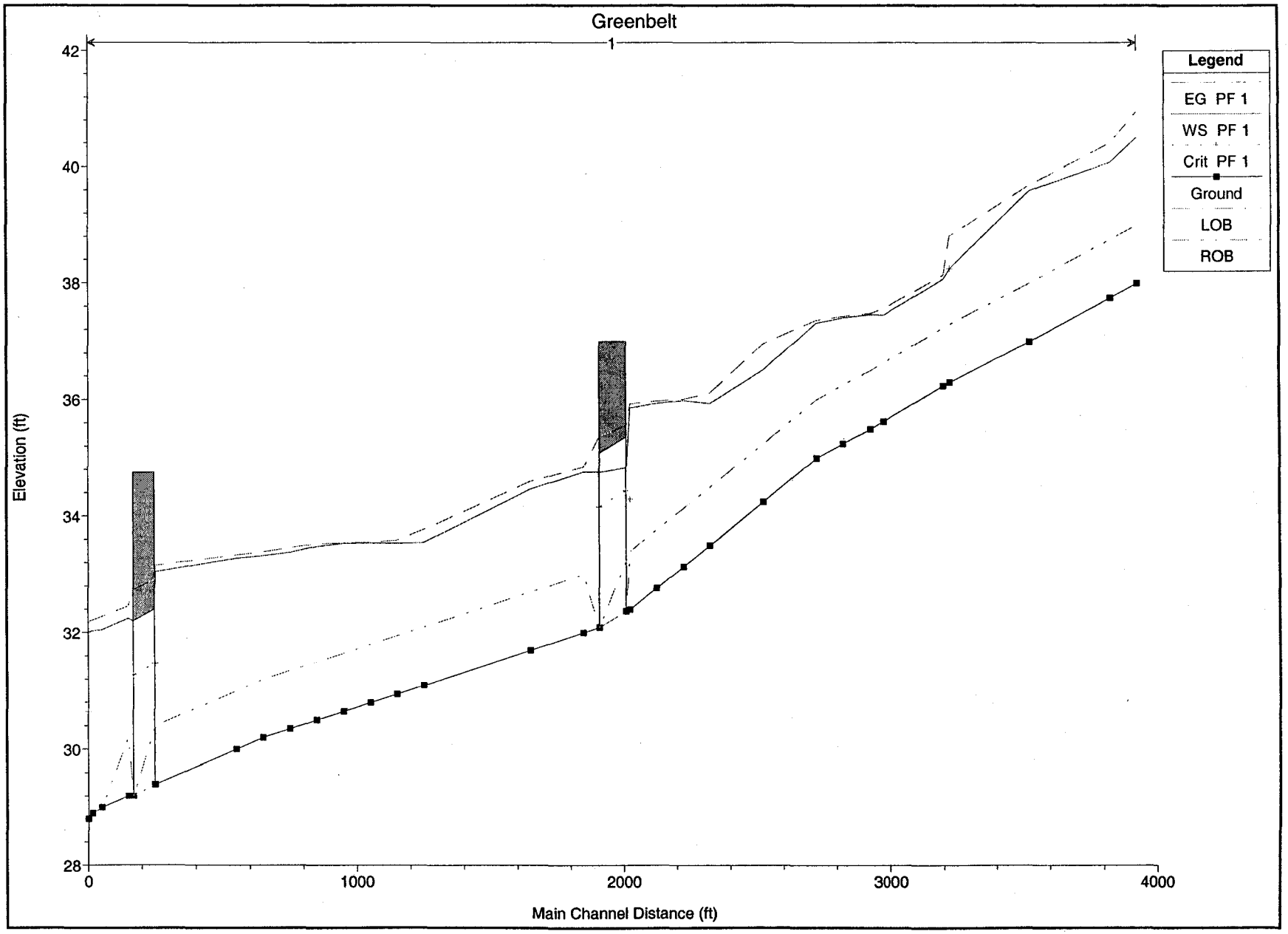

Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 2+48; Last crossing before Colter Ch RS = 248
.03 .03 .03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 1+50 RS = 150
.035 .035 .035
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 0+50 RS = 50
.035
.035
.035
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 0+15 RS = 15
.035
.035
.035
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greenbelt (Phase 1) Greenbelt 2/27/01
Sta 0+00 RS = 0
.035
.035
.035
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greenbelt
1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
LOB
ROB
Elevation (ft)
42
40
38
36
34
32
30
28
0
1000
2000
3000
4000
Main Channel Distance (ft)

