Peterson Air Force Base
Colorado Springs, Colorado

Type "A" Report
Basewide Storm Drainage Study
Peterson Project No. 91-1061E
for
1003 CES/DEED, Stop 37, Peterson AFB, Colorado 80914

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100% Submittal

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PART 1

GENERAL DESCRIPTION

1

1.1 Purpose:

The purpose of this report is to provide Type "A" services for Peterson AFB, Project 91-1061E, Basewide Storm Drainage Study. The existing storm drainage system was constructed in phases without the benefit of a comprehensive drainage plan. The result is an incohesive and inadequate system. This report will identify existing problem drainage areas and make recommendations for improving the major drainage system. Future development will also be anticipated. Drainage system improvements will comply with future flows and drainage patterns.

1.2 Project Description:

The study area includes all of Peterson AFB north and east of the existing runways except Peterson East. The area is approximately 1,000 acres of mostly developed land. The storm water runoff will be analyzed using the Army Corps of Engineers hydraulics computer program HEC-1. Hydrographs and rainfall rates are provided by the City of Colorado Springs. Future drainage requirements will be anticipated and incorporated into the proposed drainage plan.

1.3 Authorization:

This Type "A" report was authorized by 3 SSW/PKBAC Contract No. DACA21-90-00004, "Basewide Storm Drainage Study, No. 91-1061E".

1.4 Criteria Used:

1.4.1 City of Colorado Springs and El Paso County, Drainage Criteria Manual, 1987.

1.4.2 All applicable Air Force regulations.

PART 2

ANALYSIS CRITERIA AND METHODS

2

2.1 General:

The City of Colorado Springs and El Paso County have developed a Drainage Criteria Manual which presents analysis criteria and methods appropriate for use by Peterson Air Force Base. That manual is generally the basis of all storm water analysis presented in this report. The City of Colorado Springs will be supplied with copies of all phases of this report. Final review and approval of this report will not be made by the City, although it is technically in their jurisdiction. Air Force personnel are solely responsible for internal drainage issues. The City of Colorado Springs comments, suggestions, and guidance are always welcome.

2.2 Storm Water Runoff:

The general approach to determining the storm water runoff for Peterson AFB is first to identify drainage patterns, organize the site into drainage areas, determine the hydraulic properties of each drainage area, and develop computer models which describes the behavior of storm water. For this site the existing drainage areas are organized according to the underground storm sewer collector to which it contributes. The main exception to this rule is when a storm sewer diverts flow from the natural surface drainage pattern and it is known that the culvert will not receive or convey a significant percentage of the flow generated by that drainage area.

The hydraulic properties of the site are determined by first considering the type of soil on the site, the type and condition of vegetation covering the site, the percent of the site with impervious cover, the slope of the surface, and the storm water collection system. All of these variables are subject to some judgment and no two hydrologists will reach exactly the same conclusions.

Runoff can be modeled by two methods: the Rational Method or the Soil Conversation Service (SCS) Hydrograph Method. The rational method is appropriate for drainage areas of less than 100 acres and is easily performed by hand calculations. The hydrograph method is appropriate for large areas and requires computer analysis. It is determined that the hydrograph method should be used for this site due to the large basin sizes and the flexibility of computer analysis. The Drainage Criteria Manual has no preferences as to the computer program used to generate storm water runoff from the SCS Type IIA, 24-hour hydrograph. The Army Corps of Engineers HEC-1 program is acceptable and is used in this report. HEC-1 is powerful, flexible and is completely appropriate for this site.

Two storm reoccurrence frequencies are recommended by the Drainage Criteria Manual; the 10-year and 100-year intervals. The storm sewer system should be capable of conveying the 10-year rainfall. The 100-year runoff should be considered in the storm sewer system design; however, a system capable of conveying a 100-year storm would be expensive and generally not cost effective. A well designed system will adequately convey frequent storms without disrupting normal activities or resulting in damage. Low

reoccurrence frequency storms will result in some flooding, and minor damage should be tolerated.

2.3 Storm Sewers and Hydraulic Structures:

Storm sewers, drop structures and other structures are designed based on the criteria provided in the drainage manual. Storm sewers are intended to function at capacity for the 10-year storm. This means the culvert will be flowing full with maximum depth in the inlets and manholes. Rainfall exceeding the 10-year event will flow on the surface.

2.4 Roads and Inlets:

The size and spacing of inlets is to be determined using the Drainage Criteria Manual. The intent is to provide a system which allows normal traffic patterns during minor storms and allows access of emergency vehicles during major events. These criteria should apply to both new systems and improvements to existing storm sewers.

PART 3

EXISTING CONDITIONS

3

3.1 General:

The study area encompasses approximately 1,000 acres of mostly developed land. The slope of the site is generally to the south at approximately 1 1/2 percent. The natural soil type is SCS Type A, Blakeland Sandy Loam, which is highly porous. Vegetation cover is generally good. There are no natural drainage features on the site, although Sand Creek passes along the northwest corner. The area in the vicinity of the creek slopes to the west.

3.2 Existing Collector System:

The existing storm drain system can be divided into seven main collectors. They are:

3.2.1 Main line in Hamilton Avenue. This line ties most of the onsite storm sewers to a swale which discharges into the recreational pond at the southern most limits of the study area. The storm sewer is 72" from the discharge headwall to Peterson Boulevard. Between Peterson Boulevard and Otis Street the pipe diameter decreases in stages to a final diameter of 24". Either directly or indirectly drainage areas A, B, C, D, E, and F contribute to this storm sewer. (Refer to map in the Appendix).

3.2.2 A 36" collector runs up Mitchell Street from the 72" main line in Hamilton Avenue to Stewart Avenue. It continues north in Mitchell Street as a 21" line which collects storm water from the family housing area. A second 36" line branches west in Stewart Avenue and collects additional runoff from family housing to the north. Drainage area B is the main source of runoff for this storm sewer.

3.2.3 A major collector ties to the 72" main line in Hamilton Avenue and runs north along Peterson Boulevard to almost Paine Street. The line is tied to a secondary network of storm sewers and inlets which collect runoff from a large area west of Peterson Boulevard. The line diameter is 48" at Hamilton Avenue and decreases in stages to a final 18" diameter. Drainage Area E contributes to this storm sewer.

3.2.4 A 21" storm sewer extends north along Otis Street from Hamilton Avenue to approximately Ent Avenue. From there it branches into a system of minor roof and parking lot drains. Much of the flow in this storm sewer comes from drainage Area F. Some flow is diverted from drainage Area D.

3.2.5 Space Command Headquarters has a 48" storm sewer system which collects flow in the vicinity of the building and conveys it west to Sand Creek. Drainage Area H is the main contributor to this storm sewer.

3.2.6 A storm sewer system in the area near the west entrance to the base collects flow from a large area west of Peterson Boulevard and generally north of Paine Street. The system varies in size but discharges to Sand Creek as a 54" pipe. This storm sewer conveys storm water from Drainage Area G.

3.2.7 A 30" storm sewer extends west from the intersection of Hamilton Avenue and Paine Street. This line discharges into a swale which discharges into Sand Creek. Drainage Area F is the main source of storm water for this storm sewer.

Numerous minor culverts and storm sewers exist onsite which collect roof and surface runoff. Some are tied to the above mentioned storm sewer collectors while others daylight and surface flow to an inlet or other collection structure.

3.3 Major Drainage Areas:

The study area has been divided into nine existing major drainage areas: one for each of the seven main collectors and two which contribute directly to detention pond #3. The drainage areas are:

3.3.1 Drainage Area A consists mainly of the golf course located at the south end of the Base. A large pond in the center of the basin receives much of the runoff. A 36" pipe at Kincheloe Loop ties this basin to the 72" Hamilton Avenue Main Collector. The vegetation cover is good and very little impervious cover exists. Calculations indicate the runoff from this area to be 32 cfs and 87 cfs for the 10-year and 100-year events, respectively. These numbers ignore the detention affects of the existing pond and other depressions. Considering this the actual runoff from Drainage Area A is probably much less.

3.3.2 Drainage Area B is the largest of all the drainage areas encompassing almost all of the family housing area and a large area north of the Family Housing Area to State Highway 94. All this drainage flows into the Mitchell Street Collector. The storm water runoff from this 292 acre area is relatively modest at 73 cfs and 213 cfs for the 10-year and 100-year rainfalls respectively. This is mainly due to good vegetation cover, Type A soil north of the family housing area and low impervious cover. Planned development in the area north of family housing and south of State Highway 94 will significantly increase runoff.

3.3.3 Drainage Area C is small at 14 acres. Minor culverts tie the area to both the Mitchell Street and Hamilton Avenue Collectors. However, the majority of the 37 cfs/63 cfs runoff surface flows to a sump area south of Hamilton Avenue.

3.3.4 Drainage Area D consists of all areas which flow directly into the Hamilton Avenue Collector west of Mitchell Street. The basin encompasses 136 acres of mostly developed land. There is some overlap between these drainage areas and other collectors: however, their diversion is assumed minimal. The calculated runoff is 90 cfs and 207 cfs for the 10-year and 100-year events.

3.3.5 Drainage Area E contributes to the Peterson Boulevard Collector. This area is 80 acres of developed land with a high percentage of impervious cover. As a result, the runoff is high at 152 cfs and 277 cfs for the 10-year and 100-year

storms. The area is covered with a network of secondary storm sewers which collect roof and surface runoff.

3.3.6 Drainage Area F is unusual in that four different collectors intercept some flow from the basin, however, none to a degree which affects the general surface flow patterns. Field investigations indicate the majority of the flow enters the Hamilton Avenue Collector near Paine Street. The basin size is approximately 57 acres. Storm water runoff is calculated to be 63 cfs and 134 cfs for the 10-year and 100-year events. Significant development opportunities exist in this basin. Future development will significantly increase flows and should be anticipated with drainage improvements.

3.3.7 Drainage Area G consists of 197 acres mostly west of Peterson Boulevard and north of Paine Street. The basin flows into the 54" collector to Sand Creek. The area is generally not developed with a relatively low percent impervious cover. The calculated flows are 102 cfs and 257 cfs for the 10-year and 100-year events, respectively. Future development in this basin will increase flows significantly.

3.3.8 Drainage Area H encompasses Space Command Headquarters and flows into a 48" storm sewer to Sand Creek. This area is 51 acres with a modest percent impervious cover. Storm water runoff is 64 cfs and 133 cfs for the 10-year and 100-year events, respectively. No further development is anticipated in this drainage area.

3.3.9 Drainage Area I consists of the golf course, shooting range and an undeveloped area. Impervious cover is very low. This area surface flows to a sump inlet which discharges directly into City Detention Pond # 11. Calculated runoff is very low at 29 cfs and 90 cfs. Little future development is anticipated.

3.4 Locations of Special Concern

Throughout Peterson Air Force Base there are localized areas which exhibit frequent flooding. These areas are numerous with existing conditions; however, considerable relief of this flooding will be realized by the major drainage system improvements presented in this report.

3.5 Analysis of Existing Storm Sewer System:

In general, the storm sewer system is not capable of conveying the 10-year event. Flows were calculated based on existing conditions and compared with the capacity of the existing collectors. Those findings are presented in Table 1. No effort was made to confirm the adequacy of the existing inlets to divert surface flow to the collectors.

3.6 Analysis of Detention Ponds

City Detention Pond #11 is the only existing detention pond which is designed to accept flow from the study area. That pond has been analyzed in previous reports and found

to have adequate capacity. It is not analyzed in detail in this report; however, it is included in the computer model. The intent of doing this is to provide an approximate water surface elevation which will indicate if further detailed analysis is warranted.

Incorporating local detention ponds into the future drainage system was not considered, due to the high value of the limited remaining space available for development.

3.7 Offsite Drainage Areas

There are no offsite drainage areas which contribute significant flow to the study area. There is a small area on the north side of State Highway 94 which flows into existing Drainage Area B. Runoff from this area is minor and is due to a low percent impervious cover and high infiltration rate.

TABLE 1
EXISTING MAJOR DRAINAGE COLLECTOR

COLLECTOR	EXISTING CAPACITY (CFS)	EXISTING FLOWS (CFS) 10-YEAR	EXISTING FLOWS (CFS) 100-YEAR
Hamilton Avenue - Peterson to Mitchell - Mitchell to Det. Pond #3	 250 310	 262 316	 536 662
Mitchell Street	60	73	213
Peterson Boulevard	130	152	277
Space Command 48"	125	64	133
Sand Creek 54"	220	102	257
Sand Creek 30"	70	63	134

PART 4

FUTURE DEVELOPMENT

4

4.1 General:

The study area is generally developed; however, opportunities exist for further development. The major area for development is the open area east of Space Command Headquarters, between State Highway 94 and the Family Housing area. This area encompasses approximately 100 acres. This area is now in a relatively natural state and runoff is light. Major drainage improvements will be required to protect existing facilities from increased flows resulting from the development of this area.

Additional development is also planned for a 20 acre area west of Peterson Boulevard and north of Paine Street. This area will also require storm sewer improvements when developed.

Numerous smaller areas onsite will also be developed. Computer models used in the analysis of the future sites are adjusted for maximum buildout.

PART 5

PROPOSED DRAINAGE IMPROVEMENTS

5

5.1 Proposed Major Drainage Areas:

The proposed drainage areas are delineated by generally the same boundaries as the existing drainage area. The main difference between the existing and proposed areas is that additional basins were created where key flows were needed. These key flows were necessary to size diversions which convey flow from the existing storm sewer system or to confirm the capacity of the existing system. The proposed diversions are detailed in Section 5.2.

5.1.1 Drainage Area A consists of 47 acres of mainly golf course with little impervious cover. Vegetation cover is in good condition. A pond is located roughly in the center of the drainage area. The flow direction is to the southwest at 2 percent. Computer analysis indicates runoff from this area to be 15 cfs and 45 cfs for the 10-year and 100-year events respectively. These flows do not account for the detention provided by the pond and other depressions. The actual flows will probably be considerably less. No significant future development is anticipated in this area.

5.1.2 Drainage Area B is 40 acres of mostly open space. Included is a portion of the family housing area and part of the shooting range. Some building and road improvements are expected in the area. Flow is to the west at approximately 1 percent. The calculated flows from this basin are 12 cfs and 38 cfs for the 10-year and 100-year events respectively.

5.1.3 Drainage Area C encompasses 147 acres of mostly family housing. No further development is anticipated in this area. The surface flow is to the south at 1.2 percent. The calculated flows from this area are 145 cfs and 316 cfs for the 10-year and 100-year storms. Flow from this area will be collected in an improved Stewart Avenue storm sewer and diverted east to a new swale.

5.1.4 Drainage Area D is relatively small with 28 acres. Future land use indicates the area will be administrative, community commercial, community services, and housing. A high impervious cover is assumed. All flow from this basin enters the Mitchell Street Collector. The calculated flows will be 75 cfs and 126 cfs for the 10-year and 100-year storms.

5.1.5 Drainage Area E is very small at 14 acres of mostly administrative use. The open space in the basin is assumed to be fully developed. Impervious cover will be high. Flow is to the south at 1 1/2 percent.

This basin contributes to both the Mitchell Street and Hamilton Avenue Collector. The total calculated flow is 38 cfs and 63 cfs for the 10-year and 100-year events.

5.1.6 Drainage Area F covers 121 acres which will be fully developed. The land use categories included are administrative, industrial, community commercial, aircraft O&M, and outdoor recreation. The majority of storm water from this area flows south to the Hamilton Avenue Collector. The flows are 63 cfs and 184 cfs for the 10-year and 100-year storms.

5.1.7 Drainage Area G encompasses 34 acres of medical, community commercial, community services, and administrative land use. The area is now fully developed and no significant changes in cover are anticipated. The direction of flow is to the south at approximately 1 1/2 percent. All the runoff from this area goes into the Peterson Boulevard Collector system. The calculated flows are 91 cfs and 151 cfs for the 10-year and 100-year events.

5.1.8 Drainage Area H is 48 acres of fully developed land. Land use is administrative, community commercial, and community services. No additional development is anticipated. The entire drainage area now flows into the Peterson Boulevard collector. This drainage area was added to define the flow converging at Peterson Boulevard and Stewart Avenue. That intersection is a convenient location to construct a diversion storm sewer in Stewart Avenue which will convey flow from the overloaded Peterson Boulevard and Hamilton Avenue Collectors. The calculated flows are 124 cfs and 204 cfs for the 10-year and 100-year events.

5.1.9 Drainage Area I covers 52 acres of industrial, open space, administrative, community commercial and community services. The majority of flow from this area goes to the 30" storm sewer to Sand Creek however some flow is diverted to the Otis Street Collector and to Sand Creek in the 54" Collector. There are opportunities for development in this drainage area. It is considered fully developed in the flow rate calculations. The 10-year and 100-year flows are 136 cfs and 227 cfs.

5.1.10 Drainage Area J is large at 105 acres. Land use will be outdoor recreation, industrial, community services, and community commercial. All storm water runoff from this drainage area enters the 54" collector which flows directly to Sand Creek. Some future development will be made. The calculated flow rates are 161 cfs and 325 cfs for the 10-year and 100-year storms.

5.1.11 Drainage Area K encompasses 31 acres. The land use will be mostly special space missions with some community commercial. The drainage area was added because future development will require a storm sewer system to tie into. Diverting flow from this area to Sand Creek will help

reduce the load on down stream collectors. The calculated flow rates are 83 cfs and 138 cfs for the 10-year and 100-year events.

5.1.12 Drainage Area L is 53 acres of administrative land. No further development is anticipated. The impervious cover is moderate with considerable open space. All the storm water runoff from this area flows to a 48" collector to Sand Creek. No other drainage areas contribute significant flow to this culvert. The calculated flows are 74 cfs and 151 cfs for the 10-year and 100-year storms.

5.1.13 Drainage Area M encompasses 62 acres of land dedicated for administrative use. The area is open space at present so considerable development will occur. This basin slopes to the south at approximately 2 percent. At present this area sheet flows south across the north boundary of the existing family housing. The extensive development anticipated will require a storm sewer system. It is recommended a diversion storm sewer be constructed to convey flow from this area through family housing to a new swale. The flow rates are 160 cfs and 270 cfs for the 10-year and 100-year events.

5.1.14 Drainage Area N is a long thin drainage area along the east boundary of the study area. The area is now open space and is expected to remain so. Paine Street will ultimately be extended to the north end of this area. It is not known how much it will affect storm water runoff in the area. All the flow from this site will be collected into a swale which runs from the southeast corner of Drainage Area M to City Detention Pond # 11. The calculated flows are 21 cfs and 74 cfs for the 10-year and 100-year storms.

5.1.15 Drainage Area O is 117 acres of land reserved for outdoor recreation. Vegetation cover is good and very little impervious cover exists. The flow direction is to the south at an average slope of 2 percent. A sump inlet into City Detention Pond #11 receives the runoff. No further development is anticipated in this drainage area. The calculated flows are 34 cfs and 108 cfs for the 10-year and 100-year storms.

5.1.16 Drainage Area P is approximately 17 acres of land mostly dedicated for highway use with some commercial zoning. At present, most of this area flows into a detention area created by State Highway 94. When development occurs in this area it is assumed a culvert will be constructed under the highway which will allow flow to impact the site. It is recommended that a 48" storm sewer be constructed along the north Peterson property line to intercept this flow. Calculations indicate the flow rates to be 2 and 14 for the 5-year and 100-year events.

5.1.17 Drainage Area Q is a 100 acre offsite flow which combines with Drainage Area P at the north property line. At present, the area discharges very little flow; however, once development occurs the runoff will be significant, 216 cfs and 372 cfs. It is recommended that a 60" storm sewer be constructed to intercept this flow and divert it to the new

swale on the east side of family housing.

5.2 Major New Drainage Improvements:

The existing storm sewer system is undersized for existing conditions based on the 10-year storm. Future development will increase drainage problems on site. To help eliminate the need to perform expensive replacement of undersized existing collectors it is recommended that where possible storm water be diverted away from these collectors. The following new drainage systems are recommended:

5.2.1 The East Swale is a swale to be constructed from the northeast corner of the Family Housing Area to City Detention Pond # 11. The swale would collect and divert flow away from the existing undersized storm sewer system. The swale should be grass lined and designed with a slope gradual enough to prevent erosion during minor storm events. Drop structures consisting of a concrete runoff wall and extensive riprap will be required at intervals varying with the slope of the surface. Drainage areas C, H, M and N contribute to this swale.

5.2.2 The North 60" Storm Sewer is a 60" RCP to be constructed from the north side of the Family Housing Area to the East Swale. Temporary swales would be constructed along the north side of the family housing area to divert flow into the 60" pipe. The temporary swales could be replaced by culverts and inlets when the area is further developed. Drainage Area M contributes to this storm sewer.

5.2.3 The East 72" Storm Sewer is necessary to lessen the required improvements to the Mitchell Street Collector and Hamilton Avenue Collector. A 72" RCP should be constructed from Mitchell Street at Stewart Avenue east to the new swale east of the golf course. This line, in conjunction with the new north 60" storm sewer, would reduce the flow to the Mitchell Street Collector to its existing capacity. Drainage Areas H and C contribute to this storm sewer.

5.2.4 The Sand Creek 48" storm sewer should extend from Sand Creek at the west entrance east to Peterson Boulevard. Development west of Peterson Boulevard and north of Paine Street will be tied to this line. Drainage Area K contributes to this storm sewer.

