ANNEXE C

Étude des effets hydrologiques de l’urbanisation du bassin ruisseau des Fées à Hull (février 1989)

Étude du bassin du ruisseau des Fées (octobre 1993).

Pink

6001739-000-030-R-011

classer C-05-54
(Pochette)

les consultants de l'outaouais inc.

experts-conseils

VILLE DE HULL

LES DÉVELOPPEMENTS IMMOBILIERS GAMELIN LTÉE

ÉTUDE DU BASSIN DU RUISSEAU DES FÉES

NOTRE DOSSIER: 368-013

AH/dp
Révisé le 04 octobre 1993

INTRODUCTION:

Notre firme a été mandatée par la compagnie Les Développements Immobiliers Gamelin Ltée afin de poursuivre notre étude préliminaire du bassin du ruisseau des Fées. Cette étude préliminaire préparée en 1989, rappelons-le, avait pour but de déterminer l'influence du développement urbain prévu dans ce bassin sur le débit des eaux de ruissellement et d'esquiver différents scénarios d'interventions possibles.

La présente étude a donc pour but de raffiner les interventions suggérées et de préciser dans quelles mesures le débit des eaux de ruissellement sera affecté. Ceci sera fait en tenant compte des données recueillies initialement ainsi que de nouveaux facteurs tels que des modifications apportées aux limites des sous-bassins considérés, ainsi que les développements domiciliaires en cours et projetés.

SOMMAIRE:

Le présent rapport d'étude comporte quatre (4) étapes principales. La première étape consiste en une description et une caractérisation des sous-bassins actuels de la portion du bassin du ruisseau des Fées en amont du chemin de la Montagne.

La seconde étape comporte une description du modèle informatique utilisé ainsi que les résultats de la modélisation des eaux de ruissellement générées par le bassin du ruisseau dans les conditions actuelles.

Les réaultats issus de la modélisation en fonction de l'urbanisation prévue du bassin constitue la troisième étape de la présente étude.

La quatrième étape du rapport comporte une analyse des résultats de modélisation en fonction du bassin urbanisé à l'intérieur duquel on aurait aménagé des volumes de rétention additionnels, ainsi que quelques commentaires sur la localisation et répartition de ces ouvrages de rétention des eaux de ruissellement.

1. DESCRIPTION DES SOUS-BASSINS

SOUS-BASSIN 1 (63.0 ha)

Le sous-bassin 1 est limité au sud par le chemin de la Montagne, à l'ouest et au nord par la limite de partage des eaux formées par des collines de la Gatineau et à l'est également par la ligne de partage des eaux qui correspond approximativement à un prolongement théorique de l'axe du chemin Vanier. Ce sous-bassin est fortement boisé et le sol en surface se compose d'une bonne épaisseur de matière organique et de débris forestiers.

SOUS-BASSIN 1 AB (141.0 ha)

Le sous-bassin 1 AB est situé immédiatement à l'est du sous-bassin 1 et est limité au nord par la ligne de partage des eaux, à l'est par une ligne imaginaire passant à l'est de la rue Skyridge et au sud par le chemin Cook. Mise à part les quelques résidences en bordure des chemins Skyridge et Notch, la partie du présent sous-bassin située au nord du chemin de la Montagne, présente les mêmes caractéristiques topographiques et pédologiques que le sous-bassin 1. La partie méridionale du sous-bassin 1 AB, qui est sise dans le triangle formé par les chemins Cook, de la Montagne et Vanier, est caractérisée par une topographie relativement plate et une répartition à peu près égale au niveau de l'occupation du sol entre les zones boisées et marécageuses. Ces zones basses de paire avec une sablière abandonnée constituent un immense volume de rétention naturelle. La majorité de ces terrains sont présentement zonés agricole. Nous avons pris comme hypothèse de calcul qu'ils le demeureraient. Advenant un changement de zonage et une urbanisation subséquente de ces terrains, il serait nécessaire alors d'aménager un réservoir permettant de compenser à la fois pour le volume naturel de rétention ainsi perdu et pour le volume d'eau généré par l'urbanisation de ce territoire.

SOUS-BASSIN 2 (248.0 ha)

Le sous-bassin 2 est situé au sud du sous-bassin 1 et est limité du côté ouest et sud par la ligne naturelle de partage des eaux. La limite est du sous-bassin, quant à elle, est formée par la ligne de partage des eaux joignant le chemin Cook au chemin Vanier et passant par l'exutoire du présent sous-bassin (noté par la lettre "A" sur le plan numéro 368-013-100).

Zoné agricole, le sous-bassin 2 est partiellement boisé et on y retrouve un bon nombre de zones marécageuses, dont un pourcentage appréciable est concentré le long des berges du ruisseau des Fées.

SOUS-BASSIN 3 (205.0 ha)

Compris à l'intérieur des limites du parc de la Gatineau, le sous-bassin numéro 3 est adjacent au sous-bassin 1 AB et est limité au nord par la ligne de partage des eaux, au sud par le chemin de la Montagne et à l'est, tel qu'indiqué au plan.

Ce sous-bassin présente les mêmes caractéristiques topographiques et pédologiques que le sous-bassin 1 et la portion septentrionale du sous-bassin 1 AB. De plus, la forêt mature et son sol riche en terre organique et débris végétaux sont protégés par la Commission de la Capitale Nationale.

SOUS-BASSIN 4 (357.0 ha)

Le sous-bassin numéro 4 est limité à l'ouest par le sous-bassin numéro 2, au nord par le sous-bassin numéro 3, à l'est par le sous-bassin numéro 5 (tel qu'indiqué au plan) et au sud par le chemin Pink.

Ce sous-bassin se caractérise par une topographie peu accidentée et un sol qui est en majeure partie fermé d'une couche de surface, d'une épaisseur appréciable de matériau sablonneux. Les quantités de ce matériau sont à ce point appréciables qu'elles justifiraient facilement l'exploitation d'une carrière. Le couvert végétal de ce sous-bassin se divise à part égale entre des champs autrefois cultivés et des forêts à différents stages de croissance.

SOUS-BASSIN 5 (31.0 ha)

Ce sous-bassin dont les principales caractéristiques sont similaires à celles du sous-bassin numéro 4, est limité à l'ouest par ce dernier, au nord-est par le chemin de la Montagne et au sud par le chemin Pink.

SOUS-BASSIN 6A (142.0 ha)

Situé au sud du chemin Pink, le sous-bassin numéro 6A est limité du côté sud-ouest par la ligne de partage des eaux et du côté est par la limite de la zone habitée le long de la rue des Pommiers (telle qu'indiquée au plan).

Le terrain est en général relativement plat, peu boisé et constitué en grande partie de champs abandonnés et de marécages. Le type de sol varie de sableux-silteux par endroits à argileux en d'autres endroits.

SOUS-BASSIN 6B (51.0 ha)

Le sous-bassin numéro 6B se trouve à l'est du sous-bassin numéro 6A et est limité par l'ancien tracé du chemin de la Montagne et la ligne de partage des eaux au sud.

Le territoire compris à l'intérieur de ce sous-bassin est partiellement urbanisé par un développement de très faible densité regroupé dans le secteur des chemins de la

Montagne et des rues des Pommiers et des Peupliers.

Le sol y est de nature silteuse et la topographie existante permet d'assurer un bon drainage de surface.

2. MODÉLISATION EN FONCTION DES CONDITIONS AVANT URBANISATION PLANIFIÉE:

Notre analyse hydrologique du bassin du ruisseau des Fées a été réalisée à l'aide du logiciel OTTHYMO (version interhymo 1989 b) distribué par le centre INTERHYMO d'Ottawa. Le croquis 368-013-1 démontre le schéma de modélisation utilisé pour simuler le réseau de drainage du bassin du ruisseau des Fées. Les caractéristiques hydrologiques du bassin actuel ont été consignées au tableau suivant:

TABLEAU NUMÉRO 1

LES CARACTÉRISTIQUES DES SOUS-BASSINS ACTUELS

Sous-bassin	Superficie (ha)	Occupation	CN*	Tp (hres)	Surface imperméable
1 AB	141.0	rural	63	1.4	-----
1	63.0	rural	68	1.57	-----
2	248.0	rural	55	2.0	-----
3	205.0	rural	68	1.58	-----
4	357.0	rural	55	0.79	-----
5	31.0	rural	55	0.39	-----
6 A	142.0	rural	55	0.88	-----
6 B	51.0	urbain	--	----	15%

Les résultats obtenus au moyen de notre simulation informatique pour le bassin actuel aux points de contrôles A, C et D' pour des évènements correspondant à une pluie de fréquence de une fois dans 2 ans, 5 ans et 100 ans sont présentés au tableau 1.1 et les résultats détaillés ont été consignés en annexe.

TABLEAU NUMÉRO 1.1

DÉBIT DE POINTE

Point	Pluie 2 ans	Pluie 5 ans	Pluie 100 ans
A	0.9m^3/s	2.1m^3/s	4.4m^3/s
C	2.7m^3/s	6.5m^3/s	14.4m^3/s
D'	3.0m^3/s	7.6m^3/s	15.3m^3/s

3. MODÉLISATION EN FONCTION DES CONDITIONS HYDROLOGIQUES DU BASSIN URBANISÉ:

L'urbanisation du bassin ainsi que la construction de grands axes routiers auront un impact important, non seulement sur les débits des eaux de ruissellement générés, mais aussi sur les limites futures des sous-bassins.

Conscients de ces phénomènes, nous avons modifié les limites des sous-bassins de notre modèle urbanisé (voir plan 368-013-101-01) afin de tenir compte des facteurs mentionnés précédemment à la lumière des informations présentement disponibles. Certaines de ces informations, comme les parcours de l'autoroute 50 et de l'autoroute Deschênes, ainsi que l'implantation du parc industriel de la rue Vernon, peuvent être considérées comme définitives.

Le parcours des rues et des axes routiers secondaires ainsi que le cheminement du drainage qui y sont associés pourraient toutefois facilement subir des modifications substantielles sans que les impacts sur les débits aux points importants soient modifiés visiblement.

La numérotation des sous-bassins urbanisés correspond approximativement à la numérotation des sous-bassin actuels et les principales caractéristiques hydrologiques de ces sous-bassins sont consignées au tableau suivant:

TABLEAU NUMÉRO 2

LES CARACTÉRISTIQUES DES SOUS-BASSINS FUTURES APRÈS URBANISATION

Sous-bassin	Superficie (ha)	Occupation	CN*	Tp (hres)	Surface imperméable
1 AB	268	rural	65	2.0	-----
2	247	rural	55	1.07	-----
3	204	rural	68	1.58	-----
5	136	urbain	--	----	45
6	167	urbain	--	----	35
4	220	urbain	--	----	75

Le croquis numéro 368-13-2 démontre la modélisation utilisée lors de notre simulation du réseau de drainage du bassin urbanisé du ruisseau des Fées. Afin de faciliter la comparaison des débits des eaux de ruissellement générées, le bassin dans son état actuel versus par le bassin après urbanisation, nous avons repris les tableaux 1 et 2 et formé le tableau 2.1.

TABLEAU NUMÉRO 2.1

DÉBIT DE POINTE (M³/SEC)

Point	Pluie de 2 ans (non urbanisé)	Pluie de 2 ans (urbanisé)	Pluie de 5 ans (non urbanisé)	Pluie de 5 ans (urbanisé)	Pluie de 100 ans (non urbanisé)	Pluie de 100 ans (urbanisé)
A	0.9	0.9	2.1	2.1	4.4	5.0
B	---	15.5	---	25.3	---	43.1
C	2.7	---	6.5	---	14.4	---
C'	---	13.9	---	20.3	---	34.1
D	---	14.0	---	19.8	---	32.9
D'	3.0	---	7.6	---	15.3	---

Les débits obtenus nous permettent de constater la nécessité d'aménager à l'intérieur du bassin du ruisseau des Fées des ouvrages de rétention.

4. MODÉLISATION EN FONCTION DES CONDITIONS HYDROLOGIQUES DU BASSIN URBANISÉ AVEC OUVRAGES DE CONTRÔLE:

Le croquis numéro 368-13-3 montre un schéma du modèle utilisé pour simuler le réseau de drainage du bassin urbanisé avec la localisation relative de tous les ouvrages de rétention qu'ils soient du type naturel ou artificiel existant ou projeté.

Nous avons modifié notre modèle de façon à prendre en considération les facteurs énumérés précédemment et les caractéristiques hydrologiques de ces sous-bassins ont été consignées au tableau 2.2.

TABLEAU NUMÉRO 2.2

Sous-bassin	Superficie (ha)	Occupation	CN*	Tp (hres)	Surface imperméable
1 AB	268	rural	65	2.0	-----
2	247	rural	55	1.07	-----
3	204	rural	68	1.58	-----
5	136	urbain	--	----	45
6	167	urbain	--	----	35
4 A	90	urbain	--	----	75
4 B	130	urbain	--	----	75

Les résultats obtenus confirment la nécessité d'aménager un volume additionnel de rétention de 5.4 ha.m en amont du point C'. Le point C' correspond à l'intersection projetée du boulevard des Grives et du ruisseau des Fées. Nous sommes d'avis qu'il est relativement facile d'aménager 3.5 ha.m entre le chemin Pink et le boulevard des Grives. Le volume additionnel 2.0 ha.m devra être implanté à l'intérieur des limites du sous-bassin numéro 5 au nord du chemin Pink.

Le volume de 1.5 ha.m indiqué au point "D", point qui correspond à l'intersection du chemin de la Montagne et du ruisseau des Fées, sera aménagé lors de l'excavation du canal en amont du point "D".

Le débit obtenu par nos simulations confirme le contenu des conclusions. Le croquis numéro 368-13-4, quant à lui, montre les volumes maximaux utilisables, ainsi que les débits de pointe aux endroits importants, soit les points A, B, C' et D.

Enfin, le tableau numéro 3 résume les débits calculés aux points importants. Pour les trois (3) cas que nous avons étudiés, soit le bassin actuel, le bassin après urbanisation et le bassin après urbanisation avec structure de contrôle et ce, en fonction d'évènements simulants une pluie de fréquence de une fois dans 2 ans, 5 ans et 100 ans.

TABLEAU NUMÉRO 3
DÉBIT DE POINTE (M^3/SEC)

PLUIE 2 ANS

Endroit	Non urbanisé	Urbanisé non contrôlé	Urbanisé contrôlé
A	0.9	0.9	0.9
B		15.5	2.4
C	2.7		
C'		13.9	3.3
D		14.0	4.9
D'	3.0		

TABLEAU NUMÉRO 3

DÉBIT DE POINTE (M³/SEC)

PLUIE 5 ANS

Endroit	Non urbanisé	Urbanisé non contrôlé	Urbanisé contrôlé
A	2.1	2.2	2.7
B		25.3	4.0
C	6.5		
C'		20.3	6.1
D		19.8	8.3
D'	7.6		

TABLEAU NUMÉRO 3

DÉBIT DE POINTE (M³/SEC)

PLUIE 100 ANS

Endroit	Pluie 100 ans	Non urbanisé	Urbanisé non contrôlé	Urbanisé contrôlé
A		4.4	5.0	5.7
B			43.1	6.6
C		14.4		
C'			34.1	10.5
D			32.9	15.3
D'		15.8		

De notre rapport préliminaire à l'effet qu'il faudrait augmenter la capacité, des ponceaux sous l'ancien et le nouveau tracé du chemin de la Montagne, de façon à pouvoir accepter un débit de plus de 15.3m^3/s, sans toutefois augmenter le niveau du gradient hydraulique du réseau d'égout pluvial.

Alexandre Hotovec, ing. M.Sc.

AH/dp
le 1er juin 1992

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       OOO    TTTTT   TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
      O   O     T       T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
      O   O     T       T    HHHHH    Y    M M M  O   O
      O   O     T       T    H   H    Y    M   M  O   O
       OOO      T       T    H   H    Y    M   M   OOO    bK-915981900004
```



```
 Input    filename: B:OTFC.FEE
 Output   filename: B:OUFC.FEE
 Summary  filename: B:SUFC.FEE


ATE: 01-16-1991                      TIME: 17:23:13

<=== comment ===>-----------------------------------------------------------

<=== comment ===>-----------------------------------------------------------

<=== comment ===>-----------------------------------------------------------

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 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************


#==========================
#  DOSSIER    OTFC.FEE     ||
#==========================
#===============================================================
#  PROJET  RUISSEAU DES FEES  GPD
#===============================================================
#  CONDITIONE FUTURE  SIMULATION FINALE  (CN* = VARIABLE)
#===============================================================
#                   -CONTROLEE-
#===============================================================
#     ORAGE DE 100-ANS
#===============================================================


-------------------
    READ STORM     |     Filename: b:100.ANS
 Ptotal= 72.30 mm  |     Comments: 100 YEAR STORM (DE FEES)
-------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	4.92	.83	78.42	1.58	12.65	2.33	5.89
.17	4.92	.92	107.19	1.67	12.65	2.42	5.20
.25	6.35	1.00	107.19	1.75	9.85	2.50	5.20
.33	6.35	1.08	99.64	1.83	9.85	2.58	4.65
.42	8.95	1.17	99.64	1.92	8.05	2.67	4.65
.50	8.95	1.25	31.10	2.00	8.05	2.75	4.21
.58	18.54	1.33	31.10	2.08	6.81	2.83	4.21
.67	18.54	1.42	17.51	2.17	6.81	2.92	3.85
.75	78.42	1.50	17.51	2.25	5.89	3.00	3.85

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#===============================================================

#=====================
# SOUS-BASSIN -1AB- ||
#=====================

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 CALIB             |
 NASHYD    (0111)  |   Area     (ha)= 268.00   Curve Number   (CN)= 65.0
ID= 1 DT= 5.0 min  |   Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=    2.00

    Unit Hyd Qpeak   (cms)=   5.12

    PEAK FLOW        (cms)=   4.40 (i)
    TIME TO PEAK     (hrs)=   3.33
    RUNOFF VOLUME     (mm)=  23.58
    TOTAL RAINFALL    (mm)=  72.30
    RUNOFF COEFFICIENT    =    .33

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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 ------------------
 | RESERVOIR (0201) |
 | IN= 1---> OUT= 2 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 ------------------        (cms)      (ha.m.)   |  (cms)      (ha.m.)
                            .000       .000     |   .500      50.000

                                  AREA      QPEAK      TPEAK       R.V.
                                  (ha)      (cms)      (hrs)       (mm)
    INFLOW : ID= 1 (0111)        268.00      4.40       3.33       23.58
    OUTFLOW: ID= 2 (0201)        268.00       .06      10.83        5.84

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.40
                 TIME SHIFT OF PEAK FLOW          (min)=450.00
                 MAXIMUM  STORAGE   USED        (ha.m.)=  6.15

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#=====================
# SOUS-BASSIN -2-    ||
#=====================

 ------------------
 | CALIB            |
 | NASHYD    (0200) |   Area     (ha)= 247.00   Curve Number    (CN)= 55.0
 | ID= 1 DT= 5.0 min |  Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
 ------------------    U.H. Tp(hrs)=    1.07

    Unit Hyd Qpeak  (cms)=   8.82

    PEAK FLOW       (cms)=   4.95 (i)
    TIME TO PEAK    (hrs)=   2.33
    RUNOFF VOLUME    (mm)=  17.55
    TOTAL RAINFALL   (mm)=  72.30
    RUNOFF COEFFICIENT   =    .24

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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#==================================
#   POINT  -A-                    ||
#==================================

 ------------------
 | ADD HYD   (0321) |
 |   2 +  1 =   3   |          AREA      QPEAK      TPEAK      R.V.
 ------------------            (ha)      (cms)      (hrs)      (mm)
          ID1= 2 (0201):      268.00       .06      10.83       5.84
        + ID2= 1 (0200):      247.00      4.95       2.33      17.55
          ================================================================
          ID = 3 (0321):      515.00      4.96       2.33      11.45

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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#=======================
# SOUS-BASSIN -4A- Urbain|
#=======================

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 | DESIGN           |
 | STANDHYD   (0401) |   Area     (ha)=  90.00
 | ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
 ------------------
                             IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=    67.50         22.50
    Dep. Storage      (mm)=      .80          1.50
    Average Slope      (%)=     1.00          1.00
    Length             (m)=   774.00         40.00
    Mannings n            =     .013          .250

    Max.eff.Inten.(mm/hr)=    107.19         29.97
             over (min)       10.00         25.00
    Storage Coeff.  (min)=      8.48 (ii)    22.55 (ii)
    Unit Hyd. Tpeak (min)=     10.00         25.00
    Unit Hyd. peak  (cms)=       .12           .05
                                                           *TOTALS*
    PEAK FLOW       (cms)=     18.06           .99          18.65 (iii)
    TIME TO PEAK    (hrs)=      1.17          1.50           1.17
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     RUNOFF VOLUME     (mm)=        71.50         17.99          58.12
     TOTAL RAINFALL    (mm)=        72.30         72.30          72.30
     RUNOFF COEFFICIENT    =          .99           .25            .80

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*   =  55.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | COMPUTE VOLUME  |
 | ID= 1   (0401)  |                 DISCHARGE      TIME
 -------------------                   (cms)       (hrs)
          START CONTROLLING AT           .03          .17
          INFLOW HYD. PEAKS AT         18.65         1.17
          STOP  CONTROLLING AT          1.50         2.39

          REQUIRED STORAGE VOLUME (ha.m.)=    4.2844
          TOTAL HYDROGRAPH VOLUME (ha.m.)=    5.2307
          % OF HYDROGRAPH TO STORE       =   81.9083

          NOTE:  Storage was computed to reduce the Inflow
                 peak to    1.50  (cms).

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 #============================================================
 #              RESERVOIR  NATURELE                          ||
 #============================================================

 -------------------
 | RESERVOIR (0201) |
 | IN= 1---> OUT= 4 |
 | DT=  5.0 min     |      OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
 -------------------        (cms)      (ha.m.)   |   (cms)      (ha.m.)
                             .000        .000    |   1.500      10.000

                                 AREA      QPEAK      TPEAK        R.V.
                                 (ha)      (cms)      (hrs)        (mm)
     INFLOW : ID= 1 (0401)      90.00      18.65       1.17        58.12
     OUTFLOW: ID= 4 (0201)      90.00        .71       3.08        57.42

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.78
                TIME SHIFT OF PEAK FLOW         (min)=115.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  4.71

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 -------------------
 | ADD HYD   (0321) |
 |   3 +  4 =  5    |       AREA     QPEAK     TPEAK      R.V.
 -------------------        (ha)     (cms)     (hrs)      (mm)
         ID1= 3 (0321):    515.00     4.96      2.33      11.45
       + ID2= 4 (0201):     90.00      .71      3.08      57.42
         ==================================================
         ID = 5 (0321):    605.00     5.65      2.33      18.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 #============================================================
 #              DE  POINT "A" A POINT "B"                    ||
 #============================================================

 -------------------
 | ROUTE      (0110) |     Routing time step (min) =   6.00
 | CHANNEL  #SEG= 3  |
 | IN= 5---> OUT= 3  |     Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
 -------------------                 LENGTH = 1600.00     (m)

              <------ DATA FOR SECTION (   1.0) ------>
              Distance      Elevation        Manning
                   .00        104.24          .0500
                100.00        101.79          .0500
                110.00        101.17          .0500
                113.00        101.17       .0500 / .0300    Main Channel
                113.80        100.57          .0300         Main Channel
                116.50        100.57          .0300         Main Channel
                117.00        101.30       .0300 / .0500    Main Channel
                120.00        101.52          .0500
                126.00        102.40          .0500
```

```
        226.00          102.98          .0500
```

<--------------------- TRAVEL TIME TABLE --------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
.12	100.69	.542E+03	.2	.49	54.71
.24	100.81	.113E+04	.5	.74	36.00
.36	100.93	.176E+04	1.0	.93	28.53
.48	101.05	.245E+04	1.7	1.10	24.35
.60	101.17	.317E+04	2.4	1.23	21.60
.73	101.30	.483E+04	3.7	1.21	22.04
.86	101.43	.710E+04	5.4	1.21	22.10
.99	101.56	.102E+05	7.6	1.20	22.26
1.12	101.69	.139E+05	10.5	1.21	22.04
1.25	101.82	.182E+05	14.0	1.22	21.77
1.38	101.95	.237E+05	17.9	1.21	21.97
1.51	102.08	.303E+05	23.0	1.21	21.95
1.63	102.20	.383E+05	29.3	1.23	21.77
1.76	102.33	.475E+05	37.0	1.24	21.44
1.89	102.46	.586E+05	44.1	1.20	22.16
2.02	102.59	.747E+05	54.4	1.16	22.91
2.15	102.72	.966E+05	68.6	1.14	23.45
2.28	102.85	.124E+06	87.2	1.12	23.74
2.41	102.98	.157E+06	110.5	1.12	23.74

```
                                      <---- hydrograph ---->   <--- channel --->
                             AREA     QPEAK   TPEAK    R.V.    MAX DEPTH  MAX VEL
                             (ha)     (cms)   (hrs)    (mm)       (m)      (m/s)
 INFLOW : ID= 5 (0321)     605.00     5.65    2.33    18.29      .88       1.21
 OUTFLOW: ID= 3 (0110)     605.00     5.27    2.75    18.26      .85       1.21
-------------------------------------------------------------------------------

#========================
# SOUS-BASSIN -4B- Urbain|
#========================

------------------
 DESIGN            |
 STANDHYD  (0402)  |   Area      (ha)= 130.00
ID= 1 DT= 5.0 min  |   Total Imp(%)=   75.00    Dir. Conn.(%)=   75.00
------------------
                               IMPERVIOUS     PERVIOUS (i)
    Surface Area       (ha)=      97.50          32.50
    Dep. Storage       (mm)=        .80           1.50
    Average Slope       (%)=       1.00           1.00
    Length              (m)=     930.00          40.00
    Mannings n             =       .013           .250

    Max.eff.Inten.(mm/hr)=       107.19          29.97
               over (min)         10.00          25.00
    Storage Coeff.  (min)=         9.47 (ii)     23.54 (ii)
    Unit Hyd. Tpeak (min)=        10.00          25.00
    Unit Hyd. peak  (cms)=          .12            .05
                                                             *TOTALS*
    PEAK FLOW       (cms)=        25.64           1.41        26.46 (iii)
    TIME TO PEAK    (hrs)=         1.17           1.50         1.17
    RUNOFF VOLUME    (mm)=        71.50          17.99        58.12
    TOTAL RAINFALL   (mm)=        72.30          72.30        72.30
    RUNOFF COEFFICIENT   =          .99            .25          .80

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------

#==================================
#   POINT  -B-                   ||
#==================================

------------------
 ADD HYD   (0231) |
   3 +  1 =  2    |          AREA      QPEAK      TPEAK       R.V.
------------------           (ha)      (cms)      (hrs)       (mm)
          ID1= 3 (0110):    605.00      5.27       2.75       18.26
        + ID2= 1 (0402):    130.00     26.46       1.17       58.12
          ==================================================
          ID = 2 (0231):    735.00     26.69       1.17       25.31

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
---------------------------------------------------------------------------------------

-------------------
 COMPUTE VOLUME   |
 ID= 2   (0231)   |             DISCHARGE       TIME
-------------------               (cms)        (hrs)
          START CONTROLLING AT     2.73          .60
          INFLOW HYD. PEAKS AT    26.69         1.17
          STOP  CONTROLLING AT    13.00         1.49

          REQUIRED STORAGE VOLUME (ha.m.)=   2.8944
          TOTAL HYDROGRAPH VOLUME (ha.m.)=  18.6039
          % OF HYDROGRAPH TO STORE       =  15.5583

          NOTE:   Storage was computed to reduce the Inflow
                  peak to   13.00  (cms).

---------------------------------------------------------------------------------------

#=====================================================================
#              RESERVOIR  #1+ #2                                    ||
#=====================================================================

-------------------
 RESERVOIR (0201) |
 IN= 2---> OUT= 3 |
 DT=  5.0 min     |      OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
-------------------       (cms)      (ha.m.)   |   (cms)      (ha.m.)
                           .000        .000    |   7.000       5.800

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 2 (0231)     735.00     26.69       1.17        25.31
    OUTFLOW: ID= 3 (0201)     735.00      6.62       2.92        25.24

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 24.80
                  TIME SHIFT OF PEAK FLOW         (min)=105.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  5.48

---------------------------------------------------------------------------------------

#=====================================================================
#              DE  POINT "B" A POINT "C"                            ||
#=====================================================================

-------------------
 ROUTE      (0110) |     Routing time step (min) =   6.00
 CHANNEL   #SEG= 3 |
 IN= 3---> OUT= 2  |     Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
-------------------                  LENGTH = 1800.00     (m)

                  <------ DATA FOR SECTION (    1.0) ------>
                  Distance      Elevation        Manning
                       .00        104.24          .0500
                    100.00        101.79          .0500
                    110.00        101.17          .0500
                    113.00        101.17      .0500 / .0300   Main Channel
                    113.80        100.57          .0300       Main Channel
                    116.50        100.57          .0300       Main Channel
                    117.00        101.30      .0300 / .0500   Main Channel
                    120.00        101.52          .0500
                    126.00        102.40          .0500
                    226.00        102.98          .0500

     <-------------------- TRAVEL TIME TABLE --------------------->
      DEPTH     ELEV       VOLUME      FLOW RATE      VELOCITY     TRAV.TIME
       (m)       (m)      (cu.m.)        (cms)          (m/s)        (min)
       .12     100.69    .609E+03          .2             .49        61.55
       .24     100.81    .127E+04          .5             .74        40.50
       .36     100.93    .199E+04         1.0             .93        32.10
       .48     101.05    .275E+04         1.7            1.10        27.39
       .60     101.17    .357E+04         2.4            1.23        24.30
       .73     101.30    .543E+04         3.7            1.21        24.79
       .86     101.43    .799E+04         5.4            1.21        24.86
       .99     101.56    .114E+05         7.6            1.20        25.04
      1.12     101.69    .156E+05        10.5            1.21        24.79
      1.25     101.82    .205E+05        14.0            1.22        24.49
      1.38     101.95    .266E+05        17.9            1.21        24.71
      1.51     102.08    .341E+05        23.0            1.21        24.70
      1.63     102.20    .431E+05        29.3            1.23        24.49
      1.76     102.33    .535E+05        37.0            1.24        24.12
      1.89     102.46    .659E+05        44.1            1.20        24.93
      2.02     102.59    .841E+05        54.4            1.16        25.78
      2.15     102.72    .109E+06        68.6            1.14        26.38
      2.28     102.85    .140E+06        87.2            1.12        26.71
      2.41     102.98    .177E+06       110.5            1.12        26.71
```

```
                                         <---- hydrograph ---->   <---  channel --->
                                AREA     QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                                (ha)     (cms)   (hrs)   (mm)       (m)      (m/s)
  INFLOW : ID= 3 (0201)       735.00      6.62    2.92   25.24       .93      1.20
  OUTFLOW: ID= 2 (0110)       735.00      6.52    3.25   25.21       .92      1.20

----------------------------------------------------------------------------------


#===============================================================
#                DE  POINT "C" A POINT "C'"                   ||
#===============================================================

-------------------
 ROUTE      (0110) |    Routing time step (min) =   6.00
 CHANNEL   #SEG= 3 |
 IN= 2---> OUT= 3  |    Slopes (%), CHANNEL= .35   FLOODPLAIN= .35
-------------------                 LENGTH =  800.00     (m)

              <------ DATA FOR SECTION (    1.0) ------>
              Distance      Elevation        Manning
                   .00         97.89          .0500
                100.00         95.77          .0500
                102.50         95.57      .0500 / .0300  Main Channel
                103.50         94.48          .0300      Main Channel
                106.50         94.48          .0300      Main Channel
                107.50         95.39      .0300 / .0500  Main Channel
                110.00         95.78          .0500
                210.00         96.54          .0500

       <--------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV       VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
         (m)       (m)      (cu.m.)      (cms)        (m/s)       (min)
         .10      94.58    .251E+03        .1           .41       32.38
         .20      94.68    .518E+03        .4           .63       21.11
         .30      94.78    .802E+03        .8           .80       16.61
         .40      94.88    .110E+04       1.3           .95       14.10
         .51      94.99    .142E+04       1.9          1.07       12.46
         .61      95.09    .175E+04       2.6          1.18       11.28
         .71      95.19    .210E+04       3.4          1.28       10.40
         .81      95.29    .247E+04       4.2          1.38        9.69
         .91      95.39    .285E+04       5.2          1.46        9.12
        1.03      95.51    .334E+04       6.5          1.57        8.50
        1.14      95.62    .391E+04       8.1          1.65        8.06
        1.25      95.74    .466E+04       9.9          1.70        7.84
        1.37      95.85    .595E+04      11.9          1.60        8.31
        1.48      95.96    .901E+04      15.0          1.33       10.04
        1.60      96.08    .140E+05      19.5          1.12       11.94
        1.71      96.19    .208E+05      26.0          1.00       13.33
        1.83      96.31    .295E+05      34.9           .95       14.10
        1.94      96.42    .402E+05      46.6           .93       14.37
        2.06      96.54    .527E+05      61.4           .93       14.31

                                         <---- hydrograph ---->   <---  channel --->
                                AREA     QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                                (ha)     (cms)   (hrs)   (mm)       (m)      (m/s)
  INFLOW : ID= 2 (0110)       735.00      6.52    3.25   25.21      1.02      1.57
  OUTFLOW: ID= 3 (0110)       735.00      6.51    3.42   25.20      1.02      1.57

----------------------------------------------------------------------------------


#====================
# SOUS-BASSIN -3-   ||
#====================

-------------------
 CALIB             |
 NASHYD     (0300) |   Area     (ha)= 204.00    Curve Number   (CN)= 68.0
ID= 1 DT= 5.0 min  |   Ia       (mm)=   2.50    # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=    1.58

    Unit Hyd Qpeak  (cms)=    4.93

    PEAK FLOW       (cms)=    4.44 (i)
    TIME TO PEAK    (hrs)=    2.92
    RUNOFF VOLUME    (mm)=   25.73
    TOTAL RAINFALL   (mm)=   72.30
    RUNOFF COEFFICIENT   =     .36

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------


#========================
```

```
# SOUS-BASSIN -5- Urbain|
#========================

 -------------------
 | DESIGN            |
 | STANDHYD  (0500)  |   Area    (ha)= 136.00
 |ID= 2 DT= 5.0 min  |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=     61.20        74.80
     Dep. Storage      (mm)=       .80         1.50
     Average Slope      (%)=      1.00         1.00
     Length             (m)=    952.00        40.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    107.19        29.97
                over (min)      10.00        25.00
     Storage Coeff.   (min)=      9.60 (ii)   23.67 (ii)
     Unit Hyd. Tpeak  (min)=     10.00        25.00
     Unit Hyd. peak   (cms)=       .11          .05
                                                           *TOTALS*
     PEAK FLOW        (cms)=     16.05         3.23          17.94 (iii)
     TIME TO PEAK     (hrs)=      1.17         1.50           1.17
     RUNOFF VOLUME     (mm)=     71.50        17.99          42.07
     TOTAL RAINFALL    (mm)=     72.30        72.30          72.30
     RUNOFF COEFFICIENT    =       .99          .25            .58

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  55.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-----------------------------------------------------------------------------


 -------------------
 | ADD HYD   (0412)  |
 |   1 +  2 =  4     |          AREA     QPEAK     TPEAK      R.V.
 -------------------            (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (0300):      204.00      4.44      2.92     25.73
        + ID2= 2 (0500):      136.00     17.94      1.17     42.07
          ==================================================
          ID = 4 (0412):      340.00     18.33      1.17     32.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

#==================================
#    POINT  -C'-                 ||
#==================================


 -------------------
 | ADD HYD   (0143)  |
 |   4 +  3 =  1     |          AREA     QPEAK     TPEAK      R.V.
 -------------------            (ha)     (cms)     (hrs)      (mm)
          ID1= 4 (0412):      340.00     18.33      1.17     32.26
        + ID2= 3 (0110):      735.00      6.51      3.42     25.20
          ==================================================
          ID = 1 (0143):     1075.00     18.80      1.17     27.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

 -------------------
 | COMPUTE VOLUME    |
 | ID= 1   (0143)    |            DISCHARGE       TIME
 -------------------                (cms)        (hrs)
           START CONTROLLING AT      2.40          .67
           INFLOW HYD. PEAKS AT     18.80         1.17
           STOP  CONTROLLING AT     15.00         1.39

           REQUIRED STORAGE VOLUME (ha.m.)=    1.1543
           TOTAL HYDROGRAPH VOLUME (ha.m.)=   29.4907
           % OF HYDROGRAPH TO STORE       =    3.9143

           NOTE:   Storage was computed to reduce the Inflow
                   peak to    15.00  (cms).