Culvert Calculator Report
Greenbelt Culvert 248

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	34.75	ft	Headwater Depth/ Height	1.27	
Computed Headwater Elevation	33.22	ft	Discharge	446.00	cfs
Inlet Control HW Elev	33.22	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev	33.20	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	29.40	ft	Downstream Invert	29.20	ft
Length	80.00	ft	Constructed Slope	0.002500	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	2.21	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	2.21	ft
Velocity Downstream	8.42	ft/s	Critical Slope	0.003398	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 3 ft		Rise	3.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev	33.20	ft	Upstream Velocity Head	0.92	ft
Ke	0.50		Entrance Loss	0.46	ft

Inlet Control Properties					
Inlet Control HW Elev	33.22	ft	Flow Control	N/A	
Inlet Type	90 and 15 ° wingwall flares		Area Full	72.0	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

© Haestad Methods, Inc.
Coe & Van Loo Consultants
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Calculator Report
GreenBelt Culvert 2010

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	36.40	ft	Headwater Depth/ Height	1.27	
Computed Headwater Elevation	36.19	ft	Discharge	446.00	cfs
Inlet Control HW Elev	36.19	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev	36.18	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	32.37	ft	Downstream Invert	32.09	ft
Length	100.00	ft	Constructed Slope	0.002800	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	2.21	ft
Slope Type	Mild		Normal Depth	2.36	ft
Flow Regime	Subcritical		Critical Depth	2.21	ft
Velocity Downstream	8.42	ft/s	Critical Slope	0.003398	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 3 ft		Rise	3.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev	36.18	ft	Upstream Velocity Head	0.97	ft
Ke	0.50		Entrance Loss	0.48	ft

Inlet Control Properties					
Inlet Control HW Elev	36.19	ft	Flow Control	N/A	
Inlet Type	90 and 15 ° wingwall flares		Area Full	72.0	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

© Haestad Methods, Inc.
Coe & Van Loo Consultants
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

APPENDIX F

Excerpt from Preliminary Drainage Report

APPENDIX G

FCD Table

FCD Table Wigwam Creek (980098-02)		
Miles/Acres of Protected Natural Watercourse	0	0
Miles of Improved Watercourse or Storm Drain	0.45	
Acres of Retention or Detention Areas	5.6	

n:\980098\hydro\lotus\FCD.xls

APPENDIX H

Off-site Swale Calculations & Drainage Exhibit

CVL

Cross Section A-A
Worksheet for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION A-A
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

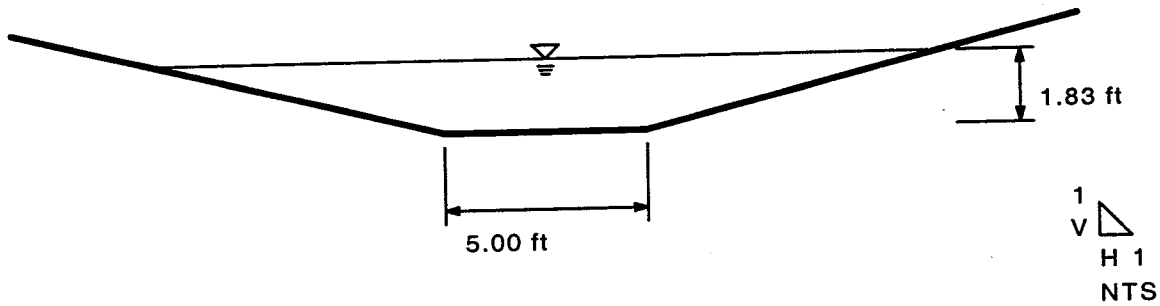
Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	73.00	cfs

Results		
Depth	1.83	ft
Flow Area	22.53	ft^2
Wetted Perimeter	20.08	ft
Top Width	19.63	ft
Critical Depth	1.33	ft
Critical Slope	0.019165	ft/ft
Velocity	3.24	ft/s
Velocity Head	0.16	ft
Specific Energy	1.99	ft
Froude Number	0.53	
Flow is subcritical.		