5.2.5 The Stewart Avenue 54" storm sewer is required to relieve the undersized Peterson Boulevard Collector. Rather than replacing the existing Peterson Boulevard Collector it would be preferable to extend the new 72" culvert mentioned in paragraph 5.2.3 at Stewart Avenue and Mitchell Street along Stewart Avenue to Peterson Boulevard. This extension should be 54" diameter. The flow in the 42" storm sewer in Peterson Boulevard could then be diverted east relieving the load on the Peterson Boulevard and Hamilton Avenue Collectors. Drainage Area H contributes to this storm sewer.

5.2.6 Northeast 60" diversion is a 60" storm sewer which will collect offside flows entering the north property line east of Space Command Headquarters. This storm sewer should start approximately 1,500 feet east of Peterson Boulevard and extend east 1,200 feet to the existing fence line. At the fence it will run south approximately 3,000 feet where it will discharge into the proposed East Swale. Drainage Areas P and Q contributed to this culvert.

5.3 Major Existing Drainage Structure Improvements:

The proposed new storm sewers and swale will divert enough flow away from the existing system that no major reconstruction will be required for the existing system. Minor improvements such as inlet replacements will still be required. See Table 2 for a summary of the Flowrates after the Proposed Drainage Improvements.

TABLE 2
FUTURE MAJOR DRAINAGE COLLECTORS

COLLECTOR	CAPACITY (CFS)	FUTURE FLOWS 10-YEAR	FUTURE FLOWS 100-YEAR
Hamilton Avenue - Peterson to Mitchell - Mitchell to Det. Pond #3	 250 310	 154 290	 335 602
Mitchell Street	60	86	161
Peterson Boulevard	130	91	151
Space Command	125	74	151
Sand Creek 54"	220	161	325
Sand Creek 30"	70	136	227
East Swale (15', 3:1, S=0.0025)	1,200	647	1,180
New North 60"	190	160	270
New East 72"	300	269	534
New Sand Creek 48"	110	83	138
New Stewart Avenue 54"	140	124	207
New Northeast 60"	190	218	387

PART 6

PHASING OF IMPROVEMENTS

1. Improve inlets in Peterson Boulevard.

2. Improve inlets in Mitchell Street.

3. Improve inlets and ditch along Hamilton Boulevard.

4. Construct East Swale from City Detention Pond #11 to the East 72".

5. Construct the East 72", Stewart Avenue 54" and Stewart Avenue 48" Storm Sewers. Improve inlets in Stewart. Tie the Stewart Avenue 48" to existing Peterson Boulevard 42" storm sewer.

6. Extend the East Swale from the East 72" to a point approximately 1,100 feet north of family housing. Much of this swale will be temporary and will be replaced by the Northeast 60" storm sewer.

7. Construct the 60" Family Housing storm sewer and the 60" Northeast storm sewer. Both of these lines will be constructed prior to development of Drainage Area M. However, prior to development, the temporary portion of the East Swale can divert much of the flow from Family Housing. Area development of the west portion of Drainage Area O north of State Highway 94 may require construction of the Northeast 60" prior to construction of the Family Housing 60" line.

8. Construction of the 48" Sand Creek Line should be coordinated with development west of Peterson Boulevard and north of Pain Street.

PART 7

SUMMARY

7.1 General:

The storm sewer system in the study area can be improved to adequately convey the 10-year storm by the construction of new storm sewers and swales to divert storm water runoff form existing undersized storm sewers. By diverting flows away from developed areas, removal and replacement of existing storm sewers can be minimized which will minimize cost and disruption of normal base operations.

PART 8

REFERENCES

1) Base Comprehensive Plan, Phase I, Peterson Air Force Base, Colorado Springs, Colorado, December, 1990

2) Drainage Criteria Manual, City of Colorado Springs / El Paso County, October, 1987

3) Peterson Field Drainage Basin Master Plan Update, City of Colorado Springs, Colorado, URS, August, 1984

APPENDIX

GENERAL INFORMATION

TABLE 5-7
RUNOFF CURVE NUMBERS
FOR HYDROLOGIC SOIL-COVER COMPLEXES
URBAN AND SUBURBAN CONDITIONS 1/
(For Antecedent Moisture Condition III)
(From: U.S. Department of Agriculture, Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 2-HOUR STORM ONLY.

Land Use	Average % impervious 3/	Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition: grass cover on 75% or more of the area		59*	78	88	91
Fair conditon: grass cover on 50% to 75% of the area		69*	84	91	93
Commercial and business areas (85% impervious)		96*	97	98	98
Industrial districts 72% impervious)		92*	95	97	98
Residential: 2/					
Acres per Dwelling Unit					
1/8 acre or less	65	89*	94	96	97
1/4 acre	38	78*	88	93	95
1/3 acre	30	75*	86	92	94
1/2 acre	25	73*	85	91	94
1 acre	20	70*	84	91	93
Paved parking lots, roofs, driveways, etc.		99	99	99	99
Streets and roads:					
paved with curbs and storm sewers		99	99	99	99
gravel		89*	94	96	97
dirt		86*	92	95	96

1/ For a more detailed description of agricultural land use curve numbers, refer to in the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).

2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

TABLE 5-6
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL-COVER COMPLEXES--RURAL CONDITIONS
(Antecedent Moisture Condition III, and I_a = 0.2 S)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 2-HOUR STORM ONLY.

Land Use	Cover Treatment or Practice	Hydrologic Condition	Runoff curve number by Hydrologic soil group A	B	C	D
Fallow	Straight Row	----	89	94	97	98
Row crops	Straight Row	Poor	86	92	95	97
	Straight Row	Good	83	90	94	96
	Contoured	Poor	85	91	93	95
	Contoured	Good	82	88	92	94
	Cont. and terraced	Poor	82	88	91	92
	Cont. and terraced	Good	79	86	90	92
Small grain	Straight Row	Poor	82	89	93	95
		Good	80	88	93	95
	Contoured	Poor	80	88	92	94
		Good	78	87	92	93
	Cont. and terraced	Poor	78	86	91	92
		Good	77	85	90	92
Close-seeded legumes 1/ or rotation meadow	Straight Row	Poor	82	89	94	96
	Straight Row	Good	76	86	92	94
	Contoured	Poor	81	88	93	94
	Contoured	Good	74	84	90	93
	Cont. and terraced	Poor	80	87	91	93
	Cont. and terraced	Good	70	83	89	91
Pasture or range		Poor	84	91	94	96
		Fair	69	84	91	93
		Good	59	78	88	91
	Contoured	Poor	67	83	92	95
	Contoured	Fair	64	77	88	93
	Contoured	Good	15	55	85	91
Meadow		Good	50	76	86	90
Woods		Poor	65	82	89	93
		Fair	56	78	87	91
		Good	43	74	85	89
Farmsteads		----	77	88	92	94
Roads (dirt) 2/		----	86	92	95	96
(hard surface) 2/		----	88	93	96	97

1/ Close-drilled or broadcast
2/ Including right-of-way

TABLE 5-5
RUNOFF CURVE NUMBERS
FOR HYDROLOGIC SOIL-COVER COMPLEXES
URBAN AND SUBURBAN CONDITIONS 1/
(For Antecedent Moisture Condition II)
(From: U.S. Department of Agriculture, Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 24-HOUR STORM ONLY.

Land Use	Average % impervious 3/	Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition: grass cover on 75% or more of the area		39*	61	74	80
Fair conditon: grass cover on 50% to 75% of the area		49*	69	79	84
Commercial and business areas (85% impervious)		89*	92	94	95
Industrial districts 72% impervious)		81*	88	91	93
Residential: 2/					
Acres per Dwelling Unit					
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

1/ For a more detailed description of agricultural land use curve numbers, refer to in the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).

2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

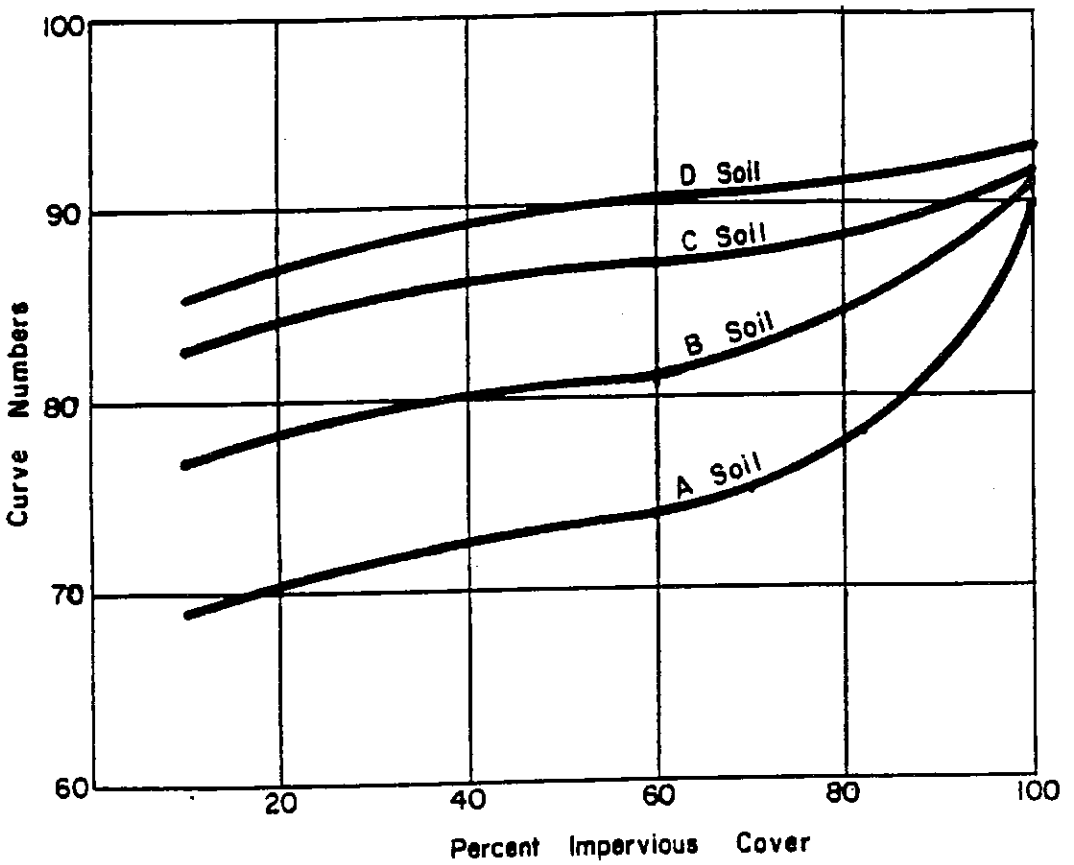
* Not to be used wherever overlot grading or filling is to occur.

TABLE 5-4
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL-COVER COMPLEXES--RURAL CONDITIONS
(Antecedent Moisture Condition II, and I_a = 0.2 S)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 24-HOUR STORM ONLY.

Land Use	Cover Treatment or Practice	Hydrologic Condition	Runoff curve number by Hydrologic soil group A	B	C	D
Fallow	Straight Row	----	77	86	91	94
Row crops	Straight Row	Poor	72	81	88	91
	Straight Row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Cont. and terraced	Poor	66	74	80	82
	Cont. and terraced	Good	62	71	78	81
Small grain	Straight Row	Poor	65	76	84	88
		Good	63	75	83	87
	Contoured	Poor	63	74	82	85
		Good	61	73	81	84
	Cont. and terraced	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight Row	Poor	66	77	85	89
	Straight Row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Cont. and terraced	Poor	63	73	80	83
	Cont. and terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		----	74	84	90	92

1/ Close-drilled or broadcast
2/ Including right-of-way



URBAN HYDROLOGIC SOIL COVER COMPLEX
& ASSOCIATED CURVE NUMBERS

REFERENCE : Pikes Peak Area Council of Governments Areawide Urban Runoff Control Manual

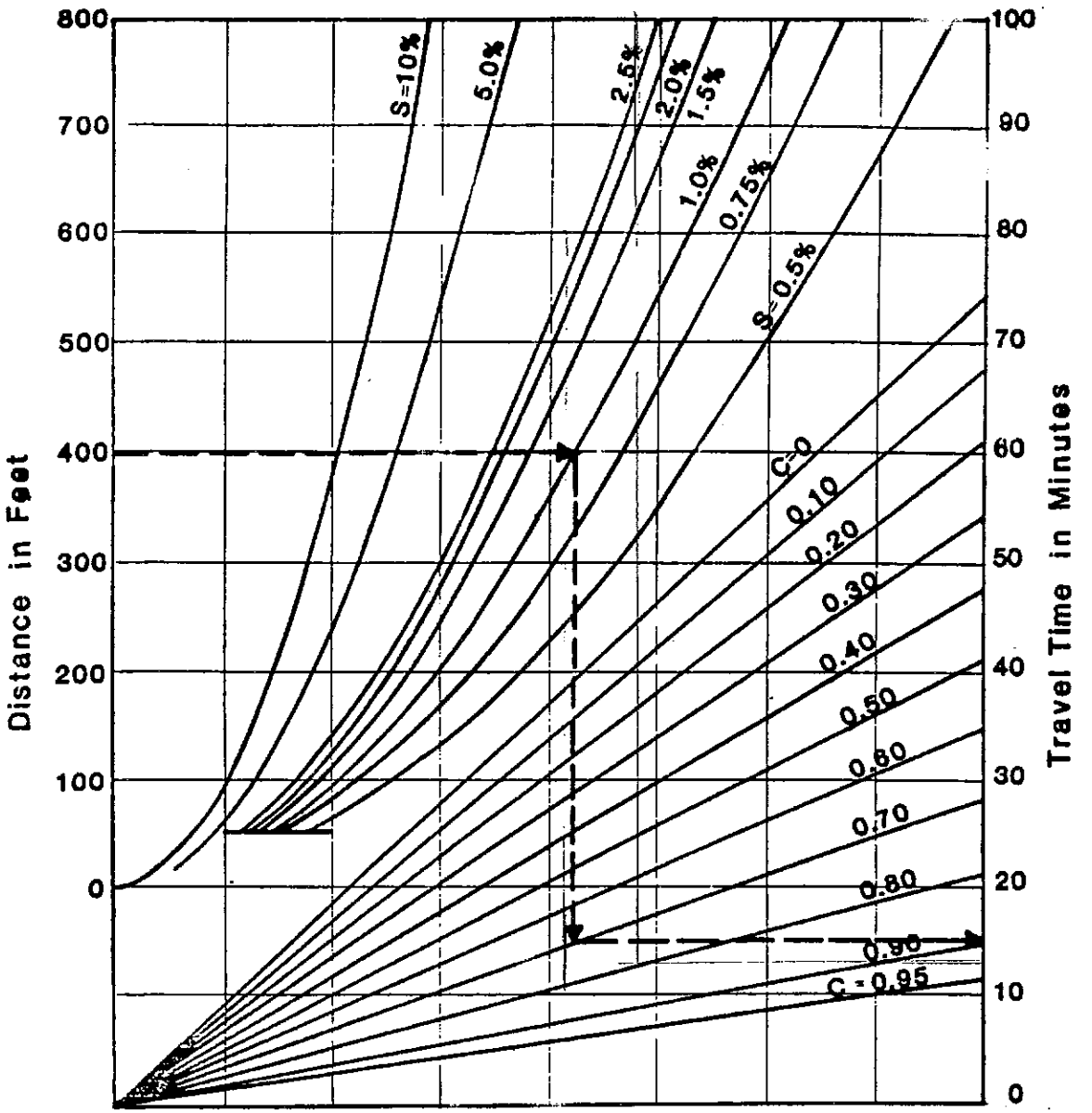
HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Urban Hydrologic Soil Cover
Complex and Associated Curve Numbers

Date
OCT. 1987

Figure
5-7



REFERENCE : Wright - McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1, Denver Regional Council of Governments, Denver, Co. 1977

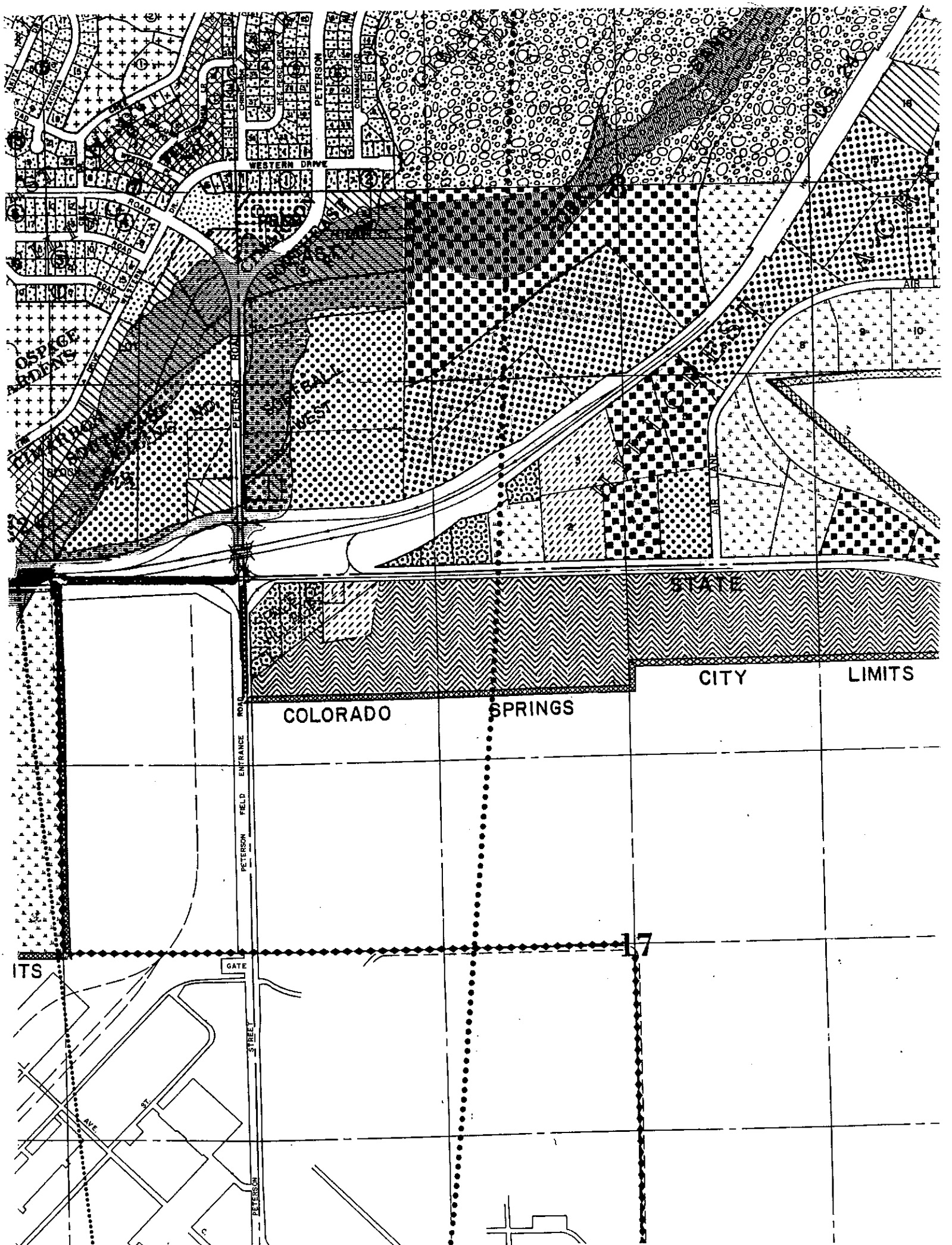
HDR Infrastructure, Inc.
A Centerra Company

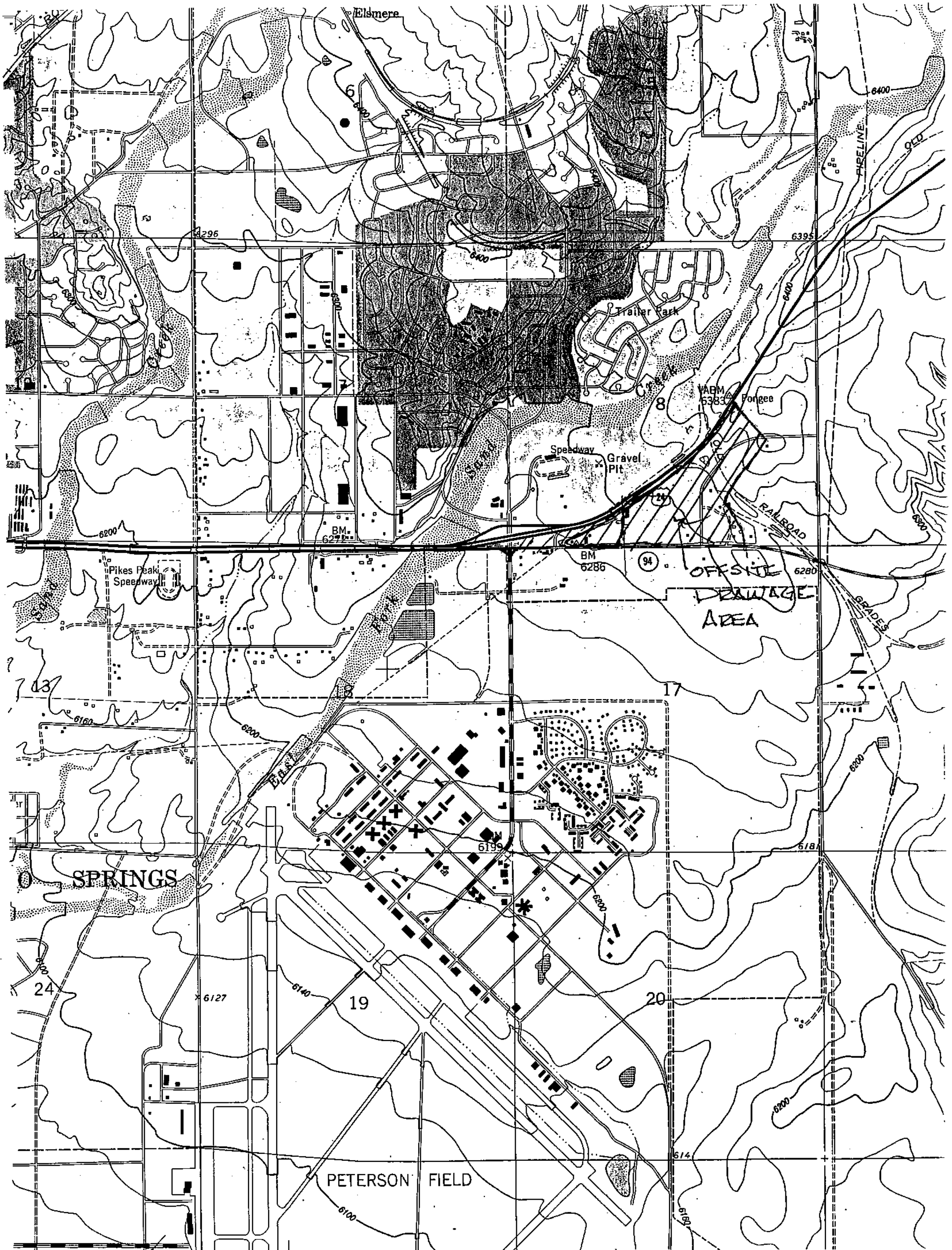
The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Overland Flow Curves

Date
OCT. 1987

Figure
5-2


WESTERN DRIVE
PETERSON
ROAD
PETERSON FIELD
ENTRANCE ROAD
STATE
CITY
LIMITS
COLORADO
SPRINGS
GATE
STREET
17
ITS



Elsmere
Trailer Park
Creek
Sand
ABM 6383
Pongee
Speedway
Gravel Pit
BM 6272
BM 6286
94
24
RAILROAD
GRADES
OFFSITE DRAINAGE AREA
Pikes Peak Speedway
Sand
East Fork
PIPELINE
OLD
SPRINGS
BM 6199
PETERSON FIELD
6400
6296
6395
6300
6200
6280
6160
6140
6127
6100
6
7
8
13
18
17
19
20
24

Title PAFB DRAINAGE Date Job No.