-----------------------------------------------------------------------------
```

```
#==============================================================
#                 RESERVOIR      #3                          ||
#==============================================================

 ------------------
 | RESERVOIR (0201) |
 | IN= 1---> OUT= 4 |
 | DT=  5.0 min     |     OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
 ------------------        (cms)      (ha.m.)   |    (cms)      (ha.m.)
                            .000        .000    |   11.000       5.600

                                  AREA       QPEAK       TPEAK        R.V.
                                  (ha)       (cms)       (hrs)        (mm)
      INFLOW : ID= 1 (0143)    1075.00      18.80        1.17        27.43
      OUTFLOW: ID= 4 (0201)    1075.00      10.50        3.67        27.40

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)= 55.84
                     TIME SHIFT OF PEAK FLOW          (min)=150.00
                     MAXIMUM   STORAGE   USED       (ha.m.)=   5.35

 -----------------------------------------------------------------------------

#==============================================================
#                 DE  POINT "C'" A POINT "D "                ||
#==============================================================

 ------------------
 | ROUTE      (0110) |     Routing time step (min) =   6.00
 | CHANNEL   #SEG= 3 |
 | IN= 4---> OUT= 1  |     Slopes (%), CHANNEL= .35    FLOODPLAIN= .35
 ------------------                   LENGTH = 2050.00       (m)

                 <------ DATA FOR SECTION (    1.0) ------>
                 Distance         Elevation          Manning
                      .00           97.89              .0500
                   100.00           95.77              .0500
                   102.50           95.57        .0500 / .0300   Main Channel
                   103.50           94.48              .0300     Main Channel
                   106.50           94.48              .0300     Main Channel
                   107.50           95.39        .0300 / .0500   Main Channel
                   110.00           95.78              .0500
                   210.00           96.54              .0500

        <--------------------- TRAVEL TIME TABLE ---------------------->
         DEPTH       ELEV       VOLUME      FLOW RATE      VELOCITY     TRAV.TIME
          (m)         (m)       (cu.m.)       (cms)          (m/s)        (min)
          .10        94.58     .643E+03          .1            .41         82.98
          .20        94.68     .133E+04          .4            .63         54.10
          .30        94.78     .206E+04          .8            .80         42.57
          .40        94.88     .283E+04         1.3            .95         36.12
          .51        94.99     .364E+04         1.9           1.07         31.92
          .61        95.09     .449E+04         2.6           1.18         28.92
          .71        95.19     .539E+04         3.4           1.28         26.64
          .81        95.29     .633E+04         4.2           1.38         24.84
          .91        95.39     .731E+04         5.2           1.46         23.38
         1.03        95.51     .855E+04         6.5           1.57         21.79
         1.14        95.62     .100E+05         8.1           1.65         20.67
         1.25        95.74     .119E+05         9.9           1.70         20.09
         1.37        95.85     .152E+05        11.9           1.60         21.29
         1.48        95.96     .231E+05        15.0           1.33         25.73
         1.60        96.08     .358E+05        19.5           1.12         30.59
         1.71        96.19     .533E+05        26.0           1.00         34.16
         1.83        96.31     .757E+05        34.9            .95         36.13
         1.94        96.42     .103E+06        46.6            .93         36.82
         2.06        96.54     .135E+06        61.4            .93         36.66

                                        <---- hydrograph ---->     <---  channel --->
                              AREA      QPEAK    TPEAK    R.V.     MAX DEPTH   MAX VEL
                              (ha)      (cms)    (hrs)    (mm)        (m)       (m/s)
      INFLOW : ID= 4 (0201) 1075.00     10.50     3.67    27.40       1.29       1.67
      OUTFLOW: ID= 1 (0110) 1075.00     10.38     4.08    27.37       1.28       1.68

 -----------------------------------------------------------------------------

#========================
# SOUS-BASSIN -6-Urbain |
#========================

 ------------------
 | DESIGN            |
 | STANDHYD   (0600) |    Area    (ha)= 167.00
 | ID= 2 DT= 5.0 min |    Total  Imp(%)=  35.00    Dir. Conn.(%)=  35.00
 ------------------
                                 IMPERVIOUS     PERVIOUS (i)
      Surface Area     (ha)=       58.45          108.55
      Dep. Storage     (mm)=         .80            1.50
```

```
Average Slope      (%)=        1.00          1.00
Length             (m)=     1055.00         40.00
Mannings n            =        .013          .250

Max.eff.Inten.(mm/hr)=       104.67         29.97
           over (min)         10.00         25.00
Storage Coeff.  (min)=        10.31 (ii)    24.38 (ii)
Unit Hyd. Tpeak (min)=        10.00         25.00
Unit Hyd. peak  (cms)=          .11           .05
                                                            *TOTALS*
PEAK FLOW       (cms)=        15.12          4.63             17.81 (iii)
TIME TO PEAK    (hrs)=         1.17          1.50              1.17
RUNOFF VOLUME    (mm)=        71.50         17.99             36.72
TOTAL RAINFALL   (mm)=        72.30         72.30             72.30
RUNOFF COEFFICIENT    =          .99           .25               .51


  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
      CN*  =  55.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------


#===================================
#   POINT   -D -                    ||
#===================================


------------------
 ADD HYD    (0312) |
   1 +  2 =  3     |           AREA     QPEAK     TPEAK        R.V.
------------------             (ha)     (cms)     (hrs)        (mm)
            ID1= 1 (0110):  1075.00     10.38      4.08       27.37
          + ID2= 2 (0600):   167.00     17.81      1.17       36.72
            =================================================
            ID = 3 (0312):  1242.00     19.05      1.25       28.63

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------


------------------
 RESERVOIR (0201) |
 IN= 3---> OUT= 2 |
 DT=  5.0 min     |       OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
------------------         (cms)      (ha.m.)   |    (cms)      (ha.m.)
                            .000         .000   |   16.000       1.500

                              AREA      QPEAK       TPEAK          R.V.
                              (ha)      (cms)       (hrs)          (mm)
   INFLOW : ID= 3 (0312)   1242.00      19.05        1.25         28.63
   OUTFLOW: ID= 2 (0201)   1242.00      15.30        1.42         28.63

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 80.31
               TIME SHIFT OF PEAK FLOW          (min)= 10.00
               MAXIMUM   STORAGE   USED       (ha.m.)=  1.45

-----------------------------------------------------------------------------


#=============================================================
#     ORAGE DE 5-ANS
#=============================================================


------------------
   READ STORM     |     Filename: b:5.ANS
 Ptotal= 48.36 mm |     Comments: 5 YEAR STORM (DE FEES)
------------------
                  TIME     RAIN |  TIME     RAIN |  TIME     RAIN |  TIME     RAIN
                   hrs    mm/hr |   hrs    mm/hr |   hrs    mm/hr |   hrs    mm/hr
                   .08     4.23 |   .83    45.05 |  1.58     9.50 |  2.33     4.94
                   .17     4.23 |   .92    72.96 |  1.67     9.50 |  2.42     4.44
                   .25     5.27 |  1.00    72.96 |  1.75     7.67 |  2.50     4.44
                   .33     5.27 |  1.08    62.52 |  1.83     7.67 |  2.58     4.03
                   .42     7.07 |  1.17    62.52 |  1.92     6.46 |  2.67     4.03
                   .50     7.07 |  1.25    19.19 |  2.00     6.46 |  2.75     3.70
                   .58    11.52 |  1.33    19.19 |  2.08     5.59 |  2.83     3.70
                   .67    11.52 |  1.42    12.59 |  2.17     5.59 |  2.92     3.42
                   .75    45.05 |  1.50    12.59 |  2.25     4.94 |  3.00     3.42

-----------------------------------------------------------------------------

#=============================================================
```

```
#=====================
# SOUS-BASSIN -1AB- ||
#=====================

------------------
 CALIB            |
 NASHYD    (0111) |   Area     (ha)= 268.00   Curve Number    (CN)= 65.0
ID= 1 DT= 5.0 min |   Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
------------------    U.H. Tp(hrs)=    2.00

    Unit Hyd Qpeak  (cms)=    5.12

    PEAK FLOW       (cms)=    2.12 (i)
    TIME TO PEAK    (hrs)=    3.50
    RUNOFF VOLUME    (mm)=   11.51
    TOTAL RAINFALL   (mm)=   48.36
    RUNOFF COEFFICIENT   =     .24

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

------------------
 RESERVOIR (0201) |
 IN= 1---> OUT= 2 |
 DT=  5.0 min     |      OUTFLOW     STORAGE    |   OUTFLOW     STORAGE
------------------        (cms)      (ha.m.)    |    (cms)      (ha.m.)
                           .000        .000     |     .500      50.000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 1 (0111)    268.00      2.12        3.50       11.51
    OUTFLOW: ID= 2 (0201)    268.00       .03       10.92        2.85

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.41
                  TIME SHIFT OF PEAK FLOW         (min)=445.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  3.00

------------------------------------------------------------------------------

#=====================
# SOUS-BASSIN -2-    ||
#=====================

------------------
 CALIB            |
 NASHYD    (0200) |   Area     (ha)= 247.00   Curve Number    (CN)= 55.0
ID= 1 DT= 5.0 min |   Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
------------------    U.H. Tp(hrs)=    1.07

    Unit Hyd Qpeak  (cms)=    8.82

    PEAK FLOW       (cms)=    2.23 (i)
    TIME TO PEAK    (hrs)=    2.42
    RUNOFF VOLUME    (mm)=    8.29
    TOTAL RAINFALL   (mm)=   48.36
    RUNOFF COEFFICIENT   =     .17

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

#==================================
#   POINT  -A-                   ||
#==================================

------------------
 ADD HYD   (0321) |
   2 +  1 =  3    |         AREA     QPEAK      TPEAK        R.V.
------------------          (ha)     (cms)      (hrs)        (mm)
         ID1= 2 (0201):   268.00       .03      10.92        2.85
       + ID2= 1 (0200):   247.00      2.23       2.42        8.29
         ================================================
         ID = 3 (0321):   515.00      2.24       2.42        5.46

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

#========================
# SOUS-BASSIN -4A- Urbain|
#========================
```

```
 ------------------
 | DESIGN           |
 | STANDHYD  (0401) |    Area      (ha)=  90.00
 | ID= 1 DT= 5.0 min|    Total Imp(%)=  75.00    Dir. Conn.(%)=  75.00
 ------------------
                              IMPERVIOUS      PERVIOUS (i)
    Surface Area      (ha)=      67.50          22.50
    Dep. Storage      (mm)=        .80           1.50
    Average Slope      (%)=       1.00           1.00
    Length             (m)=     774.00          40.00
    Mannings n            =       .013           .250

    Max.eff.Inten.(mm/hr)=      72.96          10.77
              over (min)        10.00          35.00
    Storage Coeff.   (min)=      9.89 (ii)     31.08 (ii)
    Unit Hyd. Tpeak  (min)=     10.00          35.00
    Unit Hyd. peak   (cms)=       .11            .03
                                                              *TOTALS*
    PEAK FLOW        (cms)=     11.30            .36           11.44 (iii)
    TIME TO PEAK     (hrs)=      1.17           1.67            1.17
    RUNOFF VOLUME     (mm)=     47.56           8.62           37.82
    TOTAL RAINFALL    (mm)=     48.36          48.36           48.36
    RUNOFF COEFFICIENT    =       .98            .18             .78

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =   55.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------

 ------------------
 | COMPUTE VOLUME  |
 | ID= 1   (0401)  |               DISCHARGE       TIME
 ------------------                  (cms)        (hrs)
          START CONTROLLING AT         .01          .18
          INFLOW HYD. PEAKS AT       11.44         1.17
          STOP  CONTROLLING AT        1.50         2.16

          REQUIRED STORAGE VOLUME (ha.m.)=    2.4552
          TOTAL HYDROGRAPH VOLUME (ha.m.)=    3.4041
          % OF HYDROGRAPH TO STORE       =   72.1254

          NOTE:  Storage was computed to reduce the Inflow
                 peak to     1.50  (cms).

 ------------------------------------------------------------------------------

 #=============================================================
 #               RESERVOIR  NATURELE                         ||
 #=============================================================

 ------------------
 | RESERVOIR (0201) |
 | IN= 1---> OUT= 4 |
 | DT=  5.0 min     |      OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
 ------------------         (cms)      (ha.m.)  |    (cms)      (ha.m.)
                             .000        .000   |    1.500      10.000

                                   AREA      QPEAK      TPEAK        R.V.
                                   (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 1 (0401)          90.00     11.44       1.17        37.82
    OUTFLOW: ID= 4 (0201)          90.00       .46       3.17        37.37

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   4.00
                TIME SHIFT OF PEAK FLOW          (min)=120.00
                MAXIMUM  STORAGE   USED        (ha.m.)=   3.05

 ------------------------------------------------------------------------------


 ------------------
 | ADD HYD   (0321) |
 |  3 +  4 =  5     |        AREA     QPEAK     TPEAK       R.V.
 ------------------          (ha)     (cms)     (hrs)       (mm)
          ID1= 3 (0321):   515.00      2.24      2.42       5.46
        + ID2= 4 (0201):    90.00       .46      3.17      37.37
          ===================================================
          ID = 5 (0321):   605.00      2.68      2.42      10.20

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 #=============================================================
```

```
#               DE  POINT "A" A POINT "B"                             ||
#===================================================================

-------------------
 ROUTE       (0110)  |      Routing time step (min) =   6.00
 CHANNEL   #SEG= 3   |
 IN= 5---> OUT= 3    |      Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
-------------------                LENGTH = 1600.00     (m)

              <------ DATA FOR SECTION (   1.0) ------>
              Distance       Elevation       Manning
                   .00          104.24         .0500
                100.00          101.79         .0500
                110.00          101.17         .0500
                113.00          101.17      .0500 / .0300  Main Channel
                113.80          100.57         .0300       Main Channel
                116.50          100.57         .0300       Main Channel
                117.00          101.30      .0300 / .0500  Main Channel
                120.00          101.52         .0500
                126.00          102.40         .0500
                226.00          102.98         .0500

     <--------------------- TRAVEL TIME TABLE ---------------------->
      DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY     TRAV.TIME
       (m)       (m)      (cu.m.)       (cms)         (m/s)        (min)
       .12    100.69     .542E+03         .2            .49        54.71
       .24    100.81     .113E+04         .5            .74        36.00
       .36    100.93     .176E+04        1.0            .93        28.53
       .48    101.05     .245E+04        1.7           1.10        24.35
       .60    101.17     .317E+04        2.4           1.23        21.60
       .73    101.30     .483E+04        3.7           1.21        22.04
       .86    101.43     .710E+04        5.4           1.21        22.10
       .99    101.56     .102E+05        7.6           1.20        22.26
      1.12    101.69     .139E+05       10.5           1.21        22.04
      1.25    101.82     .182E+05       14.0           1.22        21.77
      1.38    101.95     .237E+05       17.9           1.21        21.97
      1.51    102.08     .303E+05       23.0           1.21        21.95
      1.63    102.20     .383E+05       29.3           1.23        21.77
      1.76    102.33     .475E+05       37.0           1.24        21.44
      1.89    102.46     .586E+05       44.1           1.20        22.16
      2.02    102.59     .747E+05       54.4           1.16        22.91
      2.15    102.72     .966E+05       68.6           1.14        23.45
      2.28    102.85     .124E+06       87.2           1.12        23.74
      2.41    102.98     .157E+06      110.5           1.12        23.74

                                     <---- hydrograph ---->   <--- channel --->
                              AREA    QPEAK   TPEAK    R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)    (mm)      (m)      (m/s)
    INFLOW : ID= 5 (0321)   605.00     2.68    2.42   10.20      .62       1.23
    OUTFLOW: ID= 3 (0110)   605.00     2.56    2.75   10.19      .61       1.23

------------------------------------------------------------------------------

#=========================
# SOUS-BASSIN -4B- Urbain|
#=========================

-------------------
 DESIGN              |
 STANDHYD   (0402)   |    Area    (ha)= 130.00
ID= 1 DT= 5.0 min    |    Total Imp(%)=  75.00    Dir. Conn.(%)=  75.00
-------------------
                                   IMPERVIOUS    PERVIOUS (i)
    Surface Area        (ha)=         97.50         32.50
    Dep. Storage        (mm)=           .80          1.50
    Average Slope        (%)=          1.00          1.00
    Length               (m)=        930.00         40.00
    Mannings n              =          .013          .250

    Max.eff.Inten.(mm/hr)=            69.48         10.77
               over (min)             10.00         35.00
    Storage Coeff.   (min)=           11.26 (ii)    32.45 (ii)
    Unit Hyd. Tpeak  (min)=           10.00         35.00
    Unit Hyd. peak   (cms)=             .10           .03
                                                                *TOTALS*
    PEAK FLOW        (cms)=           15.88           .51        16.07 (iii)
    TIME TO PEAK     (hrs)=            1.17          1.67         1.17
    RUNOFF VOLUME     (mm)=           47.56          8.62        37.82
    TOTAL RAINFALL    (mm)=           48.36         48.36        48.36
    RUNOFF COEFFICIENT    =             .98           .18          .78

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  55.0     Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
----------------------------------------------------------------------------

#===================================
#    POINT   -B-                  ||
#===================================

-------------------
 ADD HYD    (0231) |
   3 +  1 =   2    |        AREA     QPEAK     TPEAK      R.V.
-------------------         (ha)     (cms)     (hrs)      (mm)
          ID1= 3 (0110):   605.00     2.56      2.75     10.19
        + ID2= 1 (0402):   130.00    16.07      1.17     37.82
          ==================================================
          ID = 2 (0231):   735.00    16.16      1.17     15.08

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------

-------------------
 COMPUTE VOLUME    |
 ID= 2    (0231)   |              DISCHARGE      TIME
-------------------                 (cms)       (hrs)
          START CONTROLLING AT      2.34          .67
          INFLOW HYD. PEAKS AT     16.16         1.17
          STOP  CONTROLLING AT     13.00         1.30

          REQUIRED STORAGE VOLUME (ha.m.)=     .7700
          TOTAL HYDROGRAPH VOLUME (ha.m.)=   11.0812
          % OF HYDROGRAPH TO STORE       =    6.9486

          NOTE:  Storage was computed to reduce the Inflow
                 peak to   13.00  (cms).

----------------------------------------------------------------------------

#===========================================================
#              RESERVOIR  #1+ #2                          ||
#===========================================================

-------------------
 RESERVOIR (0201)  |
 IN= 2---> OUT= 3  |
 DT=  5.0 min      |     OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
-------------------       (cms)      (ha.m.)   |   (cms)      (ha.m.)
                           .000        .000    |   7.000       5.800

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 2 (0231)     735.00     16.16       1.17       15.08
    OUTFLOW: ID= 3 (0201)     735.00      3.98       2.67       15.04

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 24.65
               TIME SHIFT OF PEAK FLOW         (min)= 90.00
               MAXIMUM  STORAGE   USED        (ha.m.)=  3.30

----------------------------------------------------------------------------

#===========================================================
#              DE  POINT "B" A POINT "C"                  ||
#===========================================================

-------------------
 ROUTE       (0110) |     Routing time step (min) =   6.00
 CHANNEL   #SEG= 3  |
 IN= 3---> OUT= 2   |     Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
-------------------                   LENGTH = 1800.00     (m)

           <------ DATA FOR SECTION (    1.0) ------>
           Distance      Elevation          Manning
                .00        104.24            .0500
             100.00        101.79            .0500
             110.00        101.17            .0500
             113.00        101.17       .0500 / .0300   Main Channel
             113.80        100.57            .0300      Main Channel
             116.50        100.57            .0300      Main Channel
             117.00        101.30       .0300 / .0500   Main Channel
             120.00        101.52            .0500
             126.00        102.40            .0500
             226.00        102.98            .0500

  <--------------------- TRAVEL TIME TABLE --------------------->
   DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
```

(m)	(m)	(cu.m.)	(cms)	(m/s)	(min)
.12	100.69	.609E+03	.2	.49	61.55
.24	100.81	.127E+04	.5	.74	40.50
.36	100.93	.199E+04	1.0	.93	32.10
.48	101.05	.275E+04	1.7	1.10	27.39
.60	101.17	.357E+04	2.4	1.23	24.30
.73	101.30	.543E+04	3.7	1.21	24.79
.86	101.43	.799E+04	5.4	1.21	24.86
.99	101.56	.114E+05	7.6	1.20	25.04
1.12	101.69	.156E+05	10.5	1.21	24.79
1.25	101.82	.205E+05	14.0	1.22	24.49
1.38	101.95	.266E+05	17.9	1.21	24.71
1.51	102.08	.341E+05	23.0	1.21	24.70
1.63	102.20	.431E+05	29.3	1.23	24.49
1.76	102.33	.535E+05	37.0	1.24	24.12
1.89	102.46	.659E+05	44.1	1.20	24.93
2.02	102.59	.841E+05	54.4	1.16	25.78
2.15	102.72	.109E+06	68.6	1.14	26.38
2.28	102.85	.140E+06	87.2	1.12	26.71
2.41	102.98	.177E+06	110.5	1.12	26.71

	AREA	<---- hydrograph ---->			<--- channel --->	
		QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 3 (0201)	735.00	3.98	2.67	15.04	.75	1.21
OUTFLOW: ID= 2 (0110)	735.00	3.92	3.17	15.03	.75	1.21

#===
DE POINT "C" A POINT "C'" ||
#===

```
------------------
 ROUTE     (0110) |     Routing time step (min) =   6.00
 CHANNEL   #SEG= 3|
 IN= 2---> OUT= 3 |     Slopes (%), CHANNEL= .35   FLOODPLAIN= .35
------------------                  LENGTH =  800.00     (m)
```

<------ DATA FOR SECTION (1.0) ------>

Distance	Elevation	Manning	
.00	97.89	.0500	
100.00	95.77	.0500	
102.50	95.57	.0500 / .0300	Main Channel
103.50	94.48	.0300	Main Channel
106.50	94.48	.0300	Main Channel
107.50	95.39	.0300 / .0500	Main Channel
110.00	95.78	.0500	
210.00	96.54	.0500	

<-------------------- TRAVEL TIME TABLE --------------------->

DEPTH	ELEV	VOLUME	FLOW RATE	VELOCITY	TRAV.TIME
(m)	(m)	(cu.m.)	(cms)	(m/s)	(min)
.10	94.58	.251E+03	.1	.41	32.38
.20	94.68	.518E+03	.4	.63	21.11
.30	94.78	.802E+03	.8	.80	16.61
.40	94.88	.110E+04	1.3	.95	14.10
.51	94.99	.142E+04	1.9	1.07	12.46
.61	95.09	.175E+04	2.6	1.18	11.28
.71	95.19	.210E+04	3.4	1.28	10.40
.81	95.29	.247E+04	4.2	1.38	9.69
.91	95.39	.285E+04	5.2	1.46	9.12
1.03	95.51	.334E+04	6.5	1.57	8.50
1.14	95.62	.391E+04	8.1	1.65	8.06
1.25	95.74	.466E+04	9.9	1.70	7.84
1.37	95.85	.595E+04	11.9	1.60	8.31
1.48	95.96	.901E+04	15.0	1.33	10.04
1.60	96.08	.140E+05	19.5	1.12	11.94
1.71	96.19	.208E+05	26.0	1.00	13.33
1.83	96.31	.295E+05	34.9	.95	14.10
1.94	96.42	.402E+05	46.6	.93	14.37
2.06	96.54	.527E+05	61.4	.93	14.31

	AREA	<---- hydrograph ---->			<--- channel --->	
		QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0110)	735.00	3.92	3.17	15.03	.77	1.34
OUTFLOW: ID= 3 (0110)	735.00	3.91	3.33	15.02	.77	1.34

#====================
SOUS-BASSIN -3- ||
#====================

```
------------------
 CALIB            |
 NASHYD    (0300) |   Area    (ha)= 204.00   Curve Number    (CN)= 68.0
ID= 1 DT= 5.0 min |   Ia      (mm)=   2.50   # of Linear Res.(N)= 3.00
------------------    U.H. Tp(hrs)=   1.58

    Unit Hyd Qpeak  (cms)=    4.93

    PEAK FLOW       (cms)=    2.14 (i)
    TIME TO PEAK    (hrs)=    3.00
    RUNOFF VOLUME    (mm)=   12.71
    TOTAL RAINFALL   (mm)=   48.36
    RUNOFF COEFFICIENT   =     .26

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------


#======================
# SOUS-BASSIN -5- Urbain|
#======================

------------------
 DESIGN           |
 STANDHYD  (0500) |   Area    (ha)= 136.00
ID= 2 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
------------------
                              IMPERVIOUS     PERVIOUS (i)
    Surface Area      (ha)=     61.20          74.80
    Dep. Storage      (mm)=       .80           1.50
    Average Slope      (%)=      1.00           1.00
    Length             (m)=    952.00          40.00
    Mannings n            =      .013           .250

    Max.eff.Inten.(mm/hr)=      69.48          10.77
              over (min)        10.00          35.00
    Storage Coeff.   (min)=     11.42 (ii)     32.61 (ii)
    Unit Hyd. Tpeak  (min)=     10.00          35.00
    Unit Hyd. peak   (cms)=       .10            .03
                                                             *TOTALS*
    PEAK FLOW        (cms)=      9.93           1.17          10.37 (iii)
    TIME TO PEAK     (hrs)=      1.17           1.67           1.17
    RUNOFF VOLUME     (mm)=     47.56           8.62          26.14
    TOTAL RAINFALL    (mm)=     48.36          48.36          48.36
    RUNOFF COEFFICIENT    =       .98            .18            .54

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  55.0     Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------


------------------
 ADD HYD   (0412) |
   1 +  2 =  4    |          AREA      QPEAK      TPEAK       R.V.
------------------           (ha)      (cms)      (hrs)       (mm)
        ID1= 1 (0300):     204.00       2.14       3.00      12.71
      + ID2= 2 (0500):     136.00      10.37       1.17      26.14
        ==================================================
        ID = 4 (0412):     340.00      10.53       1.17      18.09

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

#================================
#   POINT  -C'-               ||
#================================


------------------
 ADD HYD   (0143) |
   4 +  3 =  1    |          AREA      QPEAK      TPEAK       R.V.
------------------           (ha)      (cms)      (hrs)       (mm)
        ID1= 4 (0412):     340.00      10.53       1.17      18.09
      + ID2= 3 (0110):     735.00       3.91       3.33      15.02
        ==================================================
        ID = 1 (0143):    1075.00      10.72       1.17      15.99

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

COMPUTE VOLUME
ID= 1 (0143)

	DISCHARGE (cms)	TIME (hrs)

**** WARNING: NO STORAGE REQUIRED, RELEASE > INFLOW PEAK

#===
RESERVOIR #3 ||
#===

RESERVOIR (0201)
IN= 1---> OUT= 4
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.000	11.000	5.600

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1 (0143)	1075.00	10.72	1.17	15.99
OUTFLOW: ID= 4 (0201)	1075.00	6.08	3.58	15.97

PEAK FLOW REDUCTION [Qout/Qin](%)= 56.68
TIME SHIFT OF PEAK FLOW (min)=145.00
MAXIMUM STORAGE USED (ha.m.)= 3.09

#===
DE POINT "C'" A POINT "D " ||
#===

ROUTE (0110)
CHANNEL #SEG= 3
IN= 4---> OUT= 1

Routing time step (min) = 6.00

Slopes (%), CHANNEL= .35 FLOODPLAIN= .35
LENGTH = 2050.00 (m)

<------ DATA FOR SECTION (1.0) ------>

Distance	Elevation	Manning	
.00	97.89	.0500	
100.00	95.77	.0500	
102.50	95.57	.0500 / .0300	Main Channel
103.50	94.48	.0300	Main Channel
106.50	94.48	.0300	Main Channel
107.50	95.39	.0300 / .0500	Main Channel
110.00	95.78	.0500	
210.00	96.54	.0500	

<-------------------- TRAVEL TIME TABLE --------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
.10	94.58	.643E+03	.1	.41	82.98
.20	94.68	.133E+04	.4	.63	54.10
.30	94.78	.206E+04	.8	.80	42.57
.40	94.88	.283E+04	1.3	.95	36.12
.51	94.99	.364E+04	1.9	1.07	31.92
.61	95.09	.449E+04	2.6	1.18	28.92
.71	95.19	.539E+04	3.4	1.28	26.64
.81	95.29	.633E+04	4.2	1.38	24.84
.91	95.39	.731E+04	5.2	1.46	23.38
1.03	95.51	.855E+04	6.5	1.57	21.79
1.14	95.62	.100E+05	8.1	1.65	20.67
1.25	95.74	.119E+05	9.9	1.70	20.09
1.37	95.85	.152E+05	11.9	1.60	21.29
1.48	95.96	.231E+05	15.0	1.33	25.73
1.60	96.08	.358E+05	19.5	1.12	30.59
1.71	96.19	.533E+05	26.0	1.00	34.16
1.83	96.31	.757E+05	34.9	.95	36.13
1.94	96.42	.103E+06	46.6	.93	36.82
2.06	96.54	.135E+06	61.4	.93	36.66

	AREA (ha)	<---- hydrograph ----> QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<--- channel ---> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 4 (0201)	1075.00	6.08	3.58	15.97	.99	1.53
OUTFLOW: ID= 1 (0110)	1075.00	6.02	3.92	15.96	.98	1.52

#=======================

```
# SOUS-BASSIN -6-Urbain |
#=======================

------------------
 DESIGN           |
 STANDHYD  (0600) |   Area    (ha)= 167.00
ID= 2 DT= 5.0 min |   Total Imp(%)=  35.00   Dir. Conn.(%)=  35.00
------------------
                             IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=     58.45        108.55
    Dep. Storage      (mm)=       .80          1.50
    Average Slope      (%)=      1.00          1.00
    Length             (m)=   1055.00         40.00
    Mannings n            =      .013          .250

    Max.eff.Inten.(mm/hr)=      69.48         10.77
               over (min)       10.00         35.00
    Storage Coeff.  (min)=      12.15 (ii)    33.34 (ii)
    Unit Hyd. Tpeak (min)=      10.00         35.00
    Unit Hyd. peak  (cms)=        .10           .03
                                                          *TOTALS*
    PEAK FLOW       (cms)=       9.34          1.68          9.96 (iii)
    TIME TO PEAK    (hrs)=       1.17          1.67          1.17
    RUNOFF VOLUME    (mm)=      47.56          8.62         22.25
    TOTAL RAINFALL   (mm)=      48.36         48.36         48.36
    RUNOFF COEFFICIENT   =        .98           .18           .46

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*   =   55.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

#=================================
#   POINT  -D -                 ||
#=================================

------------------
 ADD HYD    (0312) |
   1 +  2 =  3     |        AREA       QPEAK      TPEAK       R.V.
------------------          (ha)       (cms)      (hrs)       (mm)
         ID1= 1 (0110):   1075.00       6.02       3.92      15.96
       + ID2= 2 (0600):    167.00       9.96       1.17      22.25
         ==================================================
         ID = 3 (0312):   1242.00      10.50       1.17      16.80

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

------------------
 RESERVOIR (0201) |
 IN= 3---> OUT= 2 |
 DT=  5.0 min     |     OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
------------------       (cms)     (ha.m.)    |    (cms)      (ha.m.)
                          .000        .000    |   16.000       1.500

                                  AREA      QPEAK      TPEAK       R.V.
                                  (ha)      (cms)      (hrs)       (mm)
    INFLOW : ID= 3 (0312)      1242.00      10.50       1.17      16.80
    OUTFLOW: ID= 2 (0201)      1242.00       8.33       1.42      16.80

                 PEAK    FLOW   REDUCTION [Qout/Qin](%)= 79.38
                 TIME SHIFT OF PEAK FLOW          (min)= 15.00
                 MAXIMUM   STORAGE   USED       (ha.m.)=   .79

--------------------------------------------------------------------------------

#==========================================================
#     ORAGE DE 2-ANS
#==========================================================

------------------
   READ STORM      |   Filename: b:2.ANS
 Ptotal= 30.61 mm  |   Comments: 2 YEAR STORM (DE FEES)
------------------
                  TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN
                   hrs   mm/hr  |   hrs   mm/hr  |   hrs   mm/hr  |   hrs   mm/hr
                   .08    2.08  |   .83   33.20  |  1.58    5.36  |  2.33    2.49
                   .17    2.08  |   .92   45.38  |  1.67    5.36  |  2.42    2.20
                   .25    2.69  |  1.00   45.38  |  1.75    4.17  |  2.50    2.20
```

```
                .33      2.69 |  1.08    42.19 |  1.83     4.17 |  2.58     1.97
                .42      3.79 |  1.17    42.19 |  1.92     3.41 |  2.67     1.97
                .50      3.79 |  1.25    13.17 |  2.00     3.41 |  2.75     1.78
                .58      7.85 |  1.33    13.17 |  2.08     2.88 |  2.83     1.78
                .67      7.85 |  1.42     7.41 |  2.17     2.88 |  2.92     1.63
                .75     33.20 |  1.50     7.41 |  2.25     2.49 |  3.00     1.63
-------------------------------------------------------------------------------

#==============================================================

#=====================
# SOUS-BASSIN -1AB- ||
#=====================

-------------------
 CALIB             |
 NASHYD     (0111) |   Area     (ha)= 268.00   Curve Number    (CN)= 65.0
ID= 1 DT= 5.0 min  |   Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=    2.00

    Unit Hyd Qpeak  (cms)=   5.12

    PEAK FLOW       (cms)=    .89 (i)
    TIME TO PEAK    (hrs)=   3.42
    RUNOFF VOLUME    (mm)=   4.79
    TOTAL RAINFALL   (mm)=  30.61
    RUNOFF COEFFICIENT   =    .16

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

-------------------
 RESERVOIR (0201)  |
 IN= 1---> OUT= 2  |
 DT=  5.0 min      |       OUTFLOW     STORAGE  |  OUTFLOW     STORAGE
-------------------         (cms)      (ha.m.)  |   (cms)      (ha.m.)
                             .000        .000   |    .500      50.000

                                    AREA      QPEAK      TPEAK        R.V.
                                    (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 1 (0111)          268.00       .89       3.42        4.79
    OUTFLOW: ID= 2 (0201)          268.00       .01      10.92        1.19

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.40
                  TIME SHIFT OF PEAK FLOW         (min)=450.00
                  MAXIMUM   STORAGE   USED      (ha.m.)=  1.25

-------------------------------------------------------------------------------

#=====================
# SOUS-BASSIN -2-   ||
#=====================

-------------------
 CALIB             |
 NASHYD     (0200) |   Area     (ha)= 247.00   Curve Number    (CN)= 55.0
ID= 1 DT= 5.0 min  |   Ia       (mm)=   2.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=    1.07

    Unit Hyd Qpeak  (cms)=   8.82

    PEAK FLOW       (cms)=    .93 (i)
    TIME TO PEAK    (hrs)=   2.33
    RUNOFF VOLUME    (mm)=   3.35
    TOTAL RAINFALL   (mm)=  30.61
    RUNOFF COEFFICIENT   =    .11

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

#=================================
#   POINT  -A-                  ||
#=================================

-------------------
| ADD HYD   (0321) |
|  2 +  1 =   3    |          AREA      QPEAK      TPEAK      R.V.
-------------------           (ha)      (cms)      (hrs)      (mm)
        ID1= 2 (0201):      268.00       .01      10.92       1.19
      + ID2= 1 (0200):      247.00       .93       2.33       3.35
        ===================================================
```

```
      ID = 3 (0321):   515.00      .94      2.33      2.22

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

#========================
# SOUS-BASSIN -4A- Urbain|
#========================

-------------------
 DESIGN            |
 STANDHYD  (0401)  |   Area    (ha)=  90.00
ID= 1 DT= 5.0 min  |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=     67.50        22.50
    Dep. Storage     (mm)=       .80         1.50
    Average Slope     (%)=      1.00         1.00
    Length            (m)=    774.00        40.00
    Mannings n           =      .013         .250

    Max.eff.Inten.(mm/hr)=     44.32         3.98
               over (min)      10.00        45.00
    Storage Coeff.  (min)=     12.08 (ii)   43.62 (ii)
    Unit Hyd. Tpeak (min)=     10.00        45.00
    Unit Hyd. peak  (cms)=       .10          .03
                                                           *TOTALS*
    PEAK FLOW       (cms)=      7.12          .13             7.15 (iii)
    TIME TO PEAK    (hrs)=      1.17         1.83             1.17
    RUNOFF VOLUME    (mm)=     29.81         3.58            23.25
    TOTAL RAINFALL   (mm)=     30.61        30.61            30.61
    RUNOFF COEFFICIENT   =       .97          .12              .76

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  55.0     Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------

-------------------
 COMPUTE VOLUME    |
 ID= 1   (0401)    |              DISCHARGE      TIME
-------------------                 (cms)        (hrs)
          START CONTROLLING AT       .01          .35
          INFLOW HYD. PEAKS AT      7.15         1.17
          STOP  CONTROLLING AT      1.50         1.83

          REQUIRED STORAGE VOLUME (ha.m.)=    1.3321
          TOTAL HYDROGRAPH VOLUME (ha.m.)=    2.0923
          % OF HYDROGRAPH TO STORE       =   63.6686

          NOTE:  Storage was computed to reduce the Inflow
                 peak to    1.50  (cms).

-----------------------------------------------------------------------------

#=============================================================
#              RESERVOIR  NATURELE                          ||
#=============================================================

-------------------
 RESERVOIR (0201)  |
 IN= 1---> OUT= 4  |
 DT=  5.0 min      |     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)  |   (cms)     (ha.m.)
                           .000       .000   |   1.500     10.000

                          AREA      QPEAK      TPEAK        R.V.
                          (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 1 (0401)  90.00      7.15       1.17        23.25
   OUTFLOW: ID= 4 (0201)  90.00       .28       3.17        22.97

            PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.93
            TIME SHIFT OF PEAK FLOW        (min)=120.00
            MAXIMUM  STORAGE   USED       (ha.m.)=  1.87

-----------------------------------------------------------------------------

-------------------
 ADD HYD   (0321)  |
   3 +  4 =  5     |         AREA     QPEAK     TPEAK      R.V.
```

```
 -----------------         (ha)     (cms)     (hrs)      (mm)
      ID1= 3 (0321):     515.00       .94      2.33      2.22
    + ID2= 4 (0201):      90.00       .28      3.17     22.97
      ===================================================
      ID = 5 (0321):     605.00      1.21      2.33      5.31

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 --------------------------------------------------------------------------------

#==========================================================||
#              DE  POINT "A" A POINT "B"                   ||
#==========================================================||

 ------------------
 ROUTE     (0110) |     Routing time step (min) =  6.00
 CHANNEL   #SEG= 3 |
 IN= 5---> OUT= 3 |     Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
 ------------------                 LENGTH = 1600.00    (m)

              <------ DATA FOR SECTION (   1.0) ------>
              Distance      Elevation       Manning
                   .00         104.24         .0500
                100.00         101.79         .0500
                110.00         101.17         .0500
                113.00         101.17      .0500 / .0300   Main Channel
                113.80         100.57         .0300        Main Channel
                116.50         100.57         .0300        Main Channel
                117.00         101.30      .0300 / .0500   Main Channel
                120.00         101.52         .0500
                126.00         102.40         .0500
                226.00         102.98         .0500

      <--------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
        (m)      (m)      (cu.m.)       (cms)        (m/s)        (min)
        .12    100.69    .542E+03         .2           .49        54.71
        .24    100.81    .113E+04         .5           .74        36.00
        .36    100.93    .176E+04        1.0           .93        28.53
        .48    101.05    .245E+04        1.7          1.10        24.35
        .60    101.17    .317E+04        2.4          1.23        21.60
        .73    101.30    .483E+04        3.7          1.21        22.04
        .86    101.43    .710E+04        5.4          1.21        22.10
        .99    101.56    .102E+05        7.6          1.20        22.26
       1.12    101.69    .139E+05       10.5          1.21        22.04
       1.25    101.82    .182E+05       14.0          1.22        21.77
       1.38    101.95    .237E+05       17.9          1.21        21.97
       1.51    102.08    .303E+05       23.0          1.21        21.95
       1.63    102.20    .383E+05       29.3          1.23        21.77
       1.76    102.33    .475E+05       37.0          1.24        21.44
       1.89    102.46    .586E+05       44.1          1.20        22.16
       2.02    102.59    .747E+05       54.4          1.16        22.91
       2.15    102.72    .966E+05       68.6          1.14        23.45
       2.28    102.85    .124E+06       87.2          1.12        23.74
       2.41    102.98    .157E+06      110.5          1.12        23.74

                                      <---- hydrograph ---->   <---  channel --->
                               AREA    QPEAK   TPEAK    R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)    (mm)      (m)      (m/s)
    INFLOW : ID= 5 (0321)    605.00     1.21    2.33    5.31      .39       .97
    OUTFLOW: ID= 3 (0110)    605.00     1.12    2.83    5.30      .38       .95

 --------------------------------------------------------------------------------

#========================
# SOUS-BASSIN -4B- Urbain|
#========================

 ------------------
  DESIGN           |
  STANDHYD  (0402) |   Area    (ha)= 130.00
 ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00    Dir. Conn.(%)=  75.00
 ------------------
                             IMPERVIOUS     PERVIOUS (i)
    Surface Area      (ha)=     97.50         32.50
    Dep. Storage      (mm)=       .80          1.50
    Average Slope      (%)=      1.00          1.00
    Length             (m)=    930.00         40.00
    Mannings n            =      .013          .250

    Max.eff.Inten.(mm/hr)=      44.32          3.98
               over (min)       15.00         50.00
    Storage Coeff.  (min)=      13.48 (ii)    45.03 (ii)
    Unit Hyd. Tpeak (min)=      15.00         50.00
    Unit Hyd. peak  (cms)=        .08           .02
                                                            *TOTALS*
    PEAK FLOW       (cms)=       9.57           .18          9.61 (iii)
```

```
    TIME TO PEAK     (hrs)=        1.17            1.92            1.17
    RUNOFF VOLUME     (mm)=       29.81            3.58           23.25
    TOTAL RAINFALL    (mm)=       30.61           30.61           30.61
    RUNOFF COEFFICIENT    =         .97             .12             .76

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  55.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------

#===================================
#   POINT  -B-                     ||
#===================================

-------------------
 ADD HYD    (0231)|
   3 +  1 =  2    |        AREA    QPEAK    TPEAK     R.V.
-------------------        (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0110):  605.00     1.12     2.83     5.30
       + ID2= 1 (0402):  130.00     9.61     1.17    23.25
         ===============================================
         ID = 2 (0231):  735.00     9.65     1.25     8.48

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

-------------------
 COMPUTE VOLUME   |
 ID= 2   (0231)   |          DISCHARGE      TIME
-------------------             (cms)       (hrs)
    **** WARNING: NO STORAGE REQUIRED, RELEASE > INFLOW  PEAK

-----------------------------------------------------------------------------

#============================================================
#              RESERVOIR  #1+ #2                           ||
#============================================================

-------------------
 RESERVOIR (0201) |
 IN= 2---> OUT= 3 |
 DT=  5.0 min     |      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
-------------------       (cms)    (ha.m.)   |   (cms)    (ha.m.)
                           .000       .000   |   7.000      5.800

                              AREA     QPEAK     TPEAK      R.V.
                              (ha)     (cms)     (hrs)      (mm)
    INFLOW : ID= 2 (0231)   735.00      9.65      1.25      8.48
    OUTFLOW: ID= 3 (0201)   735.00      2.40      2.08      8.46

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 24.87
                  TIME SHIFT OF PEAK FLOW          (min)= 50.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  1.99

-----------------------------------------------------------------------------

#============================================================
#              DE  POINT "B" A POINT "C"                   ||
#============================================================

-------------------
 ROUTE      (0110)|     Routing time step (min) =  6.00
 CHANNEL  #SEG= 3 |
 IN= 3---> OUT= 2 |     Slopes (%), CHANNEL= .40   FLOODPLAIN= .40
-------------------                 LENGTH = 1800.00     (m)

               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation        Manning
                    .00        104.24          .0500
                 100.00        101.79          .0500
                 110.00        101.17          .0500
                 113.00        101.17      .0500 / .0300   Main Channel
                 113.80        100.57          .0300       Main Channel
                 116.50        100.57          .0300       Main Channel
                 117.00        101.30      .0300 / .0500   Main Channel
                 120.00        101.52          .0500
                 126.00        102.40          .0500
                 226.00        102.98          .0500
```