Cross Section A-A
Cross Section for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION A-A
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Depth	1.83	ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	73.00	cfs



Cross Section B-B
Worksheet for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION B-B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

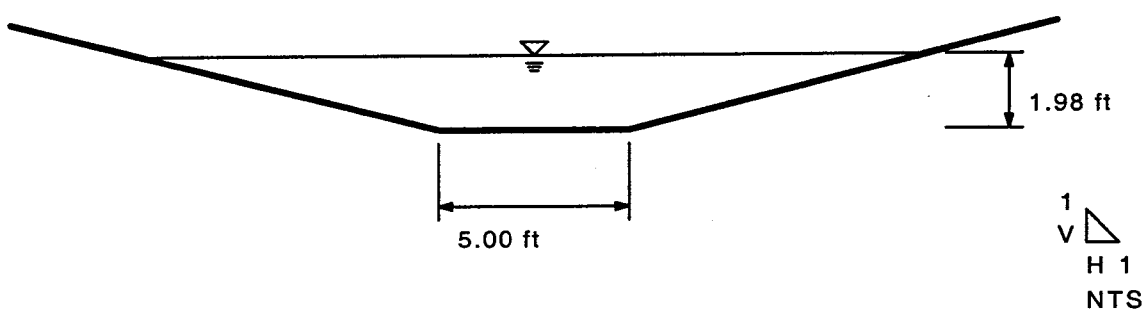
Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	87.00	cfs

Results		
Depth	1.98	ft
Flow Area	25.65	ft^2
Wetted Perimeter	21.35	ft
Top Width	20.87	ft
Critical Depth	1.46	ft
Critical Slope	0.018703	ft/ft
Velocity	3.39	ft/s
Velocity Head	0.18	ft
Specific Energy	2.16	ft
Froude Number	0.54	
Flow is subcritical.		

Cross Section B-B
Cross Section for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION B-B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Depth	1.98	ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	87.00	cfs



CROSS SECTION C-C
Worksheet for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION C-C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