RAINFALL INTENSITY By RHS Sheet of

1) 2-YR 6 HR $X_1 = 1.6$

2-YR 24 HR $X_2 = 2.0$

100-YR 6 HR $X_3 = 3.6$

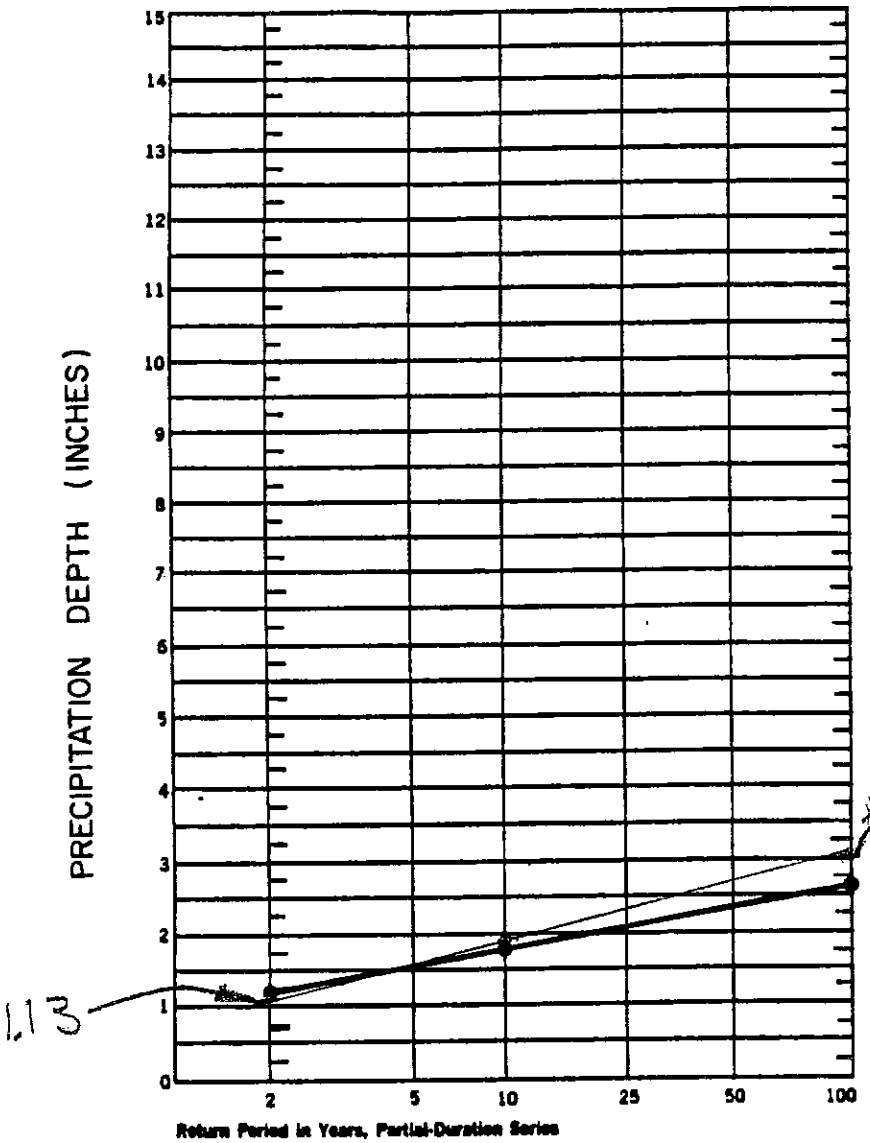
100-YR - 24 HR $X_4 = 4.5$

$Z = 6.2$

2) $Y_2 = 0.218 + 0.709 [(1.6)(1.6/2.0)] = 1.13$

3) $Y_{100} = 1.897 + 0.439 [(3.6)(3.6/4.5)]$

$- 0.008 (6.2) = 3.11$



EXAMPLE

2 yr. 1 hr rainfall (calculated) = 1.19"
100 yr. 1 hr rainfall (calculated) = 2.64"
10 yr. 1 hr rainfall (interpolated) = 1.78"

REFERENCE : NOAA Atlas 2, Volume 3 - Colorado

NOTE: This example is for Colorado Springs as indicated on the Isopluvials.

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

RAINFALL DEPTH - DURATION RELATIONSHIP

Date: OCT. 1987

Figure: 5 - 6

EXISTING CONDITION HEC-1 OUTPUT

```
*FIX
 IAGRAM
  PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO
ID HEC1 INPUT FILE PAFBFIX.HC1
ID 10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA
      15 25JAN92       0     100
       4       1
IN    15 25JAN92       0
JR  PREC     .67     1.0

      H SPACE COMMAND DRAINAGE AREA AT NORTH CENTER
KO                                    21              60
BA .0799
     4.5
PC0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143PC
PC0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530PC
  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900PC
  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550PC
PC0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938PC
PC0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270PC
  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525PC
  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775PC
PC0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913PC
PC0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000                        PC
      0      80                                                               LS
  0.19                                                                       UD
*
      G DRAINAGE AREA AT NORTHWEST CORNER
                                      21              60
BA .3085
LS    0      72                                                              LS
  0.38                                                                       UD
*
KK    F CENTRAL DRAINAGE AREA TO WEST END OF HAMILTON
KO                                    21              60
  .0889
      0      80                                                              LS
UD  0.22                                                                     UD
*
      E CENTRAL AREA TO PETERSON BLVD
                                      21              60
BA0.1257
      0      87                                                              LS
  0.19                                                                       UD
*
KK    D AREA WHICH FLOWS DIRECTLY INTO HAMILTON
                                      21              60
 \0.2121
LS    0      76                                                              LS
UD  0.41                                                                     UD
*
   DEF COMBINE AREAS D E AND F AT PETERSON AND HAMILTON
HC    3                                                                      HC
*
   B-1 OFFSITE NORTH OF 94 AND SOUTH OF U.S. 24
BA 0.125                                                                     BA
LS    0      30                                                              LS
      .33                                                                    UD
*
KK    B EAST AREA WHICH INCLUDES MOST OF FAMILY HOUSING AND AREAS TO THE NORTH KK
KO                                    21              60                     KO
 \0.4568                                                                     BA
      0      68                                                              LS
UD  0.65                                                                     UD
*
   B-TOT COMBINED OFFSITE AND ONSITE AT B                                    KK
```

```
*FIX          003
*DIAGRAM      002
ID            036
ID            036
ID            036
IT            040
IO            039
IN            038
JR            043
*             001
KK            045
KO            047
BA            008
PB            069
PC            070
PC            070
PC            070
PC            070
PC            070
PC            070
PC            070
PC            070
PC            070
LS            056
UD            112
*             001
KK            045
KO            047
BA            008
LS            056
UD            112
*             001
KK            045
KO            047
BA            008
LS            056
UD            112
*             001
KK            045
KO            047
BA            008
LS            056
UD            112
*             001
KK            045
KO            047
BA            008
LS            056
UD            112
*             001
KK            045
HC            030
*             001
KK            045
BA            008
LS            056
UD            112
*             001
KK            045
KO            047
BA            008
LS            056
UD            112
*             001
KK            045
```

```
HC     2

       C SMALL AREA ON MITCHELL
BA.02270
LS     0      90
    0.08

KK    BC COMBINE DRAINAGE AREAS B AND C AT HAMILTON AND MICHELL
HC     2

KK  BCDE COMBINE DRAINAGE AREAS BC AND DE AT HAMILTON AND MICHELL
HC     2
*
       A WEST SIDE OF GOLF COURSE
BA .0740
LS     0      68
     0.11

KK DEBCA COMBINE DRAINAGE AREAS DEBC AND A NEAR MICHELL
HC     2

       I EAST SIDE OF GOLF COURSE AND SOME OFFSITE
BA .2561
LS     0      65
     0.72

KKDEBCAI COMBINE DRAINAGE AREAS DEBCA AND I AT DETENTION POND #2
HC     2


KK    D1 DETENTION VOLUME REQUIRED
                                      21            60
     DETETIION BASIN #1
RS     1    ELEV  6110.5
SA    .1    4.14    5.82    6.47    7.84    9.17   10.55
SE6110.4    6111    6113    6115    6120    6125    6130
SQ     1       4      20      30      34      36      40
SE6110.4    6111    6113    6115    6120    6125    6130
*
ZZ
```

```
HC      030
*       001
KK      045
BA      008
LS      056
UD      112
*       001
KK      045
HC      030
*       001
KK      045
HC      030
*       001
KK      045
BA      008
LS      056
UD      112
*       001
KK      045
HC      030
*       001
KK      045
BA      008
LS      056
UD      112
*       001
KK      045
HC      030
*       001
*       001
KK      045
KO      047
KM      046
RS      092
SA      096
SE      099
SQ      104
SE      099
*       001
ZZ      127
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HEC1 S/N: HMVersion: 6.20 Data File: pafbfix.hc1

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*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*   RUN DATE  03/25/1992  TIME  14:32:08 *
*                                       *
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```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```


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XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```


37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,.
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
      LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FIX ***
           *DIAGRAM
         1 ID   PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO
         2 ID   HEC1 INPUT FILE PAFBFIX.HC1
         3 ID   10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA
         4 IT     15 25JAN92       0     100
         5 IO      4       1
         6 IN     15 25JAN92       0
         7 JR    PREC     .67     1.0
           *

         8 KK       H SPACE COMMAND DRAINAGE AREA AT NORTH CENTER
         9 KO                                    21              60
        10 BA   .0799
        11 PB    4.5
        12 PC 0.0000 0.0005 0.0015 0.0030 0.0045 0.0060 0.0080 0.0100 0.0120 0.0143
        13 PC 0.0165 0.0188 0.0210 0.0233 0.0255 0.0278 0.0320 0.0390 0.0460 0.0530
        14 PC 0.0600 0.0750 0.1000 0.4000 0.7000 0.7250 0.7500 0.7650 0.7800 0.7900
        15 PC 0.8000 0.8100 0.8200 0.8250 0.8300 0.8350 0.8400 0.8450 0.8500 0.8550
        16 PC 0.8600 0.8638 0.8675 0.8713 0.8750 0.8788 0.8825 0.8863 0.8900 0.8938
        17 PC 0.8975 0.9013 0.9050 0.9083 0.9115 0.9148 0.9180 0.9210 0.9240 0.9270
        18 PC 0.9300 0.9325 0.9350 0.9375 0.9400 0.9425 0.9450 0.9475 0.9500 0.9525
        19 PC 0.9550 0.9575 0.9600 0.9625 0.9650 0.9675 0.9700 0.9725 0.9750 0.9775
        20 PC 0.9800 0.9813 0.9825 0.9838 0.9850 0.9863 0.9875 0.9888 0.9900 0.9913
        21 PC 0.9925 0.9938 0.9950 0.9963 0.9975 0.9988 1.0000
        22 LS      0      80
        23 UD   0.19
           *

        24 KK       G DRAINAGE AREA AT NORTHWEST CORNER
        25 KO                                    21              60
        26 BA   .3085
        27 LS      0      72
        28 UD   0.38
           *

        29 KK       F CENTRAL DRAINAGE AREA TO WEST END OF HAMILTON
        30 KO                                    21              60
        31 BA   .0889
        32 LS      0      80
        33 UD   0.22
           *

        34 KK       E CENTRAL AREA TO PETERSON BLVD
        35 KO                                    21              60
        36 BA  0.1257
        37 LS      0      87
        38 UD   0.19
           *
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  39      KK       D AREA WHICH FLOWS DIRECTLY INTO HAMILTON
  40      KO                                      21            60
  41      BA  0.2121
  42      LS        0      76
  43      UD    0.41
          *

  44      KK     DEF COMBINE AREAS D E AND F AT PETERSON AND HAMILTON
  45      HC        3
          *

  46      KK     B-1 OFFSITE NORTH OF 94 AND SOUTH OF U.S. 24
  47      BA    0.14
  48      LS        0      30
  49      UD    .023
          *

  50      KK       B EAST AREA WHICH INCLUDES MOST OF FAMILY HOUSING AND AREAS TO THE NORTH
  51      KO                                      21            60
  52      BA  0.4568
  53      LS        0      68
  54      UD    0.65
          *

  55      KK   B-TOT COMBINED OFFSITE AND ONSITE AT B
  56      HC        2
          *

  57      KK       C SMALL AREA ON MITCHELL
  58      BA  .02270
  59      LS        0      90
  60      UD    0.08
          *

  61      KK      BC COMBINE DRAINAGE AREAS B AND C AT HAMILTON AND MICHELL
  62      HC        2
          *

  63      KK    BCDE COMBINE DRAINAGE AREAS BC AND DE AT HAMILTON AND MICHELL
  64      HC        2
          *

  65      KK       A WEST SIDE OF GOLF COURSE
  66      BA   .0740
  67      LS        0      68
  68      UD    0.11
          *

  69      KK   DEBCA COMBINE DRAINAGE AREAS DEBC AND A NEAR MICHELL
  70      HC        2
          *
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  71      KK       I EAST SIDE OF GOLF COURSE AND SOME OFFSITE
  72      BA   .2561
  73      LS      0      65
  74      UD   0.72
          *

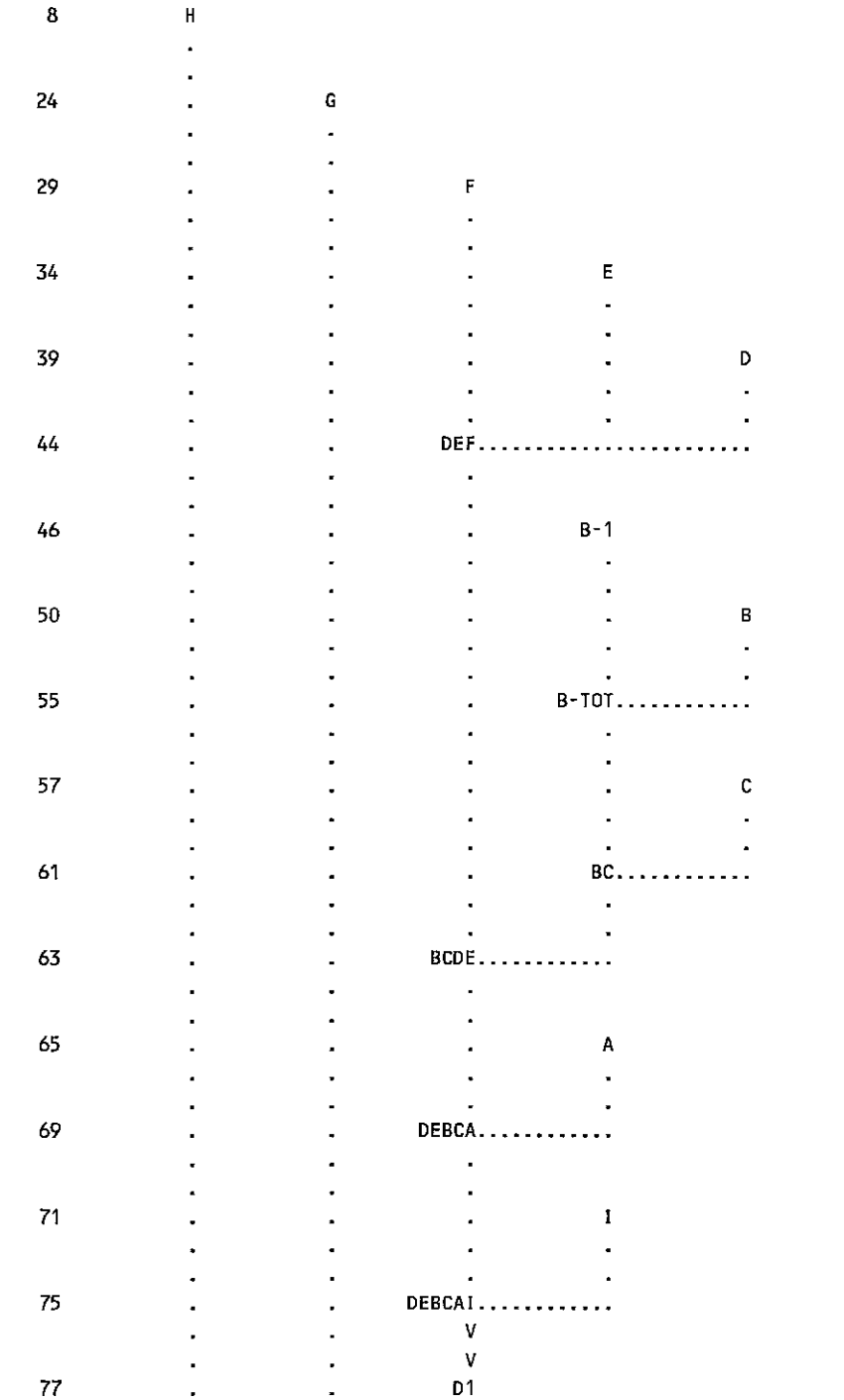
  75      KK  DEBCAI COMBINE DRAINAGE AREAS DEBCA AND I AT DETENTION POND #2
  76      HC      2
          *
          *

  77      KK     D1 DETENTION VOLUME REQUIRED
  78      KO                                      21              60
  79      KM    DETETIION BASIN #1
  80      RS      1    ELEV  6110.5
  81      SA     .1    4.14    5.82    6.47    7.84    9.17   10.55
  82      SE 6110.4    6111    6113    6115    6120    6125    6130
  83      SQ      1       4      20      30      34      36      40
  84      SE 6110.4    6111    6113    6115    6120    6125    6130
          *
  85      ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

IPUT
.INE (V) ROUTING (---->) DIVERSION OR PUMP FLOW

NO. (.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

HEC1 S/N: HMVersion: 6.20 Data File: pafbfix.hc1

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*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  03/25/1992  TIME  14:32:08 *
*                                      *
 ****************************************
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*                                      *
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*                                      *
****************************************
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PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO
HEC1 INPUT FILE PAFBFIX.HC1
10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          4  PRINT CONTROL
                      IPLOT          1  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE    25JAN92  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        100  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    26JAN92  ENDING DATE
                     NDTIME       0045  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .25 HOURS
                     TOTAL TIME BASE   24.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT

    JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                    .67      1.00
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...* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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          **************
          *            *
  8 KK    *         H  *      SPACE COMMAND DRAINAGE AREA AT NORTH CENTER
          *            *
          **************

  9 KO          OUTPUT CONTROL VARIABLES
```

```
                IPRNT          4  PRINT CONTROL
                IPLOT          1  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .250  TIME INTERVAL IN HOURS


 6 IN       TIME DATA FOR INPUT TIME SERIES
                JXMIN         15  TIME INTERVAL IN MINUTES
               JXDATE    25JAN92  STARTING DATE
               JXTIME          0  STARTING TIME

          SUBBASIN RUNOFF DATA

10 BA       SUBBASIN CHARACTERISTICS
                TAREA        .08  SUBBASIN AREA

          PRECIPITATION DATA

11 PB            STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
              .02   .02   .30   .30   .03   .02   .01   .01   .01   .01
              .01   .01   .00   .00   .00   .00   .01   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00

22 LS       SCS LOSS RATE
                STRTL        .50  INITIAL ABSTRACTION
               CRVNBR       80.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

23 UD       SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .19  LAG

                                                ***

                                            UNIT HYDROGRAPH
                                         6 END-OF-PERIOD ORDINATES
          112.      70.      18.       5.       1.       0.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
24 KK   *          G *      DRAINAGE AREA AT NORTHWEST CORNER
        *            *
        **************

25 KO       OUTPUT CONTROL VARIABLES
                IPRNT          4  PRINT CONTROL
                IPLOT          1  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
```

```
                IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
               ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
               ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
              TIMINT        .250  TIME INTERVAL IN HOURS


          SUBBASIN RUNOFF DATA

26 BA       SUBBASIN CHARACTERISTICS
                TAREA         .31  SUBBASIN AREA

            PRECIPITATION DATA

11 PB           STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .01    .01    .01    .01
               .02    .02    .30    .30    .03    .02    .01    .01    .01    .01
               .01    .01    .00    .00    .00    .00    .01    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
               .00    .00    .00    .00    .00    .00

27 LS       SCS LOSS RATE
                STRTL         .78  INITIAL ABSTRACTION
               CRVNBR       72.00  CURVE NUMBER
                RTIMP         .00  PERCENT IMPERVIOUS AREA

28 UD       SCS DIMENSIONLESS UNITGRAPH
                TLAG         .38  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          10 END-OF-PERIOD ORDINATES
          137.     297.     206.      86.      39.      17.       8.       4.       2.       0.

* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
29 KK     *          F *      CENTRAL DRAINAGE AREA TO WEST END OF HAMILTON
          *            *
          **************

30 KO       OUTPUT CONTROL VARIABLES
                IPRNT           4  PRINT CONTROL
                IPLOT           1  PLOT CONTROL
                QSCAL           0.  HYDROGRAPH PLOT SCALE
                IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                 IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT        .250  TIME INTERVAL IN HOURS


          SUBBASIN RUNOFF DATA

31 BA       SUBBASIN CHARACTERISTICS
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                TAREA         .09  SUBBASIN AREA

            PRECIPITATION DATA

11 PB           STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
               .02   .02   .30   .30   .03   .02   .01   .01   .01   .01
               .01   .01   .00   .00   .00   .00   .01   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00

32 LS       SCS LOSS RATE
              STRTL         .50  INITIAL ABSTRACTION
             CRVNBR       80.00  CURVE NUMBER
              RTIMP         .00  PERCENT IMPERVIOUS AREA

33 UD       SCS DIMENSIONLESS UNITGRAPH
               TLAG         .22  LAG

                                          ***

                                      UNIT HYDROGRAPH
                                   6 END-OF-PERIOD ORDINATES
          103.      89.      26.       8.       2.       1.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
34 KK   *         E  *      CENTRAL AREA TO PETERSON BLVD
        *            *
        **************

35 KO       OUTPUT CONTROL VARIABLES
              IPRNT          4  PRINT CONTROL
              IPLOT          1  PLOT CONTROL
              QSCAL         0.  HYDROGRAPH PLOT SCALE
              IPNCH          0  PUNCH COMPUTED HYDROGRAPH
               IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
              ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
              ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
             TIMINT       .250  TIME INTERVAL IN HOURS


          SUBBASIN RUNOFF DATA

36 BA       SUBBASIN CHARACTERISTICS
              TAREA         .13  SUBBASIN AREA

            PRECIPITATION DATA

11 PB           STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
               .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
               .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
```

```
                .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00

37 LS         SCS LOSS RATE
                   STRTL        .30  INITIAL ABSTRACTION
                  CRVNBR      87.00  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

38 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG        .19  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                              6 END-OF-PERIOD ORDINATES
            175.      109.       29.        8.        2.        0.


** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
39 KK   *        D   *      AREA WHICH FLOWS DIRECTLY INTO HAMILTON
        *            *
        **************

40 KO         OUTPUT CONTROL VARIABLES
                   IPRNT          4  PRINT CONTROL
                   IPLOT          1  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE
                   IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                    IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                   ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                   ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
                  TIMINT       .250  TIME INTERVAL IN HOURS


           SUBBASIN RUNOFF DATA

41 BA         SUBBASIN CHARACTERISTICS
                   TAREA        .21  SUBBASIN AREA

              PRECIPITATION DATA

11 PB              STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI           INCREMENTAL PRECIPITATION PATTERN
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                   .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                   .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00
```

```
42 LS          SCS LOSS RATE
                    STRTL         .63  INITIAL ABSTRACTION
                   CRVNBR       76.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

43 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .41  LAG

                                                ***

                                              UNIT HYDROGRAPH
                                            10 END-OF-PERIOD ORDINATES
              80.      191.      150.       67.       32.       15.        7.        3.        2.        1.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
44 KK     *       DEF  *      COMBINE AREAS D E AND F AT PETERSON AND HAMILTON
          *            *
          **************

45 HC          HYDROGRAPH COMBINATION
                   ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***


** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
46 KK     *       B-1  *      OFFSITE NORTH OF 94 AND SOUTH OF U.S. 24
          *            *
          **************

             SUBBASIN RUNOFF DATA

47 BA          SUBBASIN CHARACTERISTICS
                   TAREA         .14  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI              INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                     .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                     .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00

48 LS          SCS LOSS RATE
                    STRTL        4.67  INITIAL ABSTRACTION
                   CRVNBR       30.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA
```

```
49 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .02  LAG

                                                ***

                                                    UNIT HYDROGRAPH
                                                  5 END-OF-PERIOD ORDINATES
              268.       75.       15.        3.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
50 KK     *         B  *      EAST AREA WHICH INCLUDES MOST OF FAMILY HOUSING AND AREAS TO THE NORTH
          *            *
          **************

51 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           4  PRINT CONTROL
                    IPLOT           1  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                     IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT        .250  TIME INTERVAL IN HOURS


             SUBBASIN RUNOFF DATA

52 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .46  SUBBASIN AREA

               PRECIPITATION DATA

11 PB               STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                   .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                   .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00

53 LS          SCS LOSS RATE
                    STRTL         .94  INITIAL ABSTRACTION
                   CRVNBR       68.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

54 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .65  LAG

                                                ***

                                                    UNIT HYDROGRAPH
                                                 15 END-OF-PERIOD ORDINATES
              62.      209.      285.      248.      156.       89.       54.       32.       19.       11.
```

```
             7.       4.       2.       1.       0.

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
 55 KK   *     B-TOT  *      COMBINED OFFSITE AND ONSITE AT B
         *            *
         **************

 56 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
 57 KK   *          C *      SMALL AREA ON MITCHELL
         *            *
         **************

            SUBBASIN RUNOFF DATA

 58 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .02  SUBBASIN AREA

                PRECIPITATION DATA

 11 PB                STORM        4.50  BASIN TOTAL PRECIPITATION

 12 PI            INCREMENTAL PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                    .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                    .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00

 59 LS          SCS LOSS RATE
                     STRTL         .22  INITIAL ABSTRACTION
                    CRVNBR       90.00  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA

 60 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG         .08  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                              5 END-OF-PERIOD ORDINATES
                44.       12.       2.        0.        0.
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 61 KK    *        BC  *      COMBINE DRAINAGE AREAS B AND C AT HAMILTON AND MICHELL
          *            *
          **************

 62 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 63 KK    *      BCDE  *      COMBINE DRAINAGE AREAS BC AND DE AT HAMILTON AND MICHELL
          *            *
          **************

 64 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 65 KK    *         A  *      WEST SIDE OF GOLF COURSE
          *            *
          **************

             SUBBASIN RUNOFF DATA

 66 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .07  SUBBASIN AREA

                PRECIPITATION DATA

 11 PB               STORM        4.50  BASIN TOTAL PRECIPITATION

 12 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                     .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                     .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00

 67 LS          SCS LOSS RATE
                     STRTL         .94  INITIAL ABSTRACTION
                    CRVNBR       68.00  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA
```

```
68 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .11  LAG

                                                ***

                                                UNIT HYDROGRAPH
                                              5 END-OF-PERIOD ORDINATES
               142.       40.        8.        2.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
59 KK     *     DEBCA  *      COMBINE DRAINAGE AREAS DEBC AND A NEAR MICHELL
          *            *
          **************

70 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
71 KK     *         I  *      EAST SIDE OF GOLF COURSE AND SOME OFFSITE
          *            *
          **************

             SUBBASIN RUNOFF DATA

72 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .26  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                    .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                    .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00

'3 LS          SCS LOSS RATE
                     STRTL        1.08  INITIAL ABSTRACTION
                    CRVNBR       65.00  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA

'4 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .72  LAG
```