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
.12	100.69	.609E+03	.2	.49	61.55
.24	100.81	.127E+04	.5	.74	40.50
.36	100.93	.199E+04	1.0	.93	32.10
.48	101.05	.275E+04	1.7	1.10	27.39
.60	101.17	.357E+04	2.4	1.23	24.30
.73	101.30	.543E+04	3.7	1.21	24.79
.86	101.43	.799E+04	5.4	1.21	24.86
.99	101.56	.114E+05	7.6	1.20	25.04
1.12	101.69	.156E+05	10.5	1.21	24.79
1.25	101.82	.205E+05	14.0	1.22	24.49
1.38	101.95	.266E+05	17.9	1.21	24.71
1.51	102.08	.341E+05	23.0	1.21	24.70
1.63	102.20	.431E+05	29.3	1.23	24.49
1.76	102.33	.535E+05	37.0	1.24	24.12
1.89	102.46	.659E+05	44.1	1.20	24.93
2.02	102.59	.841E+05	54.4	1.16	25.78
2.15	102.72	.109E+06	68.6	1.14	26.38
2.28	102.85	.140E+06	87.2	1.12	26.71
2.41	102.98	.177E+06	110.5	1.12	26.71

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 3 (0201)	735.00	2.40	2.08	8.46	.59	1.22
OUTFLOW: ID= 2 (0110)	735.00	2.31	2.67	8.45	.58	1.21

DE POINT "C" A POINT "C'"

ROUTE (0110)
CHANNEL #SEG= 3
IN= 2---> OUT= 3

Routing time step (min) = 6.00

Slopes (%), CHANNEL= .35 FLOODPLAIN= .35
LENGTH = 800.00 (m)

DATA FOR SECTION (1.0)

Distance	Elevation	Manning	
.00	97.89	.0500	
100.00	95.77	.0500	
102.50	95.57	.0500 / .0300	Main Channel
103.50	94.48	.0300	Main Channel
106.50	94.48	.0300	Main Channel
107.50	95.39	.0300 / .0500	Main Channel
110.00	95.78	.0500	
210.00	96.54	.0500	

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
.10	94.58	.251E+03	.1	.41	32.38
.20	94.68	.518E+03	.4	.63	21.11
.30	94.78	.802E+03	.8	.80	16.61
.40	94.88	.110E+04	1.3	.95	14.10
.51	94.99	.142E+04	1.9	1.07	12.46
.61	95.09	.175E+04	2.6	1.18	11.28
.71	95.19	.210E+04	3.4	1.28	10.40
.81	95.29	.247E+04	4.2	1.38	9.69
.91	95.39	.285E+04	5.2	1.46	9.12
1.03	95.51	.334E+04	6.5	1.57	8.50
1.14	95.62	.391E+04	8.1	1.65	8.06
1.25	95.74	.466E+04	9.9	1.70	7.84
1.37	95.85	.595E+04	11.9	1.60	8.31
1.48	95.96	.901E+04	15.0	1.33	10.04
1.60	96.08	.140E+05	19.5	1.12	11.94
1.71	96.19	.208E+05	26.0	1.00	13.33
1.83	96.31	.295E+05	34.9	.95	14.10
1.94	96.42	.402E+05	46.6	.93	14.37
2.06	96.54	.527E+05	61.4	.93	14.31

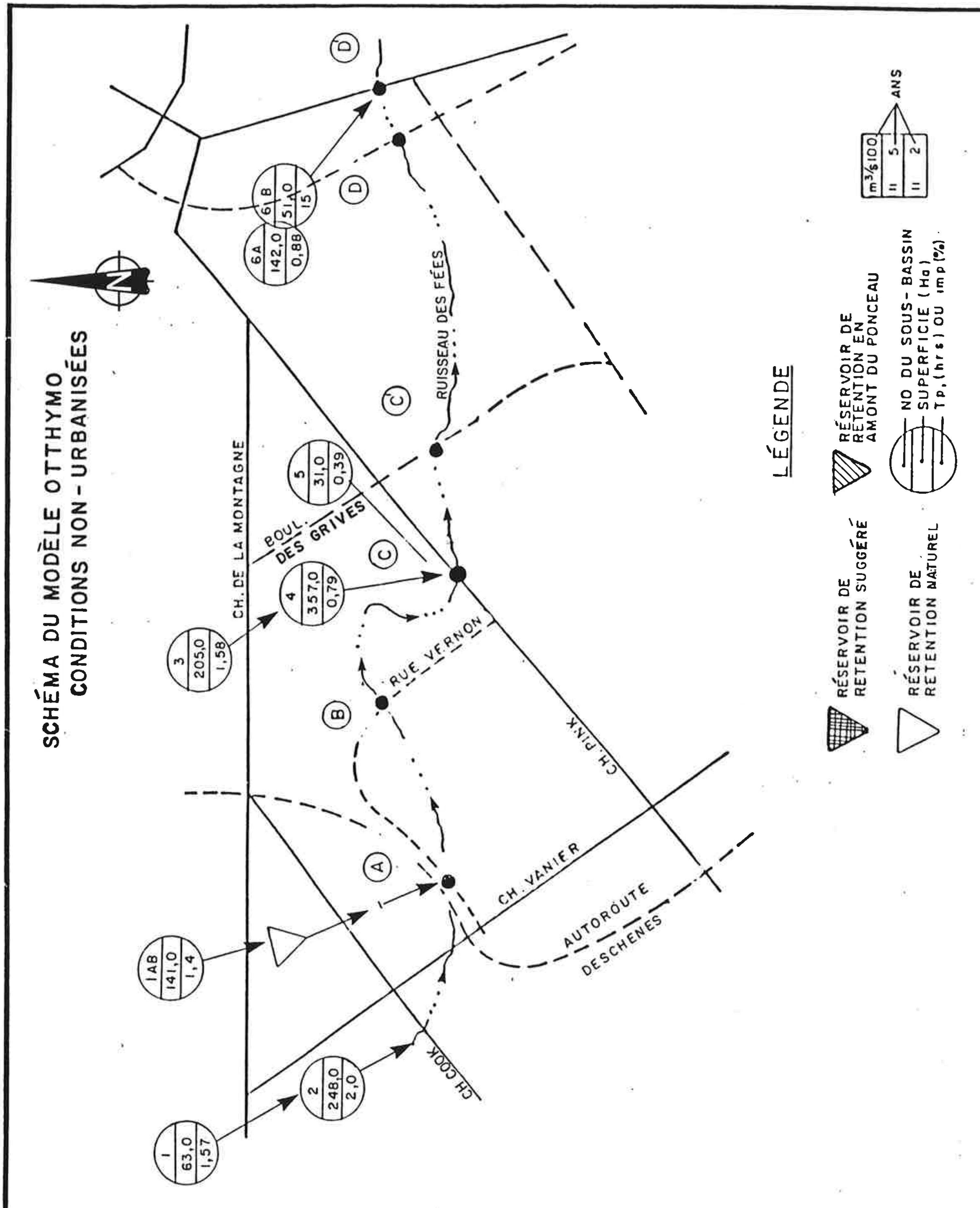
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0110)	735.00	2.31	2.67	8.45	.57	1.13
OUTFLOW: ID= 3 (0110)	735.00	2.30	2.92	8.45	.56	1.13

SOUS-BASSIN -3-

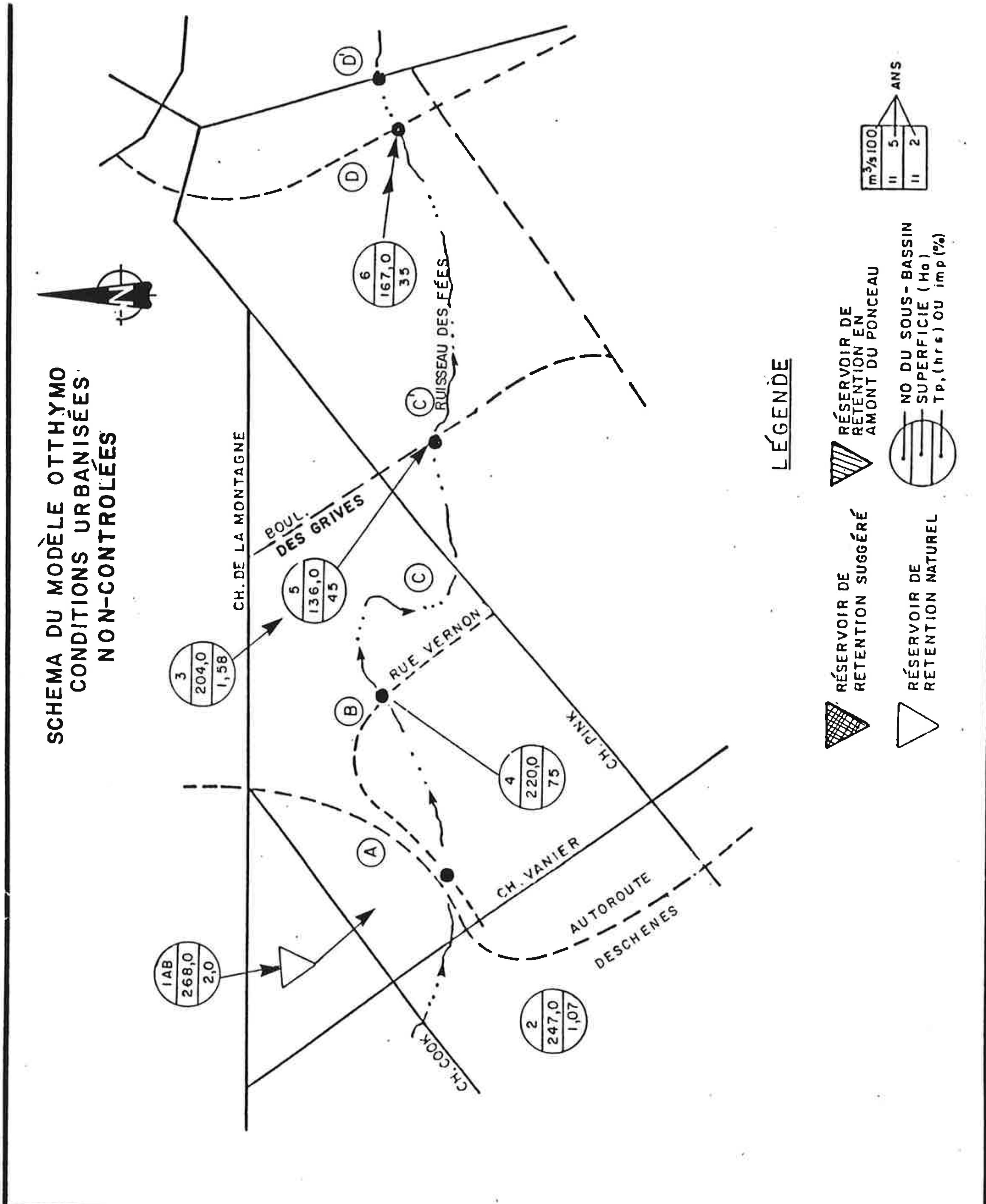
```
#=====================

-------------------
 CALIB             |
 NASHYD     (0300) |    Area      (ha)= 204.00    Curve Number     (CN)= 68.0
ID= 1 DT= 5.0 min  |    Ia        (mm)=   2.50    # of Linear Res.(N)= 3.00
-------------------     U.H. Tp(hrs)=     1.58

    Unit Hyd Qpeak  (cms)=    4.93

    PEAK FLOW        (cms)=    .92 (i)
    TIME TO PEAK     (hrs)=   3.00
    RUNOFF VOLUME     (mm)=   5.35
    TOTAL RAINFALL    (mm)=  30.61
    RUNOFF COEFFICIENT    =    .17

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------


#=========================
# SOUS-BASSIN -5- Urbain|
#=========================

-------------------
 DESIGN            |
 STANDHYD   (0500) |    Area      (ha)= 136.00
ID= 2 DT= 5.0 min  |    Total Imp(%)=  45.00    Dir. Conn.(%)=   45.00
-------------------
                               IMPERVIOUS     PERVIOUS (i)
    Surface Area      (ha)=       61.20         74.80
    Dep. Storage      (mm)=         .80          1.50
    Average Slope      (%)=        1.00          1.00
    Length             (m)=      952.00         40.00
    Mannings n            =        .013          .250

    Max.eff.Inten.(mm/hr)=        44.32          3.98
               over (min)         15.00         50.00
    Storage Coeff.  (min)=        13.67 (ii)    45.22 (ii)
    Unit Hyd. Tpeak (min)=        15.00         50.00
    Unit Hyd. peak  (cms)=          .08           .02
                                                                *TOTALS*
    PEAK FLOW       (cms)=         5.98           .41             6.09 (iii)
    TIME TO PEAK    (hrs)=         1.17          1.92             1.25
    RUNOFF VOLUME    (mm)=        29.81          3.58            15.38
    TOTAL RAINFALL   (mm)=        30.61         30.61            30.61
    RUNOFF COEFFICIENT   =          .97           .12              .50

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*   =    55.0     Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------



-------------------
 ADD HYD    (0412) |
   1 +  2 =  4     |          AREA       QPEAK      TPEAK        R.V.
-------------------           (ha)       (cms)      (hrs)        (mm)
         ID1= 1 (0300):     204.00         .92       3.00        5.35
       + ID2= 2 (0500):     136.00        6.09       1.25       15.38
         ==================================================
         ID = 4 (0412):     340.00        6.19       1.25        9.36

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

#===================================
#    POINT  -C'-                  ||
#===================================


-------------------
 ADD HYD    (0143) |
   4 +  3 =  1     |          AREA       QPEAK      TPEAK        R.V.
-------------------           (ha)       (cms)      (hrs)        (mm)
         ID1= 4 (0412):     340.00        6.19       1.25        9.36
       + ID2= 3 (0110):     735.00        2.30       2.92        8.45
         ==================================================
         ID = 1 (0143):    1075.00        6.29       1.25        8.74
```

```
    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------

------------------
 COMPUTE VOLUME  |
 ID= 1    (0143) |              DISCHARGE       TIME
------------------                (cms)        (hrs)
    **** WARNING: NO STORAGE REQUIRED, RELEASE > INFLOW  PEAK

---------------------------------------------------------------------------

#=========================================================
#              RESERVOIR     #3                        ||
#=========================================================

------------------
 RESERVOIR (0201)|
 IN= 1---> OUT= 4|
 DT=  5.0 min    |       OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
------------------        (cms)      (ha.m.)   |    (cms)      (ha.m.)
                           .000        .000    |   11.000       5.600

                                AREA      QPEAK      TPEAK       R.V.
                                (ha)      (cms)      (hrs)       (mm)
    INFLOW : ID= 1 (0143)    1075.00      6.29       1.25        8.74
    OUTFLOW: ID= 4 (0201)    1075.00      3.32       3.42        8.73

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 52.84
                 TIME SHIFT OF PEAK FLOW          (min)=130.00
                 MAXIMUM  STORAGE   USED        (ha.m.)=  1.69

---------------------------------------------------------------------------

#=========================================================
#              DE  POINT "C'" A POINT "D "             ||
#=========================================================

------------------
 ROUTE      (0110)|      Routing time step (min) =   6.00
 CHANNEL   #SEG= 3|
 IN= 4---> OUT= 1 |      Slopes (%), CHANNEL= .35    FLOODPLAIN= .35
------------------                LENGTH = 2050.00     (m)

              <------ DATA FOR SECTION (    1.0) ------>
              Distance       Elevation        Manning
                   .00         97.89           .0500
                100.00         95.77           .0500
                102.50         95.57      .0500 / .0300   Main Channel
                103.50         94.48           .0300      Main Channel
                106.50         94.48           .0300      Main Channel
                107.50         95.39      .0300 / .0500   Main Channel
                110.00         95.78           .0500
                210.00         96.54           .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH      ELEV      VOLUME     FLOW RATE     VELOCITY     TRAV.TIME
        (m)       (m)      (cu.m.)      (cms)         (m/s)         (min)
        .10      94.58    .643E+03        .1            .41         82.98
        .20      94.68    .133E+04        .4            .63         54.10
        .30      94.78    .206E+04        .8            .80         42.57
        .40      94.88    .283E+04       1.3            .95         36.12
        .51      94.99    .364E+04       1.9           1.07         31.92
        .61      95.09    .449E+04       2.6           1.18         28.92
        .71      95.19    .539E+04       3.4           1.28         26.64
        .81      95.29    .633E+04       4.2           1.38         24.84
        .91      95.39    .731E+04       5.2           1.46         23.38
       1.03      95.51    .855E+04       6.5           1.57         21.79
       1.14      95.62    .100E+05       8.1           1.65         20.67
       1.25      95.74    .119E+05       9.9           1.70         20.09
       1.37      95.85    .152E+05      11.9           1.60         21.29
       1.48      95.96    .231E+05      15.0           1.33         25.73
       1.60      96.08    .358E+05      19.5           1.12         30.59
       1.71      96.19    .533E+05      26.0           1.00         34.16
       1.83      96.31    .757E+05      34.9            .95         36.13
       1.94      96.42    .103E+06      46.6            .93         36.82
       2.06      96.54    .135E+06      61.4            .93         36.66

                                     <---- hydrograph ---->   <--- channel --->
                             AREA    QPEAK    TPEAK    R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)    (hrs)    (mm)      (m)      (m/s)
    INFLOW : ID= 4 (0201) 1075.00     3.32     3.42    8.73      .70      1.28
    OUTFLOW: ID= 1 (0110) 1075.00     3.27     3.75    8.72      .70      1.27

---------------------------------------------------------------------------
```

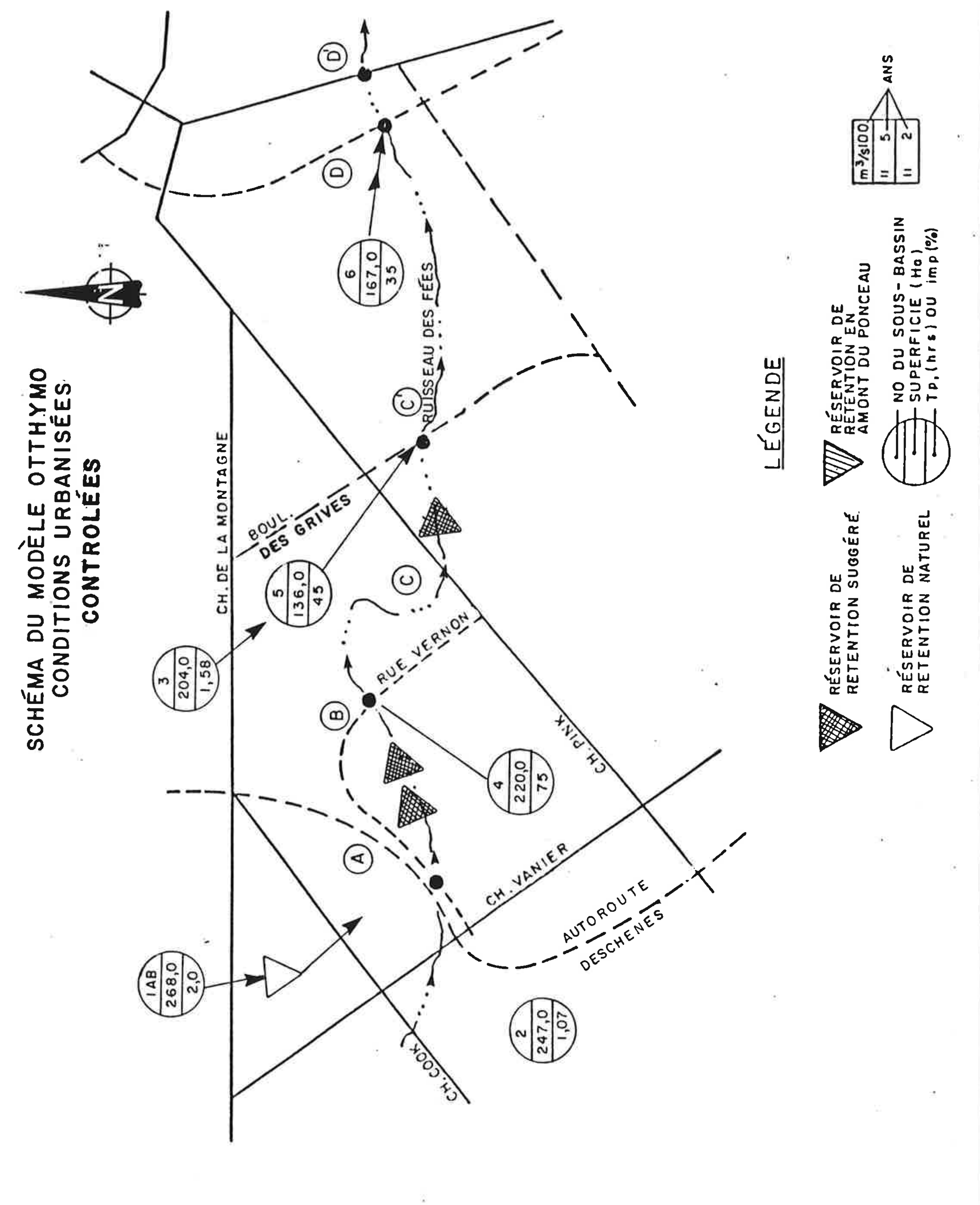
```
#========================
# SOUS-BASSIN -6-Urbain |
#========================

-------------------
 DESIGN            |
 STANDHYD  (0600)  |   Area     (ha)= 167.00
ID= 2 DT= 5.0 min  |   Total Imp(%)=  35.00   Dir. Conn.(%)=  35.00
-------------------
                               IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=      58.45        108.55
    Dep. Storage      (mm)=        .80          1.50
    Average Slope      (%)=       1.00          1.00
    Length             (m)=    1055.00         40.00
    Mannings n            =       .013          .250

    Max.eff.Inten.(mm/hr)=       44.32          3.98
               over (min)        15.00         50.00
    Storage Coeff.   (min)=      14.54 (ii)    46.09 (ii)
    Unit Hyd. Tpeak  (min)=      15.00         50.00
    Unit Hyd. peak   (cms)=        .08           .02
                                                             *TOTALS*
    PEAK FLOW        (cms)=       5.60           .59            5.78 (iii)
    TIME TO PEAK     (hrs)=       1.25          1.92            1.25
    RUNOFF VOLUME     (mm)=      29.81          3.58           12.76
    TOTAL RAINFALL    (mm)=      30.61         30.61           30.61
    RUNOFF COEFFICIENT    =        .97           .12             .42

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN*  =   55.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------

#=================================||
#   POINT  -D -                   ||
#=================================||

-------------------
 ADD HYD   (0312) |
   1 +  2 =  3    |          AREA     QPEAK     TPEAK       R.V.
-------------------          (ha)     (cms)     (hrs)       (mm)
          ID1= 1 (0110):  1075.00     3.27      3.75        8.72
        + ID2= 2 (0600):   167.00     5.78      1.25       12.76
          ==================================================
          ID = 3 (0312):  1242.00     6.07      1.25        9.26

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

-------------------
 RESERVOIR (0201) |
 IN= 3---> OUT= 2 |
 DT=  5.0 min     |      OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000       .000    |   16.000      1.500

                               AREA      QPEAK     TPEAK       R.V.
                               (ha)      (cms)     (hrs)       (mm)
    INFLOW : ID= 3 (0312)    1242.00     6.07      1.25        9.26
    OUTFLOW: ID= 2 (0201)    1242.00     4.89      1.50        9.26

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 80.58
                TIME SHIFT OF PEAK FLOW         (min)= 15.00
                MAXIMUM  STORAGE  USED        (ha.m.)=   .47

-----------------------------------------------------------------------------

FINISH
=============================================================================
```



DESSINÉ PAR: C.V. PRÉPARÉ PAR: [signature]	LES CONSULTANTS DE L'OUTAOUAIS INC. EXPERTS-CONSEILS MODÈLE OTTHYMO	DATE: 11/05/92 ÉCHELLE: ——— 368-013-1

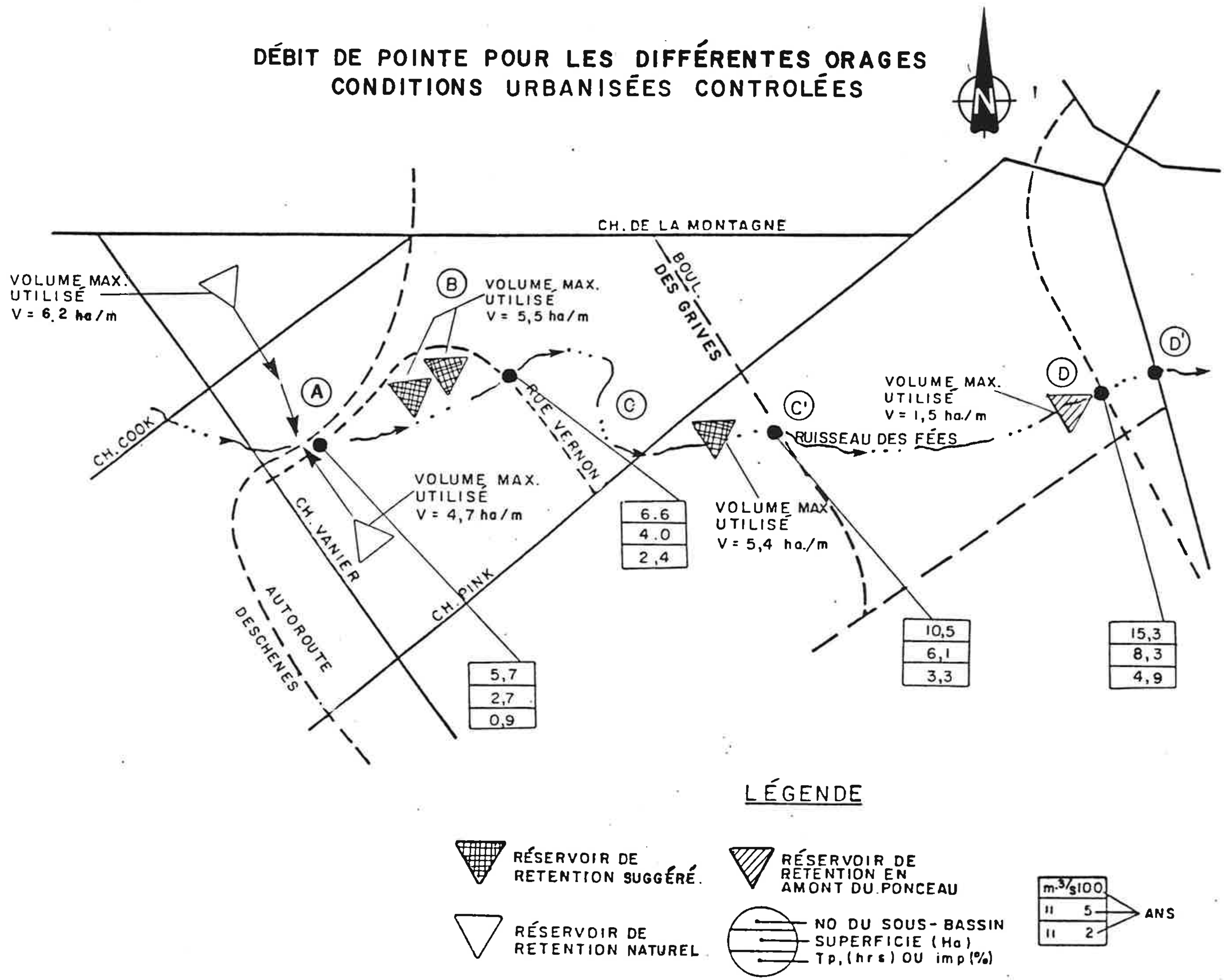


DESSINÉ PAR: C,V. PRÉPARÉ PAR: [signature]	LES CONSULTANTS DE L'OUTAOUAIS INC. EXPERTS-CONSEILS	DATE: 11/05/92 ÉCHELLE:
	MODÈLE OTTHYMO	368-013-2

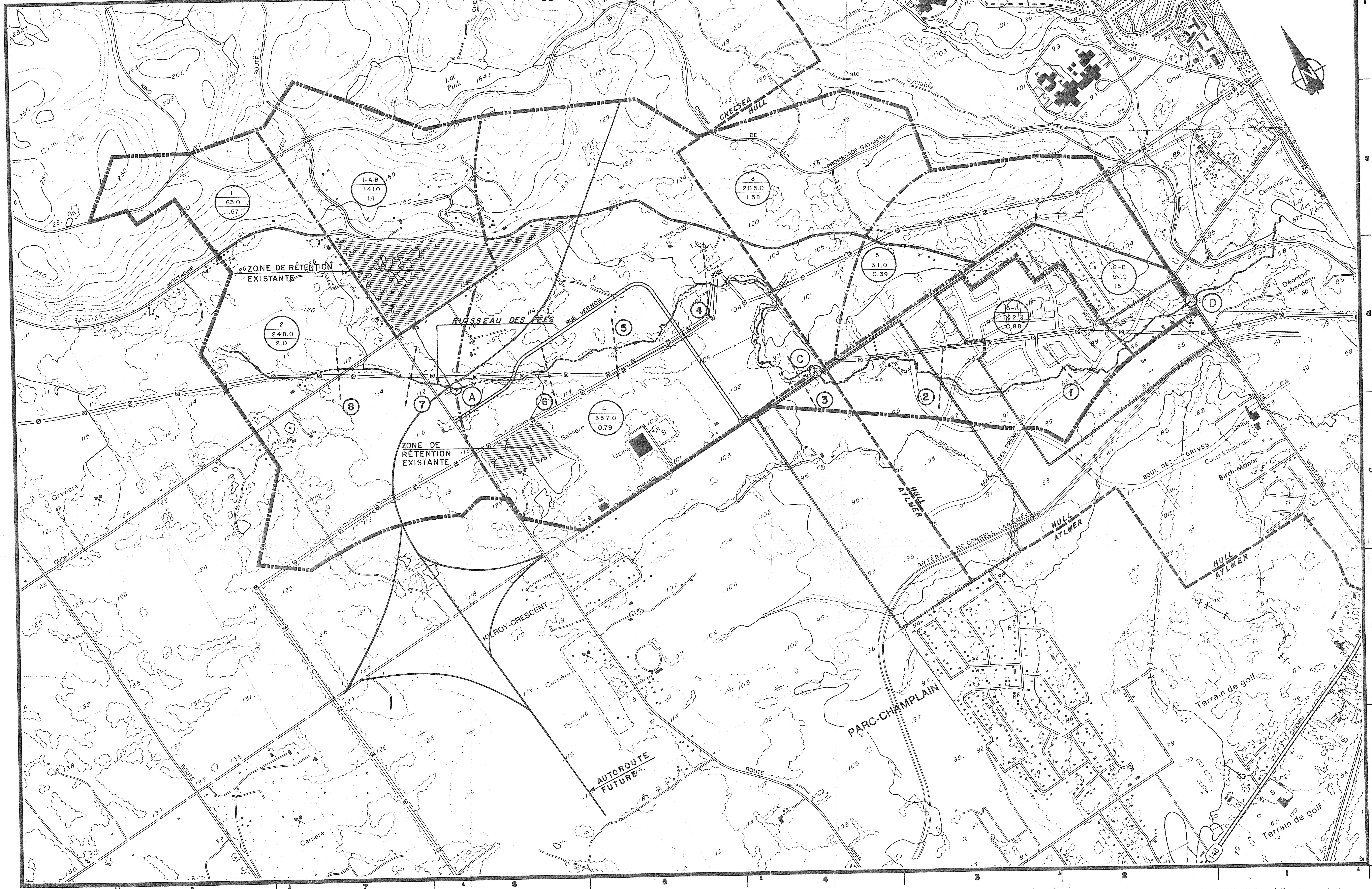


ESSINÉ PAR: C.V.	LES CONSULTANTS DE L'OUTAOUAIS INC. EXPERTS-CONSEILS	DATE: 11/05/92
RÉPARÉ PAR:		ÉCHELLE:
	MODÈLE OTTHYMO	368-013-3

DÉBIT DE POINTE POUR LES DIFFÉRENTES ORAGES CONDITIONS URBANISÉES CONTROLÉES



DESSINÉ PAR: C.V	LES CONSULTANTS DE L'OUTAOUAIS INC. EXPERTS-CONSEILS	DATE: 11/05/92
PRÉPARÉ PAR:		ÉCHELLE: ——
	MODÈLE OTTHYMO	368-013-4



LÉGENDE

- LIMITE DU BASSIN
- LIMITE DU SECTEUR À URBANISER
- SECTION VOIR PLANS 700 & 701
- LIMITE DE SOUS-BASSINS
- IDENTIFICATION DU SOUS-BASSIN
- SUPERFICIE (HECTARE)
- % DES SUPERFICIE IMPERMÉABLE (MOYENNE) / TEMPS DE POINTE (HRS)
- POINT DE CALCUL

no	date	par	révisions	app.
01	01 10/93		MODIFIER SELON VILLE DE HULL	

X NUMÉRO D'IDENTIFICATION DU DÉTAIL
Y NUMÉRO DE LA PAGE D'OÙ LE DÉTAIL PROVIENT
Z NUMÉRO DE LA PAGE OÙ LE DÉTAIL APPARAÎT

SI

les consultants de l'outaouais inc.
experts — conseils

492 boul. de l'hôpital, gatineau (819) 568-5956

étudié	dessiné	vérifié	échelle	date
	J.		1:10 000	DÉC. '89

VILLE DE HULL

LES DÉVELOPPEMENTS IMMOBILIERS GAMELIN LTÉE

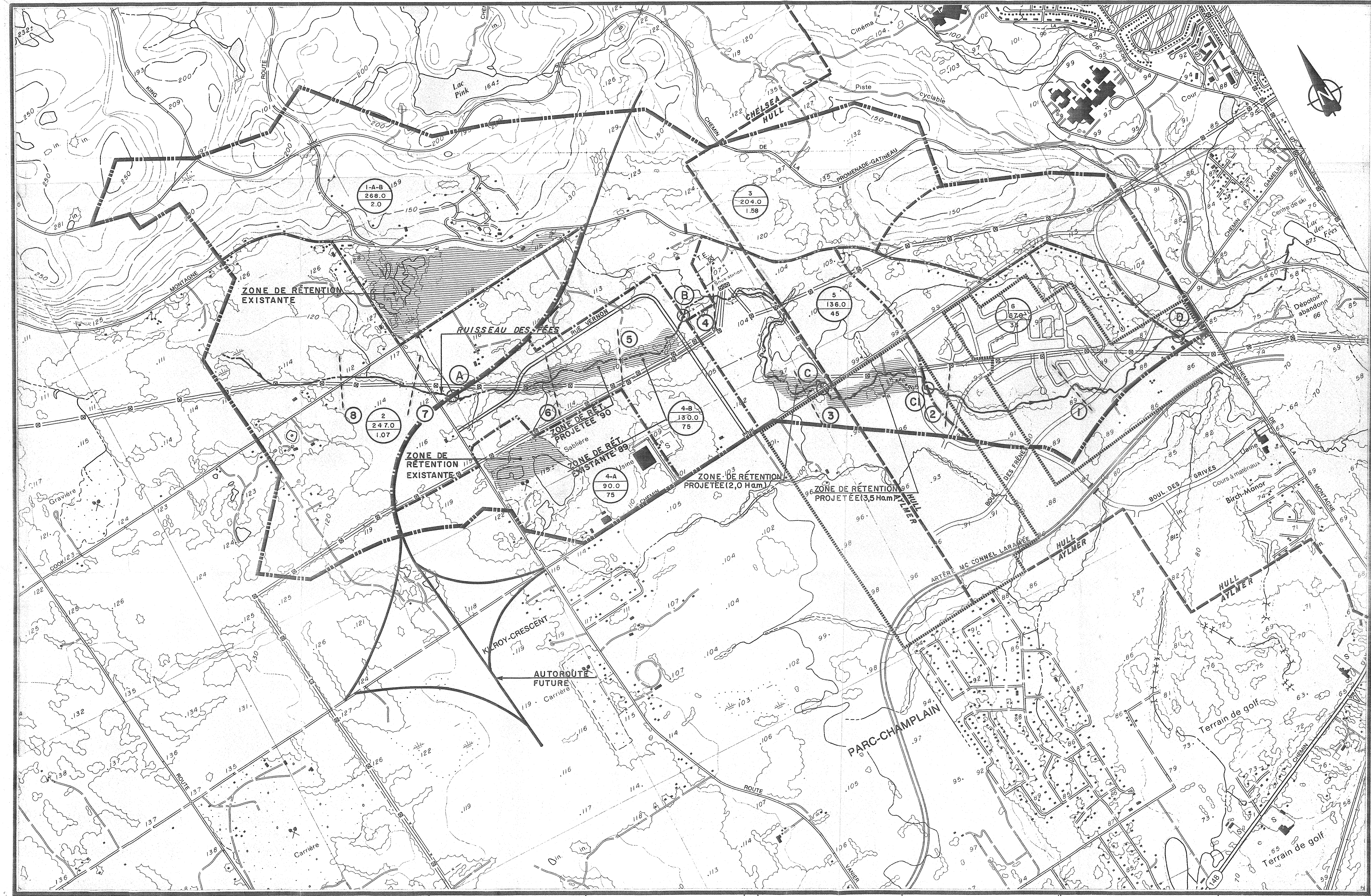
BASSIN DU RUISSEAU DES FÉES

PLAN D'ENSEMBLE

CONDITIONS AVANT URBANIBATION

projet no	plan no	rév.
368-0131	000	1

C-05-54



LÉGENDE

LIMITE DU BASSIN	
LIMITE DU SECTEUR À URBANISER	
SECTION VOIR PLANS 700 & 701	
LIMITE DE SOUS-BASSIN	
IDENTIFICATION DU SOUS-BASSIN	0
SUPERFICIE (HECTARE)	0.0
% DES SUPERFICIES IMPERMÉABLES (MOYENNE) / TEMPS DE POINTE (HRS)	0.0
POINT DE CALCUL	G

no	date	par	révisions	app.
01	01 10 93		MODIFIER SELON VILLE DE HULL	

X: NUMÉRO D'IDENTIFICATION DU DÉTAIL
Y: NUMÉRO DE LA PAGE D'OÙ LE DÉTAIL PROVIENT
Z: NUMÉRO DE LA PAGE OÙ LE DÉTAIL APPARAIT

SI

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experts — conseils

492 boul. de l'hôpital, gatineau (819) 568-5956

conçu	dessiné	vérifié	échelle	date
	J.		1:10 000	DÉC. '89

VILLE DE HULL

LES DÉVELOPPEMENTS IMMOBILIERS GAMELIN LTÉE

BASSIN DU RUISSEAU DES FÉES

PLAN D'ENSEMBLE

CONDITIONS URBANISÉES

projet no	plan no	rév.
368-0131	01	01

ECODATA INC.