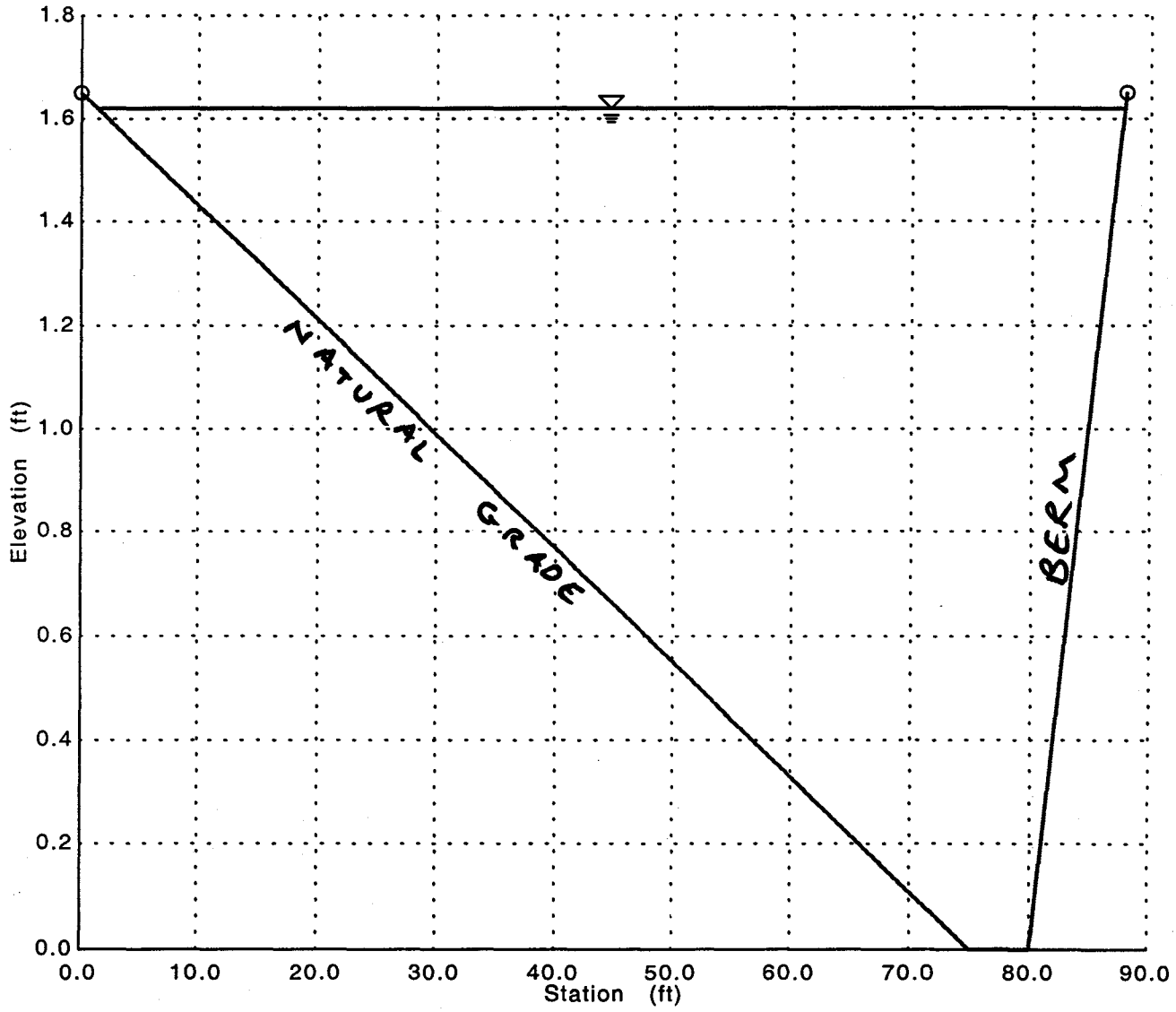
Input Data				
Channel Slope	0.002000 ft/ft			
Elevation range: 0.00 ft to 1.65 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.65	0.00	88.00	0.030
75.00	0.00			
80.00	0.00			
88.00	1.65			
Discharge	148.00 cfs			

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	1.62	ft
Flow Area	74.15	ft^2
Wetted Perimeter	86.70	ft
Top Width	86.52	ft
Height	1.62	ft
Critical Depth	1.07	ft
Critical Slope	0.015758	ft/ft
Velocity	2.00	ft/s
Velocity Head	0.06	ft
Specific Energy	1.68	ft
Froude Number	0.38	
Flow is subcritical.		

Cross Section C-C
Cross Section for Irregular Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION C-C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	1.62	ft
Discharge	148.00	cfs



Cross Section D-D
Worksheet for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION D-D
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

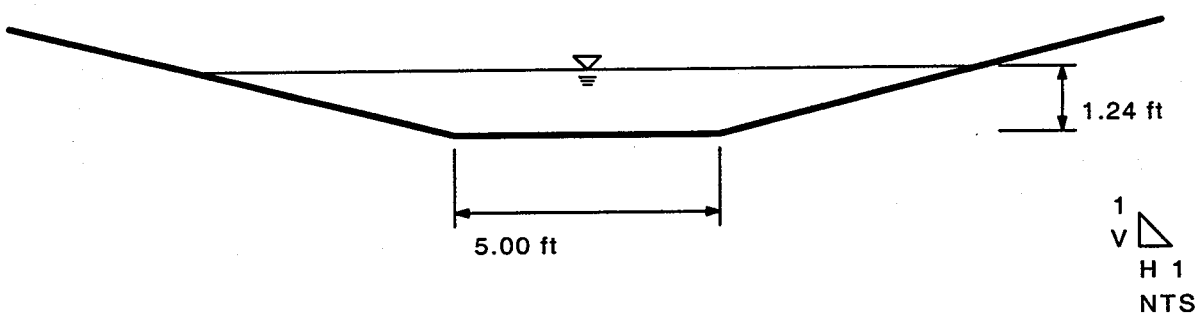
Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	32.00	cfs

Results		
Depth	1.24	ft
Flow Area	12.28	ft^2
Wetted Perimeter	15.19	ft
Top Width	14.88	ft
Critical Depth	0.86	ft
Critical Slope	0.021556	ft/ft
Velocity	2.61	ft/s
Velocity Head	0.11	ft
Specific Energy	1.34	ft
Froude Number	0.51	
Flow is subcritical.		