***

UNIT HYDROGRAPH
16 END-OF-PERIOD ORDINATES

27.	94.	144.	137.	102.	60.	37.	23.	14.	9.
5.	3.	2.	1.	1.	0.				

*** ***

```
          **************
          *            *
75 KK     *    DEBCAI  *      COMBINE DRAINAGE AREAS DEBCA AND I AT DETENTION POND #2
          *            *
          **************

76 HC          HYDROGRAPH COMBINATION
                    ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
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*** ***

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          **************
          *            *
77 KK     *        D1  *      DETENTION VOLUME REQUIRED
          *            *
          **************

78 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           4  PRINT CONTROL
                    IPLOT           1  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                     IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT        .250  TIME INTERVAL IN HOURS

                         DETETIION BASIN #1

               HYDROGRAPH ROUTING DATA

80 RS          STORAGE ROUTING
                    NSTPS           1  NUMBER OF SUBREACHES
                     ITYP        ELEV  TYPE OF INITIAL CONDITION
                    RSVRIC     6110.50  INITIAL CONDITION
                        X         .00 WORKING R AND D COEFFICIENT

81 SA               AREA          .1       4.1       5.8       6.5       7.8       9.2      10.6

82 SE          ELEVATION     6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00

83 SQ          DISCHARGE          1.        4.       20.       30.       34.       36.       40.

84 SE          ELEVATION     6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00
```

***

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	.98	10.89	23.17	58.89	101.38	150.64
ELEVATION	6110.40	6111.00	6113.00	6115.00	6120.00	6125.00	6130.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.98	10.89	23.17	58.89	101.38	150.64
OUTFLOW	1.00	4.00	20.00	30.00	34.00	36.00	40.00
ELEVATION	6110.40	6111.00	6113.00	6115.00	6120.00	6125.00	6130.00

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.67	1.00
HYDROGRAPH AT	H	.08	1	FLOW	64.	133.
				TIME	6.00	6.00
HYDROGRAPH AT	G	.31	1	FLOW	102.	257.
				TIME	6.25	6.25
HYDROGRAPH AT	F	.09	1	FLOW	63.	134.
				TIME	6.00	6.00
HYDROGRAPH AT	E	.13	1	FLOW	152.	277.
				TIME	6.00	6.00
HYDROGRAPH AT	D	.21	1	FLOW	90.	207.
				TIME	6.25	6.25
3 COMBINED AT	DEF	.43	1	FLOW	262.	536.
				TIME	6.00	6.00
HYDROGRAPH AT	B-1	.14	1	FLOW	0.	0.
				TIME	.25	.25
HYDROGRAPH AT	B	.46	1	FLOW	73.	213.
				TIME	6.50	6.50
2 COMBINED AT	B-TOT	.60	1	FLOW	73.	213.
				TIME	6.50	6.50
HYDROGRAPH AT	C	.02	1	FLOW	37.	63.
				TIME	6.00	6.00
2 COMBINED AT	BC	.62	1	FLOW	79.	222.
				TIME	6.50	6.50
COMBINED AT	BCDE	1.05	1	FLOW	316.	662.
				TIME	6.00	6.00
HYDROGRAPH AT	A	.07	1	FLOW	32.	87.
				TIME	6.00	6.00
2 COMBINED AT	DEBCA	1.12	1	FLOW	347.	749.
				TIME	6.00	6.00
HYDROGRAPH AT	I	.26	1	FLOW	29.	90.
				TIME	6.75	6.75
2 COMBINED AT	DEBCAI	1.38	1	FLOW	352.	771.
				TIME	6.00	6.00
ROUTED TO	D1	1.38	1	FLOW	31.	35.
				TIME	9.00	13.25

** PEAK STAGES IN FEET **

1	STAGE	6115.97	6122.46
	TIME	9.00	13.50

* NORMAL END OF HEC-1 ***

RMAL END OF HEC-1

FUTURE CONDITIONS HEC-1 OUTPUT

```
*FIX                                                                    *FIX          003
*DIAGRAM                                                                *DIAGRAM      002
   PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO                        ID            036
   HEC1 INPUT FILE PAFB-P1.HC1, FUTURE FLOWS                            ID            036
ID 10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA                 ID            036
IT    15 25JAN92       0     100                                        IT            040
       4       1                                                        IO            039
      15 25JAN92       0                                               IN            038
JR  PREC     .67     1.0                                               JR            043
*                                                                       *             001
      L NORTH CENTRAL DRAINAGE AREA EAST OF PETERSON AND NORTH OF PAINE KK            045
KO                                    21              60                KO            047
BA0.0825                                                                BA            008
     4.5                                                                PB            069
  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143PC      070
PC0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530PC      070
PC0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900PC      070
  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550PC      070
  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938PC      070
PC0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270PC      070
PC0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525PC      070
  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775PC      070
   .9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913PC      070
PC0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000                  PC            070
LS     0      80                                                        LS            056
    0.16                                                                UD            112
                                                                        *             001
*                                                                       *             001
      K NORTH DRAINAGE AREA WEST OF PETERSON, NORTH AND SOUTH OF PAINE  KK            045
   .0486                                                                BA            008
LS     0      91                                                        LS            056
UD  0.09                                                                UD            112
                                                                        *             001
      J NORTHWEST DRAINAGE AREA                                         KK            045
BA .1646                                                                BA            008
LS     0      80                                                        LS            056
    0.13                                                                UD            112
                                                                        *             001
KK    I WEST DRAINAGE AREA                                              KK            045
BA .0805                                                                BA            008
       0      91                                                        LS            056
UD  0.13                                                                UD            112
*                                                                       *             001
      P OFFSITE BETWEEN 24 AND 94                                       KK            045
  0.0268                                                                BA            008
LS     0      57                                                        LS            056
UD  0.13                                                                UD            112
                                                                        *             001
      Q OFFSITE AT NORTHEAST CORNER                                     KK            045
BA0.1575                                                                BA            008
LS     0      91                                                        LS            056
L   0.22                                                                UD            112
                                                                        *             001
KK    PQ COMBINE NORTHEAST OFFSITE FLOWS AT NORTH PROPERTY LINE         KK            045
HC     2                                                                HC            030
                                                                        *             001
KK    M EAST OF SPACE COMMAND HEADQUARTERS                              KK            045
KO                                    21              60                KO            047
   .0975                                                                BA            008
       0      90                                                        LS            056
UD  0.10                                                                UD            112
*                                                                       *             001
    PQM COMBINED FLOW IN EAST SWALE AT SOUTHEAST CORNER OF FAMILY HOUSING KK          045
       2                                                                HC            030
*                                                                       *             001
KK    H CENTRAL DRAINAGE AREA ON EAST SIDE OF PETERSON BLVD NORTH OF STEWART KK       045
```

```
KO                                      21          60                  KO        047
BA .0745                                                                BA        008
      0      91                                                         LS        056
   0.14                                                                 UD        112
*                                                                       *         001
KK     C FAMILY HOUSING AREA                                            KK        045
                                        21          60                  KO        047
   .2306                                                                BA        008
LS    0      80                                                         LS        056
   0.25                                                                 UD        112
                                                                        *         001
KK    HC COMBINE BASINS H AND C, FLOW IN EAST 60" STORM SEWER           KK        045
HC    2                                                                 HC        030
                                                                        *         001
   HCPQM COMBINE BASINS H, C, AND M, FLOW IN SWALE AT 60" STORM SEWER   KK        045
HC    2                                                                 HC        030
*                                                                       *         001
      N EAST DRAINAGE AREA TO PROPOSED SWALE                            KK        045
                                        21          60                  KO        047
BA0.1428                                                                BA        008
LS    0      63                                                         LS        056
   0.34                                                                 UD        112
                                                                        *         001
KKHCPQMN COMBINE BASINS H,C,P,Q,M AND N, FLOW IN SWALE AT DETENTION POND #11  KK  045
      2                                                                 HC        030
                                                                        *         001
KK    G CENTRAL DRAIANGE AREA WEST OF PETERSON BLVD AND SOUTH OF STEWART KK        045
KO                                      21          60                  KO        047
  0.0530                                                                BA        008
      0      91                                                         LS        056
UD  0.08                                                                UD        112
*                                                                       *         001
      F SOUTHWEST DRAINAGE AREA NORTH OF HAMILTON AND WEST OF MICHELL   KK        045
                                        21          60                  KO        047
BA0.1883                                                                BA        008
LS    0      67                                                         LS        056
   0.16                                                                 UD        112
                                                                        *         001
KK    GF COMBINE BASINS G AND F, FLOW IN HAMILTON COLLECTOR WEST OF MITCHELL  KK  045
      2                                                                 HC        030
                                                                        *         001
KK    B EAST DRAIANGE AREA EAST OF MICHELL AND NORTH OF GOLF COURSE     KK        045
BA.06270                                                                BA        008
      0      65                                                         LS        056
   0.25                                                                 UD        112
*                                                                       *         001
KK    D SOUTH CENTRAL DRAINAGE AREA WEST OF MITCHELL AND SOUTH OF STEWART  KK     045
   .0441                                                                BA        008
      0      91                                                         LS        056
UD  0.12                                                                UD        112
*                                                                       *         001
      BD COMBINE BASINS B AND D, FLOW IN MITCHELL COLLECTOR             KK        045
      2                                                                 HC        030
*                                                                       *         001
      E SOUTH DRAINAGE AREA WEST OF MITCHELL AND NORTH OF HAMILTON      KK        045
   .0222                                                                BA        008
LS    0      91                                                         LS        056
UD  0.08                                                                UD        112
                                                                        *         001
     BDE COMBINE BASINS B,D AND E, FLOW IN MITCHELL COLLECTOR AT HAMILTON  KK     045
HC    2                                                                 HC        030
*                                                                       *         001
   GFBDE COMBINE BASINS G,F,B,D AND E, TOTAL FLOW AT HAMILTON AND MITCHELL  KK   045
      2                                                                 HC        030
*                                                                       *         001
      A SOUTHEAST DRAINAGE AREA EAST OF MITCHELL AND NORTH OF HAMILTON  KK        045
```

```
KO                                      21              60
BA0.0741
       0      65
!   0.25
*
KKGFBDEA COMBINE BASINS G,F,B,D,E AND A, TOTAL FLOW IN HAMILTON COLLECTOR
       2
KK     O SOUTHEAST DRAIANGE AREA GOLF COURSE NORTH OF DETENTION POND #11
KO                                      21              60
  0.1822
LS     0      65
UD  0.34


KK TOTAL TOTAL FLOW FROM STUDY AREA TO DETENTION POND #11
HC     3


KK    D1 DETENTION VOLUME REQUIRED
KO                                      21              60
     DETETIION BASIN #1
       1    ELEV  6110.5
SA     .1    4.14    5.82    6.47    7.84    9.17   10.55
SE  6110.4    6111    6113    6115    6120    6125    6130
       1       4      20      30      34      36      40
SQ  6110.4    6111    6113    6115    6120    6125    6130
*
```

```
KO      047
BA      008
LS      056
UD      112
*       001
KK      045
HC      030
*       001
KK      045
KO      047
BA      008
LS      056
UD      112
*       001
*       001
KK      045
HC      030
*       001
*       001
KK      045
KO      047
KM      046
RS      092
SA      096
SE      099
SQ      104
SE      099
*       001
ZZ      127
```

```
  ****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*   RUN DATE  04/02/1992  TIME  11:15:15 *
*                                      *
****************************************
```


```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*         609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```


```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

*** FIX ***
                    *DIAGRAM
          1         ID   PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO
          2         ID   HEC1 INPUT FILE PAFB-P1.HC1, FUTURE FLOWS
          3         ID   10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA
          4         IT      15 25JAN92       0     100
          5         IO       4       1
          6         IN      15 25JAN92       0
          7         JR    PREC     .67     1.0
                    *

          8         KK       L NORTH CENTRAL DRAINAGE AREA EAST OF PETERSON AND NORTH OF PAINE
          9         KO                                      21              60
         10         BA  0.0825
         11         PB     4.5
         12         PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
         13         PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
         14         PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
         15         PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
         16         PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
         17         PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
         18         PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
         19         PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
         20         PC   .9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
         21         PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
         22         LS       0      80
         23         UD    0.16
                    *
                    *

         24         KK       K NORTH DRAINAGE AREA WEST OF PETERSON, NORTH AND SOUTH OF PAINE
         25         BA   .0486
         26         LS       0      91
         27         UD    0.09
                    *

         28         KK       J NORTHWEST DRAINAGE AREA
         29         BA   .1646
         30         LS       0      80
         31         UD    0.13
                    *

         32         KK       I WEST DRAINAGE AREA
         33         BA   .0805
         34         LS       0      91
         35         UD    0.13
                    *

         36         KK       P OFFSITE BETWEEN 24 AND 94
         37         BA  0.0268
         38         LS       0      57
         39         UD    0.13
                    *
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  40      KK       Q OFFSITE AT NORTHEAST CORNER
  41      BA  0.1575
  42      LS       0      91
  43      UD    0.22
          *

  44      KK      PQ COMBINE NORTHEAST OFFSITE FLOWS AT NORTH PROPERTY LINE
  45      HC       2
          *

  46      KK       M EAST OF SPACE COMMAND HEADQUARTERS
  47      KO                                      21             60
  48      BA   .0975
  49      LS       0      90
  50      UD    0.10
          *