P.O. BOX 9523
OTTAWA POSTAL TERMINAL
K1G 3V2
OTTAWA, ONTARIO
TEL. (613) 52[illegible]-2147

CONTRAT 90-11

ETUDE DES EFFETS HYDROLOGIQUES DE L'URBANISATION DU BASSIN RUISSEAU DES FEES A HULL

pour

Les Consultants de l'Outaouais

ECODATA INC.

P.O. BOX 9523
OTTAWA POSTAL TERMINAL
K1G 3V2
OTTAWA, ONTARIO
TEL. (613) 521-2147

ETUDE

DES EFFETS HYDROLOGIQUES DE

L'URBANISATION DU BASSIN

RUISSEAU DES FEES

A HULL

pour

Les Consultants de l'Outaouais

Fevrier 1989

CONTENU

1. INTRODUCTION

Le but de cette étude est de déterminer l'effet de l'urbanisation future sur les débits du ruisseau des Fées à Hull, Québec (fig. 1). L'étude est faite pour la partie du bassin située en amont de la route chemin Montagne (fig. 1), ou la surface du bassin est 1 155 ha.

L'occupation future du sol est donnée dans la figure 2 et le tableau 1 pour les sous-bassins montrés dans la figure 3B.

Ces développements ont pour effet un accroissement considérable de la surface impérméable et par la suite à un accroissement du ruissellement. D'autre part, en vue de l'urbanisation on doit souvent augmenter la capacité du lit naturel, afin de réduire les zones inondables et afin de prévoir la profondeur requise par les égouts pluvieux. Cette modification des canaux naturels a pour résultat une réduction des temps de concentration.

L'effet combiné de l'imperméabilisation et de la réduction du temps de concentration est un accroissement des débits de pointe. Dans les dernières dix années, on a reconnu la nécessité d'examiner ces effets et d'étuder les moyens d'éviter leur effets négatifs en aval par des méthodes de "contrôle de ruissellement". Ces études sont faites dans le cadre d'un plan directeur. La ville d'Aylmer a, par exemple, des plans directeurs pour six bassins. Un plan directeur avec l'étude de 13 alternatives a été fait à Gatineau pour le bassin Moreau, etc. Les nouveau critères de drainage d'Ontario demandent un plan directeur avant tout développement.

L'étude présente pour le ruisseau des Fées est basée sur des données limitées et étudie un nombre réduit d'options. Elle peut être considerée toutefois comme un plan directeur préliminaire. Son objectif est surtout de présenter les aspects liés à l'étude du secteur aval proposé pour un développement résidentiel.

2. MÉTHODES ET RÉSULTATS SANS CONTRÔLE DU RUISSELLEMENT

Les débits sont simulés avec le modèle OTTHYMO qui a été aussi utilisé à Aylmer et Gatineau (annexe 1). OTTHYMO (Modèle Hydrologique de l'Université d'Ottawa) permet d'obtenir des hydrogrammes pour différents sous-bassins. Ces hydrogrammes sont acheminés dans le ruisseau et additionés aux point critique. Le modèle a été vérifié sur de nombreux bassins ruraux et urbains et il a été utilisé dans la plupart des plans directeurs d'Ontario, ou il est recommandé par les nouveaux critères de drainage établis par cette province, ainsi que par la ville de Laval, Montréal Est, etc. La division en sous-bassins est montrée dans les figures 3A pour la situation présente et 3B pour la situation future (urbanisation). Les coefficients de ruissellement ont été choisis après des discussions avec Les Consultants de l'Outaouais qui ont étudié sur le terrain la nature des sols.

Le modèle utilise des "pluies de projet" déterminés à partir des courbes intensité-durée-fréquence ou des orages "historiques" qui ont causé des dégats dans la région. Les orages utilisés dans cette étude sont les mêmes que dans les plans directeurs d'Aylmer et ils sont montrés dans la figure 4.

Les résultats sont des hydrogrammes avec lesquels on peut déterminer les volumes de stockage pour les réservoirs pluviaux. Pour nos objectifs il est surtout intéressant de comparer les débits de pointe avant et après l'urbanisation totale du bassin qui sont donnés dans le tableau 2.

On peut observer un accroissement considérable des débits. Dans la zone résidentielle et à la sortie du bassin, le débit de 100 ans augmente de 47 m^3/s à 82,4 m^3/s. Cette augmentation est en partie causée par le coefficient de débit relativement réduit dans les conditions rurales, à cause des zones sableuses. (Des calculs préliminaires ont indiqué que pour un sol argileux le débit de 100 ans serait 30.6 m^3/s.) Les résultats pour différents temps de retour sont montrés dans le tableau 2.

Il faut remarquer que sans des mesures de débits pour calibrer le modèle les débits ruraux donnent une ordre de grandeur. Par contre les débits après urbanisation qui sont nécéssaire pour la détermination des niveaux sont plus précis (étant donné que l'effet des pertes par infiltration est moins important).

Des accroissements des débits obtenus dans le tableau 2, où la comparaison est faite pour des pluies torrentielles sont plus critiques pour les effets de l'urbanisation que pour les fontes de neige.

Pour un certain débit on doit déterminer les niveaux avec l'aide d'un modèle de calculs des niveaux en régime non-uniforme (calcul de remous) tel que HEC-2. Pour une analyse préliminaire on a utilisé la formule de Manning (écoulement normal). On obtient dans la zone résidentielle aval les niveaux montrés dans la figure 7.

La figure 9 montre d'une manière approximative les niveaux amont du ponçon existant sous le chemin La Montagne. Ce ponçon a une capacité limitée et pour des débits très rare, la route sera déversée.

La capacité du nouveau ponçon en construction sous la nouvelle route est environ 16,6 m^3/s (soit environ pour un période de retour de 100 ans).

Le ponçon a un diamètre de 2 100 mm, un peu plus grand que celui du ponçon existant qui a un diamètre de 1 820 mm. Les niveaux créés par le ponçon aval peuvent noyer le nouveau ponçon amont. Pour le débit de 100 ans, on trouve aussi une possibilité d'un déversement dans le bassin du ruisseau situé au sud dans la zone de la propriété de l'Institut de recherche du Ministère de l'agriculture.

Le projet de développement doit évidemment assurer la protection contre l'inondation pour une période de retour de 100 ans par des solutions telles que des canalisations digues ou remblais. Un calcul de remous sera donc nécessaire pour la phase finale du projet. Tenant compte des conditions présentes, le contrôle du ruissellement est très important.-

3. URBANISATION PARTIELLE ET CONTRÔLE DU RUISSELLEMENT

La tableau 3 donne les résultats pour trois scénarios étudiés pour les conditions futures (voir schémes dans les figures 8A, 8B, 8C).

α Développement limité à la zone résidentielle du secteur aval (sans réservoir pluvial);

β Développement du bassin entier avec des réservoirs pluviaux dans tous les développements;

γ Développement du bassin entier avec des réservoirs pluviaux dans le secteur amont de la zone industrielle.

Le "reservoir pluvial" peut avoir différentes solutions pratiques telles que stockage dans les parcs, stationnements, toits, etc. Le choix nécéssite données additionnelles, discussions avec la ville, etc. Pour cette étude on donne seulement les volumes. La surface approximative peut être déterminée pour une profondeur moyenne de 1,5 ÷ 2 m.

Dans le scénario α l'accroissement du débit de 100 ans est environ 100 % au lieu de 300 % pour le développement total sans contrôle du ruissellement.

Dans le scénario β le débit pour chaque zone est réduit par des réservoirs à la valeur des conditions présentes. On voit dans le tableau 3 que le débit à la sortie de la zone développée est un peu plus grand que dans les conditions présentes. La différence pour le débit de 100 est toutefois de moins de 10 %. Il est toutefois distribué sur une durée plus grande, donc l'effet d'érosion aval peut être tout de même accru.

Les volumes des réservoirs pluviaux ont les valeurs suivantes:

Bassin résidentiel aval	58 800 m^3
Bassin amont du chemin Pink	296 000 m^3.

Dans le scénario γ on a vérifié la possibilité du contrôle de ruissellement seulement pour la partie amont du bassin. On trouve tel que montré dans le tableau 3 que l'accroissement de débit est de 60 %, ce qui n'est pas acceptable.

4. CONCLUSIONS

Tenant compte de l'accroissement considérable des débits causé dans le cas d'une urbanisation totale du bassin du ruisseau des Fées, il est nécessaire de prévoir un programme de contrôle du ruissellement.

Si la ville de Hull accepte le principe du contrôle du ruissellement, on peut utiliser le modèle développé pour les bassins pour un calcul détaillé des storages.

L'étude préliminaire montre que le storage peut être étapisé en commençant avec 50 800 m^3 dans la zone résidentielle.

L'effet d'érosion du secteur avant demande des études supplémentaires. On peut toutefois considérer que le contrôle des érosions peut conduire à accroissement des volumes indiqués pour le contrôle des débits de pointe. Un accroissement des volumes de 25 % est possible.

Paul Wisner, ingénieur, PhD

Peter Spal, hydrologiste

Tableau 1 Occupation du Sol			
Sous Bassin	**Surface (ha)**	**Type**	**Imperméabilité**
2A	230	Res. 36 per./ac	36 %
2B	23	Res. 36 per./ac	36 %
4A	98	Ind.	75 %
4B	269	Ind.	75 %
7A	62.5	Res. 54 per./ac	45 %
7B	77.8	Res. 54 per./ac	45 %
7C	45.5	36 per./ac	30 %

Tableau 2 Effet de l'urbanisation sans contrôle du ruissellement				
Section du Ruisseau	**Débit 5 ans (mcs)**		**Débit 100 ans (mcs)**	
	Présent	**Futures**	**Présent**	**Futures**
B	2.7	29.6	5.4	54.7
D	6.2	52.0	12.9	95.0
G	7.2	45.6	14.7	82.4

Tableau 3 Débit avec contrôle du ruissellement								
Section	**5 Ans (mcs)**				**100 Ans (mcs)**			
	Présent	α	β	γ	**Présent**	α	β	γ
A			20.2	20.2			38.6	38.6
B	2.7	2.7	29.6	29.6	5.4	5.4	54.7	54.7
C			49.2 52.0*	49.2 52.0*			89.0 95.0*	89.0 95.0*
D	6.2	6.2	7.6	7.6	12.9	12.9	13.0	13.0
E		6.8		8.0		13.9		13.2
F		12.0		12.6		22.5		23.1
G	7.2	11.5	9.3	11.8	14.7	23.5	15.9	24.0

*Débit d'entrée dans le reservoir

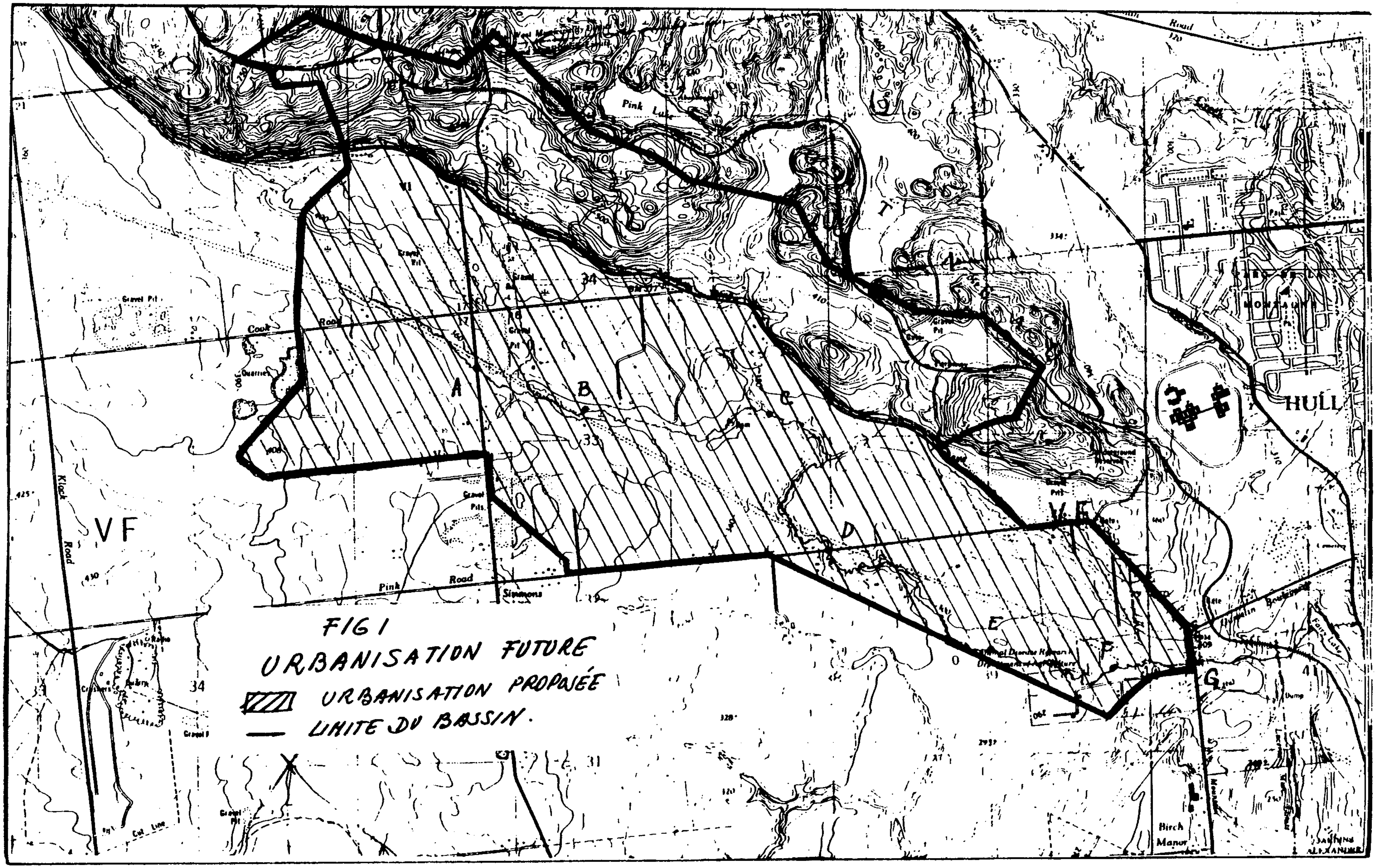


FIG 1
URBANISATION FUTURE

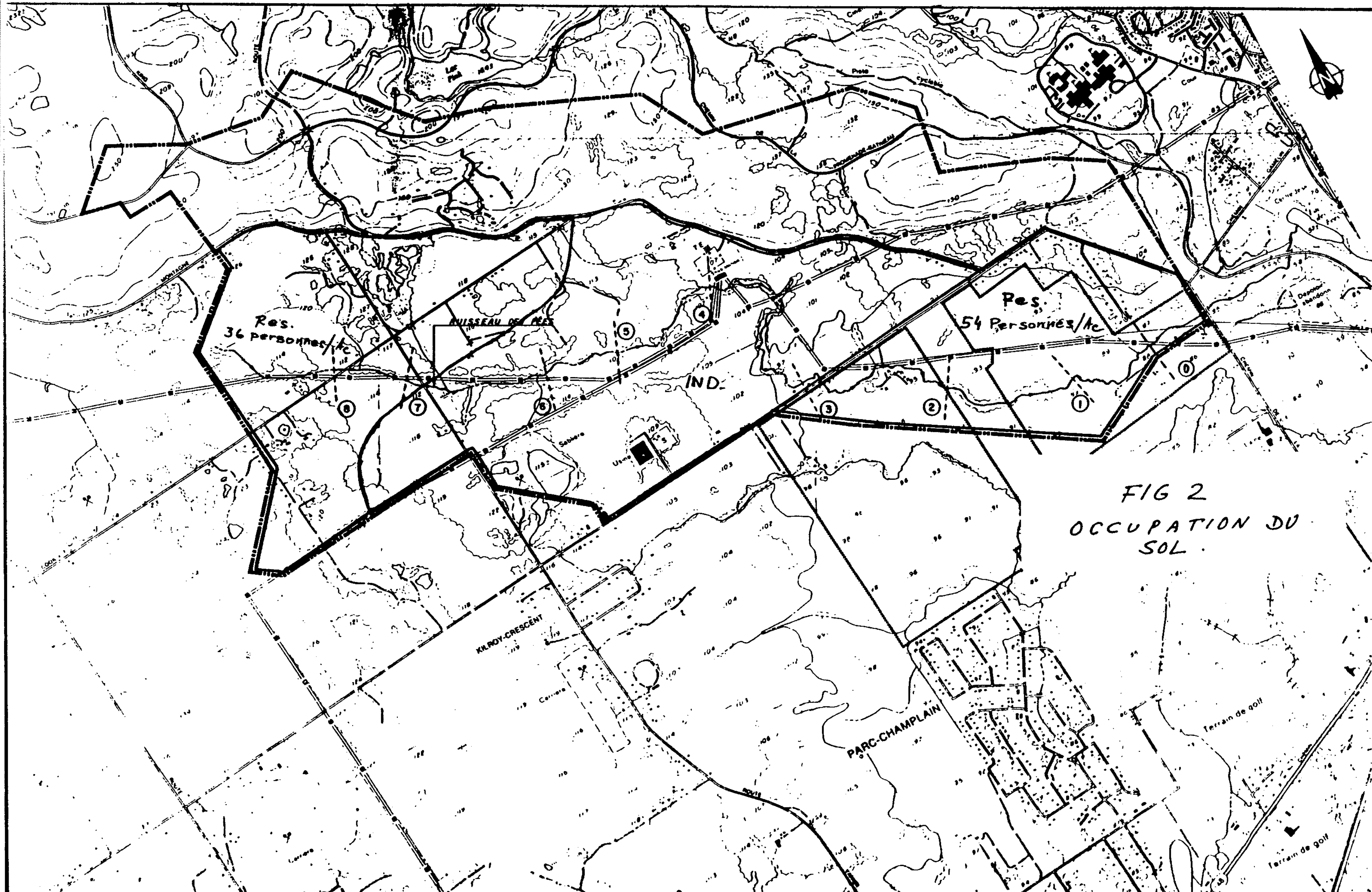


FIG 2
OCCUPATION DU SOL.

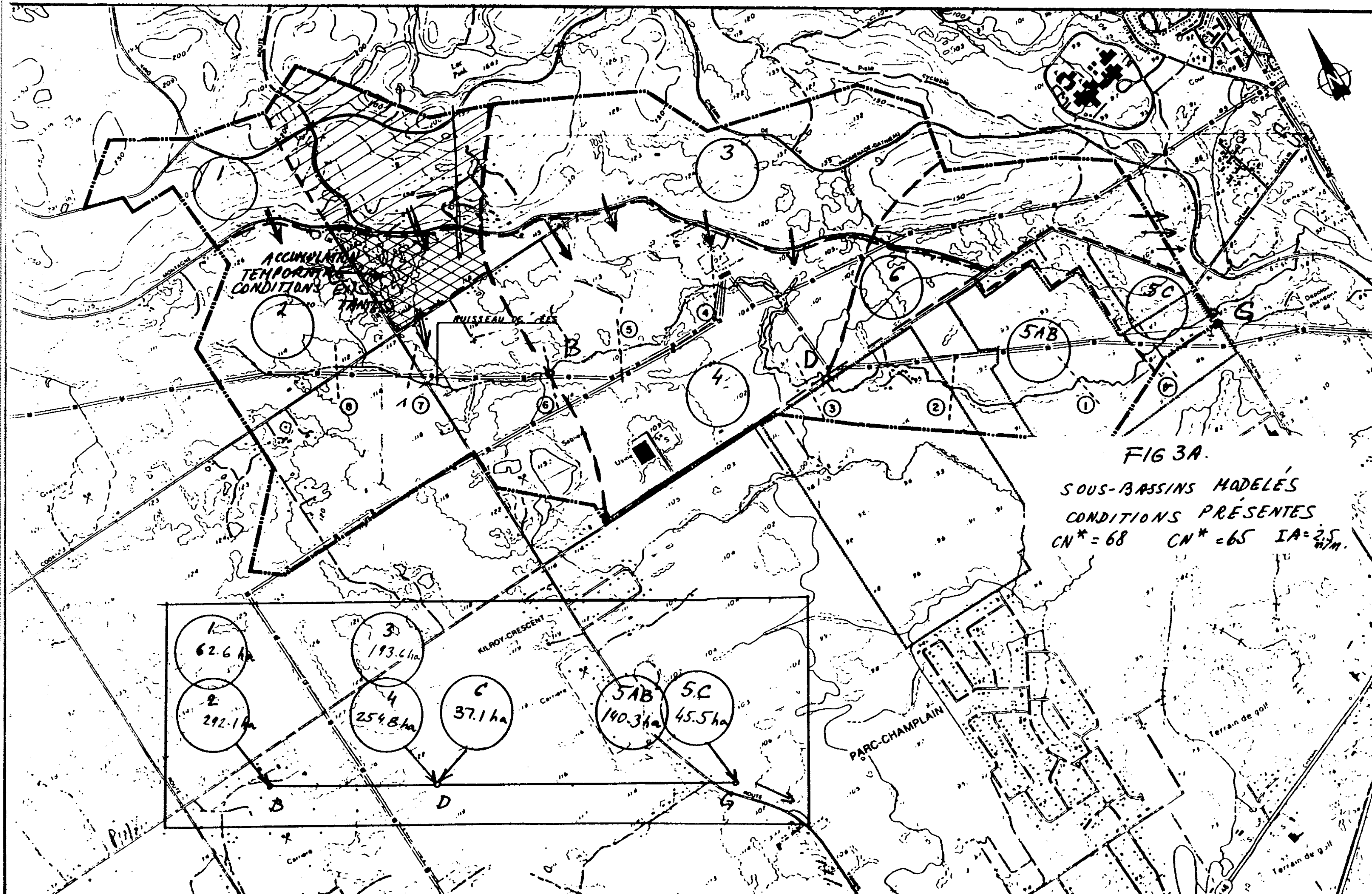


FIG 3A.
SOUS-BASSINS MODELÉS
CONDITIONS PRÉSENTES
CN* = 68 CN* = 65 IA = 2.5 m/m.

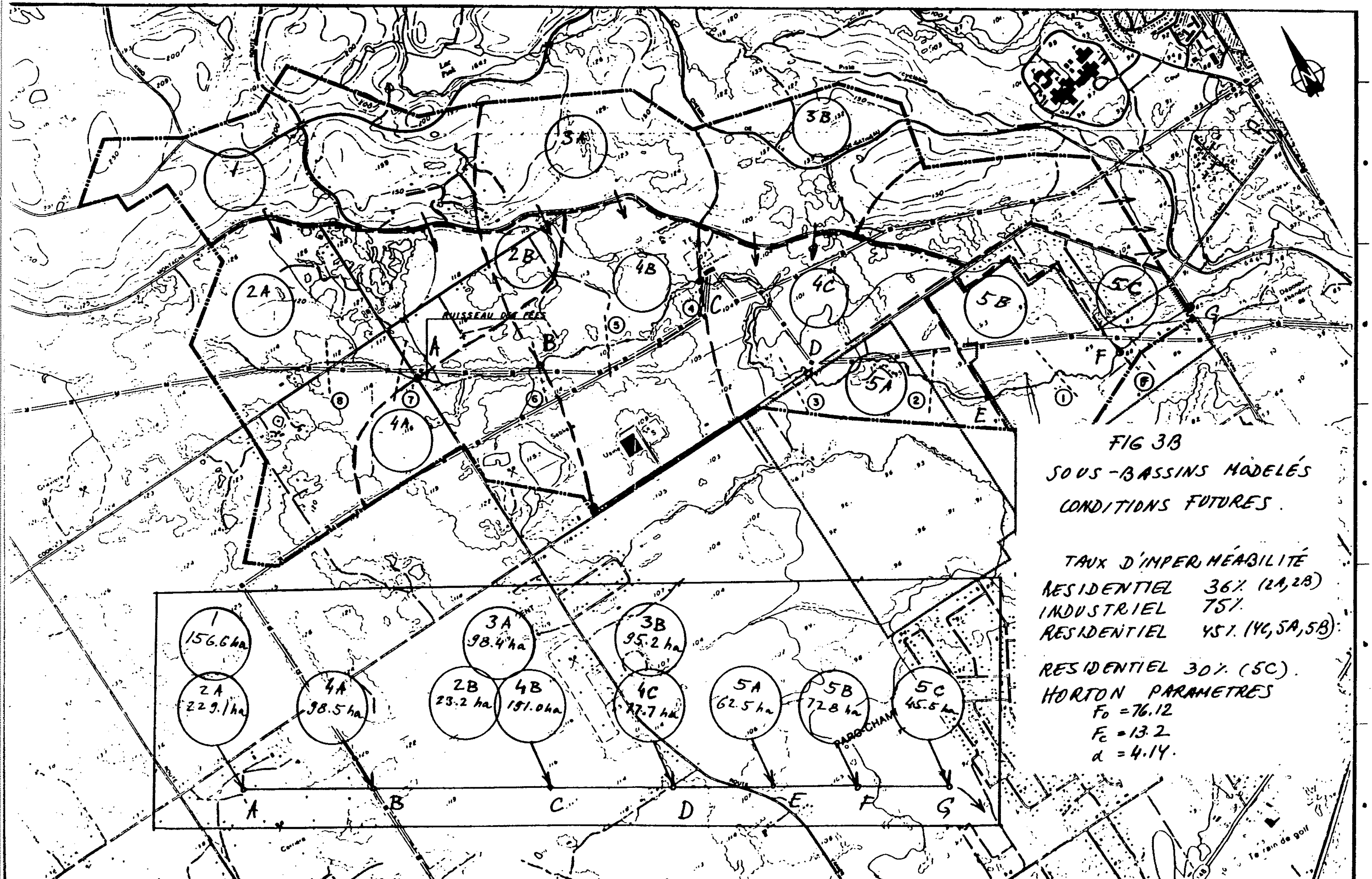


FIG 3B
SOUS-BASSINS MODELÉS
CONDITIONS FUTURES.
TAUX D'IMPERMÉABILITÉ
RESIDENTIEL 36% (2A, 2B)
INDUSTRIEL 75%
RESIDENTIEL 45% (4C, 5A, 5B)
RESIDENTIEL 30% (5C)
HORTON PARAMETRES
Fo = 76.12
Fc = 13.2
α = 4.14
1 156.6 ha
2A 229.1 ha
4A 98.5 ha
3A 98.4 ha
2B 23.2 ha
4B 151.0 ha
3B 95.2 ha
4C 77.7 ha
5A 62.5 ha
5B 72.8 ha
5C 45.5 ha
A
B
C
D
E
F
G
RUISSEAU DES FÉES

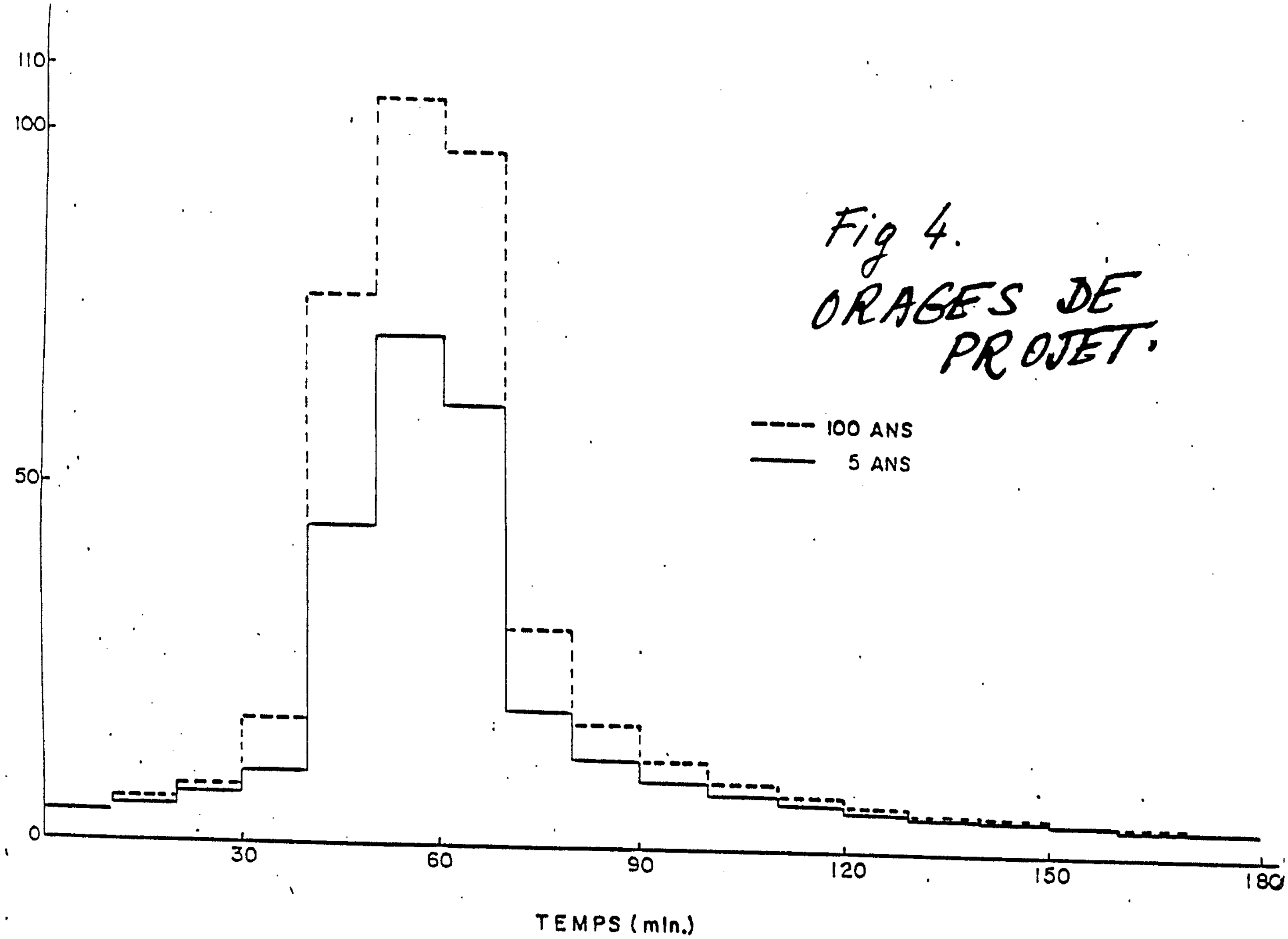


Fig 4.
ORAGES DE PROJET.

VALEUR EN mm/hr

TEMPS/min.	5 ANS	100 ANS
10	4.23	4.92
20	5.27	6.35
30	7.07	8.95
40	11.52	18.54
50	45.05	78.42
60	72.96	107.19
70	62.52	99.64
80	19.19	31.1
90	12.59	17.51
100	9.5	12.65
110	7.67	9.85
120	6.46	8.05
130	5.59	6.81
140	4.94	5.89
150	4.44	5.2
160	4.03	4.65
170	3.7	4.21
180	3.42	3.85

FIG 5 HYDROGRAME T = 100 ANS (PRESENT)

POINT 6 (CHEMIN DE LA MONTAGNE).

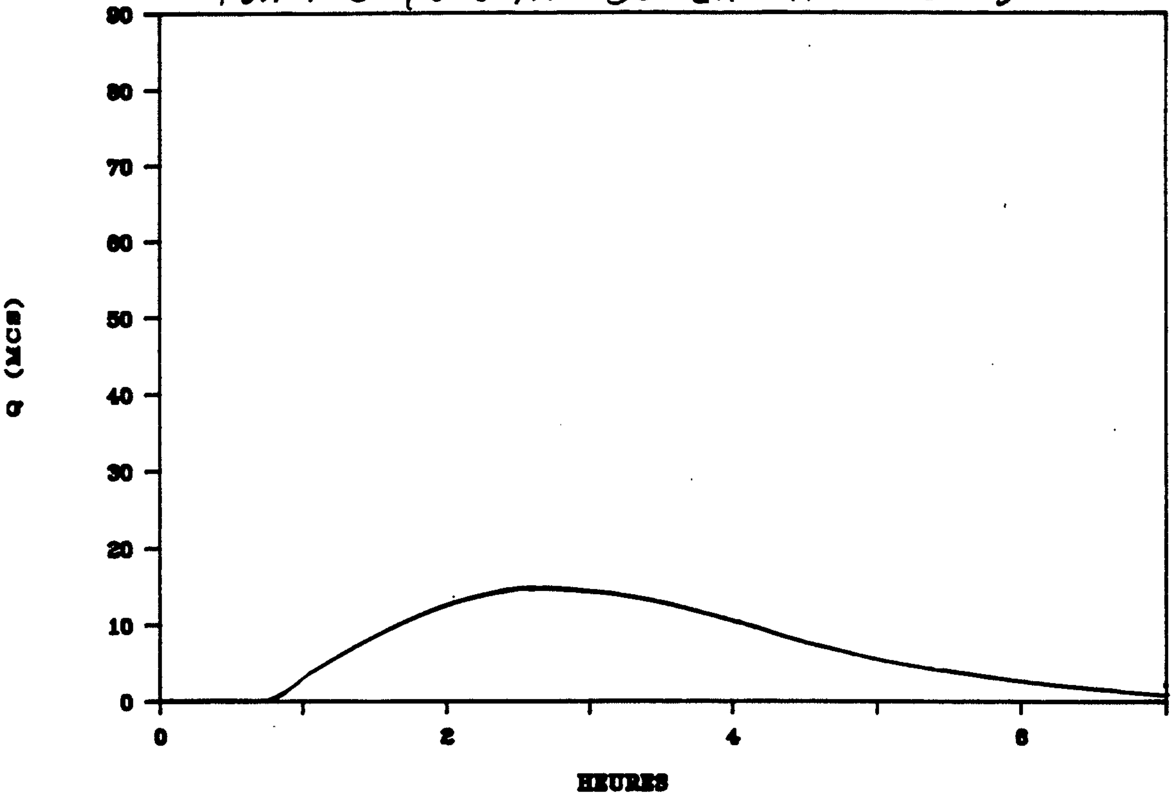
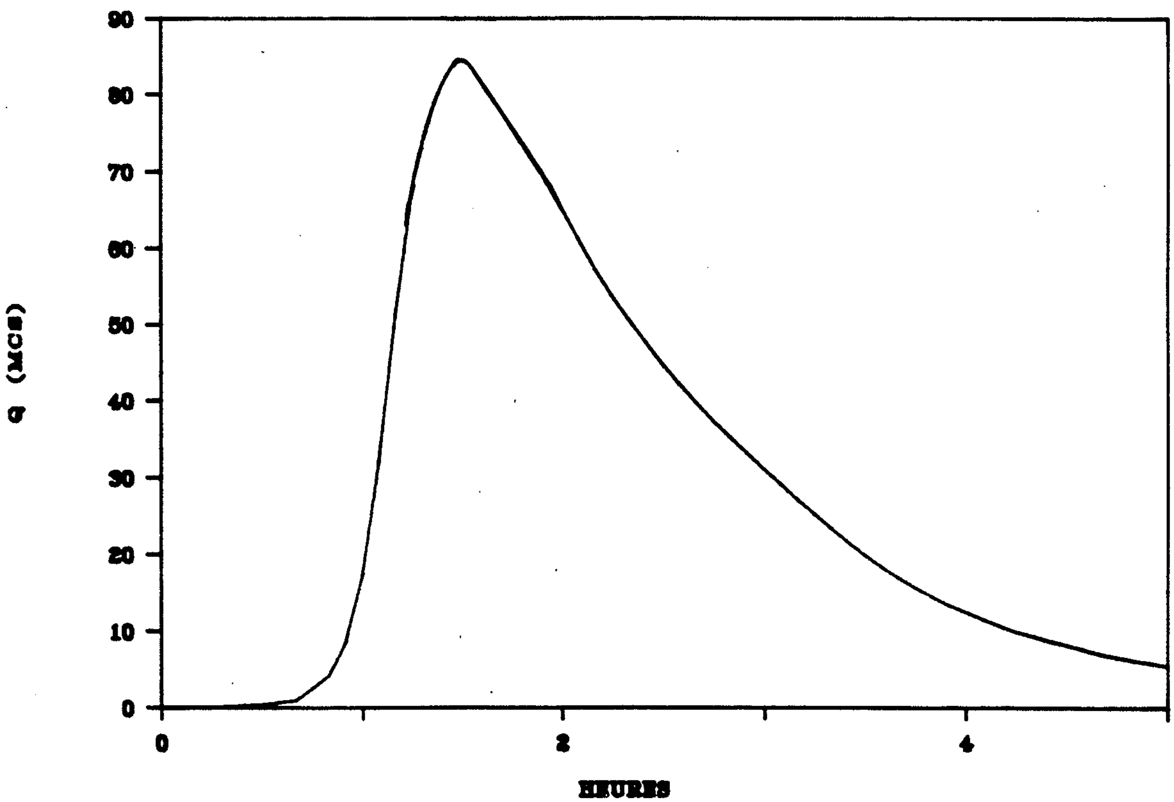
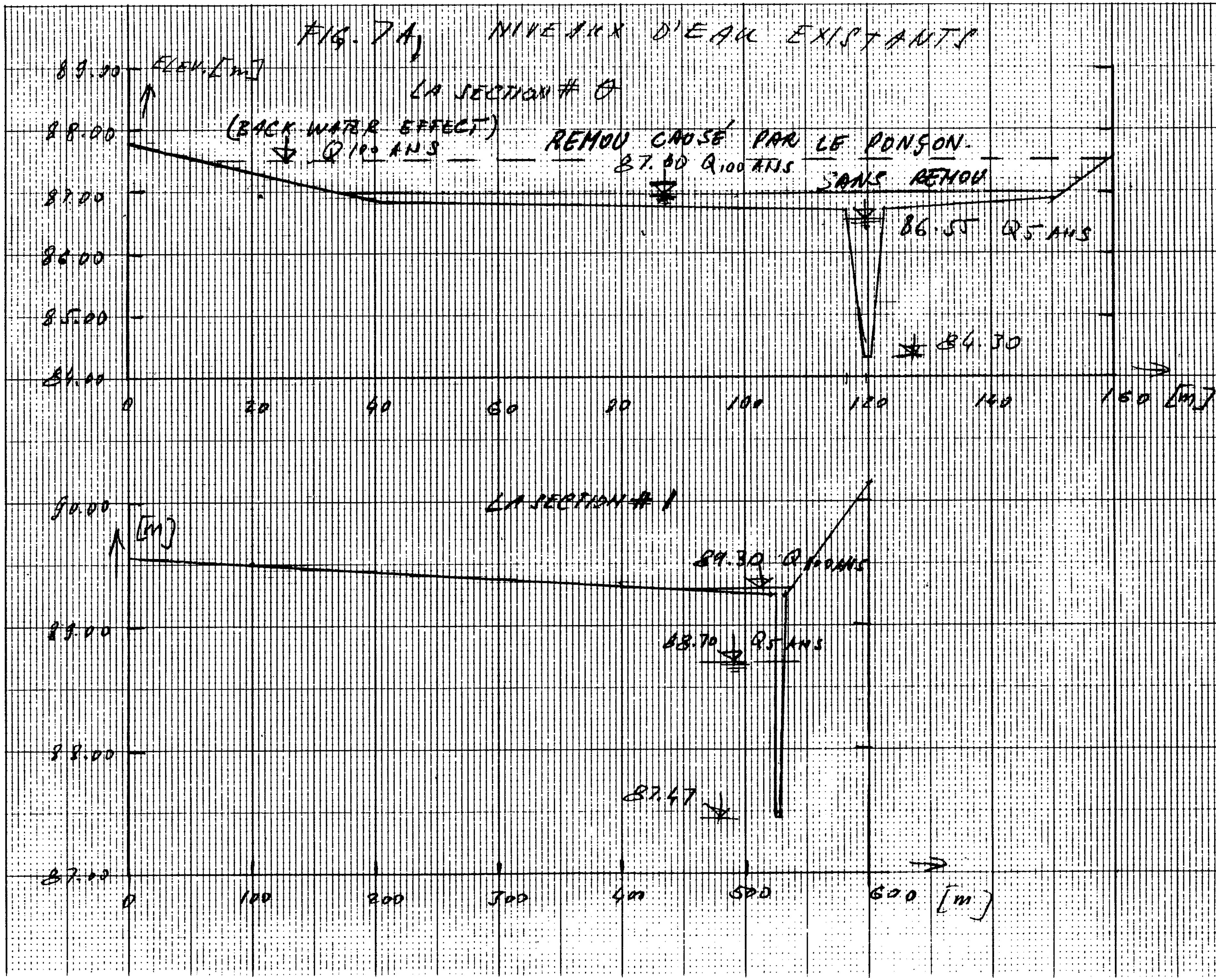


FIG 6 HYDROGRAME T = 100 ANS (FUTUR)





W98060 20 X 20

les cours d'eau, canaux ou conduites est en général non-continu, non-uniforme et ne peut être décrit qu'avec l'aide des équations dynamiques complètes de mouvement et de continuité connues sous le nom d'équation de St-Venant. Une solution directe de ces équations n'est pas possible et leur résolution pour "l'acheminement hydraulique" se fait à l'aide de méthodes numériques ou par différence finie (par exemple la méthode implicite du modèle HVM-Dorsch ou celle explicite du modèle WRE-Transport) ou alors par simplification de ces équations en utilisant les différentes formes de la méthode de la cinématique des ondes. Pour "l'acheminement hydrologique" les méthodes sont dérivées des relations de stockage où le débit sortant d'un bief à un temps (t+Δt) est une fonction linéaire du débit entrant à un temps (t) et (t+Δt) et du débit sortant au temps (t).