Cross Section D-D
Cross Section for Trapezoidal Channel

Project Description	
Project File	n:\980098\hydro\haestad\swale.fm2
Worksheet	CROSS-SECTION D-D
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Depth	1.24	ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Bottom Width	5.00	ft
Discharge	32.00	cfs



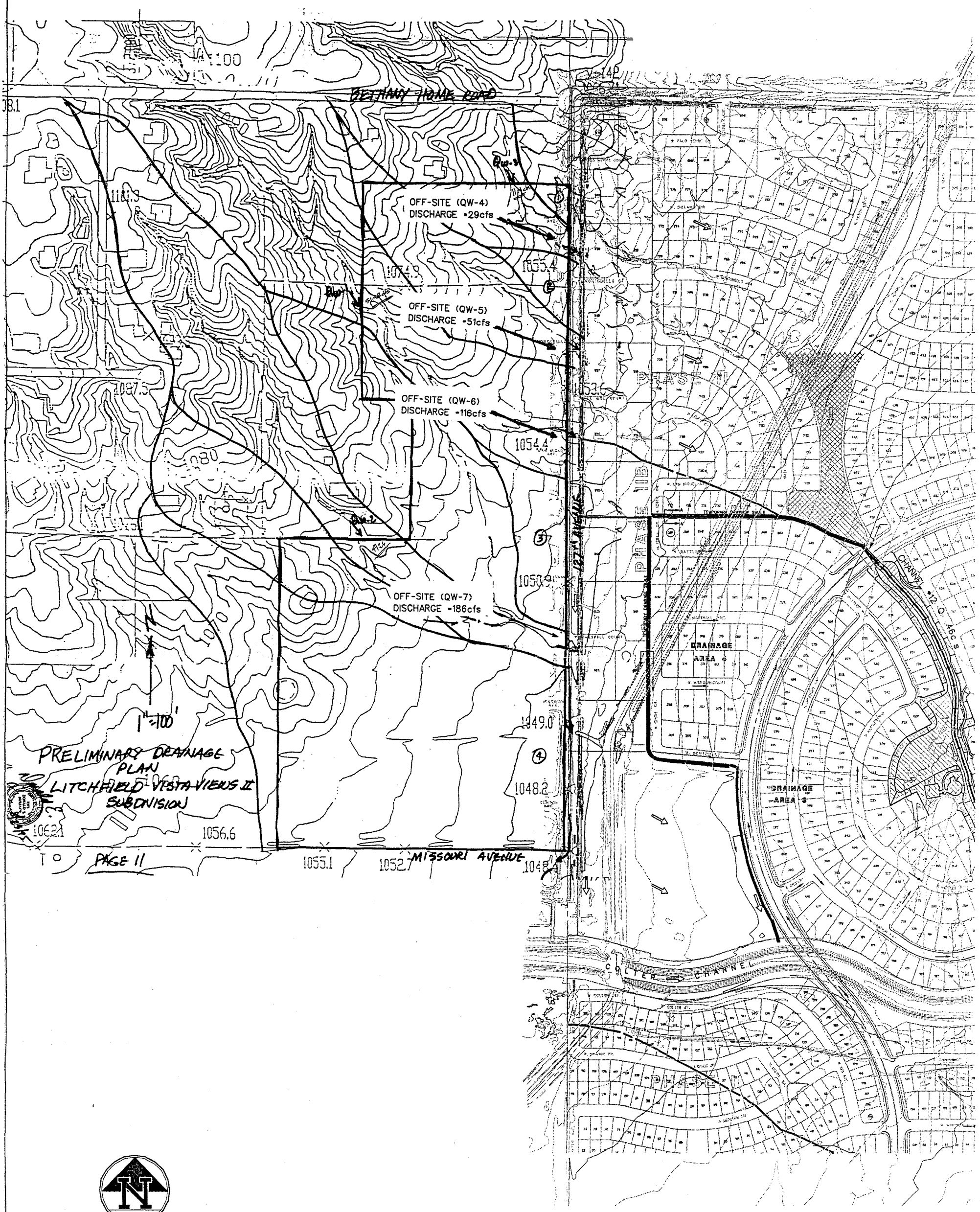


FIGURE	JOB NO. 980098-07	DRAINAGE EXHIBIT	WIGWAM CREEK
		4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

PLATE

NOTE: OFFSITE FLOWS ALONG 127TH AVE DRAINING TOWARD CHANNEL 12 WIL BE ADDRESSED IN THE PHASE II FINAL DRAINAGE REPORT

OFF-SITE (QW-6)
DISCHARGE =116cfs

OFF-SITE (QW-7)
DISCHARGE =186cfs

FOR SWALE CROSS SECTION A-A

BOUNDARY AFFECTING THE SWALE = 3.6acres
TOTAL AREA FOR HEC-1 NODE A = 58 acres
FLOW FOR NODE A = 129cfs
TOTAL ONSITE FLOW = 129(3.6/58) = 8cfs
OFFSITE FLOW = 116cfs
OFFSITE FLOW UPSTREAM NOT AFFECTING SWALE = 51cfs
TOTAL OFFSITE FLOW = 65cfs
TOTAL FLOW IN THE SWALE = 73cfs

FOR SWALE CROSS SECTION B-B

BOUNDARY AFFECTING THE SWALE = 7.8 acres
TOTAL AREA FOR HEC-1 NODE A = 58 acres
FLOW FOR NODE A = 129cfs
TOTAL FLOW IN SWALE = 129(7.8/58) = 17cfs
OFF-SITE FLOW = 186cfs
OFF-SITE FLOW UPSTREAM NOT AFFECTING SWALE = 116cfs
TOTAL OFFSITE FLOW = 70cfs