  51      KK     PQM COMBINED FLOW IN EAST SWALE AT SOUTHEAST CORNER OF FAMILY HOUSING
  52      HC       2
          *

  53      KK       H CENTRAL DRAINAGE AREA ON EAST SIDE OF PETERSON BLVD NORTH OF STEWART
  54      KO                                      21             60
  55      BA   .0745
  56      LS       0      91
  57      UD    0.14
          *

  58      KK       C FAMILY HOUSING AREA
  59      KO                                      21             60
  60      BA   .2306
  61      LS       0      80
  62      UD    0.25
          *

  63      KK      HC COMBINE BASINS H AND C, FLOW IN EAST 60" STORM SEWER
  64      HC       2
          *

  65      KK   HCPQM COMBINE BASINS H, C, AND M, FLOW IN SWALE AT 60" STORM SEWER
  66      HC       2
          *

  67      KK       N EAST DRAINAGE AREA TO PROPOSED SWALE
  68      KO                                      21             60
  69      BA  0.1428
  70      LS       0      63
  71      UD    0.34
          *
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  72      KK  HCPQMN COMBINE BASINS H,C,P,Q,M AND N, FLOW IN SWALE AT DETENTION POND #11
  73      HC       2
          *

  74      KK       G CENTRAL DRAIANGE AREA WEST OF PETERSON BLVD AND SOUTH OF STEWART
  75      KO                                      21             60
  76      BA  0.0530
  77      LS       0      91
  78      UD    0.08
          *

  79      KK       F SOUTHWEST DRAINAGE AREA NORTH OF HAMILTON AND WEST OF MICHELL
  80      KO                                      21             60
  81      BA  0.1883
  82      LS       0      67
  83      UD    0.16
          *

  84      KK      GF COMBINE BASINS G AND F, FLOW IN HAMILTON COLLECTOR WEST OF MITCHELL
  85      HC       2
          *

  86      KK       B EAST DRAIANGE AREA EAST OF MICHELL AND NORTH OF GOLF COURSE
  87      BA  .06270
  88      LS       0      65
  89      UD    0.25
          *

  90      KK       D SOUTH CENTRAL DRAINAGE AREA WEST OF MITCHELL AND SOUTH OF STEWART
  91      BA   .0441
  92      LS       0      91
  93      UD    0.12
          *

  94      KK      BD COMBINE BASINS B AND D, FLOW IN MITCHELL COLLECTOR
  95      HC       2
          *

  96      KK       E SOUTH DRAINAGE AREA WEST OF MITCHELL AND NORTH OF HAMILTON
  97      BA   .0222
  98      LS       0      91
  99      UD    0.08
          *

 100      KK     BDE COMBINE BASINS B,D AND E, FLOW IN MITCHELL COLLECTOR AT HAMILTON
 101      HC       2
          *

 102      KK   GFBDE COMBINE BASINS G,F,B,D AND E, TOTAL FLOW AT HAMILTON AND MITCHELL
 103      HC       2
          *
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

104       KK       A SOUTHEAST DRAINAGE AREA EAST OF MITCHELL AND NORTH OF HAMILTON
105       KO                                        21              60
106       BA  0.0741
107       LS        0      65
108       UD     0.25
          *

109       KK  GFBDEA COMBINE BASINS G,F,B,D,E AND A, TOTAL FLOW IN HAMILTON COLLECTOR
110       HC        2
          *

111       KK       O SOUTHEAST DRAIANGE AREA GOLF COURSE NORTH OF DETENTION POND #11
112       KO                                        21              60
113       BA  0.1822
114       LS        0      65
115       UD     0.34
          *
          *

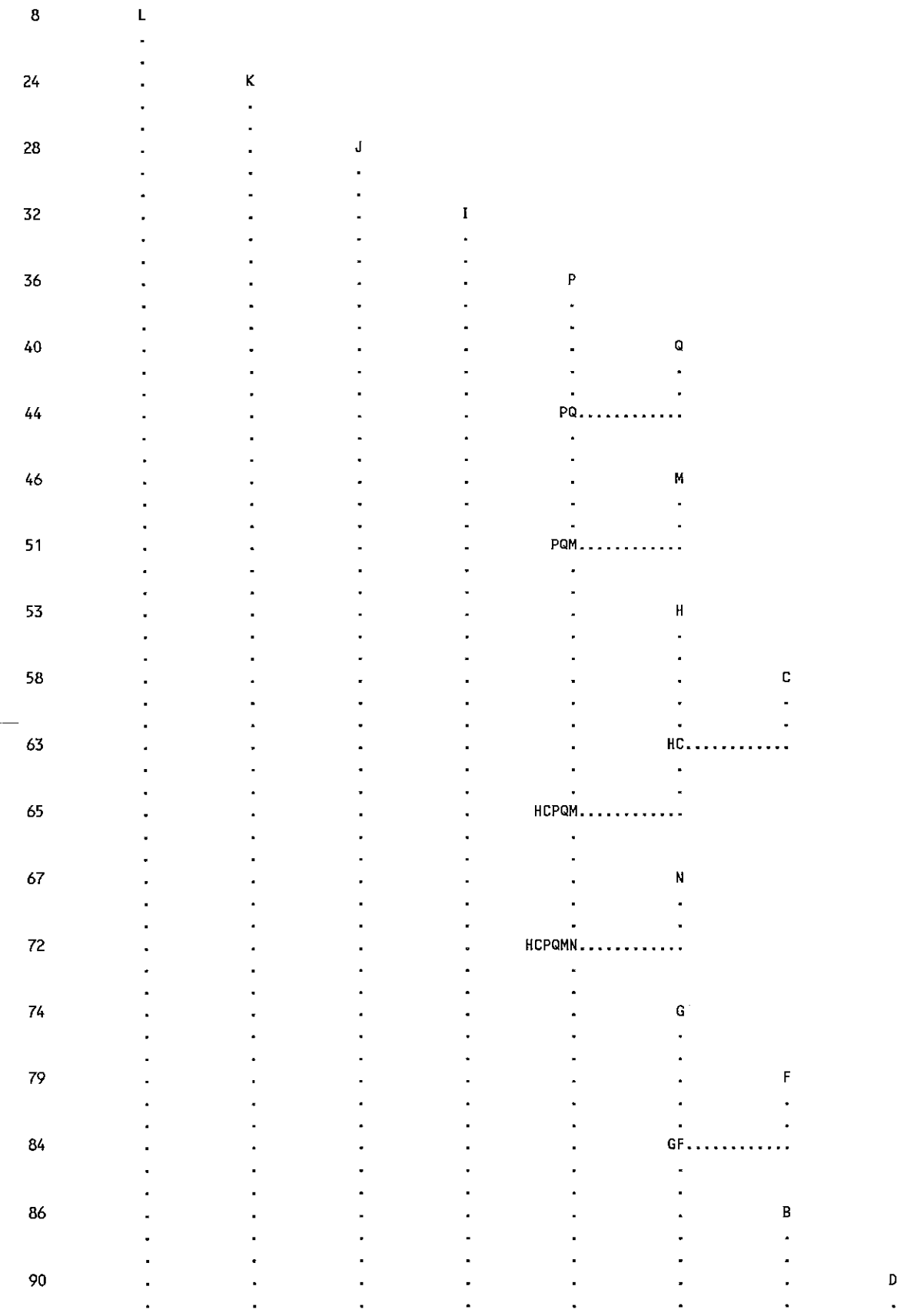
116       KK   TOTAL TOTAL FLOW FROM STUDY AREA TO DETENTION POND #11
117       HC        3
          *
          *

118       KK      D1 DETENTION VOLUME REQUIRED
119       KO                                        21              60
120       KM     DETETIION BASIN #1
121       RS        1    ELEV  6110.5
122       SA       .1    4.14    5.82    6.47    7.84    9.17   10.55
123       SE   6110.4    6111    6113    6115    6120    6125    6130
124       SQ        1       4      20      30      34      36      40
125       SE   6110.4    6111    6113    6115    6120    6125    6130
          *
126       ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

PUT
INE (V) ROUTING (---->) DIVERSION OR PUMP FLOW

NO. (.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW



```
**************************************
*                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*            SEPTEMBER 1990          *
*             VERSION 4.0            *
*                                    *
*  RUN DATE  04/02/1992  TIME  11:15:15 *
*                                    *
**************************************
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```
**************************************
*                                    *
*    U.S. ARMY CORPS OF ENGINEERS    *
*    HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616      *
*           (916) 756-1104           *
*                                    *
**************************************
```


PETERSON AIR FORCE BASE, COLORADO SPRINGS, CO
HEC1 INPUT FILE PAFB-P1.HC1, FUTURE FLOWS
10 AND 100-YEAR EVENTS - 24 HOUR DURATION - TYPE IIA

```
  5 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          4  PRINT CONTROL
                     IPLOT          1  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN         15  MINUTES IN COMPUTATION INTERVAL
                     IDATE    25JAN92  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        100  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE    26JAN92  ENDING DATE
                    NDTIME       0045  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL      .25 HOURS
                    TOTAL TIME BASE    24.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

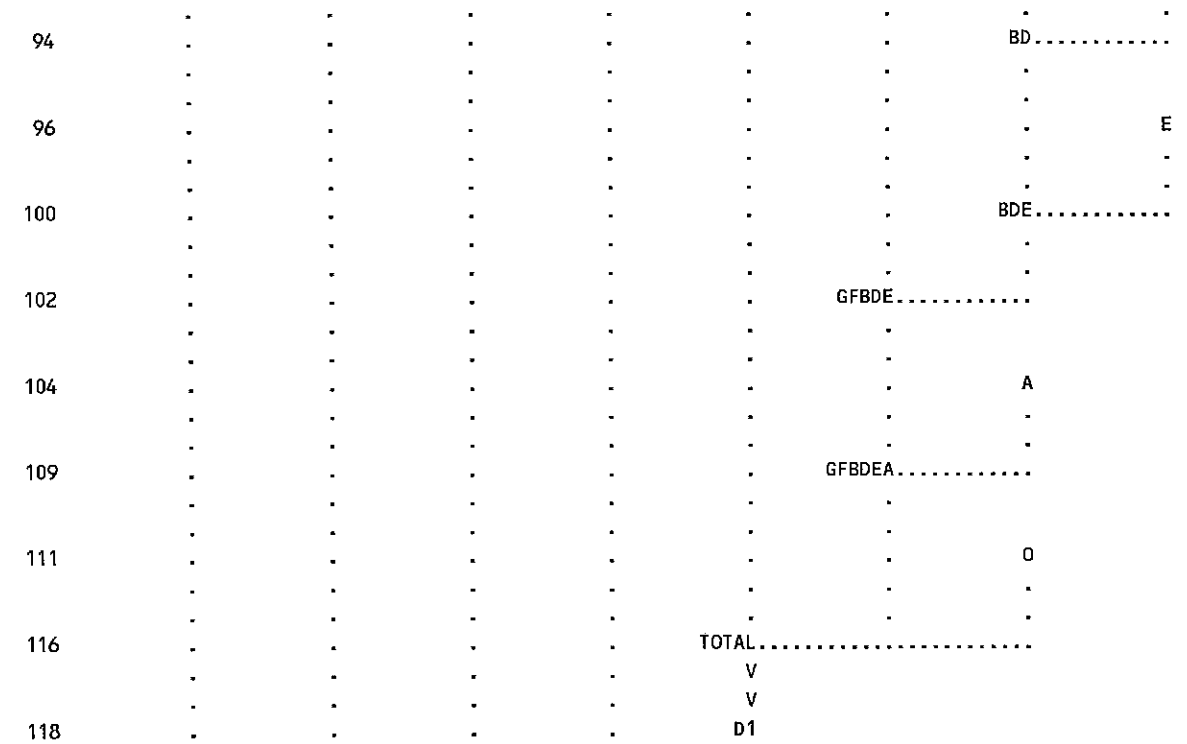
    JP          MULTI-PLAN OPTION
                     NPLAN          1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                    .67      1.00
```

*** ***

```
          **************
          *            *
  8 KK    *         L  *      NORTH CENTRAL DRAINAGE AREA EAST OF PETERSON AND NORTH OF PAINE
          *            *
          **************

  9 KO          OUTPUT CONTROL VARIABLES
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
                IPRNT          4  PRINT CONTROL
                IPLOT          1  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .250  TIME INTERVAL IN HOURS


6 IN       TIME DATA FOR INPUT TIME SERIES
                JXMIN         15  TIME INTERVAL IN MINUTES
               JXDATE    25JAN92  STARTING DATE
               JXTIME          0  STARTING TIME

         SUBBASIN RUNOFF DATA

10 BA       SUBBASIN CHARACTERISTICS
              TAREA        .08  SUBBASIN AREA

            PRECIPITATION DATA

11 PB            STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
              .02   .02   .30   .30   .03   .02   .01   .01   .01   .01
              .01   .01   .00   .00   .00   .00   .01   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00

22 LS       SCS LOSS RATE
              STRTL        .50  INITIAL ABSTRACTION
             CRVNBR      80.00  CURVE NUMBER
              RTIMP        .00  PERCENT IMPERVIOUS AREA

23 UD       SCS DIMENSIONLESS UNITGRAPH
               TLAG        .16  LAG

                                          ***

                                        UNIT HYDROGRAPH
                                      5 END-OF-PERIOD ORDINATES
          136.      59.      14.       3.       1.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
24 KK   *          K *      NORTH DRAINAGE AREA WEST OF PETERSON, NORTH AND SOUTH OF PAINE
        *            *
        **************

          SUBBASIN RUNOFF DATA

25 BA       SUBBASIN CHARACTERISTICS
              TAREA        .05  SUBBASIN AREA
```

PRECIPITATION DATA

11 PB STORM 4.50 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.02	.02	.30	.30	.03	.02	.01	.01	.01	.01
.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00				

26 LS SCS LOSS RATE

STRTL	.20	INITIAL ABSTRACTION
CRVNBR	91.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

27 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.09	LAG

***

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

93. 26. 5. 1. 0.

* ***

****
* *
28 KK * J * NORTHWEST DRAINAGE AREA
* *
****

SUBBASIN RUNOFF DATA

29 BA SUBBASIN CHARACTERISTICS

TAREA	.16	SUBBASIN AREA

PRECIPITATION DATA

11 PB STORM 4.50 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.02	.02	.30	.30	.03	.02	.01	.01	.01	.01
.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00				

30 LS SCS LOSS RATE

STRTL	.50	INITIAL ABSTRACTION
CRVNBR	80.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

```
31 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .13  LAG

                                                ***

                                                      UNIT HYDROGRAPH
                                                    5 END-OF-PERIOD ORDINATES
               309.       93.       19.        4.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
32 KK     *          I *      WEST DRAINAGE AREA
          *            *
          **************

             SUBBASIN RUNOFF DATA

33 BA          SUBBASIN CHARACTERISTICS
                     TAREA        .08  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                    .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                    .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00

34 LS          SCS LOSS RATE
                     STRTL        .20  INITIAL ABSTRACTION
                    CRVNBR      91.00  CURVE NUMBER
                     RTIMP        .00  PERCENT IMPERVIOUS AREA

35 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .13  LAG

                                                ***

                                                      UNIT HYDROGRAPH
                                                    5 END-OF-PERIOD ORDINATES
               151.       45.       9.        2.        0.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
36 KK     *          P *      OFFSITE BETWEEN 24 AND 94
          *            *
          **************
```

SUBBASIN RUNOFF DATA

37 BA SUBBASIN CHARACTERISTICS
TAREA .03 SUBBASIN AREA

PRECIPITATION DATA

11 PB STORM 4.50 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.02	.02	.30	.30	.03	.02	.01	.01	.01	.01
.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00				

38 LS SCS LOSS RATE
STRTL 1.51 INITIAL ABSTRACTION
CRVNBR 57.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

39 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .13 LAG

***

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES
50. 15. 3. 1. 0.

*** ***

****
* *
40 KK * Q * OFFSITE AT NORTHEAST CORNER
* *
****

SUBBASIN RUNOFF DATA

41 BA SUBBASIN CHARACTERISTICS
TAREA .16 SUBBASIN AREA

PRECIPITATION DATA

11 PB STORM 4.50 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.02	.02	.30	.30	.03	.02	.01	.01	.01	.01
.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

```
                .00       .00       .00       .00       .00       .00

42 LS         SCS LOSS RATE
                STRTL       .20  INITIAL ABSTRACTION
               CRVNBR     91.00  CURVE NUMBER
                RTIMP       .00  PERCENT IMPERVIOUS AREA

43 UD         SCS DIMENSIONLESS UNITGRAPH
                TLAG       .22  LAG

                                                ***

                                            UNIT HYDROGRAPH
                                          6 END-OF-PERIOD ORDINATES
          182.      157.      47.       14.       4.        1.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
44 KK   *         PQ *      COMBINE NORTHEAST OFFSITE FLOWS AT NORTH PROPERTY LINE
        *            *
        **************

45 HC         HYDROGRAPH COMBINATION
                ICOMP         2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
46 KK   *          M *      EAST OF SPACE COMMAND HEADQUARTERS
        *            *
        **************

47 KO         OUTPUT CONTROL VARIABLES
                IPRNT         4  PRINT CONTROL
                IPLOT         1  PLOT CONTROL
                QSCAL        0.  HYDROGRAPH PLOT SCALE
                IPNCH         0  PUNCH COMPUTED HYDROGRAPH
                 IOUT        21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1         1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT      .250  TIME INTERVAL IN HOURS


           SUBBASIN RUNOFF DATA

48 BA         SUBBASIN CHARACTERISTICS
                TAREA       .10  SUBBASIN AREA

           PRECIPITATION DATA

11 PB           STORM      4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
               .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
               .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
```

```
                .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00

49 LS         SCS LOSS RATE
                   STRTL        .22  INITIAL ABSTRACTION
                  CRVNBR      90.00  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

50 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG        .10  LAG

                                                  ***

                                                  UNIT HYDROGRAPH
                                                5 END-OF-PERIOD ORDINATES
              187.       52.       10.        2.        0.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
51 KK    *       PQM  *      COMBINED FLOW IN EAST SWALE AT SOUTHEAST CORNER OF FAMILY HOUSING
         *            *
         **************

52 HC         HYDROGRAPH COMBINATION
                 ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
53 KK    *         H  *      CENTRAL DRAINAGE AREA ON EAST SIDE OF PETERSON BLVD NORTH OF STEWART
         *            *
         **************

54 KO         OUTPUT CONTROL VARIABLES
                 IPRNT           4  PRINT CONTROL
                 IPLOT           1  PLOT CONTROL
                 QSCAL          0.  HYDROGRAPH PLOT SCALE
                 IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                  IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                 ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                 ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
                TIMINT        .250  TIME INTERVAL IN HOURS


            SUBBASIN RUNOFF DATA

55 BA          SUBBASIN CHARACTERISTICS
                 TAREA         .07  SUBBASIN AREA
```

```
            PRECIPITATION DATA

11 PB              STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI           INCREMENTAL PRECIPITATION PATTERN
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .01      .01      .01      .01
                  .02      .02      .30      .30      .03      .02      .01      .01      .01      .01
                  .01      .01      .00      .00      .00      .00      .01      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00

56 LS         SCS LOSS RATE
                 STRTL        .20  INITIAL ABSTRACTION
                CRVNBR      91.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

57 UD         SCS DIMENSIONLESS UNITGRAPH
                  TLAG        .14  LAG

                                                ***

                                              UNIT HYDROGRAPH
                                            5 END-OF-PERIOD ORDINATES
            134.       46.       10.        2.        0.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
58 KK    *          C *      FAMILY HOUSING AREA
         *            *
         **************

59 KO         OUTPUT CONTROL VARIABLES
                IPRNT          4  PRINT CONTROL
                IPLOT          1  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .250  TIME INTERVAL IN HOURS


           SUBBASIN RUNOFF DATA

60 BA         SUBBASIN CHARACTERISTICS
                TAREA        .23  SUBBASIN AREA

            PRECIPITATION DATA

11 PB              STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI           INCREMENTAL PRECIPITATION PATTERN
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .01      .01      .01      .01
                  .02      .02      .30      .30      .03      .02      .01      .01      .01      .01
                  .01      .01      .00      .00      .00      .00      .01      .00      .00      .00
```

```
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00

61 LS         SCS LOSS RATE
                   STRTL        .50  INITIAL ABSTRACTION
                  CRVNBR      80.00  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

62 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG        .25  LAG

                                                  ***

                                                 UNIT HYDROGRAPH
                                               7 END-OF-PERIOD ORDINATES
             225.      245.       82.       29.       10.        3.        1.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
63 KK    *        HC  *      COMBINE BASINS H AND C, FLOW IN EAST 60" STORM SEWER
         *            *
         **************

64 HC         HYDROGRAPH COMBINATION
                 ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
65 KK    *     HCPQM  *      COMBINE BASINS H, C, AND M, FLOW IN SWALE AT 60" STORM SEWER
         *            *
         **************

66 HC         HYDROGRAPH COMBINATION
                 ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
67 KK    *         N  *      EAST DRAINAGE AREA TO PROPOSED SWALE
         *            *
         **************

68 KO         OUTPUT CONTROL VARIABLES
                 IPRNT           4  PRINT CONTROL
```

```
          IPLOT          1  PLOT CONTROL
          QSCAL         0.  HYDROGRAPH PLOT SCALE
          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
           IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
          ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
         TIMINT       .250  TIME INTERVAL IN HOURS


      SUBBASIN RUNOFF DATA

69 BA   SUBBASIN CHARACTERISTICS
          TAREA        .14  SUBBASIN AREA

        PRECIPITATION DATA

11 PB     STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI     INCREMENTAL PRECIPITATION PATTERN
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .01     .01     .01     .01
          .02     .02     .30     .30     .03     .02     .01     .01     .01     .01
          .01     .01     .00     .00     .00     .00     .01     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
          .00     .00     .00     .00     .00     .00

70 LS   SCS LOSS RATE
          STRTL       1.17  INITIAL ABSTRACTION
         CRVNBR      63.00  CURVE NUMBER
          RTIMP        .00  PERCENT IMPERVIOUS AREA

71 UD   SCS DIMENSIONLESS UNITGRAPH
           TLAG        .34  LAG

                                        ***

                                   UNIT HYDROGRAPH
                               9 END-OF-PERIOD ORDINATES
      81.    148.     82.     34.     14.      6.      2.      1.      0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


      **************
      *            *
72 KK *   HCPQMN   *     COMBINE BASINS H,C,P,Q,M AND N, FLOW IN SWALE AT DETENTION POND #11
      *            *
      **************

73 HC   HYDROGRAPH COMBINATION
          ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                        ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


      **************
```

```
          *           *
74 KK     *         G *      CENTRAL DRAIANGE AREA WEST OF PETERSON BLVD AND SOUTH OF STEWART
          *           *
          **************

75 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           4  PRINT CONTROL
                    IPLOT           1  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                     IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT        .250  TIME INTERVAL IN HOURS


               SUBBASIN RUNOFF DATA

76 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .05  SUBBASIN AREA

               PRECIPITATION DATA

11 PB               STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                   .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                   .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00

77 LS          SCS LOSS RATE
                    STRTL         .20  INITIAL ABSTRACTION
                   CRVNBR       91.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

78 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .08  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                              5 END-OF-PERIOD ORDINATES
               102.       28.       6.        1.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *           *
79 KK     *         F *      SOUTHWEST DRAINAGE AREA NORTH OF HAMILTON AND WEST OF MICHELL
          *           *
          **************

80 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           4  PRINT CONTROL
                    IPLOT           1  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
```

```
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .250  TIME INTERVAL IN HOURS


          SUBBASIN RUNOFF DATA

81 BA       SUBBASIN CHARACTERISTICS
                TAREA        .19  SUBBASIN AREA

            PRECIPITATION DATA

11 PB           STORM       4.50  BASIN TOTAL PRECIPITATION

12 PI         INCREMENTAL PRECIPITATION PATTERN
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
              .02   .02   .30   .30   .03   .02   .01   .01   .01   .01
              .01   .01   .00   .00   .00   .00   .01   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
              .00   .00   .00   .00   .00   .00

82 LS       SCS LOSS RATE
                STRTL        .99  INITIAL ABSTRACTION
               CRVNBR      67.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

83 UD       SCS DIMENSIONLESS UNITGRAPH
                TLAG        .16  LAG

                                                ***

                                              UNIT HYDROGRAPH
                                            5 END-OF-PERIOD ORDINATES
          310.      134.      32.       8.       2.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
84 KK   *        GF  *      COMBINE BASINS G AND F, FLOW IN HAMILTON COLLECTOR WEST OF MITCHELL
        *            *
        **************

85 HC       HYDROGRAPH COMBINATION
                ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


        **************
        *            *
86 KK   *         B  *      EAST DRAIANGE AREA EAST OF MICHELL AND NORTH OF GOLF COURSE
```

```
         *           *
         **************

            SUBBASIN RUNOFF DATA

97 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .06  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI             INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                     .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                     .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00

88 LS          SCS LOSS RATE
                    STRTL        1.08  INITIAL ABSTRACTION
                   CRVNBR       65.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

89 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .25  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                              7 END-OF-PERIOD ORDINATES
                     61.       67.       22.        8.        3.        1.        0.


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *           *
90 KK    *         D *      SOUTH CENTRAL DRAINAGE AREA WEST OF MITCHELL AND SOUTH OF STEWART
         *           *
         **************

            SUBBASIN RUNOFF DATA

91 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .04  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI             INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                     .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                     .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