II.4.1 Acheminement par des conduites

Le modèle OTTHYMO possède une nouvelle commande appelée KINROUTE pour acheminer les hydrogrammes par des conduites. Des tests ont montré que l'acheminement par KINROUTE donne des résultats proches de ceux obtenus par des modèles dynamiques plus complets de systèmes de drainages, ceci pour des pentes rencontrées généralement dans la pratique (Réf. no

KINROUTE est un modèle du type Cunge-Muskingum qui permet la représentation de l'atténuation des ondes. Cette méthode diffère de celles qui cherchent des solutions directes des équations cinématiques des ondes. Le système de résolution est simple et les paramètres sont fonctions des caractéristiques physiques et hydrauliques des conduites. Un des avantages sur les solutions numériques est qu'il est possible de faire varier les paramètres du modèle (en particulier la vitesse de l'onde) avec la variation du débit.

Le modèle utilise la relation de la cinématique des ondes dans la forme:

$$\frac{1}{C}\frac{\partial Q}{\partial t} + \frac{\partial Q}{\partial X} = 0$$

Fig. 8A ALTERNATIVE α

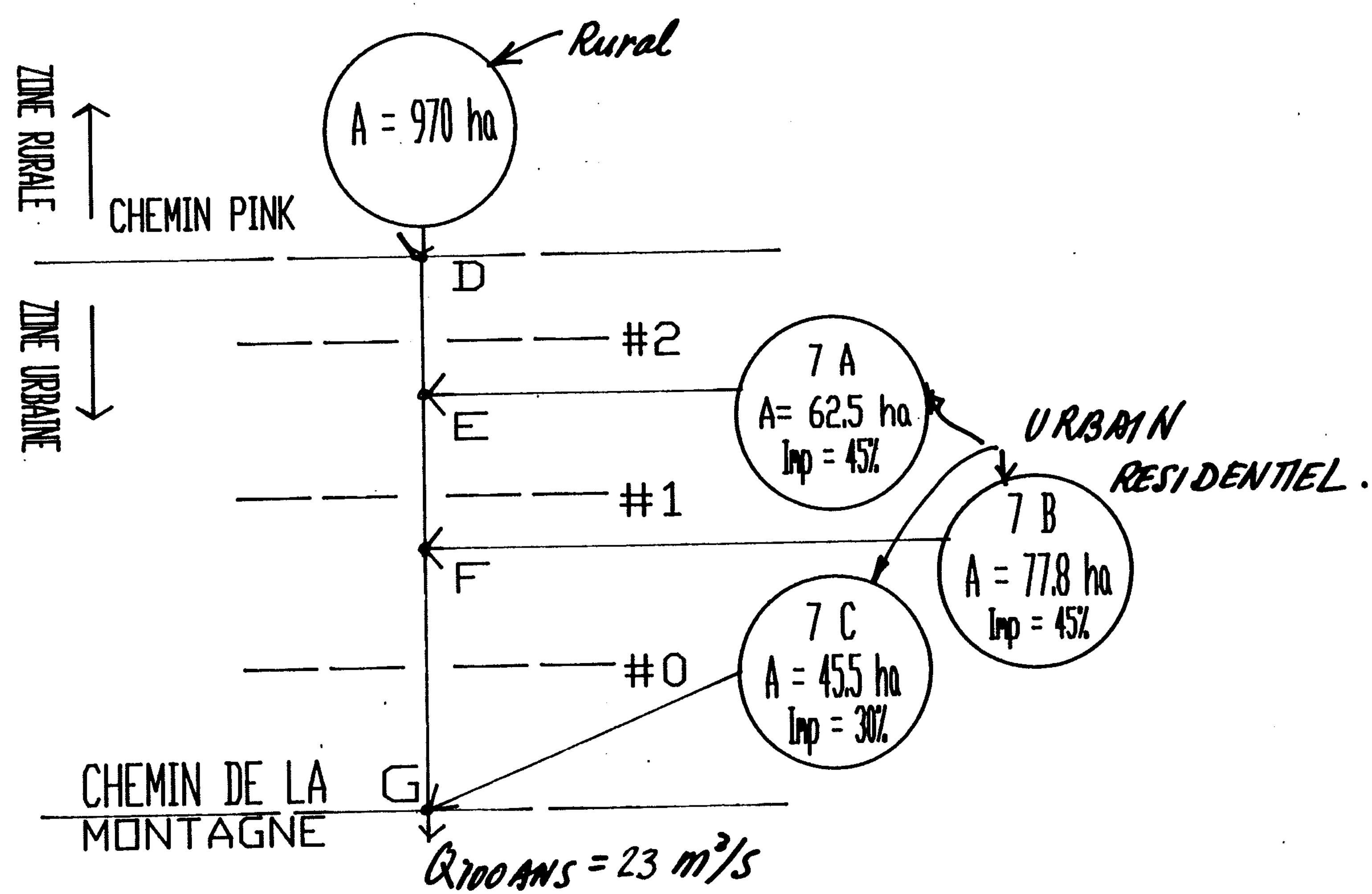


Fig. 8B. ALTERNATIVE β

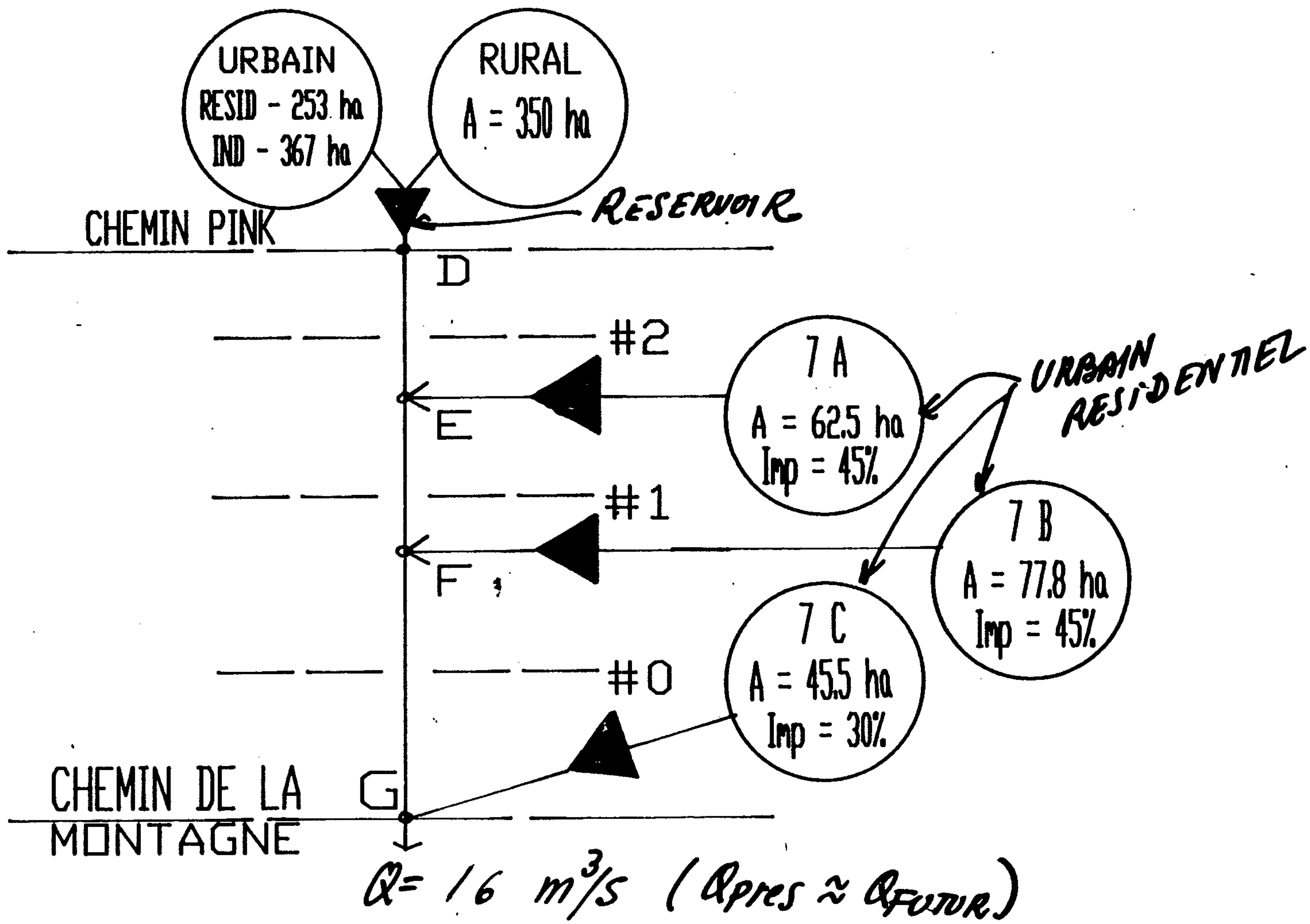
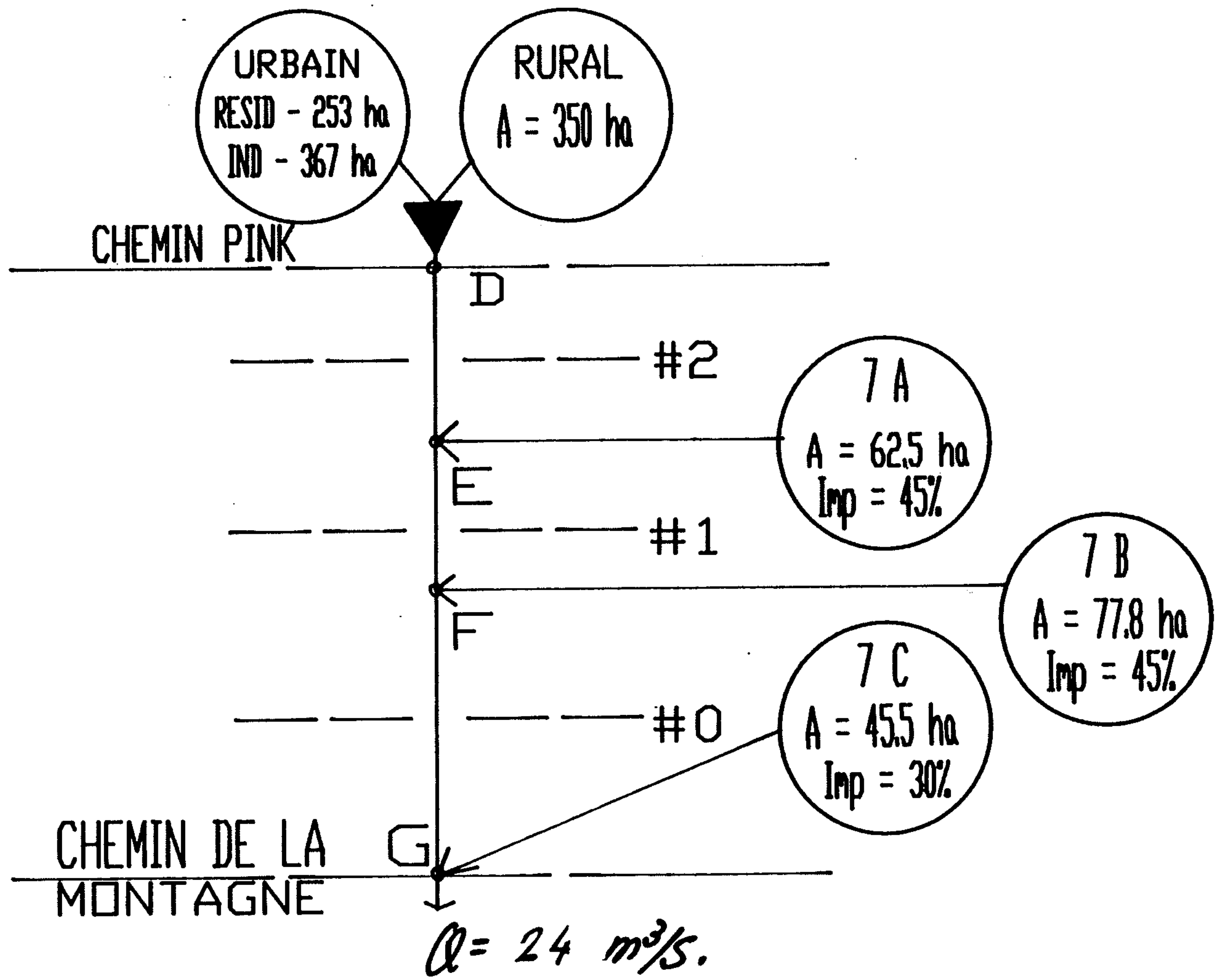


Fig. 8C. ALTERNATIVE 8c



ANNEXE 1

Modéle OTTHYMO
Modéle Hydrologique de
L'Univeristé Ottawa

I PRESENTATION D'OTTHYMO

Les modifications apportées au modèle Hymo ont été effectuées afin d'adapter ce modèle aux études de systèmes de drainage et aux simulations des hydrogrammes des bassins-versants en partie urbanisées.

Les compléments principaux apportés à HYMO sont les sous-programmes:

COMPUTE URBHYD pour la simulation des surfaces urbanisées en tenant compte des différentes réponses des zones imperméables et perméables.

KINROUTE pour acheminer les hydrogrammes, par la méthode de la cinématique des ondes, dans les conduites et déterminer leurs diamètres.

Le modèle possède d'autres modifications, incluant un programme pour l'écoulement un milieu rural basé sur le modèle de Nash (COMPUTE NASHYD) et une amélioration de la procédure pour le calcul des pertes par infiltration. En outre, OTTHYMO peut être utilisé soit en unités anglaises soit en unités métriques.

Les principes d'utilisation d'OTTHYMO sont les mêmes que ceux de HYMO. Dans une application typique, OTTHYMO simule les hydrogrammes pour chaque sous-bassin, achemine les hydrogrammes par un cours d'eau ou une conduite et les additionne à l'aval.

Le programme calcule de l'amont vers l'aval en utilisant les ouvrages de drainage, (conduites ou canaux) jusqu'à l'exutoire. Il est également possible d'acheminer les hydrogrammes par des réservoirs dans le but d'une étude du contrôle de l'écoulement. Les principes de base d'OTTHYMO seront mieux illustrés par un simple exemple (exemple 1).

Il y a trois types d'opérations:

a) les opérations d'exécutions pour ajouter, imprimer, dessiner les hydrogrammes

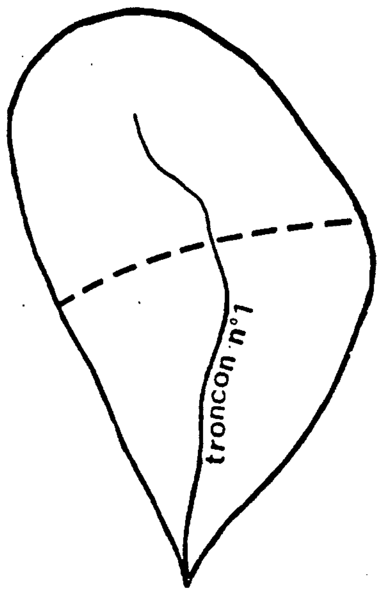
b) les opérations de simulation des hydrogrammes pour chaque sous-bassin

c) l'acheminement par des cours d'eau, conduites ou réservoirs.

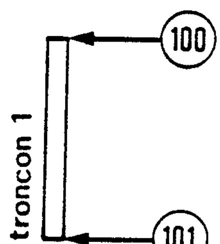
Chacune de ces opérations s'effectue à l'aide d'une "commande" indiquant le sous-programme à utiliser. L'utilisateur spécifie la commande et les autres données comme entrée, dans un certain ordre, mais avec format libre. Les hydrogrammes calculés et la description des tronçons du cours d'eau sont chacuns identifiés par un identificateur "ID" pour le stockage, temporaire, en mémoire. Le programme accepte 6 "ID" à la fois pour les hydrogrammes. Malgré cette limitation en réutilisant ceux-ci, il est possible de faire une simulation avec un grand nombre de sous-bassins.

Exemple n° 1

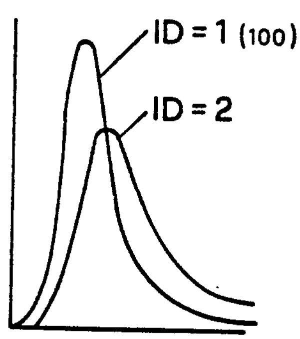
principe de bases de l'utilisation de OTTHYMO



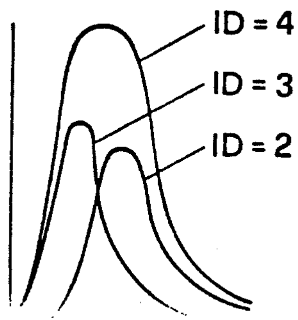
1. Calcul de l'hydrogramme pour le sous-bassin 100 (et lui donner une identité: ID = 1) (commande COMPUTE NASHYD et COMPUTE HYD)



2. Acheminer l'hydrogramme (ID = 1) par le canal (tronçon n° 1). L'hydrogramme acheminé est modifié et reçoit une nouvelle identité (ID = 2) (commande ROUTE associée avec COMPUTE RATING CURVE et COMPUTE TRAVEL TIME ou commande KINROUTE pour les conduites)



3. Calcul de l'hydrogramme du sous-bassin 101 (et lui donner une identité; ID = 3) (commande COMPUTE URBHYD)



4. Faire la somme des hydrogrammes ID = 2 et ID = 3 et donner une nouvelle identité à l'hydrogramme résultant (ID = 4) (commande ADDHYD)

II PROCEDURES HYDROLOGIQUES UTILISEES PAR OTTHYMO

Ce chapitre décrit brièvement la procédure de calcul pour la simulation des hydrogrammes et leur acheminement par une rivière ou dans un réservoir. Des précisions au sujet de ces procédures figurent au chapitre IV.

II.1 Rappel des principes de base de la simulation des hydrogrammes

Chaque sous-programme calculant un hydrogramme est composé de deux sous-modèles.

1. Un premier sous-modèle qui calcule les pertes totales de la précipitation en tenant compte de la rétention initiale ou du stockage dans les dépressions de surface de même que de l'infiltration.

2. Un deuxième sous-modèle qui transforme la pluie nette en ruissellement simulant la réponse du bassin-versant à la précipitation excédentaire.

Si la réponse instantanée du bassin-versant, c'est-à-dire l'hydrogramme unitaire instantané (HUI), est connue, l'hydrogramme peut être déterminé par intégration de l'HUI. En pratique, cette transformation est effectuée par pas de temps fini. Celui-ci ne doit pas être plus grand que le cinquième, environ, du temps de concentration.

Dans un modèle conceptuel, la forme de l'HUI est définie par une équation mathématique. Le modèle conceptuel le plus simple fait l'hypothèse d'un bassin-versant se comportant comme un "réservoir linéaire" dans lequel le stockage S est directement proportionnel au débit sortant Q. ($S = K\,Q$). Un tel modèle possède un unique paramètre K qui est le coefficient de stockage du réservoir linéaire. D'autres modèles, tel que celui proposé par Nash (1957), sont composés d'une cascade de n réservoirs, linéaires et égaux, et ont 2 paramètres. Il est possible d'augmenter le degré de liberté en utilisant des modèles conceptuels composés de cascades de réservoirs en parallèles tels que ceux proposés par Wittenberg (1975) et

Diskin (1978). Il existe donc de nombreux modèles conceptuels linéaires utilisant diverses combinaisons de réservoirs (Dodge, 1973). Des modèles non-linéaires qui tiennent compte de la non-linéarité de la réponse du bassin-versant existent également (Ding, 1974).

Deux facteurs principaux doivent être pris en compte pour la conception d'un modèle opérationnel.

1. Le nombre minimum de paramètre à calibrer.
2. La possibilité de simuler une surface urbanisée d'une façon détaillée.

II.2 Simulation de l'hydrogramme pour des bassins ruraux

Les commandes COMPUTE NASHYD et COMPUTE HYD sont utilisées pour la simulation des bassins ruraux.

II.2.1 COMPUTE NASHYD

Cette commande utilise la procédure modifiée du CN pour calculer les pertes et le modèle de Nash (1957) pour calculer l'hydrogramme unitaire. Le modèle de Nash est un modèle conceptuel utilisant une cascade de n réservoirs linéaires. On peut montrer que le débit à la sortie du dernier réservoir au temps t est:

$$q(t) = \frac{1}{K_n \quad \Gamma(n)} e^{-t/K_n} (t/K_n)^{n-1}$$

où $\Gamma(n)$ est la fonction gamma

n le nombre de réservoirs

K_n le coefficient de stockage de chaque réservoir.

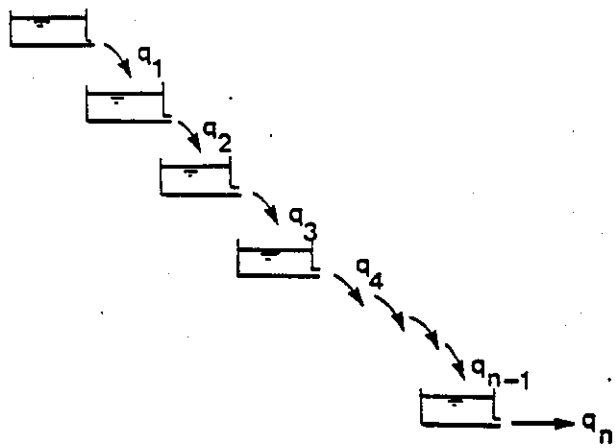


Fig. 2.1 : Cascade de réservoirs linéaires (Nash, 1957)

Cette relation est utilisée pour définir la forme de l'hydrogramme unitaire instantané (HUI). Pour dq/dt = 0, le débit étant maximum nous trouvons que le temps de montée t_p est fonction de n et K_n.

$$t_p = (n-1)K_n$$

Le HUI peut être exprimé en un terme sans dimensions par les paramètres de l'équation de la distribution gamma:

$$q = q_p \; [t/t_p]^{(n-1)} e^{(1-n)(t/t_p-1)}$$

Deux paramètres doivent être déterminés pour obtenir l'hydrogramme unitaire. Si n peut être déterminé, alors il ne reste qu'un seul paramètre à fixer. A partir d'un nombre limité de simulations sur des petits bassins-versants, il a été trouvé en première approximation que n = 3. Une discussion des valeurs de t_p est donnée en appendice B.

Le calcul des pertes par le SCS (Soil Conservation Service) a été légèrement modifié.

L'équation de transformation de la précipitation en volume ruisselé est:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

où Q = volume ruisselé en mm
P = précipitations totales (mm)
S = pertes potentielles totales en paramètre de stockage
I_a = pertes initiales.

Les courbes CN du SCS sont fréquemment utilisées. S est relié au CN par CN = 25400 /(254+S) (en unités métriques). La sélection du CN est basée sur 4 groupes de sols différents, A,B,C,D et sur la couverture végétale. Le sol A correspond à un sol à haut taux d'infiltration tandis que le D à un bas taux d'infiltration. Les tables permettant de fixer le CN se trouvent dans les manuels du SCS tel que le NEH-4 et le SCS TR-55.

Le modèle Hymo, ainsi que d'autres modèles, font l'hypothèse que les pertes initiales sont égales aux 20 % des pertes par stockage, I_a= 0.2 S, ce qui réduit le nombre de paramètre à ún. Mais cette hypothèse amène quelquefois à des résultats erronés, spécialement pour des orages de courtes durées et de hautes fréquences. Le volume ruisselé calculé est beaucoup plus petit que celui observé. Une étude faite en collaboration avec l'Institut de Génie rural montre que les résultats seront meilleurs si les pertes initiales sont basées sur les observations (Jobin, 1982). Il a été proposé dans la recherche IMPSWM-IGR d'utiliser l'indice de précipitation antécédente (IPA) qui est un meilleur indicateur du stockage que les classes AMC de la méthode SCS. Les essais sur le bassin-versant suisse de la Seymaz et les bassins canadiens Etobiwke, Sawmill Creek l'ont confirmé. On déterminera les pertes initiales de la façon suivante: (Cette méthode conduira par la suite à la calibration du paramètre CN qui sera noté CN*).

Initialement, il s'agit d'analyser les débits pour savoir si oui ou non une précipitation a engendré un ruissellement. Chaque événement est reporté sur un graphe, avec en ordonnée la précipitation et l'IPA en abscisse, en distinguant si il a provoqué ou non un ruissellement. Nous pouvons ainsi tracer une courbe séparant les différents événements. Cette courbe représente le seuil de ruissellement. Ainsi pour un état antécédent d'humidité du sol donné nous pourrons tirer une valeur qui représente la hauteur minimale de pluie qui doit précipiter avant qu'un ruissellement ne se produise. Cette valeur qui est en fait égale aux pertes initiales a été déterminée dans les bassins mentionnés plus haut comme étant plus petite que 0,2S. Cette procédure améliore largement la calibration. Ainsi, la commande COMPUTE NASHYD permet que l'on spécifie les pertes initiales.

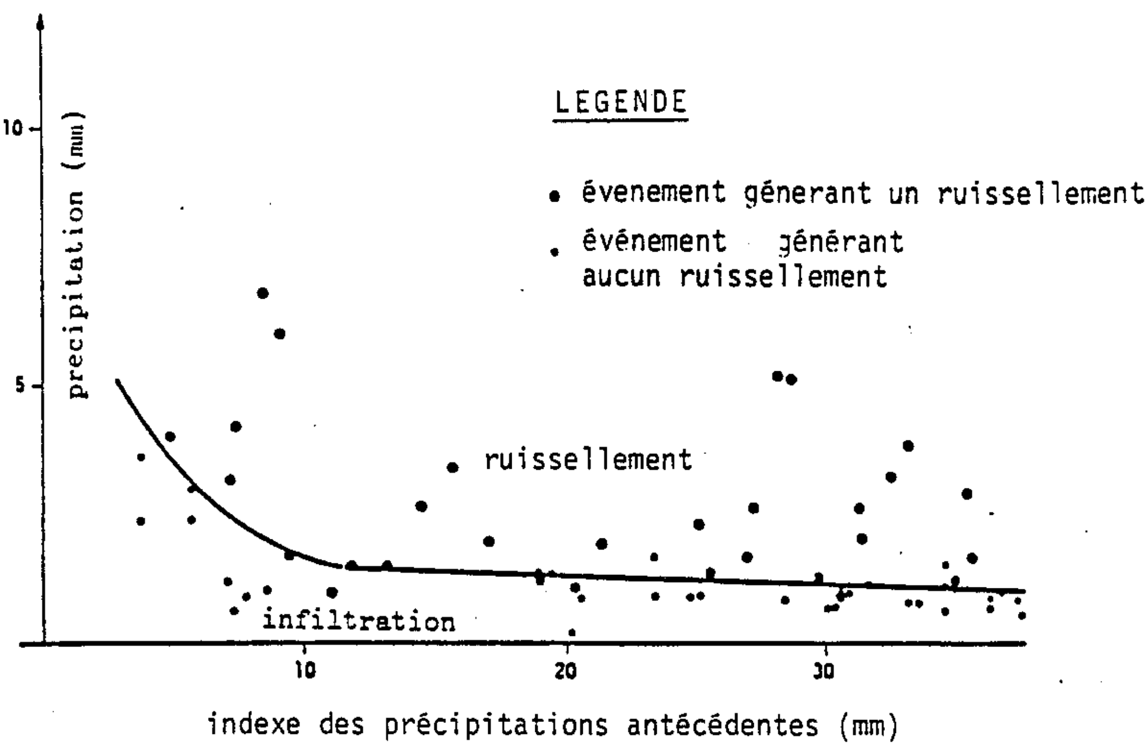


Fig. 2.2 : Seuil de ruissellement pour le bassin-versant de la Seymaz. (Réf. no

II.2.2 COMPUTE HYD

Cette commande utilisée dans le modèle original HYMO a subi quelques modifications. Les précipitations sont dorénavant introduites sous forme d'un hyétogramme et les pertes initiales peuvent être fixées par l'utilisateur.

L'HUI se compose de trois parties.

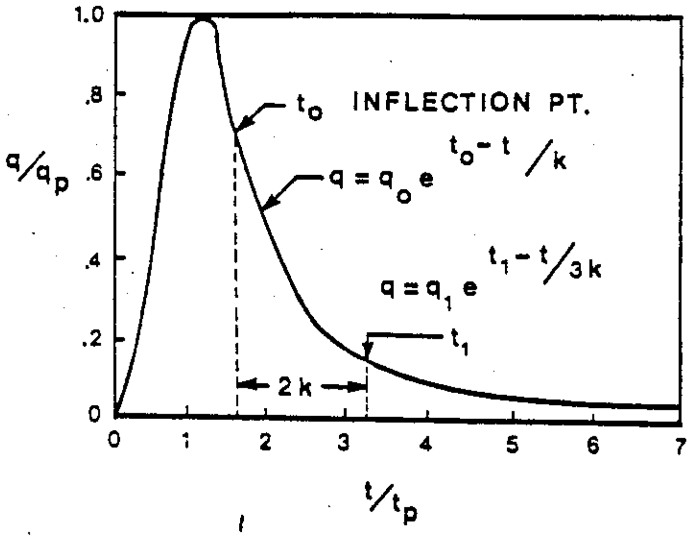


Fig. 2.3 : Hydrogramme unitaire sans dimension

La permière partie, du début de la montée jusqu'au point d'inflexion, t_0, est calculée par l'équation de la distribution gamma à 2 paramètres (éq.p. 6). Les autres équations sont sur la figure 2.3.

Le paramètre de forme sans dimension, n, est une fonction de K/t_p et q_p est une fonction de n et t_p. Ainsi, il n'y a besoin que de 2 paramètres, K et t_p, pour calculer l'HUI (le manuel d'utilisation de HYMO donne des relations empiriques pour K et t_p en fonction des caractéristiques du bassin-versant. Ces relations sont basées sur les bassins du sud des Etats-Unis et ne sont pas applicables ailleurs).

II.3 Simulation de l'hydrogramme pour des bassins urbains

II.3.1 COMPUTE URBHYD

Cette commande est utilisée pour simuler les hydrogrammes des zones urbaines. Elle fait appel à un modèle conceptuel utilisant deux réservoirs linéaires en parallèle, (fig. 2.4) pour simuler les hydrogrammes des parties perméables et imperméables du bassin-versant (P'ng, 1982).

Hydrogramme unitaire

Dans un réservoir linéaire, le stockage S est directement proportionnel au débit sortant Q.

$$S = K.Q$$

où K est le coefficient de stockage.

L'hydrogramme unitaire de durée Δt pour un réservoir linéaire peut être obtenu par les deux équations suivantes:

$$Q_p = I\,(1 - e^{-\Delta t/K})$$

$$Q = Q_p\, e^{-\zeta/K}$$

où Q_p = débit maximum de l'hydrogramme unitaire
Q = ordonnée au temps ζ
ζ = $t - \Delta t$
I = débit entrant

Différentes relations basées sur le temps d'équilibre calculé à partir de la théorie cinématique des ondes sont utilisées pour obtenir le coefficient de stockage de deux réservoirs linéaires (ex. Neuman, 1977, Pedersen, 1980). Elles ont été testées. Ces relations font l'hypothèse que le bassin-versant peut être représenté par une surface plane. Dans OTTHYMO, le coefficient de stockage utilisé est celui de Pedersen (1980) qui est égal à la moitié du temps d'équilibre obtenu par la méthode des ondes cinématiques.

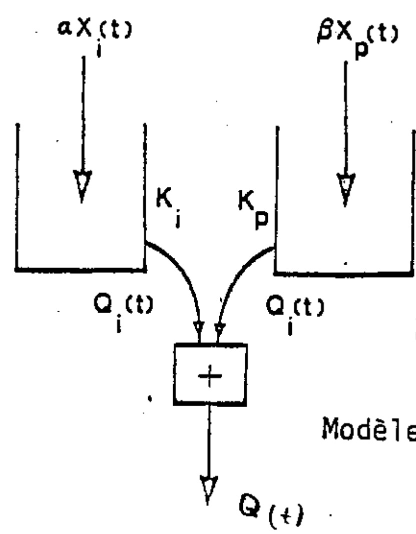


Fig. 2.4 :

Modèle de deux réservoirs parallèles

L'équation pour le coefficient de stockage est:

$$K = \frac{a\, L^{0.6}\, n^{0.6}}{i^{0.4} S^{0.3}}$$

où K = coefficient de stockage

L = longueur de parcours du ruissellement superficiel sur le bassin-versant (m)

n = coefficient de rugosité de Manning

i = intensité maximale de la pluie nette (mm/hr)

S = pente (%)

a = coefficient

Le coefficient de stockage est différent pour les deux réservoirs linéaires afin de tenir compte des temps de réponse des parties perméables et imperméables du bassin-versant.

Volume ruisselé

La commande, à partir d'un hyétogramme d'entrée (mm/hr) calcule deux distributions de pluie nette. La pluie nette de la partie imperméable est obtenue après déduction du stockage dans les dépressions. La pluie tombant sur la surface imperméable non directement connectée est supposée tomber sur la surface perméable. Les pertes pour les surfaces perméables sont calculées en tenant compte des pertes par infiltration et des pertes par stockage dans les dépressions de surface. Il y a deux options pour calculer les pertes par infiltrations sur la surface perméable. La première option est le calcul de l'infiltration à l'aide de l'équation de Horton, la deuxième est la procédure modifiée, utilisant le CN*, discutée précédemment.

L'équation de Horton est:

$$f = f_c + (f_o - f_c)e^{-\alpha t}$$

ou f_o = taux d'infiltration initial (mm/hr)

f_c = taux d'infiltration final (mm/hr)

α = facteur de décroissance

Les deux pluies nettes calculées sont alors combinées aux hydrogrammes unitaires correspondant pour donner deux hydrogrammes. Ceux-ci sont additionnés pour obtenir l'hydrogramme final du bassin-versant.