TOTAL FLOW IN SWALE = 87cfs

FOR SWALE CROSS SECTION C-C

FLOW FROM CROSS SECTION B-B = 87cfs
SCHOOL SITE ONSITE FLOW = 61cfs
TOTAL FLOW IN THE SWALE = 148cfs

FOR SWALE CROSS SECTION D-D

BOUNDARY AFFECTING THE SWALE = 14 acres
TOTAL AREA FOR HEC-1 NODE G = 32 acres
FLOW FOR NODE G = 72cfs
TOTAL ONSITE FLOW = 72(14/32) = 32cfs
TOTAL FLOW IN THE SWALE = 32cfs

NOTE: THE FLOW USED FOR THE ANALYSIS OF THE TEMPORARY DRAINAGE SWALES WAS BASED ON THE PRELIMINARY DRAINAGE REPORT

KEY TO SYMBOLS

- DRAINAGE AREA BOUNDARY
- DIRECTION OF OFF-SITE FLOW
- DIRECTION OF ON-SITE FLOW
- CB*-* CATCH BASIN (CB* XX-YY-ZZ)
- STORM DRAIN (SD* XX-YY)
- 1 CONCENTRATION POINT (CP)
- 6" VERTICAL CURB LOCATION
- R-3 RETENTION BASIN IDENTIFICATION
- APPROXIMATE FLOODPLAIN BOUNDARY
- SWALE BOUNDARY

DESIGNATION OF HYDRAULIC STRUCTURES (XX-YY-ZZ)

XX=PARCEL OR UNIT DESIGNATION
YY = STORM DRAIN SYSTEM NUMBER
ZZ = FACILITY NUMBER
(NUMBERED SEQUENTIALLY FROM DOWNSTREAM END)

200' 100' 0 200'
SCALE IN FEET

WIGWAM CREEK PHASE 1

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

DRAINAGE MAP

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO.
980098-07

PLATE 1

DATE- JUL 06, 2000
TIME- 07:15:31
FILE- M:\980098\land\phase1\gdmap.dgn