```
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00

92 LS         SCS LOSS RATE
                 STRTL        .20  INITIAL ABSTRACTION
                CRVNBR      91.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

93 UD         SCS DIMENSIONLESS UNITGRAPH
                  TLAG        .12  LAG

                                                  ***

                                                 UNIT HYDROGRAPH
                                               5 END-OF-PERIOD ORDINATES
              85.       24.       5.        1.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         ***************
         *             *
94 KK    *         BD  *      COMBINE BASINS B AND D, FLOW IN MITCHELL COLLECTOR
         *             *
         ***************

95 HC         HYDROGRAPH COMBINATION
                ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         ***************
         *             *
96 KK    *          E  *      SOUTH DRAINAGE AREA WEST OF MITCHELL AND NORTH OF HAMILTON
         *             *
         ***************

            SUBBASIN RUNOFF DATA

97 BA         SUBBASIN CHARACTERISTICS
                TAREA         .02  SUBBASIN AREA

              PRECIPITATION DATA

11 PB           STORM        4.50  BASIN TOTAL PRECIPITATION

12 PI           INCREMENTAL PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .01       .01       .01       .01
                .02       .02       .30       .30       .03       .02       .01       .01       .01       .01
                .01       .01       .00       .00       .00       .00       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00
```

```
98 LS          SCS LOSS RATE
                    STRTL         .20  INITIAL ABSTRACTION
                   CRVNBR       91.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

99 UD          SCS DIMENSIONLESS UNITGRAPH
                    TLAG         .08  LAG

                                                      ***

                                                   UNIT HYDROGRAPH
                                                5 END-OF-PERIOD ORDINATES
              43.       12.       2.        0.        0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
00 KK     *       BDE  *      COMBINE BASINS B,D AND E, FLOW IN MITCHELL COLLECTOR AT HAMILTON
          *            *
          **************

01 HC          HYDROGRAPH COMBINATION
                   ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                      ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
.02 KK    *     GFBDE  *      COMBINE BASINS G,F,B,D AND E, TOTAL FLOW AT HAMILTON AND MITCHELL
          *            *
          **************

103 HC         HYDROGRAPH COMBINATION
                   ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                      ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
104 KK    *         A  *      SOUTHEAST DRAINAGE AREA EAST OF MITCHELL AND NORTH OF HAMILTON
          *            *
          **************

105 KO         OUTPUT CONTROL VARIABLES
                   IPRNT           4  PRINT CONTROL
                   IPLOT           1  PLOT CONTROL
                   QSCAL          0.  HYDROGRAPH PLOT SCALE
                   IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                    IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                   ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                   ISAV2          60  LAST ORDINATE PUNCHED OR SAVED
                  TIMINT        .250  TIME INTERVAL IN HOURS
```

SUBBASIN RUNOFF DATA

106 BA SUBBASIN CHARACTERISTICS
TAREA .07 SUBBASIN AREA

PRECIPITATION DATA

11 PB STORM 4.50 BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.02	.02	.30	.30	.03	.02	.01	.01	.01	.01
.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00				

107 LS SCS LOSS RATE
STRTL 1.08 INITIAL ABSTRACTION
CRVNBR 65.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

08 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .25 LAG

***

UNIT HYDROGRAPH
7 END-OF-PERIOD ORDINATES

72. 79. 26. 9. 3. 1. 0.

* ***

****
* *
09 KK * GFBDEA * COMBINE BASINS G,F,B,D,E AND A, TOTAL FLOW IN HAMILTON COLLECTOR
* *
****

10 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

* ***

****
* *
111 KK * O * SOUTHEAST DRAIANGE AREA GOLF COURSE NORTH OF DETENTION POND #11
* *
****

112 KO OUTPUT CONTROL VARIABLES
IPRNT 4 PRINT CONTROL

```
                IPLOT          1  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .250  TIME INTERVAL IN HOURS


          SUBBASIN RUNOFF DATA

113 BA      SUBBASIN CHARACTERISTICS
                TAREA        .18  SUBBASIN AREA

            PRECIPITATION DATA

 11 PB          STORM       4.50  BASIN TOTAL PRECIPITATION

 12 PI        INCREMENTAL PRECIPITATION PATTERN
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .01   .01   .01   .01
                .02   .02   .30   .30   .03   .02   .01   .01   .01   .01
                .01   .01   .00   .00   .00   .00   .01   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00   .00   .00   .00   .00
                .00   .00   .00   .00   .00   .00

114 LS      SCS LOSS RATE
                STRTL       1.08  INITIAL ABSTRACTION
               CRVNBR      65.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

115 UD      SCS DIMENSIONLESS UNITGRAPH
                TLAG        .34  LAG

                                          ***

                                        UNIT HYDROGRAPH
                                     9 END-OF-PERIOD ORDINATES
          103.     189.     104.      43.      18.       7.       3.       1.       0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 16 KK    *     TOTAL  *      TOTAL FLOW FROM STUDY AREA TO DETENTION POND #11
          *            *
          **************

 17 HC      HYDROGRAPH COMBINATION
                ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                          ***


* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
```

```
          *           *
118 KK    *     D1    *     DETENTION VOLUME REQUIRED
          *           *
          *************

119 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          4  PRINT CONTROL
                     IPLOT          1  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         60  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .250  TIME INTERVAL IN HOURS

                          DETETIION BASIN #1

               HYDROGRAPH ROUTING DATA

121 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       ELEV  TYPE OF INITIAL CONDITION
                     RSVRIC    6110.50  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 22 SA              AREA          .1       4.1       5.8       6.5       7.8       9.2      10.6

123 SE          ELEVATION    6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00

 24 SQ          DISCHARGE         1.        4.       20.       30.       34.       36.       40.

125 SE          ELEVATION    6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00

                                                    ***

                                        COMPUTED STORAGE-ELEVATION DATA

          STORAGE        .00       .98     10.89     23.17     58.89    101.38    150.64
        ELEVATION    6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .98     10.89     23.17     58.89    101.38    150.64
          OUTFLOW       1.00      4.00     20.00     30.00     34.00     36.00     40.00
        ELEVATION    6110.40   6111.00   6113.00   6115.00   6120.00   6125.00   6130.00
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.67	1.00
HYDROGRAPH AT	L	.08	1	FLOW	74.	151.
				TIME	6.00	6.00
DROGRAPH AT	K	.05	1	FLOW	83.	138.
				TIME	6.00	6.00
DROGRAPH AT	J	.16	1	FLOW	161.	325.
				TIME	6.00	6.00
HYDROGRAPH AT	I	.08	1	FLOW	136.	227.
				TIME	6.00	6.00
HYDROGRAPH AT	P	.03	1	FLOW	2.	14.
				TIME	6.00	6.00
HYDROGRAPH AT	Q	.16	1	FLOW	216.	372.
				TIME	6.00	6.00
COMBINED AT	PQ	.18	1	FLOW	218.	387.
				TIME	6.00	6.00
DROGRAPH AT	M	.10	1	FLOW	160.	270.
				TIME	6.00	6.00
? COMBINED AT	PQM	.28	1	FLOW	378.	657.
				TIME	6.00	6.00
HYDROGRAPH AT	H	.07	1	FLOW	124.	207.
				TIME	6.00	6.00
HYDROGRAPH AT	C	.23	1	FLOW	145.	316.
				TIME	6.00	6.00
COMBINED AT	HC	.31	1	FLOW	269.	523.
				TIME	6.00	6.00
COMBINED AT	HCPQM	.59	1	FLOW	647.	1180.
				TIME	6.00	6.00
HYDROGRAPH AT	N	.14	1	FLOW	21.	74.
				TIME	6.25	6.25
2 COMBINED AT	HCPQMN	.73	1	FLOW	658.	1225.
				TIME	6.00	6.00
HYDROGRAPH AT	G	.05	1	FLOW	91.	151.
				TIME	6.00	6.00
DROGRAPH AT	F	.19	1	FLOW	63.	184.
				TIME	6.00	6.00
COMBINED AT	GF	.24	1	FLOW	154.	335.
				TIME	6.00	6.00
DROGRAPH AT	B	.06	1	FLOW	12.	38.

				TIME	6.25	6.25
DROGRAPH AT	D	.04	1	FLOW	75.	126.
				TIME	6.00	6.00
? COMBINED AT	BD	.11	1	FLOW	86.	161.
				TIME	6.00	6.00
HYDROGRAPH AT	E	.02	1	FLOW	38.	63.
				TIME	6.00	6.00
⌐ COMBINED AT	BDE	.13	1	FLOW	124.	225.
				TIME	6.00	6.00
COMBINED AT	GFBDE	.37	1	FLOW	278.	560.
				TIME	6.00	6.00
DROGRAPH AT	A	.07	1	FLOW	15.	45.
				TIME	6.25	6.25
? COMBINED AT	GFBDEA	.44	1	FLOW	290.	602.
				TIME	6.00	6.00
HYDROGRAPH AT	O	.18	1	FLOW	34.	108.
				TIME	6.25	6.25
ↄ COMBINED AT	TOTAL	1.36	1	FLOW	965.	1894.
				TIME	6.00	6.00
UTED TO	D1	1.36	1	FLOW	33.	37.
				TIME	8.75	14.25

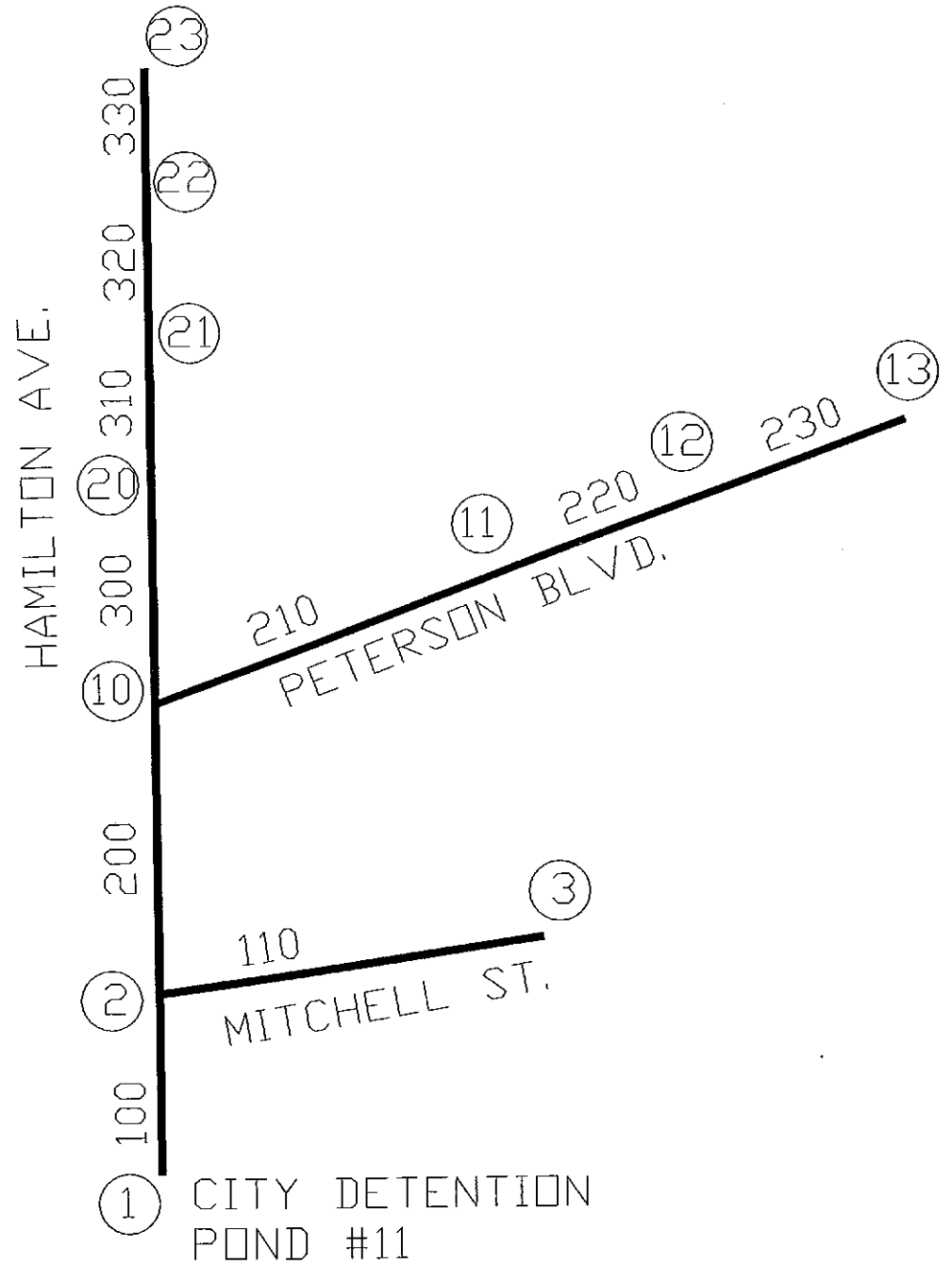
** PEAK STAGES IN FEET **

1	STAGE	6119.01	6126.36
	TIME	8.75	14.25

*** NORMAL END OF HEC-1 ***

^^RMAL END OF HEC-1

PIPE CAPACITY CALCULATIONS



PAFB EXISTING MAIN STORM SEWER
UDSEWER COMPUTER MODEL

```
PETERSON AFB BASEWIDE DRAINAGE STUDY
EXISTING STORM SEWER CAPACITY CALCULATIONS
2 , 18 , 30 , 1 , 2 , 1 , .8 , 500 , 300 , .2 ,N
2 , 10
4.9 , 3.8 , 2.7 , 2.2 , 1.8 , 1.4 , .89
11
1 , 6145 , 0 , 1 , 100 , 0 , 0 , 0
310 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
2 , 6166 , 100 , 2 , 110 , 200 , 0 , 0
510 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
5 , 6197 , 110 , 0 , 0 , 0 , 0 , 0
60 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
10 , 6172 , 200 , 2 , 210 , 300 , 0 , 0
250 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
11 , 6190 , 210 , 1 , 220 , 0 , 0 , 0
130 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
12 , 6208 , 220 , 1 , 230 , 0 , 0 , 0
100 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
13 , 6210 , 230 , 0 , 0 , 0 , 0 , 0
100 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
20 , 6177 , 300 , 1 , 310 , 0 , 0 , 0
30 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
21 , 6178 , 310 , 1 , 320 , 0 , 0 , 0
45 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
22 , 6179 , 320 , 1 , 330 , 0 , 0 , 0
30 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
23 , 6184 , 330 , 0 , 0 , 0 , 0 , 0
20 , 0 , 50 , .7 , 0 , 0 , 0 , 0 , 0
10
100 , 2600 , .81 , 6159 , .015 , 0 , 0 , 1 , 72 , 0
110 , 2470 , 1.417 , 6194 , .015 , 0 , 0 , 1 , 36 , 0
200 , 1700 , .453 , 6166 , .015 , 0 , 0 , 1 , 72 , 0
210 , 1200 , 1.75 , 6186 , .015 , 0 , 0 , 1 , 48 , 0
220 , 1200 , 1.175 , 6201.7 , .015 , 0 , 0 , 1 , 42 , 0
230 , 450 , 1.18 , 6207 , .015 , 0 , 0 , 1 , 42 , 0
300 , 850 , .447 , 6169 , .015 , 0 , 0 , 1 , 42 , 0
310 , 450 , .489 , 6171 , .015 , 0 , 0 , 1 , 36 , 0
320 , 200 , 1.35 , 6174 , .015 , 0 , 0 , 1 , 30 , 0
330 , 430 , 1.395 , 6180 , .015 , 0 , 0 , 1 , 24 , 0
```

REPORT OF STORM SEWER SYSTEM DESIGN

USING UDSEWER-MODEL VERSION 2
DEVELOPED
BY
JAMES C.Y. GUO ,PHD, PE
DEPARTMENT OF CIVIL ENGINEERING, UNIVERSITY OF COLORADO AT DENVER
IN COOPERATION WITH
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
DENVER, COLORADO

** EXECUTED BY HOLLAND WEST COMPANY- DENVER COLORADO
ON DATA 04-03-1992 AT TIME 06:48:03

** PROJECT TITLE :

PETERSON AFB BASEWIDE DRAINAGE STUDY

** RETURN PERIOD OF FLOOD IS 10 YEARS

RAINFALL INTENSITY TABLE IS GIVEN

** SUMMARY OF SUBBASIN RUNOFF PREDICTIONS

MANHOLE ID NUMBER	BASIN AREA * C	TIME OF CONCENTRATION OVERLAND To (MIN)	GUTTER Tf (MIN)	BASIN Tc (MIN)	RAIN I INCH/HR	PEAK FLOW CFS
1.00	35.00	0.00	0.00	0.00	4.90	171.50
2.00	35.00	0.00	0.00	0.00	4.90	171.50
3.00	35.00	0.00	0.00	44.29	1.71	60.00
10.00	35.00	0.00	0.00	0.00	4.90	171.50
11.00	35.00	0.00	0.00	0.00	4.90	171.50
12.00	35.00	0.00	0.00	0.00	4.90	171.50
13.00	35.00	0.00	0.00	18.57	2.86	100.00
20.00	35.00	0.00	0.00	0.00	4.90	171.50
21.00	35.00	0.00	0.00	0.00	4.90	171.50
22.00	35.00	0.00	0.00	0.00	4.90	171.50
23.00	35.00	0.00	0.00	157.48	0.57	20.00