Le modèle a été vérifié par comparaison avec des simulations (SWMM) plus détaillées, ceci pour différents bassins-versants, différents taux d'imperméabilités et différentes tailles des bassins. La commande URBHYD a été employée pour des bassins-versants non-discrétisés et donc sans acheminement, et les résultats comparés avec ceux obtenus avec le modèle SWMM qui utilise des bassins-versants très détaillés. La comparaison entre les différents débits de pointe est bonne.

Le modèle a également été vérifié à l'aide des mesures sur les bassins-versants Gray Haven à Baltimore, Malvern à Burlington et Fulton Drive à Edmonton. La figure 2.6 montre la comparaison entre les débits de pointes maximum simulés et mesurés. D'autres comparaisons se trouvent au chapitre IV.

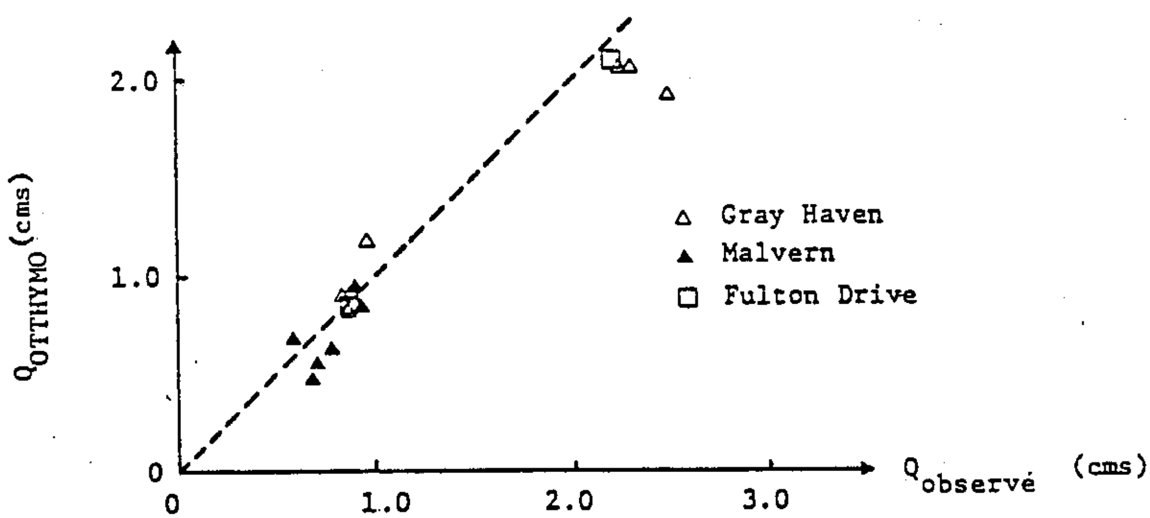


Fig. 2.5 : Comparaison des débits maximum observés et simulés

II.4 Procédures d'acheminement

Les techniques d'acheminement peuvent être classées en "acheminement hydraulique" et "acheminement hydrologique". L'écoulement dans les cours d'eau, canaux ou conduites est en général non-continu, non-uniforme et ne peut être décrit qu'avec l'aide des équations dynamiques complètes de mouvement et de continuité connues sous le nom d'équation de St-Venant. Une solution directe de ces équations n'est pas possible et leur résolution pour "l'acheminement hydraulique" se fait à l'aide de méthodes numériques ou par différence finie (par exemple la méthode implicite du modèle HVM-Dorsch ou celle explicite du modèle WRE-Transport) ou alors par simplification de ces équations en utilisant les différentes formes de la méthode de la cinématique des ondes. Pour "l'acheminement hydrologique" les méthodes sont dérivées des relations de stockage où le débit sortant d'un bief à un temps $(t+\Delta t)$ est une fonction linéaire du débit entrant à un temps (t) et $(t+\Delta t)$ et du débit sortant au temps (t).

II.4.1 Acheminement par des conduites

Le modèle OTTHYMO possède une nouvelle commande appelée KINROUTE pour acheminer les hydrogrammes par des conduites. Des tests ont montré que l'acheminement par KINROUTE donne des résultats proches de ceux obtenus par des modèles dynamiques plus complets de systèmes de drainages, ceci pour des pentes rencontrées généralement dans la pratique (Réf. no

KINROUTE est un modèle du type Cunge-Muskingum qui permet la représentation de l'atténuation des ondes. Cette méthode diffère de celles qui cherchent des solutions directes des équations cinématiques des ondes. Le système de résolution est simple et les paramètres sont fonctions des caractéristiques physiques et hydrauliques des conduites. Un des avantages sur les solutions numériques est qu'il est possible de faire varier les paramètres du modèle (en particulier la vitesse de l'onde) avec la variation du débit.

Le modèle utilise la relation de la cinématique des ondes dans la forme:

$$\frac{1}{C}\frac{\partial Q}{\partial t} + \frac{\partial Q}{\partial X} = 0$$

où C est la vitesse de l'onde qui peut être évaluée par la loi de Kleitz-Seddar:

$$C = \frac{dQ}{dA}_{x=const.} = \frac{1}{B}\,\frac{dQ}{dy}_{x=const.}$$

Q (x,t) est le débit et, x et t sont respectivement les coordonnées de lieu et de temps.

La forme de l'équation est identique à celle du modèle de Muskingum:

$$Q_{i+1}^{j+1} = C_1\;Q_i^j + C_2\,Q_i^{j+1} + C_3\,Q_{i+1}^j$$

$$C_1 = \frac{K\theta + \Delta t/2}{K(1-\theta) + \Delta t/2}\;;\quad C_2 = \frac{-K\theta + \Delta t/2}{K(1-\theta) + \Delta t/2}\;;\quad C_3 = \frac{K(1-\theta) - \Delta t/2}{K(1-\theta) + \Delta t/2}$$

La vitesse de l'onde C est par hypothèse constante. Δx est la longueur du tronçon et K représente le temps de parcours d'un certain débit dont on fait également l'hypothèse qu'il est constant. Le facteur pondéral θ varie avec l'écoulement et peut être obtenu à l'aide de l'équation suivante:

$$\theta = \frac{1}{2}\left(1 - \frac{Q}{BS_o\;C\Delta_x}\right)\;;\quad 0 \leqslant \theta \leqslant 0.5$$

où B est la largeur de la surface d'écoulement
S_o est la pente de la conduite.

En ce qui concerne la précision du modèle cinématique par différence finie, elle peut être considérée comme identique à une approximation du second ordre du modèle de la diffusion des ondes. KINROUTE calcule également le diamètre des conduites.

ANNEXE 2

Résultats Détaillés
Des Simulation

```
*******************************************************************************************
**                                                                                       **
**                       M I C R O H Y M O --- 3                                         **
**                                                                                       **
**                       (P . C . O T T H Y M O)                                         **
**                                                                                       **
**                       V E R S I O N  2.0+                                             **
**                                                                                       **
**                                                                                       **
**                       ADAPTED FOR MICROCOMPUTER BY                                    **
**                                                                                       **
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**                                                                                       **
**                                                                                       **
**                                                                                       **
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**                                                                                       **
*******************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START               RAINFALL BEGIN AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 5   STROM
* PRE-DEV COND.  R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEESSP.OT1
*-----------------------------
* GET INFLOW TO THE POINT -B-
*-----------------------------
*------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD      ID=1 HYD=101 DT=0.0833H  DA=62.6 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                    4.23 4.23 5.27 5.27 7.07 7.07 11.52 11.52 45.05 45.05
                    72.96 72.96 62.52 62.52 19.19 19.19 12.59 12.59 9.5 9.5
                    7.67 7.67 6.46 6.46 5.59 5.59 4.94 4.94 4.44 4.44
                    4.03 4.03 3.7 3.7 3.42 3.42
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        1.52 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =       .660 CMS   RUNOFF VOLUME =    12.71 MM TIME TO PEAK =     2.999 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
PRINT HYD           ID=1 1

                                        HYDROGRAPH FROM AREA 101


     RUNOFF VOLUME =    12.71 MM
     PEAK DISCHARGE RATE =       .660 CMS



*------------------
* SUBAREA 2
*------------------
COMPUTE NASHYD      ID=2 HYD=102 DT=0.0833 H  DA=292.1 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=2.0 H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        5.58 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      1.662 CMS   RUNOFF VOLUME =     8.28 MM TIME TO PEAK =     3.499 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =     .17
ADD HYD             ID=4 HYD=312 IDI=1 IDII=2
    PEAK FLOW =       2.297 CMS     RUNOFF VOLUME =      9.06 MM     TIME TO PEAK=  3.33 HOURS

          ADD HYD        ID=4     HYD NO=312     ID I=1          ID II=2
STORE HYD           ID=6 HYD=102 DT=0.0833 H  DA=285.64 HECT AA=0.0 AB=0.0
                    .0 .0 .0 .0 .2 .2 .3 .3 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4
                    .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4
    TPEAK(  6)=        .8330
PRINT HYD           ID=6 1

                                        HYDROGRAPH FROM AREA 102
```

```
RUNOFF VOLUME =      1.28 MM
PEAK DISCHARGE RATE =       .400 CMS


ADD HYD             ID=3 HYD=312 IDI=6 IDII=4
   PEAK FLOW =       2.662 CMS    RUNOFF VOLUME =      5.59 MM     TIME TO PEAK=  3.08 HOURS

        ADD HYD        ID=3     HYD NO=312     ID I=6         ID II=4
*------------------------------
* INFLOW TO THE POINT -B-
*------------------------------
PRINT HYD           ID=3 1

                                        HYDROGRAPH FROM AREA 312


RUNOFF VOLUME =      5.59 MM
PEAK DISCHARGE RATE =      2.662 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  D
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=100.57
                                       MAXEL=104.24
                                       CHSLP=0.004
                                       FPSLP=0.004
                  N=0.05  DIST=113 N=-0.03 DIST=117 N=0.05 DIST=226
                  0 104.24 100 101.79 110 101.17 113.0 101.17
                  113.8  100.57 116.5 100.57 117 101.30 120 101.52
                  126 102.40 226 102.98
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
100.57	.0	.0
100.76	.6	.4
100.96	1.2	1.2
101.15	1.9	2.3
101.34	3.4	4.2
101.54	6.0	7.2
101.73	9.5	11.6
101.92	14.1	17.1
102.12	20.4	24.9
102.31	28.5	35.4
102.50	39.3	46.7
102.69	57.3	65.4
102.89	83.2	93.4
103.08	116.2	135.2
103.27	151.5	190.8
103.47	188.3	257.2
103.66	226.6	334.1
103.85	266.5	421.4
104.05	307.8	519.1
104.24	350.7	627.1

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                  L=2800  SLP=0.004
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.19	0.	1.1938
.39	1.	.7999
.58	2.	.6417
.77	4.	.6414
.97	7.	.6490
1.16	12.	.6390
1.35	17.	.6401
1.55	25.	.6390
1.74	35.	.6274
1.93	47.	.6540
2.12	65.	.6812
2.32	93.	.6931
2.51	135.	.6689
2.70	191.	.6177
2.90	257.	.5695
3.09	334.	.5276
3.28	421.	.4918
3.48	519.	.4612
3.67	627.	.4350

```
ROUTE               ID=6    HYD=201
```

```
                                              HYDROGRAPH FROM AREA 201

     RUNOFF VOLUME =     5.59 MM
     PEAK DISCHARGE RATE =      2.286 CMS


*------------------------------
* GET  INFLOW TO POINT -D-
*------------------------------
* SUBAREA 3
*------------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=193.55 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.58H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        4.68 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      2.032 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.999 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*------------------
* SUBAREA 4
*------------------
COMPUTE NASHYD      ID=2 HYD=104 DT=0.0833 H  DA=254.84 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.79H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       12.32 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      2.856 CMS   RUNOFF VOLUME =    8.28 MM TIME TO PEAK =    1.999 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .17
ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =       4.418 CMS     RUNOFF VOLUME =     10.19 MM     TIME TO PEAK=  2.25 HOURS

           ADD HYD       ID=3     HYD NO=312     ID I=1          ID II=2
ADD HYD             ID=1 HYD=163 IDI=6 IDII=3
    PEAK FLOW =       6.046 CMS     RUNOFF VOLUME =      7.49 MM     TIME TO PEAK=  2.83 HOURS

           ADD HYD       ID=1     HYD NO=163     ID I=6          ID II=3
*------------------
* SUBAREA 6
*------------------
COMPUTE NASHYD      ID=2 HYD=106 DT=0.0833 H  DA=37.10 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.39H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       3.63 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =       .670 CMS   RUNOFF VOLUME =    8.28 MM TIME TO PEAK =    1.499 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .17
ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =       6.229 CMS     RUNOFF VOLUME =      7.51 MM     TIME TO PEAK=  2.67 HOURS

           ADD HYD       ID=3     HYD NO=312     ID I=1          ID II=2
*------------------------------
*  INFLOW TO POINT -D-
*------------------------------
PRINT HYD           ID=3 1

                                              HYDROGRAPH FROM AREA 312

     RUNOFF VOLUME =     7.51 MM
     PEAK DISCHARGE RATE =      6.229 CMS


*-----------------------------------------------------
* ROUTING FROM THE POINT D TO POINT  6
*-----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=94.48
                                       MAXEL=97.89
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                    N=0.05 DIST=102.5 N=-0.03 DIST=107.5 N=0.05 DIST=210
                    0.0 97.89 100 95.77 102.5 95.57 103.5 94.48
                    106.5 94.48 107.5 95.39  110 95.78 210 96.54

                                   RATING CURVE VALLEY SECTION  1.0
                                        WATER      FLOW      FLOW
                                       SURFACE     AREA      RATE
                                        ELEV    SQ METRES    CMS
```

6

94.66	.6	.3
94.84	1.2	1.1
95.02	1.9	2.1
95.20	2.7	3.5
95.38	3.5	5.1
95.56	4.5	7.2
95.74	5.8	9.9
95.92	9.3	13.5
96.10	18.5	20.2
96.27	33.3	31.9
96.45	54.0	50.0
96.63	79.8	78.0
96.81	107.6	116.0
96.99	136.9	161.8
97.17	167.8	215.5
97.35	200.1	276.9
97.53	234.0	346.2
97.71	269.4	423.3
97.89	306.4	508.3

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=2850  SLP=0.0035
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.18	0.	1.3471
.36	1.	.8953
.54	2.	.7145
.72	3.	.6126
.90	5.	.5454
1.08	7.	.4929
1.26	10.	.4654
1.44	14.	.5472
1.62	20.	.7217
1.79	32.	.8267
1.97	50.	.8536
2.15	78.	.8097
2.33	116.	.7345
2.51	162.	.6698
2.69	216.	.6164
2.87	277.	.5722
3.05	346.	.5352
3.23	423.	.5040
3.41	508.	.4772

```
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.0833
PRINT HYD           ID=6 1

                                          HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =      7.51 MM
     PEAK DISCHARGE RATE =       5.940 CMS


*------------------------------
* GET  INFLOW TO POINT -6-
*------------------------------
*------------------
* SUBAREA 5AB
*------------------
COMPUTE NASHYD      ID=1 HYD=107 DT=0.0833 H  DA=140.30 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.88H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       6.09 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
    PEAK DISCHARGE =     1.456 CMS   RUNOFF VOLUME =     8.28 MM TIME TO PEAK =     2.166 HRS
    TOTAL RAINFALL =     48.34 MM  RUNOFF VOL. COEFFICIENT =     .17
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=45.5 CKK=1.0
                    XIMP=0.15 TIMP=0.15 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=550 MNI=0.013
                    SLP=1 LGP=550 MNP=0.25
                    -1
    UNIT PEAK =     .157 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =     8.06 MINS
```

```
SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .027 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   59.39 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =      2.083 CMS  RUNOFF VOLUME =   16.08 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .33

ADD HYD              ID=3 HYD=261 IDI=1 IDII=2
    PEAK FLOW =        2.375 CMS    RUNOFF VOLUME =    10.19 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD        ID=3     HYD NO=261     ID I=1         ID II=2
ADD HYD              ID=2 HYD=216 IDI=3 IDII=6
    PEAK FLOW =        7.200 CMS    RUNOFF VOLUME =     7.89 MM     TIME TO PEAK=  2.92 HOURS

          ADD HYD        ID=2     HYD NO=216     ID I=3         ID II=6
*------------------------------
*    INFLOW TO POINT -G-
*------------------------------
PRINT HYD            ID=2 1

                                    HYDROGRAPH FROM AREA 216

     RUNOFF VOLUME =      7.89 MM
     PEAK DISCHARGE RATE =      7.200 CMS


FINISH
```

```
***************************************************************************************
**                                                                                   **
**                        M I C R O H Y M O --- 3                                   **
**                                                                                   **
**                        (P . C . O T T H Y M O)                                    **
**                                                                                   **
**                        V E R S I O N  2.0+                                        **
**                                                                                   **
**                                                                                   **
**                        ADAPTED FOR MICROCOMPUTER BY                               **
**                                                                                   **
**                        ANDREW  BRODIE  ASSOCIATES  INC.                           **
**                                                                                   **
**                                                                                   **
**                                                                                   **
**ANDREW BRODIE & ASSOCIATES INC                                                     **
**                                                                                   **
***************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START                RAINFALL BEGIN AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 100   STROM
* PRE-DEV COND.  R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES100P.OT1
*-----------------------------
* GET INFLOW TO THE POINT -B-
*-----------------------------
*------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD       ID=1 HYD=101 DT=0.0833H  DA=62.6 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                     4.92 4.92 6.35 6.35 8.95 8.95 18.54 18.54 78.42 78.42
                     107.19 107.19 99.64 99.64 31.1 31.1 17.51 17.51 12.65
                     12.65 9.85 9.85 8.05 8.05 6.81 6.81 5.89 5.89 5.2 5.2
                     4.65 4.65 4.21 4.21 3.85 3.85
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        1.52 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      1.368 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =     2.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
PRINT HYD            ID=1 1

                                        HYDROGRAPH FROM AREA 101


     RUNOFF VOLUME =    25.71 MM
     PEAK DISCHARGE RATE =      1.368 CMS



*------------------
* SUBAREA 2
*------------------
COMPUTE NASHYD       ID=2 HYD=102 DT=0.0833 H  DA=292.1 HECT AA=0.0 AB=0.0
                     CN=55 IA=2.5 MM N=3 TP=2.0 H NI=36
                     -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        5.58 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      3.561 CMS   RUNOFF VOLUME =   17.54 MM TIME TO PEAK =     3.332 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .24
ADD HYD              ID=4 HYD=312 IDI=1 IDII=2
    PEAK FLOW =       4.873 CMS     RUNOFF VOLUME =     18.98 MM     TIME TO PEAK=  3.25 HOURS

           ADD HYD          ID=4      HYD NO=312      ID I=1          ID II=2
STORE HYD            ID=6 HYD=102 DT=0.0833 H  DA=285.64 HECT AA=0.0 AB=0.0
                     .0 .0 .0 .0 .2 .2 .3 .3 .4 .4 .5 .5 .5 .5 .5 .5 .5 .5
                     .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5
    TPEAK(  6)=           .9996
PRINT HYD            ID=6 1

                                        HYDROGRAPH FROM AREA 102
```

```
    PEAK DISCHARGE RATE =        .500 CMS


ADD HYD              ID=3 HYD=312 IDI=6 IDII=4
    PEAK FLOW =       5.351 CMS    RUNOFF VOLUME =    11.21 MM     TIME TO PEAK=  3.08 HOURS

          ADD HYD        ID=3     HYD NO=312     ID I=6         ID II=4
*------------------------------
* INFLOW TO THE POINT -B-
*------------------------------
PRINT HYD            ID=3 1

                                          HYDROGRAPH FROM AREA 312


    RUNOFF VOLUME =     11.21 MM
    PEAK DISCHARGE RATE =       5.351 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  D                      # 4
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=100.57
                                        MAXEL=104.24
                                        CHSLP=0.004
                                        FPSLP=0.004
                     N=0.05  DIST=113 N=-0.03 DIST=117 N=0.05 DIST=226
                     0 104.24 100 101.79 110 101.17 113.0 101.17
                     113.8  100.57 116.5 100.57 117 101.30 120 101.52
                     126 102.40 226 102.98
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
100.57	.0	.0
100.76	.6	.4
100.96	1.2	1.2
101.15	1.9	2.3
101.34	3.4	4.2
101.54	6.0	7.2
101.73	9.5	11.6
101.92	14.1	17.1
102.12	20.4	24.9
102.31	28.5	35.4
102.50	39.3	46.7
102.69	57.3	65.4
102.89	83.2	93.4
103.08	116.2	135.2
103.27	151.5	190.8
103.47	188.3	257.2
103.66	226.6	334.1
103.85	266.5	421.4
104.05	307.8	519.1
104.24	350.7	627.1

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                     L=2800  SLP=0.004
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.19	0.	1.1938
.39	1.	.7999
.58	2.	.6417
.77	4.	.6414
.97	7.	.6490
1.16	12.	.6390
1.35	17.	.6401
1.55	25.	.6390
1.74	35.	.6274
1.93	47.	.6540
2.12	65.	.6812
2.32	93.	.6931
2.51	135.	.6689
2.70	191.	.6177
2.90	257.	.5695
3.09	334.	.5276
3.28	421.	.4918
3.48	519.	.4612
3.67	627.	.4350

```
ROUTE                ID=6    HYD=201
```

```
PRINT HYD           ID=6 1

                                        HYDROGRAPH FROM AREA 201

      RUNOFF VOLUME =    11.21 MM
      PEAK DISCHARGE RATE =     4.639 CMS


*-----------------------------
* GET  INFLOW TO POINT -D-
*-----------------------------
* SUBAREA 3
*-----------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=193.55 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.58H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        4.68 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      4.209 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =     2.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =     .36
*-----------------
* SUBAREA 4
*-----------------
COMPUTE NASHYD      ID=2 HYD=104 DT=0.0833 H  DA=254.84 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.79H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       12.32 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      6.439 CMS   RUNOFF VOLUME =   17.54 MM TIME TO PEAK =     1.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =     .24
ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =     9.677 CMS     RUNOFF VOLUME =    21.07 MM     TIME TO PEAK=  2.17 HOURS

          ADD HYD       ID=3     HYD NO=312     ID I=1          ID II=2
ADD HYD             ID=1 HYD=163 IDI=6 IDII=3
    PEAK FLOW =     12.463 CMS    RUNOFF VOLUME =    15.27 MM     TIME TO PEAK=  2.50 HOURS

          ADD HYD       ID=1     HYD NO=163     ID I=6          ID II=3
*-----------------
* SUBAREA 6
*-----------------
COMPUTE NASHYD      ID=2 HYD=106 DT=0.0833 H  DA=37.10 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.39H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        3.63 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      1.547 CMS   RUNOFF VOLUME =   17.53 MM TIME TO PEAK =     1.499 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =     .24
ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =     12.908 CMS    RUNOFF VOLUME =    15.34 MM     TIME TO PEAK=  2.42 HOURS

          ADD HYD       ID=3     HYD NO=312     ID I=1          ID II=2
*-----------------------------
*  INFLOW TO POINT -D-
*-----------------------------
PRINT HYD           ID=3 1

                                        HYDROGRAPH FROM AREA 312

      RUNOFF VOLUME =    15.34 MM
      PEAK DISCHARGE RATE =     12.908 CMS


*--------------------------------------------------
* ROUTING FROM THE POINT D TO POINT  G
*--------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=94.48
                                       MAXEL=97.89
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                    N=0.05 DIST=102.5 N=-0.03 DIST=107.5 N=0.05 DIST=210
                    0.0 97.89 100 95.77 102.5 95.57 103.5 94.48
                    106.5 94.48 107.5 95.39  110 95.78 210 96.54

                                   RATING CURVE VALLEY SECTION  1.0
                                     WATER      FLOW        FLOW
                                    SURFACE     AREA        RATE
                                     ELEV     SQ METRES     CMS
```

94.66	.6	.3
94.84	1.2	1.1
95.02	1.9	2.1
95.20	2.7	3.5
95.38	3.5	5.1
95.56	4.5	7.2
95.74	5.8	9.9
95.92	9.3	13.5
96.10	18.5	20.2
96.27	33.3	31.9
96.45	54.0	50.0
96.63	79.8	78.0
96.81	107.6	116.0
96.99	136.9	161.8
97.17	167.8	215.5
97.35	200.1	276.9
97.53	234.0	346.2
97.71	269.4	423.3
97.89	306.4	508.3

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=2850  SLP=0.0035
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.18	0.	1.3471
.36	1.	.8953
.54	2.	.7145
.72	3.	.6126
.90	5.	.5454
1.08	7.	.4929
1.26	10.	.4654
1.44	14.	.5472
1.62	20.	.7217
1.79	32.	.8267
1.97	50.	.8536
2.15	78.	.8097
2.33	116.	.7345
2.51	162.	.6698
2.69	216.	.6164
2.87	277.	.5722
3.05	346.	.5352
3.23	423.	.5040
3.41	508.	.4772

```
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.0833
PRINT HYD           ID=6 1
```

HYDROGRAPH FROM AREA 201

```
     RUNOFF VOLUME =     15.34 MM
     PEAK DISCHARGE RATE =      12.002 CMS


*------------------------------
* GET  INFLOW TO POINT -6-
*------------------------------
*------------------
* SUBAREA 5AB
*------------------
COMPUTE NASHYD      ID=1 HYD=107 DT=0.0833 H  DA=140.30 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=0.88H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        6.09 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =     3.270 CMS   RUNOFF VOLUME =   17.54 MM TIME TO PEAK =     2.082 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .24
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=45.5 CKK=1.0
                    XIMP=0.15 TIMP=0.15 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=550 MNI=0.013
                    SLP=1 LGP=550 MNP=0.25
                    -1
    UNIT PEAK =    .175 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    6.91 MINS
```

```
    UNIT PEAK =    .035 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   45.45 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    5.009 CMS  RUNOFF VOLUME =   37.41 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .52

ADD HYD            ID=3 HYD=261 IDI=1 IDII=2
    PEAK FLOW =     5.729 CMS    RUNOFF VOLUME =    22.40 MM    TIME TO PEAK=  1.17 HOURS

          ADD HYD       ID=3     HYD NO=261     ID I=1        ID II=2
ADD HYD            ID=2 HYD=216 IDI=3 IDII=6
    PEAK FLOW =    14.714 CMS    RUNOFF VOLUME =    16.34 MM    TIME TO PEAK=  2.67 HOURS

          ADD HYD       ID=2     HYD NO=216     ID I=3        ID II=6
*-----------------------------
*    INFLOW TO POINT -6-
*-----------------------------
PRINT HYD          ID=2 1

                                          HYDROGRAPH FROM AREA 216


     RUNOFF VOLUME =    16.34 MM
     PEAK DISCHARGE RATE =     14.714 CMS


FINISH
```

```
**********************************************************************************
**                                                                              **
**                      M I C R O H Y M O --- 3                                 **
**                                                                              **
**                      (P . C . O T T H Y M O)                                 **
**                                                                              **
**                      V E R S I O N  2.0+                                     **
**                                                                              **
**                                                                              **
**                      ADAPTED FOR MICROCOMPUTER BY                            **
**                                                                              **
**                      ANDREW  BRODIE  ASSOCIATES  INC.                        **
**                                                                              **
**                                                                              **
**                                                                              **
**ANDREW BRODIE & ASSOCIATES INC                                                **
**                                                                              **
**********************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START               RAINFALL BEGIN AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 5   STROM
* POST-DEV COND.ALT.-ALFA-  R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES5F.OT6
*-----------------------------
* GET INFLOW TO THE POINT -B-
*-----------------------------
*------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD      ID=1 HYD=101 DT=0.0833H  DA=62.6 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                    4.23 4.23 5.27 5.27 7.07 7.07 11.52 11.52 45.05 45.05
                    72.96 72.96 62.52 62.52 19.19 19.19 12.59 12.59 9.5 9.5
                    7.67 7.67 6.46 6.46 5.59 5.59 4.94 4.94 4.44 4.44
                    4.03 4.03 3.7 3.7 3.42 3.42
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       1.52 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      .660 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =     2.999 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
PRINT HYD           ID=1 1
```

```
                                   HYDROGRAPH FROM AREA 101

     RUNOFF VOLUME =     12.71 MM
     PEAK DISCHARGE RATE =   .   .660 CMS


*------------------
* SUBAREA 2
*------------------
COMPUTE NASHYD      ID=2 HYD=102 DT=0.0833 H  DA=292.1 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=2.0 H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        5.58 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =     1.662 CMS   RUNOFF VOLUME =    6.28 MM TIME TO PEAK =    3.499 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .17
ADD HYD             ID=4 HYD=312 IDI=1 IDII=2
    PEAK FLOW =      2.297 CMS     RUNOFF VOLUME =     9.06 MM     TIME TO PEAK=  3.33 HOURS

         ADD HYD        ID=4     HYD NO=312      ID I=1          ID II=2
STORE HYD           ID=6 HYD=102 DT=0.0833 H  DA=285.64 HECT AA=0.0 AB=0.0
                    .0 .0 .0 .0 .2 .2 .3 .3 .4 .4 .5 .5 .5 .5 .5 .5 .5 .5
                    .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5
    TPEAK(  6)=          .9996
PRINT HYD           ID=6 1

                                   HYDROGRAPH FROM AREA 102

     RUNOFF VOLUME =      1.55 MM
     PEAK DISCHARGE RATE =       .500 CMS


ADD HYD             ID=3 HYD=312 IDI=6 IDII=4
    PEAK FLOW =      2.762 CMS     RUNOFF VOLUME =      5.71 MM     TIME TO PEAK=  3.08 HOURS

         ADD HYD        ID=3     HYD NO=312      ID I=6          ID II=4
*----------------------------
* INFLOW TO THE POINT -B-
*----------------------------
PRINT HYD           ID=3 1

                                   HYDROGRAPH FROM AREA 312

     RUNOFF VOLUME =     5.71 MM
     PEAK DISCHARGE RATE =      2.762 CMS


*----------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  D
*----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 MINEL=100.57
                                       MAXEL=104.24
                                       CHSLP=0.004
                                       FPSLP=0.004
                    N=0.05  DIST=113 N=-0.03 DIST=117 N=0.05 DIST=226
                    0 104.24 100 101.79 110 101.17 113.0 101.17
                    113.8  100.57 116.5 100.57 117 101.30 120 101.52
                    126 102.40 226 102.98
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
100.57	.0	.0
100.76	.6	.4
100.96	1.2	1.2
101.15	1.9	2.3
101.34	3.4	4.2
101.54	6.0	7.2
101.73	9.5	11.6
101.92	14.1	17.1
102.12	20.4	24.9
102.31	28.5	35.4
102.50	39.3	46.7
102.69	57.3	65.4
102.89	83.2	93.4
103.08	116.2	135.2
103.27	151.5	190.8
103.47	[illegible]	[illegible]

```
                                        103.85     266.5     421.4
                                        104.05     307.8     519.1
                                        104.24     350.7     627.1
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                L=2800  SLP=0.004

                                         TRAVEL TIME TABLE
                                               REACH  1.0

                                         WATER      FLOW      TRAVEL
                                         DEPTH      RATE       TIME
                                        METRES      CMS        HRS
                                           .19        0.     1.1938
                                           .39        1.      .7599
                                           .58        2.      .6417
                                           .77        4.      .6414
                                           .97        7.      .6490
                                          1.16       12.      .6390
                                          1.35       17.      .6401
                                          1.55       25.      .6390
                                          1.74       35.      .6274
                                          1.93       47.      .6540
                                          2.12       65.      .6812
                                          2.32       93.      .6931
                                          2.51      135.      .6689
                                          2.70      191.      .6177
                                          2.90      257.      .5695
                                          3.09      334.      .5276
                                          3.28      421.      .4918
                                          3.48      519.      .4612
                                          3.67      627.      .4350
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.08330
PRINT HYD           ID=6 1

                                          HYDROGRAPH FROM AREA 201


    RUNOFF VOLUME =      5.71 MM
    PEAK DISCHARGE RATE =      2.364 CMS



*-----------------------------
* GET  INFLOW TO POINT -D-
*-----------------------------
* SUBAREA 3
*------------------
COMPUTE NASHYD       ID=1 HYD=103 DT=0.0833 H  DA=193.55 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.58H NI=36
                     -1
   SHAPE CONSTANT, N =   3.00
   UNIT PEAK =        4.68 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
   PEAK DISCHARGE =      2.032 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =     2.999 HRS
   TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*------------------
* SUBAREA 4
*------------------
COMPUTE NASHYD       ID=2 HYD=104 DT=0.0833 H  DA=254.84 HECT AA=0.0 AB=0.0
                     CN=55 IA=2.5 MM N=3 TP=0.79H NI=36
                     -1
   SHAPE CONSTANT, N =   3.00
   UNIT PEAK =       12.32 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
   PEAK DISCHARGE =      2.856 CMS   RUNOFF VOLUME =    8.28 MM TIME TO PEAK =     1.999 HRS
   TOTAL RAINFALL =     48.34 MM  RUNOFF VOL. COEFFICIENT =    .17
ADD HYD              ID=3 HYD=312 IDI=1 IDII=2
   PEAK FLOW =        4.418 CMS     RUNOFF VOLUME =    10.19 MM     TIME TO PEAK=  2.25 HOURS

           ADD HYD        ID=3      HYD NO=312      ID I=1          ID II=2
ADD HYD              ID=1 HYD=163 IDI=6 IDII=3
   PEAK FLOW =        6.148 CMS     RUNOFF VOLUME =     7.56 MM     TIME TO PEAK=  2.83 HOURS

           ADD HYD        ID=1      HYD NO=163      ID I=6          ID II=3
*------------------
* SUBAREA 6
*------------------
COMPUTE NASHYD       ID=2 HYD=106 DT=0.0833 H  DA=37.10 HECT AA=0.0 AB=0.0
                     CN=55 IA=2.5 MM N=3 TP=0.39H NI=36
                     -1
   SHAPE CONSTANT, N =   3.00
   UNIT PEAK =        3.63 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
```

```
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .17
ADD HYD              ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =        6.327 CMS     RUNOFF VOLUME =      7.58 MM      TIME TO PEAK=  2.75 HOURS

          ADD HYD        ID=3     HYD NO=312     ID I=1          ID II=2
*------------------------------
*  INFLOW TO POINT -D-
*------------------------------
PRINT HYD           ID=3 1

                                              HYDROGRAPH FROM AREA 312


     RUNOFF VOLUME =      7.58 MM
     PEAK DISCHARGE RATE =        6.327 CMS


*------------------------------------------------------
* ROUTING FROM THE POINT D TO POINT  E
*------------------------------------------------------
*------------------------------------------------------
* ROUTING - X SECTION #2
*------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=90.58
                                       MAXEL=92.84
                                       CHSLP=0.0041
                                       FPSLP=0.0041
                  N=0.03 DIST=18
                  0.0   92.84  1.0  92.84
                  2.0   92.24  4.0  92.24
                  7.4   90.96  8.0  90.58
                  10    90.58  10.4 91.28
                  14    92.32  16   92.32
                  17    92.84  18   92.84
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
90.58	.0	.0
90.70	.3	.1
90.82	.5	.4
90.94	.9	.8
91.06	1.2	1.2
91.17	1.6	1.8
91.29	2.0	2.6
91.41	2.5	3.3
91.53	3.1	4.3
91.65	3.8	5.6
91.77	4.6	7.0
91.89	5.5	8.8
92.01	6.4	10.8
92.13	7.4	13.1
92.25	8.6	14.1
92.36	10.1	16.3
92.48	11.8	20.8
92.60	13.6	25.8
92.72	15.4	31.2
92.84	17.3	34.4

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                  L=1350  SLP=0.0041
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.12	0.	.7790
.24	0.	.5181
.36	1.	.4140
.48	1.	.3606
.59	2.	.3245
.71	3.	.2987
.83	3.	.2856
.95	4.	.2716
1.07	6.	.2579
1.19	7.	.2450
1.31	9.	.2331
1.43	11.	.2223
1.55	13.	.2123
1.67	14.	.2278
1.78	16.	.2313
1.90	21.	.2126
2.02	26.	.1977
2.14	31.	.1853

```
* INFLOW TO POIN: ---
*----------------------
PRINT HYD           ID=2 1

                    HYDROGRAPH FROM AREA 261

RUNOFF VOLUME =      9.77 MM
PEAK DISCHARGE RATE =     11.990 CMS

*-------------------------------------------------------
* ROUTING FROM THE POINT  F  TO POINT  6
*-------------------------------------------------------
* ARTIFITIAL CHANNEL
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=84.30
                                       MAXEL=87.00
                                       CHSLP=0.0004
                                       FPSLP=0.0004
              N=0.035 DIST=24.
              0.0   87.00   4.0   85.3
              6.5   85.3    8.    84.3
              16.0  84.3   17.5   85.3
              20.0  85.3   24.0   87.00
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
84.30	.0	.0
84.44	1.2	.2
84.58	2.4	.6
84.73	3.7	1.1
84.87	5.0	1.8
85.01	6.4	2.6
85.15	7.9	3.6
85.29	9.4	4.7
85.44	11.7	5.2
85.58	14.1	6.9
85.72	16.7	8.8
85.86	19.3	10.9
86.01	22.0	13.3
86.15	24.7	15.8
86.29	27.6	18.6
86.43	30.6	21.6
86.57	33.7	24.8
86.72	36.9	28.2
86.86	40.1	31.8
87.00	43.5	35.7

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
              L=600  SLP=0.0004
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.14	0.	1.0967
.28	1.	.7062
.43	1.	.5499
.57	2.	.4625
.71	3.	.4055
.85	4.	.3649
.99	5.	.3342
1.14	5.	.3778
1.28	7.	.3428
1.42	9.	.3157
1.56	11.	.2939
1.71	13.	.2760
1.85	16.	.2609
1.99	19.	.2479
2.13	22.	.2367
2.27	25.	.2268
2.42	28.	.2181
2.56	32.	.2102
2.70	36.	.2032

```
ROUTE             ID=6     HYD=201
                  INDI=2   DT= 0.08330
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   13RATE =    174.83
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   51RATE =    189.26
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   52RATE =    185.92
```

```
        OUTFLOW NUMBER =   53RATE =    182.11
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   54RATE =    177.92
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   55RATE =    173.45
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   56RATE =    168.75
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   57RATE =    163.89
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   58RATE =    158.95
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   59RATE =    153.98
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
        OUTFLOW NUMBER =   60RATE =    149.02
PRINT HYD            ID=6 1

                                    HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =      9.77 MM
     PEAK DISCHARGE RATE =       8.617 CMS


*------------------------
* GET INFLOW TO POINT -6-
*------------------------
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD       ID=1 HYD=102 DT=0.0833  DA=45.5 UKK=1.0
                     XIMP=0.30 TIMP=0.30 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=550 MNI=0.013
                     SLP=1 LGP=550 MNP=0.25
                     -1
    UNIT PEAK =     .157 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =    8.06 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .027 CMS
    PEAK INTENSITY(RAIN EXCESS) =     41.75 MM/HR
    STORAGE COEFF. SC =   59.39 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =     48.34 MM

    PEAK DISCHARGE =      3.109 CMS  RUNOFF VOLUME =    21.70 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .45

ADD HYD              ID=2 HYD=261 IDI=1 IDII=6
    PEAK FLOW =      11.494 CMS     RUNOFF VOLUME =     10.18 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD        ID=2     HYD NO=261     ID I=1          ID II=6
*-----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -6-
*-----------------------------------
PRINT HYD            ID=2 1

                                    HYDROGRAPH FROM AREA 261


     RUNOFF VOLUME =     10.18 MM
     PEAK DISCHARGE RATE =      11.494 CMS


*------------------
FINISH
```

```
****************************************************************************************
**                                                                                    **
**                          M I C R O H Y M O --- 3                                   **
**                                                                                    **
**                         (P . C . O T T H Y M O)                                    **
**                                                                                    **
**                          V E R S I O N  2.0+                                       **
**                                                                                    **
**                                                                                    **
**                          ADAPTED FOR MICROCOMPUTER BY                              **
**                                                                                    **
**                          ANDREW  BRODIE  ASSOCIATES  INC.                          **
**                                                                                    **
**                                                                                    **
**                                                                                    **
**ANDREW BRODIE & ASSOCIATES INC                                                      **
**                                                                                    **
****************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START               RAINFALL BEGIN AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 100   STROM
* POST-DEV COND.ALT.-ALFA-  R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES100F.OT6
*------------------------------
* GET INFLOW TO THE POINT -B-
*------------------------------
*------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD      ID=1 HYD=101 DT=0.0833H  DA=62.6 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                    4.92 4.92 6.35 6.35 8.95 8.95 18.54 18.54 78.42 78.42
                    107.19 107.19 99.64 99.64 31.1 31.1 17.51 17.51 12.65
                    12.65 9.85 9.85 8.05 8.05 6.81 6.81 5.89 5.89 5.2 5.2
                    4.65 4.65 4.21 4.21 3.85 3.85
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =          1.52 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =       12.00
    PEAK DISCHARGE =      1.368 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =     2.916 HRS
    TOTAL RAINFALL =     72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
```

```
     RUNOFF VOLUME =    25.71 MM
     PEAK DISCHARGE RATE =      1.368 CMS



*------------------
* SUBAREA 2
*------------------
COMPUTE NASHYD      ID=2 HYD=102 DT=0.0833 H  DA=292.1 HECT AA=0.0 AB=0.0
                    CN=55 IA=2.5 MM N=3 TP=2.0 H NI=36
                    -1
   SHAPE CONSTANT, N =   3.00
   UNIT PEAK =        5.58 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
   PEAK DISCHARGE =      3.561 CMS   RUNOFF VOLUME =   17.54 MM TIME TO PEAK =     3.332 HRS
   TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =     .24
ADD HYD             ID=4 HYD=312 IDI=1 IDII=2
   PEAK FLOW =       4.873 CMS     RUNOFF VOLUME =    18.98 MM     TIME TO PEAK=  3.25 HOURS

          ADD HYD        ID=4     HYD NO=312     ID I=1          ID II=2
STORE HYD           ID=6 HYD=102 DT=0.0833 H  DA=285.64 HECT AA=0.0 AB=0.0
                    .0 .0 .0 .0 .2 .2 .3 .3 .4 .4 .5 .5 .5 .5 .5 .5 .5 .5
                    .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5
   TPEAK(  6)=           .9996
PRINT HYD           ID=6 1

                                        HYDROGRAPH FROM AREA 102


     RUNOFF VOLUME =     1.55 MM
     PEAK DISCHARGE RATE =        .500 CMS



ADD HYD             ID=3 HYD=312 IDI=6 IDII=4
   PEAK FLOW =       5.351 CMS     RUNOFF VOLUME =     11.21 MM     TIME TO PEAK=  3.08 HOURS

          ADD HYD        ID=3     HYD NO=312     ID I=6          ID II=4
*------------------------------
* INFLOW TO THE POINT -B-
*--------------- -------------
PRINT HYD           ID=3 1

                                        HYDROGRAPH FROM AREA 312


     RUNOFF VOLUME =    11.21 MM
     PEAK DISCHARGE RATE =      5.351 CMS



*-------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  D
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=100.57
                                  MAXEL=104.24
                                  CHSLP=0.004
                                  FPSLP=0.004
                   N=0.05  DIST=113 N=-0.03 DIST=117 N=0.05 DIST=226
                   0 104.24 100 101.79 110 101.17 113.0 101.17
                   113.8  100.57 116.5 100.57.117 101.30 120 101.52
                   126 102.40 226 102.98

                              RATING CURVE VALLEY SECTION  1.0
                                  WATER      FLOW       FLOW
                                 SURFACE     AREA       RATE
                                   ELEV   SQ METRES     CMS
                                 100.57        .0         .0
                                 100.76        .6         .4
                                 100.96       1.2        1.2
                                 101.15       1.9        2.3
                                 101.34       3.4        4.2
                                 101.54       6.0        7.2
                             [illegible]      9.5       11.6
                                 101.92      14.1       17.1
                                 102.12      20.4       24.9
                                 102.31      28.5       35.4
                                 102.50      39.3       46.7
                                 102.69      57.3       65.4
                                 102.89      83.2       93.4
                                 103.08     116.2      135.2
                                 103.27     151.5      190.8
                                 103.47     188.3      257.2
```

```
                                        103.85      266.5      421.4
                                        104.05      307.8      519.1
                                        104.24      350.7      627.1
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=2600  SLP=0.004

                                          TRAVEL TIME TABLE
                                                 REACH  1.0

                                         WATER      FLOW      TRAVEL
                                         DEPTH      RATE       TIME
                                        METRES      CMS        HRS
                                           .19        0.     1.1936
                                           .39        1.      .7999
                                           .58        2.      .6417
                                           .77        4.      .6414
                                           .97        7.      .6490
                                          1.16       12.      .6390
                                          1.35       17.      .6401
                                          1.55       25.      .6390
                                          1.74       35.      .6274
                                          1.93       47.      .6540
                                          2.12       65.      .6812
                                          2.32       93.      .6931
                                          2.51      135.      .6689
                                          2.70      191.      .6177
                                          2.90      257.      .5695
                                          3.09      334.      .5276
                                          3.28      421.      .4918
                                          3.48      519.      .4612
                                          3.67      627.      .4350
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.08330
PRINT HYD           ID=6 1

                                            HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    11.21 MM
     PEAK DISCHARGE RATE =       4.639 CMS



*-----------------------------
* GET  INFLOW TO POINT -D-
*-----------------------------
* SUBAREA 3
*------------------
COMPUTE NASHYD       ID=1 HYD=103 DT=0.0833 H  DA=193.55 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.58H NI=36
                     -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        4.68 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      4.209 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =    2.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
*------------------
* SUBAREA 4
*------------------
COMPUTE NASHYD       ID=2 HYD=104 DT=0.0833 H  DA=254.84 HECT AA=0.0 AB=0.0
                     CN=55 IA=2.5 MM N=3 TP=0.79H NI=36
                     -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       12.32 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      6.439 CMS   RUNOFF VOLUME =   17.54 MM TIME TO PEAK =    1.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .24
ADD HYD              ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =      9.677 CMS     RUNOFF VOLUME =    21.07 MM     TIME TO PEAK=  2.17 HOURS

          ADD HYD        ID=3     HYD NO=312      ID I=1          ID II=2
ADD HYD              ID=1 HYD=163 IDI=6 IDII=3
    PEAK FLOW =      12.463 CMS    RUNOFF VOLUME =    15.27 MM     TIME TO PEAK=  2.50 HOURS

          ADD HYD        ID=1     HYD NO=163      ID I=6          ID II=3
*------------------
* SUBAREA 6
*------------------
COMPUTE NASHYD       ID=2 HYD=106 DT=0.0833 H  DA=37.10 HECT AA=0.0 AB=0.0
                     CN=55 IA=2.5 MM N=3 TP=0.39H NI=36
                     -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        3.63 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
```

```
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .24
ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =     12.908 CMS    RUNOFF VOLUME =    15.34 MM     TIME TO PEAK=  2.42 HOURS

          ADD HYD       ID=3     HYD NO=312     ID I=1         ID II=2
*------------------------------
*  INFLOW TO POINT -D-
*------------------------------
PRINT HYD           ID=3 1

                                        HYDROGRAPH FROM AREA 312


    RUNOFF VOLUME =    15.34 MM
    PEAK DISCHARGE RATE =     12.908 CMS



*-------------------------------------------------------
* ROUTING FROM THE POINT D TO POINT  E
*-------------------------------------------------------
*-------------------------------------------------------
* ROUTING - X SECTION #2
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=90.58
                                       MAXEL=92.84
                                       CHSLP=0.0041
                                       FPSLP=0.0041
                   N=0.03 DIST=18
                   0.0   92.84  1.0  92.84
                   2.0   92.24  4.0  92.24
                   7.4   90.96  8.0  90.58
                   10    90.58  10.4 91.28
                   14    92.32  16   92.32
                   17    92.84  18   92.84

                                    RATING CURVE VALLEY SECTION  1.0
                                       WATER      FLOW       FLOW
                                      SURFACE     AREA       RATE
                                       ELEV    SQ METRES     CMS
                                       90.58        .0         .0
                                       90.70        .3         .1
                                       90.82        .5         .4
                                       90.94        .9         .8
                                       91.06       1.2        1.2
                                       91.17       1.6        1.8
                                       91.29       2.0        2.6
                                       91.41       2.5        3.3
                                       91.53       3.1        4.3
                                       91.65       3.8        5.6
                                       91.77       4.6        7.0
                                       91.89       5.5        8.8
                                       92.01       6.4       10.8
                                       92.13       7.4       13.1
                                       92.25       8.6       14.1
                                       92.36      10.1       16.3
                                       92.48      11.8       20.8
                                       92.60      13.6       25.8
                                       92.72      15.4       31.2
                                       92.84      17.3       34.4
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                   L=1350  SLP=0.0041

                                       TRAVEL TIME TABLE
                                              REACH  1.0

                                       WATER      FLOW      TRAVEL
                                       DEPTH      RATE       TIME
                                      METRES      CMS        HRS
                                         .12        0.       .7780
                                         .24        0.       .5181
                                         .36        1.       .4140
                                         .48        1.       .3606
                                         .59        2.       .3245
                                         .71        3.       .2987
                                         .83        3.       .2856
                                         .95        4.       .2716
                                        1.07        6.       .2579
                                        1.19        7.       .2450
                                        1.31        9.       .2331
                                        1.43       11.       .2223
                                        1.55       13.       .2123
                                        1.67       14.       .2278
                                        1.78       16.       .2313
                                        1.90       21.       .2126
                                        2.02       26.       .1977
                                        2.14       31.       .1853
```

```
ROUTE              ID=6    HYD=201
                   INDI=3  DT= 0.08330
PRINT HYD          ID=6 1
```

HYDROGRAPH FROM AREA 201

```
RUNOFF VOLUME =     15.34 MM
PEAK DISCHARGE RATE =      12.765 CMS
```

```
*----------------------------
* GET  INFLOW TO POINT -E-
*----------------------------
*------------------
* SUBAREA 5A
*------------------
COMPUTE URBHYD      ID=1 HYD=102 DT=0.0833  DA=62.5 CKK=1.0
                    XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=645 MNI=0.013
                    SLP=1 LGP=645 MNP=0.25
                    -1
   UNIT PEAK =     .164 CMS
   PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
   STORAGE COEFF. SC =    7.60 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =     .032 CMS
   PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
   STORAGE COEFF. SC =   50.01 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   TOTAL RAINFALL =    72.27 MM

   PEAK DISCHARGE =    10.270 CMS  RUNOFF VOLUME =   49.56 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .69

ADD HYD             ID=2 HYD=261 IDI=1 IDII=6
   PEAK FLOW =      13.865 CMS    RUNOFF VOLUME =    17.14 MM     TIME TO PEAK=  2.42 HOURS

         ADD HYD       ID=2     HYD NO=261     ID I=1         ID II=6
*----------------------
*  INFLOW TO POINT -E-
*----------------------
PRINT HYD           ID=2 1
```

HYDROGRAPH FROM AREA 261

```
RUNOFF VOLUME =    17.14 MM
PEAK DISCHARGE RATE =      13.865 CMS
```

```
*-----------------------------------------------------
* ROUTING FROM THE POINT E TO POINT  F
*-----------------------------------------------------
*-----------------------------------------------------
* ROUTING - X SECTION #1
*-----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=87.47
                                       MAXEL=89.90
                                       CHSLP=0.0054
                                       FPSLP=0.0054
                    N=0.03 DIST=18
                    0.0   89.90   1.    89.90
                    2.0   89.27   9.0   89.27
                    9.8   87.47  12.2   87.47
                    13.   89.21  16.    89.39
                    20.   89.40  21.0   89.90
                    22    89.90
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
87.47	.0	.0
87.60	.3	.2
87.73	.6	.6
87.85	1.0	1.1
87.98	1.3	1.7
88.11	1.7	2.5

88.37	2.5	4.3
88.49	2.9	5.3
88.62	3.4	6.4
88.75	3.8	7.6
88.88	4.3	8.9
89.00	4.7	10.2
89.13	5.2	11.7
89.26	5.8	12.3
89.39	7.4	10.5
89.52	9.7	14.3
89.64	12.0	20.4
89.77	14.4	27.3
89.90	16.9	34.1

COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
L=900 SLP=0.0054

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.4259
.26	1.	.2823
.38	1.	.2254
.51	2.	.1938
.64	2.	.1732
.77	3.	.1586
.90	4.	.1475
1.02	5.	.1388
1.15	6.	.1317
1.28	8.	.1257
1.41	9.	.1206
1.53	10.	.1162
1.66	12.	.1123
1.79	12.	.1174
1.56	11.	.1152
2.05	14.	.1697
2.17	20.	.1478
2.30	27.	.1320
2.43	34.	.1236

```
ROUTE                ID=6    HYD=201
                     INDI=2  DT= 0.08330
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   27RATE =     446.88
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   28RATE =     463.11
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   29RATE =     474.28
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   30RATE =     481.45
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   31RATE =     485.36
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   32RATE =     486.84
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   33RATE =     486.42
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   34RATE =     484.56
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   35RATE =     481.55
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   36RATE =     477.64
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   37RATE =     473.02
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   38RATE =     466.67
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   39RATE =     458.54
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   40RATE =     449.92
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   41RATE =     440.98
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   42RATE =     431.69
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =   43RATE =     422.06
PRINT HYD            ID=6 1
```

HYDROGRAPH FROM AREA 201

RUNOFF VOLUME = 17.14 MM
PEAK DISCHARGE RATE = 13.787 CMS

```
* GET INFLOW TO POINT -F-
*-----------------------
*------------------
* SUBAREA 5B
*------------------
COMPUTE URBHYD      ID=1 HYD=102 DT=0.0833  DA=77.8 CKK=1.0
                    XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=720 MNI=0.013
                    SLP=1 LGP=720 MNP=0.25
                    -1
    UNIT PEAK =    .156 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    8.12 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .030 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   53.42 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    12.562 CMS  RUNOFF VOLUME =   49.56 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .69

ADD HYD             ID=2 HYD=261 IDI=1 IDII=6
    PEAK FLOW =     22.482 CMS    RUNOFF VOLUME =    19.13 MM     TIME TO PEAK=  1.17 HOURS

         ADD HYD       ID=2     HYD NO=261     ID I=1         ID II=6
*----------------------
*  INFLOW TO POINT -F-
*----------------------
PRINT HYD           ID=2 1

                                         HYDROGRAPH FROM AREA 261


     RUNOFF VOLUME =    19.13 MM
     PEAK DISCHARGE RATE =     22.482 CMS


*---------------------------------------------------------
* ROUTING FROM THE POINT  F  TO POINT  G
*---------------------------------------------------------
* ARTIFITIAL CHANNEL
*---------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=84.30
                                       MAXEL=87.00
                                       CHSLP=0.0004
                                       FPSLP=0.0004
                    N=0.035 DIST=24.
                    0.0   87.00   4.0   85.3
                    6.5   85.3    8.    84.3
                    16.0  84.3   17.5   85.3
                    20.0  85.3   24.0   87.00
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
84.30	.0	.0
84.44	1.2	.2
84.58	2.4	.6
84.73	3.7	1.1
84.87	5.0	1.8
85.01	6.4	2.6
85.15	7.9	3.6
85.29	9.4	4.7
85.44	11.7	5.2
85.58	14.1	6.9
85.72	16.7	8.8
85.86	19.3	10.9
86.01	22.0	13.3
86.15	24.7	15.8
86.29	27.6	18.6
86.43	30.6	21.6
86.57	33.7	24.8
86.72	36.9	28.2
86.86	40.1	31.8
87.00	43.5	35.7

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=600  SLP=0.0004
```

```
                                        TRAVEL TIME TABLE
                                             REACH 1.0

                                        WATER      FLOW      TRAVEL
                                        DEPTH      RATE       TIME
                                       METRES      CMS        HRS
                                          .14        0.      1.0967
                                          .28        1.      .7062
                                          .43        1.      .5499
                                          .57        2.      .4625
                                          .71        3.      .4055
                                          .85        4.      .3649
                                          .99        5.      .3342
                                         1.14        5.      .3778
                                         1.28        7.      .3428
                                         1.42        9.      .3157
                                         1.56       11.      .2939
                                         1.71       13.      .2760
                                         1.85       16.      .2609
                                         1.99       19.      .2479
                                         2.13       22.      .2367
                                         2.27       25.      .2268
                                         2.42       28.      .2181
                                         2.56       32.      .2102
                                         2.70       36.      .2032
ROUTE               ID=6    HYD=201
                    INDI=2  DT= 0.08330
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    18RATE =     562.42
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    39RATE =     493.79
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    40RATE =     488.00
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    41RATE =     480.71
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    42RATE =     472.42
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    43RATE =     463.42
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    46RATE =     436.15
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    47RATE =     427.75
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    48RATE =     416.86
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    49RATE =     404.55
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    69RATE =     192.55
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    70RATE =     187.99
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    71RATE =     182.95
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    72RATE =     177.54
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    73RATE =     171.86
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    74RATE =     165.99
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    75RATE =     160.03
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    76RATE =     154.05
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    77RATE =     148.06
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    78RATE =     142.10
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    79RATE =     136.17
   PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =    80RATE =     130.33
PRINT HYD           ID=6 1

                                        HYDROGRAPH FROM AREA 201


    RUNOFF VOLUME =    19.13 MM
    PEAK DISCHARGE RATE =      17.235 CMS


*------------------------
* GET INFLOW TO POINT -6-
*------------------------
*------------------
* SUBAREA 5C
*------------------
```

```
                    XIMP=0.30 TIMP=0.30 [illegible]
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=550 MNI=0.013
                    SLP=1 LGP=550 MNP=0.25
                    -1
    UNIT PEAK =     .175 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    6.91 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .035 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   45.45 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =     6.335 CMS  RUNOFF VOLUME =   43.49 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .60

ADD HYD             ID=2 HYD=261 IDI=1 IDII=6
    PEAK FLOW =     23.453 CMS     RUNOFF VOLUME =    19.98 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD       ID=2     HYD NO=261     ID I=1         ID II=6
*----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -6-
*----------------------------------
PRINT HYD           ID=2 1

                                          HYDROGRAPH FROM AREA 261


     RUNOFF VOLUME =    19.98 MM
     PEAK DISCHARGE RATE =     23.453 CMS


*------------------
FINISH
```

```
**
**                          ANDREW BRODIE ASSOCIATES INC.                                       **
**                                                                                              **
**                                                                                              **
**ANDREW BRODIE & ASSOCIATES INC                                                                **
**                                                                                              **
************************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START                RAINFALL BEGINS AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 5  STROM
* POST-DEV COND.ALTERNATIVE -BETA- R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES5F.OT7
*-----------------------------
* GET INFLOW TO THE POINT -A-
*-----------------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD       ID=1 HYD=101 DT=0.0833 H  DA=156.64 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                     4.23 4.23 5.27 5.27 7.07 7.07 11.52 11.52 45.05 45.05
                     72.96 72.96 62.52 62.52 19.19 19.19 12.59 12.59 9.5 9.5
                     7.67 7.67 6.46 6.46 5.59 5.59 4.94 4.94 4.44 4.44
                     4.03 4.03 3.7 3.7 3.42 3.42
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       3.81 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =     1.652 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.999 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
PRINT HYD            ID=1 1

                                    HYDROGRAPH FROM AREA 101


     RUNOFF VOLUME =    12.71 MM
     PEAK DISCHARGE RATE =       1.652 CMS



*------------------
* SUBAREA 2A
*------------------
COMPUTE URBHYD       ID=2 HYD=102 DT=0.0833  DA=299.12 CKK=1.0
                     XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=1235 MNI=0.013
                     SLP=1 LGP=1235 MNP=0.25
                     -1
    UNIT PEAK =     .108 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =   13.10 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .017 CMS
    PEAK INTENSITY(RAIN EXCESS) =     41.75 MM/HR
    STORAGE COEFF. SC =   96.49 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =    20.111 CMS  RUNOFF VOLUME =   23.94 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .50

ADD HYD              ID=4 HYD=412 IDI=1 IDII=2
    PEAK FLOW =      20.238 CMS     RUNOFF VOLUME =     20.08 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD       ID=4     HYD NO=412     ID I=1          ID II=2
*-----------------------------
* INFLOW TO THE POINT -A-
*-----------------------------
PRINT HYD            ID=4 1

                                    HYDROGRAPH FROM AREA 412


     RUNOFF VOLUME =    20.08 MM
     PEAK DISCHARGE RATE =      20.238 CMS
```

```
*-----------------------------------------------------
* ROUTING FROM THE POINT A TO POINT  B
*-----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 MINEL=0.0
                                       MAXEL=2.5
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                   N=0.03  DIST=9.5 N=-0.02 DIST=16.5 N=0.03 DIST=26
                     0   2.5       4.5 1.0
                     9.5 1.0      11.5 0.0
                    14.5 0.0      16.5 1.0
                    21.5 1.0      26.0 2.5
                   126 102.40 226 102.98

                              RATING CURVE VALLEY SECTION  1.0
                                  WATER      FLOW       FLOW
                                 SURFACE     AREA       RATE
                                  ELEV     SQ METRES    CMS
                                    .00         .0         .0
                                    .13         .4         .3
                                    .26         .9        1.0
                                    .39        1.5        2.0
                                    .53        2.1        3.4
                                    .66        2.8        5.1
                                    .79        3.6        7.2
                                    .92        4.5        9.7
                                   1.05        5.9       12.9
                                   1.18        8.2       17.8
                                   1.32   [illegible]    [illegible].8
                                   1.45       13.2       30.8
                                   1.58       15.8       38.9
                                   1.71       18.6       47.8
                                   1.84       21.4       57.7
                                   1.97       24.4       68.4
                                   2.11       27.5       80.1
                                   2.24       30.6       92.8
                                   2.37       33.9      106.3
                                   2.50       37.2      120.7
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                   L=750   SLP=0.0035

                                  TRAVEL TIME TABLE
                                       REACH  1.0

                                  WATER      FLOW      TRAVEL
                                  DEPTH      RATE       TIME
                                 METRES      CMS        HRS
                                    .13         0.      .2900
                                    .26         1.      .1920
                                    .39         2.      .1525
                                    .53         3.      .1301
                                    .66         5.      .1152
                                    .79         7.      .1044
                                    .92        10.      .0962
                                   1.05        13.      .0954
                                   1.18        18.      .0964
                                   1.32        24.      .0933
                                   1.45        31.      .0892
                                   1.58        39.      .0850
                                   1.71        48.      .0810
                                   1.84        58.      .0775
                                   1.97        68.      .0743
                                   2.11        80.      .0714
                                   2.24        93.      .0688
                                   2.37       106.      .0664
                                   2.50       121.      .0643
ROUTE              ID=6    HYD=201
                   INDI=4  DT= 0.08330
PRINT HYD          ID=6 1

                                   HYDROGRAPH FROM AREA 201


    RUNOFF VOLUME =    20.08 MM
    PEAK DISCHARGE RATE =     18.029 CMS


*------------------------------
* GET  INFLOW TO POINT -B-
*------------------------------
*------------------
* SUBAREA 4A
*------------------
COMPUTE URBHYD     ID=2 HYD=102 DT=0.0833  DA=89.43 CKK=1.0
                   XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                   F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
```

```
                 SLP=1 LGP=810 MNP=0.25
                 -1
   UNIT PEAK =    .132 CMS
   PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
   STORAGE COEFF. SC =   10.17 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =    .022 CMS
   PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
   STORAGE COEFF. SC =   74.91 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

   TOTAL RAINFALL =    48.34 MM

   PEAK DISCHARGE =    11.741 CMS  RUNOFF VOLUME =   38.54 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .80

ADD HYD          ID=3 HYD=342 IDI=6 IDII=2
   PEAK FLOW =    29.585 CMS    RUNOFF VOLUME =    23.11 MM     TIME TO PEAK=  1.17 HOURS

       ADD HYD      ID=3     HYD NO=342     ID I=6       ID II=2
*------------------------------
* INFLOW TO THE POINT -B-
*------------------------------
PRINT HYD        ID=3 1

                              HYDROGRAPH FROM AREA 342

    RUNOFF VOLUME =    23.11 MM
    PEAK DISCHARGE RATE =     29.585 CMS

*--------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  C
*--------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                 L=1300  SLP=0.0043

                              TRAVEL TIME TABLE
                                   REACH  1.0

                              WATER    FLOW     TRAVEL
                              DEPTH    RATE     TIME
                             METRES    CMS      HRS
                                .13      0.     .5027
                                .26      1.     .3327
                                .39      2.     .2643
                                .53      3.     .2254
                                .66      5.     .1997
                                .79      7.     .1810
                                .92     10.     .1667
                               1.05     13.     .1654
                               1.18     18.     .1672
                               1.32     24.     .1618
                               1.45     31.     .1546
                               1.58     39.     .1473
                               1.71     48.     .1405
                               1.84     58.     .1343
                               1.97     68.     .1287
                               2.11     80.     .1237
                               2.24     93.     .1192
                               2.37    106.     .1151
                               2.50    121.     .1114
ROUTE            ID=6    HYD=201
                 INDI=3  DT= 0.08330
PRINT HYD        ID=6 1

                              HYDROGRAPH FROM AREA 201

    RUNOFF VOLUME =    23.11 MM
    PEAK DISCHARGE RATE =     25.272 CMS

*------------------------------
* GET  INFLOW TO POINT -C-
*------------------------------
*------------------
* SUBAREA 3A
*------------------
COMPUTE NASHYD     ID=1 HYD=103 DT=0.0833 H  DA=98.38 HECT AA=0.0 AB=0.0
```

```
                        -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        3.21 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      1.288 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =     2.499 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*------------------
* SUBAREA 2B
*------------------
COMPUTE URBHYD          ID=2 HYD=102 DT=0.0833  DA=23.23 CKK=1.0
                        XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                        F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                        SLI=1 LGI=395 MNI=0.013
                        SLP=1 LGP=395 MNP=0.25
                        -1
    UNIT PEAK =     .180 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =     6.61 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .033 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   48.69 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =     1.880 CMS  RUNOFF VOLUME =   23.95 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .50

ADD HYD                 ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =        2.048 CMS     RUNOFF VOLUME =     14.85 MM      TIME TO PEAK=  1.17 HOURS

            ADD HYD        ID=3      HYD NO=312      ID I=1          ID II=2
ADD HYD                 ID=1 HYD=163 IDI=6 IDII=3
    PEAK FLOW =        26.834 CMS    RUNOFF VOLUME =     21.60 MM      TIME TO PEAK=  1.25 HOURS

            ADD HYD        ID=1      HYD NO=163      ID I=6          ID II=3
*------------------
* SUBAREA 4B
*------------------
COMPUTE URBHYD          ID=2 HYD=102 DT=0.0833  DA=191 CKK=1.0
                        XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                        F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                        SLI=1 LGI=1128 MNI=0.013
                        SLP=1 LGP=1128 MNP=0.25
                        -1
    UNIT PEAK =     .113 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =   12.40 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .018 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   91.38 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =    24.005 CMS  RUNOFF VOLUME =   38.54 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .80

ADD HYD                 ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =        49.177 CMS    RUNOFF VOLUME =     25.37 MM      TIME TO PEAK=  1.17 HOURS

            ADD HYD        ID=3      HYD NO=312      ID I=1          ID II=2
*------------------------------
*  INFLOW TO POINT -C-
*------------------------------
PRINT HYD               ID=3 1

                                                    HYDROGRAPH FROM AREA 312


     RUNOFF VOLUME =     25.37 MM
     PEAK DISCHARGE RATE =      49.177 CMS


*------------------------------------------------------
```

```
*-----------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=750  SLP=0.008

                                        TRAVEL TIME TABLE
                                              REACH  1.0

                                        WATER      FLOW      TRAVEL
                                        DEPTH      RATE      TIME
                                        METRES     CMS       HRS
                                          .13        0.      .2900
                                          .26        1.      .1920
                                          .39        2.      .1525
                                          .53        3.      .1301
                                          .66        5.      .1152
                                          .79        7.      .1044
                                          .92       10.      .0962
                                         1.05       13.      .0954
                                         1.18       18.      .0964
                                         1.32       24.      .0933
                                         1.45       31.      .0892
                                         1.58       39.      .0850
                                         1.71       48.      .0810
                                         1.84       58.      .0775
                                         1.97       68.      .0743
                                         2.11       80.      .0714
                                         2.24       93.      .0688
                                         2.37      106.      .0664
                                         2.50      121.      .0643
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.08330
PRINT HYD           ID=6 1

                                          HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    25.37 MM
     PEAK DISCHARGE RATE =      46.767 CMS



*-----------------------------------------
* GET  INFLOW TO POINT -D- ( S W M  POND )
*-----------------------------------------
*------------------
* SUBAREA 3B
*------------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=95.17 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.50 H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        2.42 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      1.038 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.916 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*------------------
* SUBAREA 4C
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=77.71 CKK=1.0
                    XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=719 MNI=0.013
                    SLP=1 LGP=719 MNP=0.25
                    -1
    UNIT PEAK =    .139 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =    9.47 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .024 CMS
    PEAK INTENSITY(RAIN EXCESS) =     41.75 MM/HR
    STORAGE COEFF. SC =   69.74 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =     6.824 CMS  RUNOFF VOLUME =   27.31 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =    .57

ADD HYD             ID=3 HYD=216 IDI=1 IDII=2
    PEAK FLOW =      6.911 CMS     RUNOFF VOLUME =    19.27 MM     TIME TO PEAK=  1.17 HOURS

            ADD HYD        ID=3     HYD NO=216     ID I=1         ID II=2
```

```
ADD HYD           ID=1 HYD=216 IDI=6 IDII=3
    PEAK FLOW =     51.997 CMS     RUNOFF VOLUME =    24.35 MM     TIME TO PEAK=  1.25 HOURS

          ADD HYD       ID=1     HYD NO=216     ID I=6          ID II=3
X--------------------------
X  INFLOW TO  S W M  POND )
X--------------------------
X
PRINT HYD           ID=1 1

                                                    HYDROGRAPH FROM AREA 216


     RUNOFF VOLUME =    24.35 MM
     PEAK DISCHARGE RATE =      51.997 CMS


ROUTE RESERVOIR      ID=5 500 1
                     DISCHARGE     STORAGE
                       0.0           0.0
                       3.0           4.2
                       6.2           7.7
                       9.0          23.1
                      13.0          29.56
    PEAK DISCHARGE =      7.6418 CMS  RUNOFF VOLUME= 24.2581 MM
X
PRINT HYD           ID=5 1

                                                    HYDROGRAPH FROM AREA 500


     RUNOFF VOLUME =    24.26 MM
     PEAK DISCHARGE RATE =      7.642 CMS


X------------------------------------------
X    OUTFLOW FROM  S W M POND ( POINT -D-)
X------------------------------------------
X-------------------------------------------------------
X ROUTING FROM THE POINT D TO POINT  E
X-------------------------------------------------------
X-------------------------------------------------------
X ROUTING - X SECTION #2
X-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=90.58
                                       MAXEL=92.84
                                       CHSLP=0.0041
                                       FPSLP=0.0041
                     N=0.03 DIST=18
                     0.0    92.84  1.0  92.84
                     2.0    92.24  4.0  92.24
                     7.4    90.96  8.0  90.58
                     10     90.58  10.4 91.28
                     14     92.32  16   92.32
                     17     92.84  18   92.84

                                 RATING CURVE VALLEY SECTION  1.0
                                    WATER      FLOW       FLOW
                                   SURFACE     AREA       RATE
                                    ELEV    SQ METRES     CMS
                                    90.58        .0         .0
                                    90.70        .3         .1
                                    90.82        .5         .4
                                    90.94        .9         .8
                                    91.06       1.2        1.2
                                    91.17       1.6        1.8
                                    91.29       2.0        2.6
                                    91.41       2.5        3.3
                                    91.53       3.1        4.3
                                    91.65       3.8        5.6
                                    91.77       4.6        7.0
                                    91.89       5.5        8.8
                                    92.01       6.4       10.8
                                    92.13       7.4       13.1
                                    92.25       8.6       14.1
                                    92.36      10.1       16.3
                                    92.48      11.8       20.8
                                    92.60      13.6       25.8
                                    92.72      15.4       31.2
                                    92.84      17.3       34.4
COMPUTE TRAVEL TIME ID=3 REACH=1 NVS=1
                    L=1350  SLP=0.0041

                                    TRAVEL TIME TABLE
                                         REACH  1.0
```

DEPTH METRES	RATE CMS	TIME HRS
.12	0.	.7780
.24	0.	.5181
.36	1.	.4140
.48	1.	.3606
.59	2.	.3245
.71	3.	.2987
.83	3.	.2856
.95	4.	.2716
1.07	6.	.2579
1.19	7.	.2450
1.31	9.	.2331
1.43	11.	.2223
1.55	13.	.2123
1.67	14.	.2278
1.78	16.	.2313
1.90	21.	.2126
2.02	26.	.1977
2.14	31.	.1853
2.26	34.	.1883

```
ROUTE               ID=3    HYD=201
                    INDI=5  DT= 0.08330
PRINT HYD           ID=3 1

                          HYDROGRAPH FROM AREA 201

     RUNOFF VOLUME =    24.24 MM
     PEAK DISCHARGE RATE =      7.631 CMS

*----------------------------
* GET  INFLOW TO POINT -E-
*----------------------------
*-------------------
* SUBAREA 5A
*-------------------
COMPUTE URBHYD      ID=1 HYD=102 DT=0.0833  DA=62.5 CKK=1.0
                    XIMP=0.45 TIMP=0.45 NI=36-FD=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=645 MNI=0.013
                    SLP=1 LGP=645 MNP=0.25
                    -1
    UNIT PEAK =    .146 CMS
    PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
    STORAGE COEFF. SC =    8.87 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .025 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   65.34 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =     5.569 CMS  RUNOFF VOLUME =   27.31 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .57

*-----------------------
*  INFLOW TO POINT -E-
*-----------------------
PRINT HYD           ID=1 1

                          HYDROGRAPH FROM AREA 102

     RUNOFF VOLUME =    27.31 MM
     PEAK DISCHARGE RATE =      5.569 CMS

*----------------------------------------------------
* ROUTING FROM THE POINT E TO POINT  F
*----------------------------------------------------
*----------------------------------------------------
* ROUTING - X SECTION #1
*----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=87.47
                                       MAXEL=89.90
                                       CHSLP=0.0054
                                       FPSLP=0.0054
                    N=0.03 DIST=18
```

3.