THE SHORTEST DESIGN RAINFALL DURATION IS FIVE MINUTES

DENVER REGIONAL DRAINAGE CRITERIA WAS NOT USED TO CHECK
THE COMPUTATION OF TIME OF CONCENTRATION

*** SUMMARY OF HYDRAULICS AT MANHOLES

MANHOLE ID	CNTRBTING AREA * C	RAINFALL DURATION MINUTES	RAINFALL INTENSITY INCH/HR	DESIGN PEAK FLOW CFS	GROUND ELEVATION FEET	WATER ELEVATION FEET	COMMENTS
1.00	0.00	0.00	0.00	310.00	6145.00	6135.00	OK
2.00	350.00	120.50	0.89	310.00	6166.00	6157.80	OK
3.00	35.00	44.29	1.71	60.00	6197.00	6193.49	OK
10.00	280.00	119.66	0.89	250.00	6172.00	6167.18	OK
11.00	105.00	79.05	1.24	130.00	6190.00	6185.39	OK
12.00	70.00	58.57	1.43	100.00	6208.00	6202.70	OK
13.00	35.00	18.57	2.86	100.00	6210.00	6208.58	OK
20.00	140.00	157.48	0.57	80.00	6177.00	6174.44	OK
21.00	105.00	174.29	0.43	45.00	6178.00	6177.59	OK
22.00	70.00	174.29	0.43	30.00	6179.00	6178.32	OK
23.00	35.00	157.48	0.57	20.00	6184.00	6181.95	OK

MEANS WATER ELEVATION IS LOWER THAN GROUND ELEVATION

THE TIME OF CONCENTRATION AT MANHOLE ID = 21 DECREASES DOWNSTREAM
E TIME OF CONCENTRATION AT MANHOLE ID = 20 DECREASES DOWNSTREAM
E TIME OF CONCENTRATION AT MANHOLE ID = 10 DECREASES DOWNSTREAM
THE TIME OF CONCENTRATION AT MANHOLE ID = 2 DECREASES DOWNSTREAM
CHECK THE GIVEN DESIGN FLOWS

* SUMMARY OF SEWER HYDRAULICS

NOTE: THE GIVEN FLOW DEPTH-TO-SEWER SIZE RATIO= .8

SEWER ID NUMBER	MAMHOLE NUMBER UPSTREAM ID NO.	DNSTREAM ID NO.	SEWER SHAPE	REQUIRED DIA(HIGH) (IN) (FT)	SUGGESTED DIA(HIGH) (IN) (FT)	EXISTING DIA(HIGH) (IN) (FT)	WIDTH (FT)
100.00	2.00	1.00	ROUND	70.32	72.00	72.00	0.00
110.00	3.00	2.00	ROUND	34.20	36.00	36.00	0.00
200.00	10.00	2.00	ROUND	72.33	78.00	72.00	0.00
210.00	11.00	10.00	ROUND	43.93	48.00	48.00	0.00
220.00	12.00	11.00	ROUND	42.90	48.00	42.00	0.00
230.00	13.00	12.00	ROUND	42.87	48.00	42.00	0.00
300.00	20.00	10.00	ROUND	47.30	48.00	42.00	0.00
310.00	21.00	20.00	ROUND	37.48	42.00	36.00	0.00
320.00	22.00	21.00	ROUND	26.61	27.00	30.00	0.00
330.00	23.00	22.00	ROUND	22.72	24.00	24.00	0.00

DIMENSION UNITS FOR ROUND AND ARCH SEWER ARE IN INCHES
MENSION UNITS FOR BOX SEWER ARE IN FEET
QUIRED DIAMETER = COMPUTED; SUGGESTED DIAMETER = COMMERCIAL
FOR A NEW SEWER, FLOW IS ANALYZED BY THE SUGGESTED SEWER SIZE; OTHERWISE,
EXISITNG SIZE IS USED

SEWER D NUMBER	DESIGN Q IN CFS	P-FULL Q IN CFS	DEPTH YN FEET	CRTC DEPTH YC FEET	VELOCITY IN FPS	FROUDE NUMBER	COMMENTS
100.00	310.00	331.23	4.60	4.80	13.31	1.09	V-OK
110.00	60.00	69.00	2.16	2.49	11.00	1.36	V-OK
200.00	250.00	247.70	6.00	4.25	8.84	0.00	V-OK
210.00	130.00	165.13	2.67	3.39	14.56	1.67	V-OK
220.00	100.00	94.77	3.50	3.04	10.39	0.00	V-OK
230.00	100.00	94.97	3.50	3.04	10.39	0.00	V-OK

300.00	80.00	58.45	3.50	2.79	8.32	0.00	V-OK
310.00	45.00	40.53	3.00	2.12	6.37	0.00	V-OK
320.00	30.00	41.41	1.58	1.87	9.20	1.39	V-OK
330.00	20.00	23.22	1.43	1.60	8.31	1.27	V-OK

)UDE NUMBER=0 INDICATES THAT A PRESSURED FLOW OCCURS

SEWER) NUMBER	SLOPE %	INVERT ELEVATION UPSTREAM (FT)	INVERT ELEVATION DNSTREAM (FT)	BURIED DEPTH UPSTREAM (FT)	BURIED DEPTH DNSTREAM (FT)	COMMENTS
100.00	0.81	6153.00	6131.94	7.00	7.06	OK
110.00	1.42	6191.00	6156.00	3.00	7.00	OK
200.00	0.45	6160.00	6152.30	6.00	7.70	OK
210.00	1.75	6182.00	6161.00	4.00	7.00	OK
220.00	1.17	6198.20	6184.10	6.30	2.40	OK
230.00	1.18	6203.50	6198.19	3.00	6.31	OK
300.00	0.45	6165.50	6161.70	8.00	6.80	OK
310.00	0.49	6168.00	6165.80	7.00	8.20	OK
320.00	1.35	6171.50	6168.80	5.00	6.70	OK
330.00	1.39	6178.00	6172.00	4.00	5.00	OK

MEANS BURIED DEPTH IS GREATER THAN REQUIRED SOIL COVER OF 2 FEET

* SUMMARY OF HYDRAULIC GRADIENT LINE ALONG SEWERS

SEWER ID NUMBER	SEWER LENGTH FEET	SURCHARGED LENGTH FEET	CROWN ELEVATION UPSTREAM FEET	CROWN ELEVATION DNSTREAM FEET	WATER ELEVATION UPSTREAM FEET	WATER ELEVATION DNSTREAM FEET	FLOW CONDITION
100.00	2600.00	0.00	6159.00	6137.94	6157.80	6135.00	JUMP
110.00	2470.00	0.00	6194.00	6159.00	6193.49	6157.80	JUMP
200.00	1700.00	1700.00	6166.00	6158.30	6167.18	6157.80	PRSS'ED
210.00	1200.00	5.89	6186.00	6165.00	6185.39	6167.18	JUMP
220.00	1200.00	1200.00	6201.70	6187.60	6202.70	6185.39	PRSS'ED
230.00	450.00	450.00	6207.00	6201.69	6208.58	6202.70	PRSS'ED
300.00	850.00	850.00	6169.00	6165.20	6174.44	6167.18	PRSS'ED
310.00	450.00	450.00	6171.00	6168.80	6177.59	6174.44	PRSS'ED
320.00	200.00	200.00	6174.00	6171.30	6178.32	6177.59	PRSS'ED
330.00	430.00	326.99	6180.00	6174.00	6181.95	6178.32	JUMP

PRSS'ED=PRESSURED FLOW; JUMP=POSSIBLE HYDRAULIC JUMP; SUBCR=SUBCRITICAL FLOW

*** SUMMARY OF ENERGY GRADIENT LINE ALONG SEWERS

SEWER ID NO.	UPSTREAM MANHOLE ID NO.	ENERGY ELEV FT	WATER ELEV FT	FRICTION LOSS FT	DOWNSTREAM MANHOLE ID	BEND K	MAIN K	JCT LOSS	ENERGY FT
100.00	2.00	6160.55	6157.80	25.55	1.00	0.00	0.00	0.00	6135.00
110.00	3.00	6195.37	6193.49	34.82	2.00	0.00	0.00	0.00	6160.55
200.00	10.00	6168.39	6167.18	7.84	2.00	0.00	0.00	0.00	6160.55
210.00	11.00	6188.68	6185.39	20.29	10.00	0.00	0.00	0.00	6168.39
220.00	12.00	6204.37	6202.70	15.69	11.00	0.00	0.00	0.00	6188.68

230.00	13.00	6210.26	6208.58	5.89	12.00	0.00	0.00	0.00	6204.37
300.00	20.00	6175.51	6174.44	7.11	10.00	0.00	0.00	0.00	6168.39
310.00	21.00	6178.22	6177.59	2.71	20.00	0.00	0.00	0.00	6175.51
320.00	22.00	6179.64	6178.32	1.42	21.00	0.00	0.00	0.00	6178.22
330.00	23.00	6183.02	6181.95	3.38	22.00	0.00	0.00	0.00	6179.64

BEND LOSS =BEND K* VHEAD IN SEWER.
MAINLINE LOSS= OUTFLOW VHEAD-JCT LOSS K*INFLOW VHEAD
JUNCTURE LOSS= 0 IF THE ABOVE DIFFERENCE IS LESS THAN ZERO
FRICTION LOSS=0 MEANS IT IS NEGLIGIBLE OR POSSIBLE ERROR DUE TO JUMP.
FRICTION LOSS INCLUDES DROP AT MANHOLE

*** SUMMARY OF EARTH EXCAVATION VOLUME FOR COST ESTIMATE.

THE TRENCH SIDE SLOPE = 1

MANHOLE D NUMBER	GROUND ELEVATION FT	INVERT ELEVATION FT	MANHOLE HEIGHT FT
1.00	6145.00	6131.94	13.06
2.00	6166.00	6152.30	13.70
3.00	6197.00	6191.00	6.00
10.00	6172.00	6160.00	12.00
11.00	6190.00	6182.00	8.00
12.00	6208.00	6198.19	9.81
13.00	6210.00	6203.50	6.50
20.00	6177.00	6165.50	11.50
21.00	6178.00	6168.00	10.00
22.00	6179.00	6171.50	7.50
23.00	6184.00	6178.00	6.00

SEWER ID NUMBER	UPST TRENCH WIDTH ON GROUND FT	UPST TRENCH WIDTH AT INVERT FT	DNST TRENCH WIDTH ON GROUND FT	DNST TRENCH WIDTH AT INVERT FT	TRENCH LENGTH FT	WALL THICKNESS INCHES	EARTH VOLUME CUBIC YD
100.00	22.83	11.17	22.95	11.17	2600.00	7.00	18397.3
110.00	10.33	5.67	18.33	5.67	2470.00	4.00	6749.3
200.00	20.83	11.17	24.24	11.17	1700.00	7.00	11817.9
210.00	13.17	6.83	19.17	6.83	1200.00	5.00	4256.8
220.00	17.35	6.25	9.55	6.25	1200.00	4.50	3203.2
230.00	10.75	6.25	17.37	6.25	450.00	4.50	1253.5
300.00	20.75	6.25	18.35	6.25	850.00	4.50	3744.8
310.00	18.33	5.67	20.73	5.67	450.00	4.00	1902.9
320.00	13.92	5.08	17.32	5.08	200.00	3.50	562.9
330.00	11.50	4.50	13.50	4.50	430.00	3.00	796.1

TOTAL EARTH VOLUME FOR SEWER TRENCHES = 52684.57 CUBIC YARDS
EWER FLOW LINE IS DETERMINED BY THE USER

EARTH VOLUME WAS ESTIMATED TO HAVE
BOTTOM WIDTH=DIAMETER OR WIDTH OF SEWER + 2 * B
B=ONE FEET WHEN DIAMETER OR WIDTH <=48 INCHES
B=TWO FEET WHEN DIAMETER OR WIDTH >48 INCHES
IF BOTTOM WIDTH <MINIMUM WIDTH, 2 FT, THE MINIMUM WIDTH WAS USED.
BACKFILL DEPTH UNDER SEWER WAS ASSUMED TO BE ONE FOOT
SEWER WALL THICKNESS=EQIVLNT DIAMATER IN INCH/12 +1 IN INCHES

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
72", PETERSON TO MITCHELL STREET

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	6.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	2100.0
Culvert Slope (feet per foot)	0.0040

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	9.00	3.84	2.38	2.75	2.69	2.75	7.90
120.0	9.00	4.29	3.17	3.06	2.96	3.06	8.26
140.0	9.00	4.73	4.09	3.36	3.21	3.36	8.59
160.0	9.00	5.17	5.16	3.66	3.44	3.66	8.86
180.0	9.00	5.60	6.38	3.97	3.66	6.00	6.37
200.0	9.00	6.03	7.73	4.29	3.86	6.00	7.07
220.0	9.00	6.47	9.23	4.66	4.06	6.00	7.78
240.0	9.00	6.91	10.87	5.13	4.24	6.00	8.49
260.0	9.00	7.55	12.65	6.00	4.42	6.00	9.20
280.0	9.00	7.92	14.58	6.00	4.58	6.00	9.90

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
72", MITCHELL TO SWALE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	6.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	3100.0
Culvert Slope (feet per foot)	0.0080

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	2.00	2.59	-20.23	1.59	1.88	1.59	8.35
75.0	2.00	3.25	-19.22	1.95	2.32	1.95	9.41
100.0	2.00	3.84	-17.93	2.27	2.69	2.27	10.20
125.0	2.00	4.40	-16.35	2.57	3.02	2.57	10.79
150.0	3.00	4.95	-14.46	2.84	3.33	2.84	11.37
175.0	3.00	5.49	-12.28	3.11	3.61	3.11	11.85
200.0	3.00	6.03	-9.78	3.38	3.86	3.38	12.17
225.0	3.00	6.58	-6.98	3.65	4.11	3.65	12.51
250.0	3.00	7.25	-3.88	3.92	4.33	3.92	12.79
300.0	3.00	8.50	3.26	4.51	4.73	4.51	13.17
325.0	3.00	9.28	7.28	4.87	4.91	4.87	13.22
350.0	3.00	10.12	11.62	5.40	5.07	5.07	13.74
375.0	3.00	11.02	16.26	6.00	5.21	5.21	14.38
400.0	3.00	11.99	21.21	6.00	5.33	5.33	15.06
425.0	4.00	13.01	26.46	6.00	5.44	5.44	15.77
450.0	4.00	14.10	32.02	6.00	5.53	5.53	16.51

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
HAMILTON AVENUE COLLECTOR
42" SECTION BETWEEN VINCENT ST AND PETERSON BLVD

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.50
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	800.0
Culvert Slope (feet per foot)	0.0050

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	10.00	1.31	6.12	0.95	0.96	3.50	1.04
15.0	10.00	1.63	6.28	1.16	1.18	3.50	1.56
20.0	10.00	1.92	6.50	1.37	1.37	3.50	2.08
25.0	10.00	2.19	6.78	1.55	1.54	3.50	2.60
30.0	10.00	2.45	7.12	1.71	1.69	3.50	3.12
35.0	10.00	2.69	7.53	1.89	1.83	3.50	3.64
40.0	10.00	2.94	8.00	2.05	1.97	3.50	4.16
45.0	10.00	3.18	8.53	2.22	2.09	3.50	4.68
50.0	10.00	3.42	9.12	2.39	2.21	3.50	5.20
55.0	10.00	3.67	9.77	2.57	2.32	3.50	5.72
60.0	10.00	3.91	10.49	2.76	2.43	3.50	6.24
65.0	10.00	4.23	11.27	3.08	2.53	3.50	6.76
70.0	10.00	4.52	12.11	3.50	2.62	3.50	7.28

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
HAMILTON AVENUE COLLECTOR
36" SECTION BETWEEN TRUAX ST AND VINCENT ST

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	550.0
Culvert Slope (feet per foot)	0.0110

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	10.00	1.38	4.15	0.82	1.00	3.00	1.41
15.0	10.00	1.74	4.40	1.02	1.23	3.00	2.12
20.0	10.00	2.07	4.75	1.19	1.43	3.00	2.83
25.0	10.00	2.38	5.21	1.34	1.61	3.00	3.54
30.0	10.00	2.69	5.76	1.49	1.77	3.00	4.24
35.0	10.00	2.99	6.41	1.64	1.92	3.00	4.95
40.0	10.00	3.30	7.17	1.78	2.06	3.00	5.66
45.0	10.00	3.70	8.02	1.92	2.19	3.00	6.37
50.0	10.00	4.00	8.97	2.08	2.30	3.00	7.07
55.0	10.00	4.42	10.03	2.24	2.41	3.00	7.78
60.0	10.00	4.88	11.18	2.43	2.50	3.00	8.49
65.0	10.00	5.38	12.44	2.75	2.59	3.00	9.20

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
HAMILTON AVENUE COLLECTOR
30" SECTION AT TRUAX STREET

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	2.50
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	250.0
Culvert Slope (feet per foot)	0.0110

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	10.00	1.50	7.52	0.88	1.06	2.50	2.04
15.0	10.00	1.92	7.87	1.10	1.31	2.50	3.06
20.0	10.00	2.32	8.35	1.30	1.52	2.50	4.07
25.0	10.00	2.72	8.96	1.50	1.70	2.50	5.09
30.0	10.00	3.21	9.72	1.69	1.87	2.50	6.11
25.0	10.00	2.72	8.96	1.50	1.70	2.50	5.09
30.0	10.00	3.21	9.72	1.69	1.87	2.50	6.11
35.0	10.00	3.70	10.61	1.93	2.01	2.50	7.13
40.0	10.00	4.32	11.63	2.29	2.13	2.50	8.15

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
HAMILTON AVENUE COLLECTOR
24" SECTION BETWEEN OTTIS ST AND TRUAX ST

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	2.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	550.0
Culvert Slope (feet per foot)	0.0110

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	10.00	1.69	5.56	0.98	1.13	2.00	3.18
12.0	10.00	1.92	6.27	1.10	1.24	2.00	3.82
14.0	10.00	2.14	7.11	1.21	1.35	2.00	4.46
16.0	10.00	2.41	8.08	1.33	1.44	2.00	5.09
18.0	10.00	2.65	9.17	1.45	1.53	2.00	5.73
20.0	10.00	2.95	10.40	1.59	1.61	2.00	6.37

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
36", MITHCELL STREET CULVERT
GLASOOW AVENUE TO 72" AT HAMILTON AVENUE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	2600.0
Culvert Slope (feet per foot)	0.0120

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	9.00	2.07	-18.96	1.16	1.43	1.16	7.95
25.0	9.00	2.38	-17.13	1.31	1.61	1.31	8.42
30.0	9.00	2.69	-14.90	1.48	1.77	1.48	8.66
35.0	9.00	2.99	-12.26	1.59	1.92	1.59	9.18
40.0	9.00	3.30	-9.22	1.73	2.06	1.73	9.48
45.0	9.00	3.70	-5.78	1.87	2.19	1.87	9.74
50.0	9.00	4.00	-1.92	2.01	2.30	2.01	9.92
55.0	9.00	4.42	2.33	2.16	2.41	2.16	10.10
60.0	9.00	4.88	7.00	2.33	2.50	3.00	8.49
65.0	9.00	5.38	12.07	2.53	2.59	3.00	9.20

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
48" PETERSON BLVD COLLECTOR
ENT AVE. TO HAMILTON AVE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	4.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	1500.0
Culvert Slope (feet per foot)	0.0140

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	9.00	1.25	-11.89	0.71	0.92	0.71	6.69
20.0	9.00	1.82	-11.57	1.00	1.32	1.00	8.19
25.0	9.00	2.06	-11.32	1.11	1.48	1.11	8.74
30.0	9.00	2.29	-11.03	1.22	1.62	1.22	9.21
35.0	9.00	2.51	-10.68	1.33	1.76	1.33	9.61
40.0	9.00	2.72	-10.27	1.42	1.89	1.42	9.96
45.0	9.00	2.92	-9.81	1.52	2.01	1.52	10.30
50.0	9.00	3.12	-9.30	1.61	2.12	1.61	10.60
55.0	9.00	3.32	-8.73	1.69	2.23	1.69	10.87
60.0	9.00	3.52	-8.11	1.78	2.33	1.78	11.11
65.0	9.00	3.72	-7.44	1.87	2.43	1.87	11.30
70.0	9.00	3.92	-6.71	1.94	2.53	1.94	11.59
75.0	9.00	4.12	-5.92	2.02	2.62	2.02	11.77
80.0	9.00	4.32	-5.09	2.10	2.71	2.10	11.99
85.0	9.00	4.52	-4.19	2.18	2.79	2.18	12.11
90.0	9.00	4.79	-3.25	2.26	2.88	2.26	12.28
95.0	9.00	5.06	-2.25	2.34	2.95	2.34	12.44
100.0	9.00	5.22	-1.20	2.42	3.03	2.42	12.60
110.0	9.00	5.73	1.07	2.57	3.17	2.57	12.89
120.0	9.00	6.31	3.56	2.75	3.30	2.75	13.05
130.0	9.00	6.94	6.26	2.92	3.41	2.92	13.23
140.0	9.00	7.62	9.18	3.12	3.51	4.00	11.14

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
PETERSON BLVD COLLECTOR
42" SECTION BETWEEN SELFRIDGE ST AND ENT AVE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.50
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	2050.0
Culvert Slope (feet per foot)	0.0110

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	7.00	1.31	-15.26	0.78	0.96	0.78	6.24
20.0	7.00	1.92	-14.40	1.11	1.37	1.11	7.61
30.0	7.00	2.45	-12.96	1.38	1.69	1.38	8.51
40.0	7.00	2.94	-10.94	1.62	1.97	1.62	9.21
50.0	7.00	3.42	-8.34	1.85	2.21	1.85	9.67
60.0	7.00	3.91	-5.17	2.07	2.43	2.07	10.13
70.0	7.00	4.52	-1.43	2.30	2.62	2.30	10.47
75.0	7.00	4.76	0.66	2.41	2.71	2.41	10.62
80.0	7.00	5.10	2.90	2.53	2.79	2.53	10.73
85.0	7.00	5.45	5.28	2.67	2.87	2.67	10.80
90.0	7.00	5.83	7.80	2.82	2.94	3.50	9.35
95.0	7.00	6.23	10.46	3.04	3.01	3.50	9.87
100.0	7.00	6.64	13.27	3.50	3.07	3.50	10.39

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
48" STORM SEWER
SPACE COMMAND HEADQUARTERS

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	4.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	4200.0
Culvert Slope (feet per foot)	0.0090

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	2.00	5.22	-12.86	2.54	3.03	2.54	11.89
105.0	2.00	5.46	-10.63	2.64	3.10	2.64	11.95
110.0	2.00	5.73	-8.30	2.72	3.17	2.72	12.07
115.0	2.00	6.01	-5.85	2.82	3.24	2.82	12.15
120.0	2.00	6.31	-3.31	2.91	3.30	2.91	12.25
125.0	2.00	6.62	-0.65	3.01	3.36	3.01	12.33
130.0	2.00	6.94	2.11	3.06	3.41	3.06	12.59
135.0	2.00	7.27	4.97	3.25	3.46	3.25	12.36
140.0	2.00	7.62	7.94	3.38	3.51	3.51	11.98

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
SAND CREEK 54" STORM SEWER
NEAR WEST ENTRANCE TO BASE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	4.50
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	1150.0
Culvert Slope (feet per foot)	0.0150

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	2.00	4.61	-9.84	2.01	2.94	2.01	14.52
120.0	2.00	5.34	-8.07	2.24	3.22	2.24	15.15
140.0	2.00	6.10	-6.02	2.46	3.48	2.46	15.70
160.0	2.00	7.04	-3.69	2.68	3.70	2.68	16.23
180.0	2.00	8.11	-1.09	2.91	3.89	2.91	16.55
200.0	2.00	9.31	1.79	3.15	4.04	3.15	16.84
220.0	2.00	10.63	4.95	3.38	4.15	3.38	17.16
240.0	2.00	12.08	8.40	3.68	4.24	3.68	17.23

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
SAND CREEK 30" STORM SEWER
NEAR WEST ENTRANCE TO BASE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	1850.0
Culvert Slope (feet per foot)	0.0140

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
10.0	1.00	1.38	-23.31	0.78	1.00	0.78	6.90
15.0	1.00	1.74	-22.46	0.95	1.23	0.95	7.75
20.0	1.00	2.07	-21.33	1.11	1.43	1.11	8.40
25.0	1.00	2.38	-19.92	1.25	1.61	1.25	8.92
30.0	1.00	2.69	-18.22	1.39	1.77	1.39	9.35
35.0	1.00	2.99	-16.24	1.52	1.92	1.52	9.72
40.0	1.00	3.30	-13.97	1.65	2.06	1.65	10.06
45.0	1.00	3.70	-11.40	1.78	2.19	1.78	10.31
50.0	1.00	4.00	-8.55	1.91	2.30	1.91	10.55
55.0	1.00	4.42	-5.41	2.04	2.41	2.04	10.76
60.0	1.00	4.88	-1.99	2.17	2.50	2.17	10.97
65.0	1.00	5.38	1.73	2.33	2.59	2.33	11.02
70.0	1.00	5.91	5.73	2.53	2.66	2.53	11.01
75.0	1.00	6.49	10.02	3.00	2.72	2.72	11.14
80.0	1.00	7.11	14.61	3.00	2.77	2.77	11.73

TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
PROPOSED EAST SWALE
SECTION OF SWALE EAST OF FAMILY HOUSING

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	250.0
Channel Bottom Slope (feet per foot)	0.0025
Manning's Roughness Coefficient (n-value)	0.0300
Channel Side Slope - Left Side (horizontal/vertical)	3.00
Channel Side Slope - Right Side (horizontal/vertical)	3.00
Channel Bottom Width (feet)	15.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	2.76
Flow Velocity (feet per second)	3.90
Froude Number (Flow is Sub-Critical)	0.482
Velocity Head (feet)	0.24
Energy Head (feet)	2.99
Cross-Sectional Area of Flow (square feet)	64.11
Top Width of Flow (feet)	31.53

TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
PROPOSED EAST SWALE
MAXIMUM 100-YEAR FLOW IN SECTION EAST OF GOLF COURSE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	950.0
Channel Bottom Slope (feet per foot)	0.0025
Manning's Roughness Coefficient (n-value)	0.0300
Channel Side Slope - Left Side (horizontal/vertical)	3.00
Channel Side Slope - Right Side (horizontal/vertical)	3.00
Channel Bottom Width (feet)	15.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	5.40
Flow Velocity (feet per second)	5.63
Froude Number (Flow is Sub-Critical)	0.526
Velocity Head (feet)	0.49
Energy Head (feet)	5.90
Cross-Sectional Area of Flow (square feet)	168.69
Top Width of Flow (feet)	47.43

TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
PROPOSED EAST SWALE
SECTION OF SWALE EAST OF GOLF COURSE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	500.0
Channel Bottom Slope (feet per foot)	0.0025
Manning's Roughness Coefficient (n-value)	0.0300
Channel Side Slope - Left Side (horizontal/vertical)	3.00
Channel Side Slope - Right Side (horizontal/vertical)	3.00
Channel Bottom Width (feet)	15.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	3.94
Flow Velocity (feet per second)	4.74
Froude Number (Flow is Sub-Critical)	0.505
Velocity Head (feet)	0.35
Energy Head (feet)	4.29
Cross-Sectional Area of Flow (square feet)	105.55
Top Width of Flow (feet)	38.62

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
60" DIVERSION STORM SEWER
PROPOSED DRAINAGE AREA M

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	5.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.02
Culvert Length (feet)	2800.0
Culvert Slope (feet per foot)	0.0050

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	3.00	4.27	-5.56	2.62	2.85	2.62	9.59
120.0	3.00	4.83	-3.43	2.94	3.13	2.94	9.98
140.0	3.00	5.40	-0.95	3.25	3.39	3.25	10.36
160.0	3.00	6.11	1.87	3.60	3.63	3.60	10.58
180.0	3.00	6.69	5.05	4.00	3.84	4.00	10.69
200.0	3.00	7.48	8.58	5.00	4.04	4.04	11.78
220.0	3.00	8.35	12.46	5.00	4.21	4.21	12.47
240.0	3.00	9.30	16.69	5.00	4.36	4.36	13.22

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
72
PROPOSED DRAINAGE AREAS H AND C

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	6.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.02
Culvert Length (feet)	1600.0
Culvert Slope (feet per foot)	0.0075

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	4.00	3.84	-6.57	2.14	2.69	2.14	11.05
120.0	4.00	4.29	-5.96	2.36	2.96	2.36	11.59
140.0	4.00	4.73	-5.27	2.57	3.21	2.57	12.11
160.0	4.00	5.17	-4.50	2.77	3.44	2.77	12.51
180.0	4.00	5.60	-3.65	2.97	3.66	2.97	12.92
200.0	4.00	6.03	-2.73	3.16	3.86	3.16	13.24
220.0	4.00	6.47	-1.72	3.35	4.06	3.35	13.55
240.0	4.00	6.91	-0.63	3.53	4.24	3.53	13.88
260.0	4.00	7.55	0.54	3.73	4.42	3.73	14.08
280.0	4.00	7.92	1.80	3.92	4.58	3.92	14.31
300.0	4.00	8.50	3.13	4.31	4.73	4.31	13.79
320.0	4.00	9.12	4.55	4.35	4.88	4.35	14.58
340.0	4.00	9.77	6.05	4.57	5.01	4.57	14.72

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
48" STORM SEWER
PROPOSED DRAINAGE AREA K

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	4.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.02
Culvert Length (feet)	2800.0
Culvert Slope (feet per foot)	0.0050

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	2.00	1.82	-10.76	1.21	1.32	1.21	6.23
25.0	2.00	2.06	-10.36	1.36	1.48	1.36	6.67
30.0	2.00	2.29	-9.88	1.49	1.62	1.49	7.04
35.0	2.00	2.51	-9.34	1.62	1.76	1.62	7.33
40.0	2.00	2.72	-8.74	1.74	1.89	1.74	7.61
45.0	2.00	2.92	-8.06	1.86	2.01	1.86	7.84
50.0	2.00	3.12	-7.32	1.98	2.12	1.98	8.05
55.0	2.00	3.32	-6.50	2.10	2.23	2.10	8.25
60.0	2.00	3.52	-5.61	2.21	2.33	2.21	8.40
65.0	2.00	3.72	-4.66	2.33	2.43	2.33	8.58
70.0	2.00	3.92	-3.63	2.44	2.53	2.44	8.72
75.0	2.00	4.12	-2.54	2.56	2.62	2.56	8.84
80.0	2.00	4.32	-1.37	2.68	2.71	2.68	8.95
85.0	2.00	4.52	-0.13	2.80	2.79	2.80	9.03
90.0	2.00	4.79	1.18	2.93	2.88	2.93	9.14
95.0	2.00	5.06	2.56	3.07	2.95	3.07	9.19
100.0	2.00	5.22	4.01	3.22	3.03	3.22	9.22
110.0	2.00	5.73	7.13	4.00	3.17	3.17	10.30
120.0	2.00	6.31	10.52	4.00	3.30	3.30	10.83

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 4, 1992
PAFB BASEWIDE DRAINAGE STUDY
54" STORM SEWER
PROPOSED DRAINAGE AREA H

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	4.50
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.02
Culvert Length (feet)	1500.0
Culvert Slope (feet per foot)	0.0050

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	8.00	2.93	1.62	1.86	2.05	1.86	8.03
60.0	8.00	3.27	2.11	2.07	2.25	2.07	8.40
70.0	8.00	3.61	2.70	2.26	2.44	2.26	8.74
80.0	8.00	3.94	3.37	2.45	2.62	2.45	9.04
90.0	8.00	4.28	4.13	2.62	2.78	2.62	9.37
100.0	8.00	4.61	4.98	2.82	2.94	4.50	6.29
110.0	8.00	4.94	5.92	3.02	3.09	4.50	6.92
120.0	8.00	5.34	6.96	3.22	3.22	4.50	7.55
130.0	8.00	5.77	8.08	3.45	3.36	4.50	8.17
140.0	8.00	6.10	9.29	3.71	3.48	4.50	8.80
150.0	8.00	6.56	10.59	4.50	3.59	4.50	9.43
160.0	8.00	7.04	11.98	4.50	3.70	4.50	10.06

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 3, 1992
PAFB BASEWIDE DRAINAGE STUDY
OTIS STREET COLLECTOR
21" SECTION BETWEEN ENT AVE AND HAMILTON AVE

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.75
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0150
Entrance Loss Coefficient of Culvert Opening	0.20
Culvert Length (feet)	1200.0
Culvert Slope (feet per foot)	0.0080

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
4.0	8.00	1.03	-0.54	0.69	0.73	0.69	4.55
6.0	8.00	1.34	0.79	0.86	0.92	0.86	5.07
8.0	8.00	1.60	2.66	1.03	1.05	1.75	3.33
10.0	8.00	1.87	5.05	1.20	1.18	1.75	4.16
12.0	8.00	2.21	7.98	1.40	1.29	1.75	4.99
14.0	8.00	2.52	11.43	1.75	1.39	1.75	5.82
16.0	8.00	2.93	15.42	1.75	1.48	1.75	6.65

TABLE 1
EXISTING MAJOR DRAINAGE COLLECTOR

COLLECTOR	EXISTING CAPACITY (CFS)	EXISTING FLOWS (CFS) 10-YEAR	EXISTING FLOWS (CFS) 100-YEAR
Hamilton Avenue - Peterson to Mitchell - Mitchell to Det. Pond #3	 250 310	 262 316	 536 662
Mitchell Street	60	73	213
Peterson Boulevard	130	152	277
Space Command 48"	125	64	133
Sand Creek 54"	220	102	257
Sand Creek 30"	70	63	134

DRAINAGE AREA	AREA (MILES²)	LAG (HRS)	% IMP. COVER	CURVE NUMBER
A	0.0741	0.22	20	68
B	0.4568	0.65	30	68
C	0.0227	0.08	90	94
D	2.2121	0.41	40	76
E	0.1257	0.19	70	87
F	0.0989	0.22	50	80
G	0.3065	0.38	40	76
H	0.6799	0.17	50	80
I	0.2561	0.72	10	65

KEY MAP

- DRAINAGE AREA BOUNDARY
- (A) DRAINAGE AREA
- INDEX CONTOUR
- INDEX DEPRESSION CONTOUR
- INTERMEDIATE CONTOUR
- INTERMEDIATE DEPRESSION CONTOUR
- RETAINING WALL
- FENCE
- RADIO TOWER
- 6155.20 BENCHMARK
- FAIRWAY
- 2001 P PERMANENT BUILDING
- 2001 S SEMI-PERMANENT BUILDING
- 2001 T TEMPORARY BUILDING
- EXISTING STORM SEWER
- PROPOSED DRAINAGE IMPROVEMENTS

LEGEND

TRUE NORTH
MAG. DEC: 11°26'

ANNUAL CHANGE: 7.3' WEST

500 0 500 1000
SCALE IN FEET

AIRFIELD ELEVATION 6172 FT.
CONTOUR INTERVAL: 5 FT.

REV	DATE	DESCRIPTION	INITIAL

PLAN REVISIONS

DEPARTMENT OF THE AIR FORCE
DIRECTORATE OF ENGINEERING & SERVICES DCS/LEE - WASHINGTON, D.C.

AIR FORCE SPACE COMMAND

COMPREHENSIVE PLAN
TAB G-3.1, EXISTING STORM DRAINAGE MAP
PETERSON AIR FORCE BASE
COLORADO SPRINGS, COLORADO

SCALE: 1 INCH = 500 FT. 2 APRIL 92	TAB NO. G-3.1
BASE COMPREHENSIVE PLAN DIRECTIVE AFR 86-4	
ANALYTICAL SURVEYS, INC. COLORADO SPRINGS, COLORADO	SHEET 1 OF 1

FIGURE 1

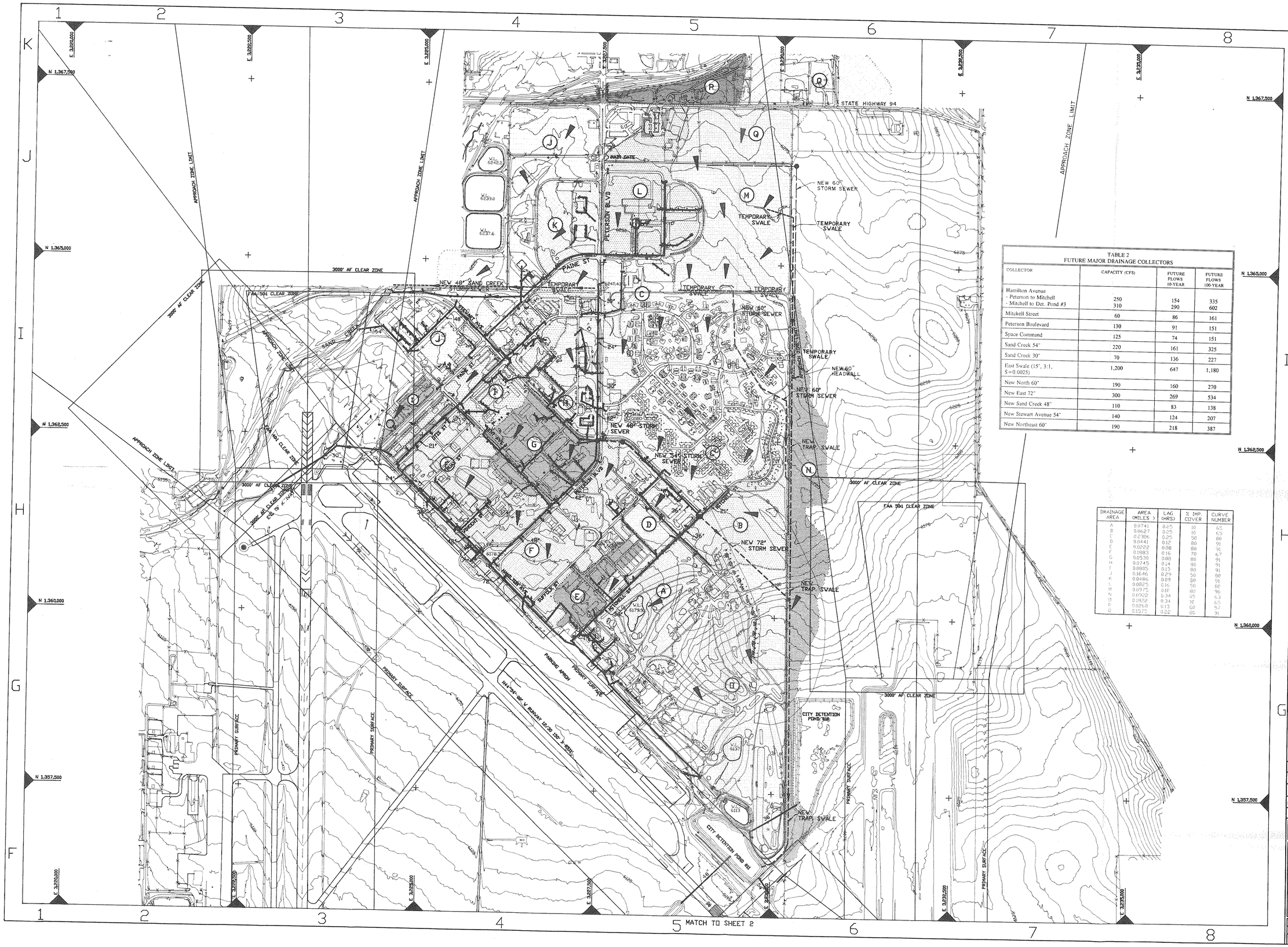
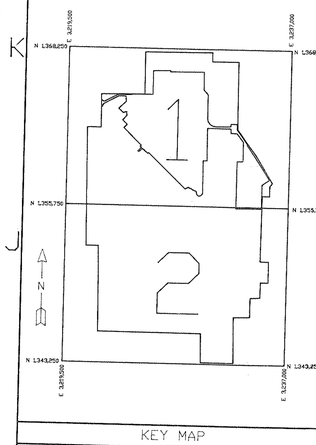


TABLE 2
FUTURE MAJOR DRAINAGE COLLECTORS

COLLECTOR	CAPACITY (CFS)	FUTURE FLOWS 10-YEAR	FUTURE FLOWS 100-YEAR
Hamilton Avenue - Peterson to Mitchell - Mitchell to Det. Pond #3	250 310	154 290	335 602
Mitchell Street	60	86	161
Peterson Boulevard	130	91	151
Space Command	125	74	151
Sand Creek 54"	220	161	325
Sand Creek 30"	70	136	227
East Swale (15', 3:1, S=0.0025)	1,200	647	1,180
New North 60"	190	160	270
New East 72"	300	269	534
New Sand Creek 48"	110	83	138
New Stewart Avenue 54"	140	124	207
New Northeast 60"	190	218	387

DRAINAGE AREA	AREA (MILES²)	LAG (HRS)	% IMP. COVER	CURVE NUMBER
A	0.0741	0.25	10	65
B	0.0627	0.25	10	65
C	0.2306	0.25	50	86
D	0.0441	0.12	80	91
E	0.0222	0.08	80	91
F	0.1883	0.16	70	87
G	0.0539	0.08	80	91
H	0.0745	0.14	80	91
I	0.0805	0.13	80	91
J	0.1646	0.29	50	80
K	0.0486	0.09	80	91
L	0.0825	0.16	50	80
M	0.0975	0.10	80	90
N	0.0922	0.34	05	63
O	0.1322	0.34	10	65
P	0.0268	0.13	60	87
Q	0.1575	0.22	80	91



KEY MAP

- DRAINAGE AREA BOUNDARY
- (A) DRAINAGE AREA
- INDEX CONTOUR
- INDEX DEPRESSION CONTOUR
- INTERMEDIATE CONTOUR
- INTERMEDIATE DEPRESSION CONTOUR
- RETAINING WALL
- FENCE
- RADIO TOWER
- 6155.20 BENCHMARK
- FAIRWAY
- 2001 P PERMANENT BUILDING
- 2001 S SEMI-PERMANENT BUILDING
- 2001 T TEMPORARY BUILDING
- EXISTING STORM SEWER
- PROPOSED DRAINAGE IMPROVEMENTS

LEGEND

TRUE NORTH
MAG. DEC: 11°26'

ANNUAL CHANGE: 7.3' WEST

500 0 500 1000
SCALE IN FEET

AIRFIELD ELEVATION 6172 FT.
CONTOUR INTERVAL: 5 FT.

REV	DATE	DESCRIPTION	INITIAL

PLAN REVISIONS

DEPARTMENT OF THE AIR FORCE
DIRECTORATE OF ENGINEERING & SERVICES DCS/LEE - WASHINGTON, DC

AIR FORCE SPACE COMMAND

COMPREHENSIVE PLAN
TAB G-3.2, FUTURE STORM DRAINAGE PLAN
PETERSON AIR FORCE BASE
COLORADO SPRINGS, COLORADO

SCALE: 1 INCH = 500 FT. 2 APRIL 92	TAB NO. G-3.2
BASE COMPREHENSIVE PLAN DIRECTIVE AFR 86-4	
ANALYTICAL SURVEYS, INC. COLORADO SPRINGS, COLORADO	SHEET 1 OF 1

FIGURE 2