[illegible]	[illegible]	[illegible]	[illegible]
2.0	89.27	9.0	89.27
9.8	87.47	12.2	87.47
13.	89.21	16.	89.39
20.	89.40	21.0	89.90
22	89.90		

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
87.47	.0	.0
87.60	.3	.2
87.73	.6	.6
87.85	1.0	1.1
87.98	1.3	1.7
88.11	1.7	2.5
88.24	2.1	3.3
88.37	2.5	4.3
88.49	2.9	5.3
88.62	3.4	6.4
88.75	3.8	7.6
88.88	4.3	8.9
89.00	4.7	10.2
89.13	5.2	11.7
89.26	5.8	12.3
89.39	7.4	10.5
89.52	9.7	14.3
89.64	12.0	20.4
89.77	14.4	27.3
89.90	16.9	34.1

COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
L=900 SLP=0.0054

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.4259
.26	1.	.2823
.38	1.	.2254
.51	2.	.1938
.64	2.	.1732
.77	3.	.1586
.90	4.	.1475
1.02	5.	.1388
1.15	6.	.1317
1.28	8.	.1257
1.41	9.	.1206
1.53	10.	.1162
1.66	12.	.1123
1.79	12.	.1174
1.56	11.	.1152
2.05	14.	.1697
2.17	20.	.1478
2.30	27.	.1320
2.43	34.	.1236

ROUTE ID=6 HYD=201
INDI=3 DT= 0.08330
PRINT HYD ID=6 1

HYDROGRAPH FROM AREA 201

RUNOFF VOLUME = 24.22 MM
PEAK DISCHARGE RATE = 7.628 CMS

```
*-------------------------
* GET INFLOW TO POINT -F-
*-------------------------
*-------------------
* SUBAREA 5B
*-------------------
COMPUTE URBHYD       ID=2 HYD=102 DT=0.0833  DA=77.8 CKK=1.0
                     XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=720 MNI=0.013
                     SLP=1 LGP=720 MNP=0.25
                     -1
```

UNIT PEAK = .139 CMS
PEAK INTENSITY(RAIN EXCESS) = 72.96 MM/HR
STORAGE COEFF. SC = 9.47 MINS

SUM OF THE UNIT HYDROGRAPH CO-ORDINATES = 12.00

```
    UNIT PEAK =    .023 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   69.80 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    46.34 MM

    PEAK DISCHARGE =     6.830 CMS  RUNOFF VOLUME =  27.31 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .57

ADD HYD              ID=4 HYD=261 IDI=1 IDII=2
    PEAK FLOW =      12.400 CMS    RUNOFF VOLUME =    27.31 MM    TIME TO PEAK=  1.17 HOURS

           ADD HYD       ID=4     HYD NO=261     ID I=1         ID II=2
ROUTE RESERVOIR      ID=1 500 4
                     DISCHARGE    STORAGE
                       0.0         0.0
                       0.8         1.16
                       1.5         2.24
                       2.0         3.74
                       3.2         4.56
    PEAK DISCHARGE =     1.6159 CMS  RUNOFF VOLUME= 27.2252 MM
ADD HYD              ID=2 HYD=261 IDI=1 IDII=3
    PEAK FLOW =       9.184 CMS    RUNOFF VOLUME =    24.59 MM    TIME TO PEAK=  3.25 HOURS

           ADD HYD       ID=2     HYD NO=261     ID I=1         ID II=3
*
*----------------------
*  INFLOW TO POINT -F-
*----------------------
PRINT HYD            ID=2 1

                                  HYDROGRAPH FROM AREA 261


     RUNOFF VOLUME =     24.59 MM
     PEAK DISCHARGE RATE =       9.184 CMS



*-------------------------------------------------------
* ROUTING FROM THE POINT  F  TO POINT  6
*-------------------------------------------------------
* ARTIFITIAL CHANNEL
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=84.30
                                       MAXEL=87.00
                                       CHSLP=0.0004
                                       FPSLP=0.0004
                     N=0.035 DIST=24.
                     0.0   87.00   4.0   85.3
                     6.5   85.3    8.    84.3
                     16.0  84.3   17.5   85.3
                     20.0  85.3   24.0   87.00

                              RATING CURVE VALLEY SECTION  1.0
                                 WATER      FLOW      FLOW
                                SURFACE     AREA      RATE
                                 ELEV    SQ METRES    CMS
                                 84.30       .0        .0
                                 84.44       1.2       .2
                                 84.58       2.4       .6
                                 84.73       3.7       1.1
                                 84.87       5.0       1.8
                                 85.01       6.4       2.6
                                 85.15       7.9       3.6
                                 85.29       9.4       4.7
                                 85.44      11.7       5.2
                                 85.58      14.1       6.9
                                 85.72      16.7       8.8
                                 85.86      19.3      10.9
                                 86.01      22.0      13.3
                                 86.15      24.7      15.8
                                 86.29      27.6      18.6
                                 86.43      30.6      21.6
                                 86.57      33.7      24.8
                                 86.72      36.9      28.2
                                 86.86      40.1      31.8
                                 87.00      43.5      35.7
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                     L=600  SLP=0.0004

                                 TRAVEL TIME TABLE
                                      REACH  1.0
```

```
                                                   DEPTH      RATE       TIME
                                                   METRES     CMS        HRS
                                                     .14        0.      1.0967
                                                     .28        1.       .7062
                                                     .43        1.       .5499
                                                     .57        2.       .4625
                                                     .71        3.       .4055
                                                     .85        4.       .3649
                                                     .99        5.       .3342
                                                    1.14        5.       .3778
                                                    1.28        7.       .3428
                                                    1.42        9.       .3157
                                                    1.56       11.       .2939
                                                    1.71       13.       .2760
                                                    1.85       16.       .2609
                                                    1.99       19.       .2479
                                                    2.13       22.       .2367
                                                    2.27       25.       .2268
                                                    2.42       28.       .2181
                                                    2.56       32.       .2102
                                                    2.70       36.       .2032
ROUTE                ID=6    HYD=201
                     INDI=2  DT= 0.08330
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =    20RATE =      172.52
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =    21RATE =      196.43
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   110RATE =      189.14
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   111RATE =      186.33
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   112RATE =      183.22
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   113RATE =      179.89
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   114RATE =      176.40
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   115RATE =      172.79
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   116RATE =      169.12
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   117RATE =      165.42
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   118RATE =      161.71
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   119RATE =      158.01
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   120RATE =      154.34
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
              OUTFLOW NUMBER =   121RATE =      150.70
PRINT HYD            ID=6 1

                                          HYDROGRAPH FROM AREA 201


      RUNOFF VOLUME =     24.55 MM
      PEAK DISCHARGE RATE =       9.032 CMS



*------------------------
* GET INFLOW TO POINT -6-
*------------------------
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD       ID=1 HYD=102 DT=0.0833  DA=45.5 CKK=1.0
                     XIMP=0.30 TIMP=0.30 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=550 MNI=0.013
                     SLP=1 LGP=550 MNP=0.25
                     -1
    UNIT PEAK =     .157 CMS
    PEAK INTENSITY(RAIN EXCESS) =     72.96 MM/HR
    STORAGE COEFF. SC =     8.06 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =    12.00

    UNIT PEAK =     .027 CMS
    PEAK INTENSITY(RAIN EXCESS) =     41.75 MM/HR
    STORAGE COEFF. SC =    59.39 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =    11.99

    TOTAL RAINFALL =     48.34 MM

    PEAK DISCHARGE =     [illegible] CMS  RUNOFF VOLUME =   [illegible] MM  TIME TO PEAK =   [illegible] HRS
```

```
    PEAK DISCHARGE =     [illegible] CMS  RUNOFF VOLUME =   21.70 MM  TIME TO PEAK =   [illegible] HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .45

ROUTE RESERVOIR      ID=5 500 1
                     DISCHARGE     STORAGE
                       0.0          0.0
                       1.0          0.19
                       2.1          0.29
                       3.0          0.36
                       5.0          0.48
    PEAK DISCHARGE =      1.9846 CMS  RUNOFF VOLUME= 21.6976 MM
*
PRINT HYD            ID=5 1

                                          HYDROGRAPH FROM AREA 500


      RUNOFF VOLUME =     21.70 MM
      PEAK DISCHARGE RATE =       1.985 CMS


ADD HYD              ID=2 HYD=261 IDI=5 IDII=6
    PEAK FLOW =       9.336 CMS     RUNOFF VOLUME =     24.44 MM     TIME TO PEAK=  3.25 HOURS

           ADD HYD        ID=2     HYD NO=261     ID I=5         ID II=6
*-----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -6-
*-----------------------------------
PRINT HYD            ID=2 1

                                          HYDROGRAPH FROM AREA 261


      RUNOFF VOLUME =     24.44 MM
      PEAK DISCHARGE RATE =       9.336 CMS


*------------------
FINISH
```

[illegible]	[illegible]	[illegible]
87.98	1.3	1.7
88.11	1.7	2.5
88.24	2.1	3.3
88.37	2.5	4.3
88.49	2.9	5.3
88.62	3.4	6.4
88.75	3.8	7.6
88.88	4.3	8.9
89.00	4.7	10.2
89.13	5.2	11.7
89.26	5.8	12.3
89.39	7.4	10.5
89.52	9.7	14.3
89.64	12.0	20.4
89.77	14.4	27.3
89.90	16.9	34.1

COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
L=900 SLP=0.0054

0 TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.4259
.26	1.	.2823
.38	1.	.2254
.51	2.	.1938
.64	2.	.1732
.77	3.	.1586
.90	4.	.1475
1.02	5.	.1388
1.15	6.	.1317
1.28	8.	.1257
1.41	9.	.1206
1.53	10.	.1162
1.66	12.	.1123
1.79	12.	.1174
1.56	11.	.1152
2.05	14.	.1697
2.17	20.	.1478
2.30	27.	.1320
2.43	34.	.1236

ROUTE ID=6 HYD=201
INDI=2 DT= 0.08330
PRINT HYD ID=6 1

0 HYDROGRAPH FROM AREA 201

0 RUNOFF VOLUME = 24.40 MM
PEAK DISCHARGE RATE = 8.038 CMS

*-------------------------
* GET INFLOW TO POINT -F-
*-------------------------
*-------------------
* SUBAREA 5B
*-------------------
COMPUTE URBHYD ID=1 HYD=102 DT=0.0833 DA=77.8 CKK=1.0
XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
SLI=1 LGI=720 MNI=0.013
SLP=1 LGP=720 MNP=0.25
-1

UNIT PEAK = .139 CMS
PEAK INTENSITY(RAIN EXCESS) = 72.96 MM/HR
STORAGE COEFF. SC = 9.47 MINS

SUM OF THE UNIT HYDROGRAPH CO-ORDINATES = 12.00

UNIT PEAK = .023 CMS
PEAK INTENSITY(RAIN EXCESS) = 41.75 MM/HR
STORAGE COEFF. SC = 69.80 MINS

SUM OF THE UNIT HYDROGRAPH CO-ORDINATES = 11.99

TOTAL RAINFALL = 48.34 MM

PEAK DISCHARGE = 6.830 CMS RUNOFF VOLUME = 27.31 MM TIME TO PEAK = 1.166 HRS

RUNOFF VOLUMETRIC COEFFICIENT = .57

ADD HYD ID=2 HYD=261 IDI=1 IDII=6
PEAK FLOW = 12.573 CMS RUNOFF VOLUME = 24.59 MM TIME TO PEAK= 1.17 HOURS

0 ADD HYD ID=2 HYD NO=261 ID I=1 ID II=6

*----------------------

```
**                                                                                  **
**                        ANDREW  BRODIE  ASSOCIATES  INC.                          **
**                                                                                  **
**                                                                                  **
**                                                                                  **
**ANDREW BRODIE & ASSOCIATES INC                                                    **
**                                                                                  **
************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START                  RAINFALL BEGINS AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 100  STROM
* POST-DEV COND.ALTERNATIVE -BETA- R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES100F.OT7
*------------------------------
* GET INFLOW TO THE POINT -A-
*------------------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD       ID=1 HYD=101 DT=0.0833 H  DA=156.64 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                     4.92 4.92 6.35 6.35 8.95 8.95 18.54 18.54 78.42 78.42
                     107.19 107.19 99.64 99.64 31.1 31.1 17.51 17.51 12.65
                     12.65 9.85 9.85 8.05 8.05 6.81 6.81 5.89 5.89 5.2 5.2
                     4.65 4.65 4.21 4.21 3.85 3.85
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       3.81 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
    PEAK DISCHARGE =     3.423 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =    2.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
PRINT HYD            ID=1 1

                                              HYDROGRAPH FROM AREA 101


     RUNOFF VOLUME =    25.71 MM
     PEAK DISCHARGE RATE =      3.423 CMS



*------------------
* SUBAREA 2A
*------------------
COMPUTE URBHYD       ID=2 HYD=102 DT=0.0833  DA=299.12 CKK=1.0
                     XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=1235 MNI=0.013
                     SLP=1 LGP=1235 MNP=0.25
                     -1
    UNIT PEAK =    .122 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =   11.23 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .022 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   73.85 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    38.319 CMS  RUNOFF VOLUME =   45.90 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .64

ADD HYD              ID=4 HYD=412 IDI=1 IDII=2
    PEAK FLOW =      38.626 CMS     RUNOFF VOLUME =    38.96 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD        ID=4     HYD NO=412     ID I=1         ID II=2
*------------------------------
* INFLOW TO THE POINT -A-
*------------------------------
PRINT HYD            ID=4 1

                                              HYDROGRAPH FROM AREA 412


     RUNOFF VOLUME =    38.97 MM
     PEAK DISCHARGE RATE =     38.626 CMS
```

```
*-----------------------------------------------------
* ROUTING FROM THE POINT A TO POINT  B
*-----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=0.0
                                       MAXEL=2.5
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                    N=0.03  DIST=9.5 N=-0.02 DIST=16.5 N=0.03 DIST=26
                      0   2.5       4.5 1.0
                     9.5 1.0       11.5 0.0
                    14.5 0.0       16.5 1.0
                    21.5 1.0       26.0 2.5
                    126 102.40 226 102.98

                                    RATING CURVE VALLEY SECTION  1.0
                                       WATER      FLOW       FLOW
                                      SURFACE     AREA       RATE
                                       ELEV    SQ METRES     CMS
                                         .00         .0         .0
                                         .13         .4         .3
                                         .26         .9        1.0
                                         .39        1.5        2.0
                                         .53        2.1        3.4
                                         .66        2.8        5.1
                                         .79        3.6        7.2
                                         .92        4.5        9.7
                                        1.05        5.9       12.9
                                        1.18        8.2       17.8
                                        1.32       10.7       23.8
                                        1.45       13.2       30.8
                                        1.58       15.8       38.9
                                        1.71       18.6       47.8
                                        1.84       21.4       57.7
                                        1.97       24.4       68.4
                                        2.11       27.5       80.1
                                        2.24       30.6       92.8
                                        2.37       33.9      106.3
                                        2.50       37.2      120.7
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=750   SLP=0.0035

                                       TRAVEL TIME TABLE
                                             REACH  1.0

                                       WATER      FLOW      TRAVEL
                                       DEPTH      RATE       TIME
                                      METRES      CMS        HRS
                                         .13         0.      .2900
                                         .26         1.      .1920
                                         .39         2.      .1525
                                         .53         3.      .1301
                                         .66         5.      .1152
                                         .79         7.      .1044
                                         .92        10.      .0962
                                        1.05        13.      .0954
                                        1.18        18.      .0964
                                        1.32        24.      .0933
                                        1.45        31.      .0892
                                        1.58        39.      .0850
                                        1.71  [illegible]    .0810
                                        1.84        58.      .0775
                                        1.97        68.      .0743
                                        2.11        80.      .0714
                                        2.24        93.      .0688
                                        2.37       106.      .0664
                                        2.50       121.      .0643
ROUTE               ID=6    HYD=201
                    INDI=4  DT= 0.08330
PRINT HYD           ID=6 1

                                          HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    38.97 MM
     PEAK DISCHARGE RATE =     35.115 CMS



*------------------------------
* GET  INFLOW TO POINT -B-
*------------------------------
*------------------
* SUBAREA 4A
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=89.43 CKK=1.0
                    XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
```

```
                                 -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =        3.21 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =      2.719 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =    2.416 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
*-------------------
* SUBAREA 2B
*-------------------
COMPUTE URBHYD          ID=2 HYD=102 DT=0.0833  DA=23.23 CKK=1.0
                        XIMP=0.36 TIMP=0.36 NI=36 F0=76.12 FC=13.2 DCAY=4.14
                        F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                        SLI=1 LGI=395 MNI=0.013
                        SLP=1 LGP=395 MNP=0.25
                        -1
    UNIT PEAK =     .199 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =     5.67 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .043 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   37.26 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =     3.721 CMS  RUNOFF VOLUME =   45.92 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .64

ADD HYD                 ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =      4.124 CMS     RUNOFF VOLUME =    29.57 MM     TIME TO PEAK=  1.17 HOURS

           ADD HYD        ID=3     HYD NO=312     ID I=1          ID II=2
ADD HYD                 ID=1 HYD=163 IDI=6 IDII=3
    PEAK FLOW =     51.591 CMS     RUNOFF VOLUME =    40.30 MM     TIME TO PEAK=  1.25 HOURS

           ADD HYD        ID=1     HYD NO=163     ID I=6          ID II=3
*-------------------
* SUBAREA 4B
*-------------------
COMPUTE URBHYD          ID=2 HYD=102 DT=0.0833  DA=191 CKK=1.0
                        XIMP=0.75 TIMP=0.75 NI=36 F0=76.12 FC=13.2 DCAY=4.14
                        F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                        SLI=1 LGI=1128 MNI=0.013
                        SLP=1 LGP=1128 MNP=0.25
                        -1
    UNIT PEAK =     .127 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =   10.63 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .023 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   69.94 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    40.276 CMS  RUNOFF VOLUME =   61.70 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .85

ADD HYD                 ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =     89.047 CMS     RUNOFF VOLUME =    45.07 MM     TIME TO PEAK=  1.17 HOURS

           ADD HYD        ID=3     HYD NO=312     ID I=1          ID II=2
*------------------------------
*  INFLOW TO POINT -C-
*------------------------------
PRINT HYD               ID=3 1

                                           HYDROGRAPH FROM AREA 312

     RUNOFF VOLUME =    45.07 MM
     PEAK DISCHARGE RATE =     89.047 CMS

*-----------------------------------------------------
```

```
*-------------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=750  SLP=0.008
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.2900
.26	1.	.1920
.39	2.	.1525
.53	3.	.1301
.66	5.	.1152
.79	7.	.1044
.92	10.	.0962
1.05	13.	.0954
1.18	18.	.0964
1.32	24.	.0933
1.45	31.	.0892
1.58	39.	.0850
1.71	48.	.0810
1.84	58.	.0775
1.97	68.	.0743
2.11	80.	.0714
2.24	93.	.0688
2.37	106.	.0664
2.50	121.	.0643

```
ROUTE                ID=6    HYD=201
                     INDI=3  DT= 0.08330
PRINT HYD            ID=6 1
```

HYDROGRAPH FROM AREA 201

```
    RUNOFF VOLUME =     45.07 MM
    PEAK DISCHARGE RATE =      85.277 CMS



*------------------------------------------
* GET  INFLOW TO POINT -D- ( S W M  POND )
*------------------------------------------
*------------------
* SUBAREA 38
*------------------
COMPUTE NASHYD       ID=1 HYD=103 DT=0.0833 H  DA=95.17 HECT AA=0.0 AB=0.0
                     CN=68 IA=2.5 MM N=3 TP=1.50 H NI=36
                     -1
   SHAPE CONSTANT, N =   3.00
   UNIT PEAK =        2.42 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
   PEAK DISCHARGE =     2.157 CMS   RUNOFF VOLUME =    25.71 MM TIME TO PEAK =     2.832 HRS
   TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =     .36
*------------------
* SUBAREA 40
*------------------
COMPUTE URBHYD       ID=2 HYD=102 DT=0.0833  DA=77.71 CKK=1.0
                     XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=719 MNI=0.013
                     SLP=1 LGP=719 MNP=0.25
                     -1
   UNIT PEAK =     .156 CMS
   PEAK INTENSITY(RAIN EXCESS) =    107.19 MM/HR
   STORAGE COEFF. SC =    8.12 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =     .030 CMS
   PEAK INTENSITY(RAIN EXCESS) =     81.48 MM/HR
   STORAGE COEFF. SC =    53.38 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   TOTAL RAINFALL =     72.27 MM

   PEAK DISCHARGE =     12.551 CMS  RUNOFF VOLUME =    49.56 MM  TIME TO PEAK =    1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =    .69

ADD HYD              ID=3 HYD=216 IDI=1 IDII=2
   PEAK FLOW =       12.760 CMS     RUNOFF VOLUME =    36.43 MM     TIME TO PEAK=  1.17 HOURS

           ADD HYD        ID=3     HYD NO=216     ID I=1          ID II=2
```

```
                    SLP=1 LGP=610 MNP=0.25
                    -1
    UNIT PEAK =     .146 CMS
    PEAK INTENSITY(RAIN EXCESS) =    107.19 MM/HR
    STORAGE COEFF. SC =     8.72 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .028 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   57.34 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    19.604 CMS  RUNOFF VOLUME =   61.71 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .85

ADD HYD              ID=3 HYD=342 IDI=6 IDII=2
    PEAK FLOW =      54.719 CMS     RUNOFF VOLUME =    42.69 MM     TIME TO PEAK=  1.17 HOURS

         ADD HYD        ID=3      HYD NO=342      ID I=6         ID II=2
*-----------------------------
* INFLOW TO THE POINT -B-
*-----------------------------
PRINT HYD            ID=3 1

                                         HYDROGRAPH FROM AREA 342


     RUNOFF VOLUME =    42.70 MM
     PEAK DISCHARGE RATE =      54.719 CMS


*--------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  C
*--------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=1300  SLP=0.0043
```

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.5027
.26	1.	.3327
.39	2.	.2643
.53	3.	.2254
.66	5.	.1997
.79	7.	.1810
.92	10.	.1667
1.05	13.	.1654
1.18	18.	.1672
1.32	24.	.1618
1.45	31.	.1546
1.58	39.	.1473
1.71	48.	.1405
1.84	58.	.1343
1.97	68.	.1287
2.11	80.	.1237
2.24	93.	.1192
2.37	106.	.1151
2.50	121.	.1114

```
ROUTE                ID=6    HYD=201
                     INDI=3  DT= 0.08330
PRINT HYD            ID=6 1

                                         HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    42.70 MM
     PEAK DISCHARGE RATE =     48.297 CMS


*-----------------------------
* GET  INFLOW TO POINT -C-
*-----------------------------
*-----------------
* SUBAREA 3A
*-----------------
COMPUTE NASHYD       ID=1 HYD=103 DT=0.0833 H  DA=98.38 HECT AA=0.0 AB=0.0
```

```
   PEAK FLOW =      95.043 CMS     RUNOFF VOLUME =     43.62 MM      TIME TO PEAK=  1.25 HOURS

           ADD HYD          ID=1      HYD NO=216      ID I=6          ID II=3
*---------------------------
*  INFLOW TO  S W M  POND )
*---------------------------
*
PRINT HYD             ID=1 1

                                              HYDROGRAPH FROM AREA 216


     RUNOFF VOLUME =    43.62 MM
     PEAK DISCHARGE RATE =     95.043 CMS



ROUTE RESERVOIR      ID=5 500 1
                     DISCHARGE     STORAGE
                       0.0          0.0
                       3.0          4.2
                       6.2          7.7
                       9.0         23.1
                      13.0         29.56

STORAGE-DISCHARGE TABLE EXCEEDED.
      PEAK DISCHARGE =     13.0348 CMS   RUNOFF VOLUME= 43.3402 MM
 *
PRINT HYD             ID=5 1

                                              HYDROGRAPH FROM AREA 500


     RUNOFF VOLUME =    43.34 MM
     PEAK DISCHARGE RATE =     13.035 CMS



 *-----------------------------------------
 *    OUTFLOW FROM  S W M POND ( POINT -D-)
 *-----------------------------------------
 *------------------------------------------------------
 * ROUTING FROM THE POINT D TO POINT  E
 *------------------------------------------------------
 *------------------------------------------------------
 * ROUTING - X SECTION #2
 *------------------------------------------------------
 COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 MINEL=90.58
                                        MAXEL=92.84
                                        CHSLP=0.0041
                                        FPSLP=0.0041

                      N=0.03 DIST=18
                      0.0   92.84  1.0  92.84
                      2.0   92.24  4.0  92.24
                      7.4   90.96  8.0  90.58
                      10    90.58  10.4 91.28
                      14    92.32  16   92.32
                      17    92.84  18   92.84

                                    RATING CURVE VALLEY SECTION  1.0
                                       WATER       FLOW        FLOW
                                      SURFACE      AREA        RATE
                                       ELEV     SQ METRES      CMS
                                       90.58         .0          .0
                                       90.70         .3          .1
                                       90.82         .5          .4
                                       90.94         .9          .8
                                       91.06        1.2         1.2
                                       91.17        1.6         1.8
                                       91.29        2.0         2.6
                                       91.41        2.5         3.3
                                       91.53        3.1         4.3
                                       91.65        3.8         5.6
                                       91.77        4.6         7.0
                                       91.89        5.5         8.8
                                       92.01        6.4        10.8
                                       92.13        7.4        13.1
                                       92.25        8.6        14.1
                                       92.36       10.1        16.3
                                       92.48       11.8        20.8
                                       92.60       13.6        25.8
                                       92.72       15.4        31.2
                                       92.84       17.3        34.4
 COMPUTE TRAVEL TIME ID=3 REACH=1 NVS=1
                      L=1350   SLP=0.0041

                                        TRAVEL TIME TABLE
```

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.12	0.	.7780
.24	0.	.5181
.36	1.	.4140
.48	1.	.3606
.59	2.	.3245
.71	3.	.2987
.83	3.	.2856
.95	4.	.2716
1.07	6.	.2579
1.19	7.	.2450
1.31	9.	.2331
1.43	11.	.2223
1.55	13.	.2123
1.67	14.	.2278
1.78	16.	.2313
1.90	21.	.2126
2.02	26.	.1977
2.14	31.	.1853
2.26	34.	.1883

```
ROUTE                ID=3    HYD=201
                     INDI=5  DT= 0.08330
PRINT HYD            ID=3 1

                                 HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =     43.29 MM
     PEAK DISCHARGE RATE =      12.997 CMS


*---------------------------
* GET  INFLOW TO POINT -E-
*---------------------------
*------------------
* SUBAREA 5A
*------------------
COMPUTE URBHYD       ID=1 HYD=102 DT=0.0833  DA=62.5 CKK=1.0
                     XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=645 MNI=0.013
                     SLP=1 LGP=645 MNP=0.25
                     -1
    UNIT PEAK =    .164 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    7.60 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .032 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   50.01 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    10.270 CMS  RUNOFF VOLUME =   49.56 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .69

*----------------------
*  INFLOW TO POINT -E-
*----------------------
PRINT HYD            ID=1 1

                                 HYDROGRAPH FROM AREA 102


     RUNOFF VOLUME =     49.56 MM
     PEAK DISCHARGE RATE =      10.270 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT E TO POINT  F
*-------------------------------------------------------
*-------------------------------------------------------
* ROUTING - X SECTION #1
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=87.47
                                       MAXEL=89.90
                                       CHSLP=0.0054
```

```
                  N=0.03 DIST=18
                  0.0   89.90   1.    89.90
                  2.0   89.27  3.0    89.27
                  9.8   87.47 12.2    87.47
                  13.   89.21 16.     89.39
                  20.   89.40 21.0    89.90
                  22    89.90

                                  RATING CURVE VALLEY SECTION  1.0
                                      WATER      FLOW       FLOW
                                     SURFACE     AREA       RATE
                                      ELEV    SQ METRES     CMS
                                     87.47         .0         .0
                                     87.60         .3         .2
                                     87.73         .6         .6
                                     87.85        1.0        1.1
                                     87.98        1.3        1.7
                                     88.11        1.7        2.5
                                     88.24        2.1        3.3
                                     88.37        2.5        4.3
                                     88.49        2.9        5.3
                                     88.62        3.4        6.4
                                     88.75        3.8        7.6
                                     88.88        4.3        8.9
                                     89.00        4.7       10.2
                                     89.13        5.2       11.7
                                     89.26        5.8       12.3
                                     89.39        7.4       10.5
                                     89.52        9.7       14.3
                                     89.64       12.0       20.4
                                     89.77       14.4       27.3
                                     89.90       16.9       34.1
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                  L=900  SLP=0.0054

                                     TRAVEL TIME TABLE
                                             REACH  1.0

                                      WATER      FLOW      TRAVEL
                                      DEPTH      RATE       TIME
                                     METRES      CMS        HRS
                                        .13        0.       .4259
                                        .26        1.       .2823
                                        .38        1.       .2254
                                        .51        2.       .1938
                                        .64        2.       .1732
                                        .77        3.       .1586
                                        .90        4.       .1475
                                       1.02        5.       .1388
                                       1.15        6.       .1317
                                       1.28        8.       .1257
                                       1.41        9.       .1206
                                       1.53       10.       .1162
                                       1.66       12.       .1123
                                       1.79       12.       .1174
                                       1.56       11.       .1152
                                       2.05       14.       .1697
                                       2.17       20.       .1478
                                       2.30       27.       .1320
                                       2.43       34.       .1236
ROUTE             ID=6    HYD=201
                  INDI=3  DT= 0.08330
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS, CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   40RATE =     440.74
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS, CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   43RATE =     446.54
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS, CONVERGENCE WAS FORCED.
            OUTFLOW NUMBER =   60RATE =     427.52
PRINT HYD         ID=6 1

                                       HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    43.25 MM
     PEAK DISCHARGE RATE =     12.846 CMS



*-------------------------
* GET INFLOW TO POINT -F-
*-------------------------
*------------------
* SUBAREA 58
*------------------
COMPUTE URBHYD     ID=2 HYD=102 DT=0.0833  DA=77.8 CKK=1.0
                   XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                   F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
```

```
                          SLP=1 LGP=720 MNP=0.25
                          -1
          UNIT PEAK =     .156 CMS
          PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
          STORAGE COEFF. SC =    8.12 MINS

          SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

          UNIT PEAK =     .030 CMS
          PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
          STORAGE COEFF. SC =   53.42 MINS

          SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

          TOTAL RAINFALL =    72.27 MM

          PEAK DISCHARGE =    12.562 CMS  RUNOFF VOLUME =   49.56 MM  TIME TO PEAK =   1.166 HRS

          RUNOFF VOLUMETRIC COEFFICIENT =   .69

      ADD HYD              ID=4 HYD=261 IDI=1 IDII=2
          PEAK FLOW =      22.833 CMS     RUNOFF VOLUME =    49.56 MM     TIME TO PEAK=  1.17 HOURS

                ADD HYD       ID=4     HYD NO=261     ID I=1         ID II=2
      ROUTE RESERVOIR     ID=1 500 4
                          DISCHARGE    STORAGE
                            0.0          0.0
                            0.8          1.16
                            1.5          2.24
                            2.0          3.74
                            3.2          4.56

  STORAGE-DISCHARGE TABLE EXCEEDED.
          PEAK DISCHARGE =     3.3355 CMS  RUNOFF VOLUME= 49.3889 MM
      ADD HYD              ID=2 HYD=261 IDI=1 IDII=3
          PEAK FLOW =      15.732 CMS     RUNOFF VOLUME =    44.02 MM     TIME TO PEAK=  3.17 HOURS

                ADD HYD       ID=2     HYD NO=261     ID I=1         ID II=3
      *
      *----------------------
      *  INFLOW TO POINT -F-
      *----------------------
      PRINT HYD            ID=2 1

                                                    HYDROGRAPH FROM AREA 261


            RUNOFF VOLUME =    44.02 MM
            PEAK DISCHARGE RATE =     15.732 CMS



      *------------------------------------------------------
      * ROUTING FROM THE POINT  F  TO POINT  G
      *------------------------------------------------------
      * ARTIFITIAL CHANNEL
      *------------------------------------------------------
      COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=84.30
                                             MAXEL=87.00
                                             CHSLP=0.0004
                                             FPSLP=0.0004
                          N=0.035 DIST=24.
                          0.0   87.00   4.0   85.3
                          6.5   85.3    8.    84.3
                          16.0  84.3   17.5   85.3
                          20.0  85.3   24.0   87.00

                                    RATING CURVE VALLEY SECTION  1.0
                                        WATER      FLOW       FLOW
                                       SURFACE     AREA       RATE
                                        ELEV    SQ METRES     CMS
                                        84.30         .0         .0
                                        84.44        1.2         .2
                                        84.58        2.4         .6
                                        84.73        3.7        1.1
                                        84.87        5.0        1.8
                                        85.01        6.4        2.6
                                        85.15        7.9        [illegible]
                                        85.29        9.4        4.7
                                        85.44       11.7        5.2
                                        85.58       14.1        6.9
                                        85.72       16.7        8.8
                                        85.86       19.3       10.9
                                        86.01       22.0       13.3
                                        86.15       24.7       15.8
                                        86.29       27.6       18.6
                                        86.43       30.6       21.6
```

```
                                                  86.?2       36.9        28.2
                                                  86.86       40.1        31.8
                                                  87.00       43.5        35.7
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=600  SLP=0.0004

                                                  TRAVEL TIME TABLE
                                                         REACH  1.0

                                                  WATER      FLOW       TRAVEL
                                                  DEPTH      RATE        TIME
                                                  METRES     CMS         HRS
                                                    .14        0.       1.0967
                                                    .28        1.        .7062
                                                    .43        1.        .5499
                                                    .57        2.        .4625
                                                    .71        3.        .4055
                                                    .85        4.        .3649
                                                    .99        5.        .3342
                                                   1.14        5.        .3778
                                                   1.28        7.        .3428
                                                   1.42        9.        .3157
                                                   1.56       11.        .2939
                                                   1.71       13.        .2760
                                                   1.85       16.        .2609
                                                   1.99       19.        .2479
                                                   2.13       22.        .2367
                                                   2.27       25.        .2268
                                                   2.42       28.        .2181
                                                   2.56       32.        .2102
                                                   2.70       36.        .2032
ROUTE               ID=6    HYD=201
                    INDI=2  DT= 0.08330
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =   18RATE =     189.53
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  162RATE =     184.77
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  163RATE =     182.26
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  164RATE =     179.39
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  165RATE =     176.23
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  166RATE =     172.87
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  167RATE =     169.37
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  168RATE =     165.77
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  169RATE =     162.11
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  170RATE =     158.43
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  171RATE =     154.74
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  172RATE =     151.08
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
             OUTFLOW NUMBER =  173RATE =     147.44
PRINT HYD           ID=6 1

                                                     HYDROGRAPH FROM AREA 201


      RUNOFF VOLUME =     43.93 MM
      PEAK DISCHARGE RATE =      15.349 CMS



*------------------------
* GET INFLOW TO POINT -6-
*------------------------
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD      ID=1 HYD=1?2 DT=0.0833  DA=45.5 CKK=1.0
                    XIMP=0.30 TIMP=0.30 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=550 MNI=0.013
                    SLP=1 LGP=550 MNP=0.25
                    -1
    UNIT PEAK =     .175 CMS
    PEAK INTENSITY(RAIN EXCESS) =    107.19 MM/HR
    STORAGE COEFF. SC =     6.91 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =    12.00

    UNIT PEAK =     [illegible] CMS
```

```
PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
STORAGE COEFF. SC =   45.45 MINS

SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

TOTAL RAINFALL =    72.27 MM

PEAK DISCHARGE =      6.335 CMS  RUNOFF VOLUME =    43.49 MM  TIME TO PEAK =   1.166 HRS

RUNOFF VOLUMETRIC COEFFICIENT =   .60

ROUTE RESERVOIR      ID=5 500 1
                     DISCHARGE     STORAGE
                       0.0          0.0
                       1.0          0.19
                       2.1          0.29
                       3.0          0.36
                       5.0          0.48
    PEAK DISCHARGE =      4.8329 CMS  RUNOFF VOLUME= 43.4858 MM
*
PRINT HYD            ID=5 1

                              HYDROGRAPH FROM AREA 500

     RUNOFF VOLUME =    43.49 MM
     PEAK DISCHARGE RATE =      4.833 CMS

ADD HYD              ID=2 HYD=261 IDI=5 IDII=6
    PEAK FLOW =      15.901 CMS     RUNOFF VOLUME =     43.91 MM     TIME TO PEAK=  3.25 HOURS

          ADD HYD        ID=2     HYD NO=261     ID I=5        ID II=6
*-----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -G-
*-----------------------------------
PRINT HYD            ID=2 1

                              HYDROGRAPH FROM AREA 261

     RUNOFF VOLUME =    43.91 MM
     PEAK DISCHARGE RATE =     15.901 CMS

*------------------
FINISH

    **************************************************************************************
    **                                                                                  **
    **                      M I C R O H Y M O --- 3                                     **
    **                                                                                  **
    **                      (P . C . O T T H Y M O)                                     **
    **                                                                                  **
    **                      V E R S I O N  2.0+                                         **
    **                                                                                  **
    **                                                                                  **
```

```
1      ***************************************************************************************
       **                                                                                   **
       **                          M I C R O H Y M O --- 3                                  **
       **                                                                                   **
       **                          (P . C . O T T H Y M O)                                  **
       **                                                                                   **
       **                          V E R S I O N  2.0+                                      **
       **                                                                                   **
       **                                                                                   **
       **                          ADAPTED FOR MICROCOMPUTER BY                             **
       **                                                                                   **
       **                          ANDREW  BRODIE  ASSOCIATES  INC.                         **
       **                                                                                   **
       **                                                                                   **
       **                                                                                   **
       **ANDREW BRODIE & ASSOCIATES INC                                                     **
       **                                                                                   **
       ***************************************************************************************
        THE METRIC UNITS OPTION HAS BEEN SPECIFIED

     START               RAINFALL BEGINS AT 0.0 HRS
     * COMMENTS
     * RUISSEEAU DES FEES
     * 5  STROM
     * POST-DEV COND.ALTERNATIVE -GAMA- R E V I S E D
     * DT=0.0833 NI=36
     * FILE NAME FEES5F.OT8
     *-----------------------------
     * GET INFLOW TO THE POINT -A-
     *-----------------------------
     * SUBAREA 1
     *------------------
     COMPUTE NASHYD      ID=1 HYD=101 DT=0.0833 H  DA=156.64 HECT AA=0.0 AB=0.0
                         CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                         4.23 4.23 5.27 5.27 7.07 7.07 11.52 11.52 45.05 45.05
                         72.96 72.96 62.52 62.52 19.19 19.19 12.59 12.59 9.5 9.5
                         7.67 7.67 6.46 6.46 5.59 5.59 4.94 4.94 4.44 4.44
                         4.03 4.03 3.7 3.7 3.42 3.42
         SHAPE CONSTANT, N =   3.00
         UNIT PEAK =       3.81 CMS

         SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
         PEAK DISCHARGE =     1.652 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.999 HRS
         TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
     PRINT HYD           ID=1 1
0                                          HYDROGRAPH FROM AREA 101

0         RUNOFF VOLUME =    12.71 MM
          PEAK DISCHARGE RATE =      1.652 CMS



     *------------------
     * SUBAREA 2A
     *------------------
     COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=299.12 CKK=1.0
                         XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                         F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                         SLI=1 LGI=1235 MNI=0.013
                         SLP=1 LGP=1235 MNP=0.25
                         -1
         UNIT PEAK =     .108 CMS
         PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
         STORAGE COEFF. SC =   13.10 MINS

         SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

         UNIT PEAK =     .017 CMS
         PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
         STORAGE COEFF. SC =   96.49 MINS

         SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

         TOTAL RAINFALL =    48.34 MM

         PEAK DISCHARGE =    20.111 CMS  RUNOFF VOLUME =   23.94 MM  TIME TO PEAK =   1.166 HRS

         RUNOFF VOLUMETRIC COEFFICIENT =     .50
```

```
ADD HYD              ID=4 HYD=412 IDI=1 IDII=2
    PEAK FLOW =      20.238 CMS     RUNOFF VOLUME =     20.08 MM      TIME TO PEAK=  1.17 HOURS
0           ADD HYD        ID=4     HYD NO=412     ID I=1          ID II=2
*-----------------------------
* INFLOW TO THE POINT -A-
*-----------------------------
PRINT HYD            ID=4 1
0                                               HYDROGRAPH FROM AREA 412

0       RUNOFF VOLUME =     20.08 MM
        PEAK DISCHARGE RATE =      20.238 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT A TO POINT  B
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=0.0
                                       MAXEL=2.5
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                     N=0.03  DIST=9.5 N=-0.02 DIST=16.5 N=0.03 DIST=26
                       0    2.5      4.5 1.0
                       9.5 1.0      11.5 0.0
                      14.5 0.0      16.5 1.0
                      21.5 1.0      26.0 2.5
                     126 102.40 226 102.98
0                                     RATING CURVE VALLEY SECTION  1.0
```

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
.00	.0	.0
.13	.4	.3
.26	.9	1.0
.39	1.5	2.0
.53	2.1	3.4
.66	2.8	5.1
.79	3.6	7.2
.92	4.5	9.7
1.05	5.9	12.9
1.18	8.2	17.8
1.32	10.7	23.8
1.45	13.2	30.8
1.58	15.8	38.9
1.71	18.6	47.8
1.84	21.4	57.7
1.97	24.4	68.4
2.11	27.5	80.1
2.24	30.6	92.8
2.37	33.9	106.3
2.50	37.2	120.7

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                     L=750    SLP=0.0035
0                                       TRAVEL TIME TABLE
                                               REACH  1.0
```

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.2900
.26	1.	.1920
.39	2.	.1525
.53	3.	.1301
.66	5.	.1152
.79	7.	.1044
.92	10.	.0962
1.05	13.	.0954
1.18	18.	.0964
1.32	24.	.0933
1.45	31.	.0892
1.58	39.	.0850
1.71	48.	.0810
1.84	58.	.0775
1.97	68.	.0743
2.11	80.	.0714
2.24	93.	.0688
2.37	106.	.0664
2.50	121.	.0643

```
ROUTE                ID=6     HYD=201
                     INDI=4  DT= 0.08330
PRINT HYD            ID=6 1
0                                       HYDROGRAPH FROM AREA 201

0       RUNOFF VOLUME =     20.08 MM
        PEAK DISCHARGE RATE =      18.029 CMS
```

```
*------------------------------
* GET  INFLOW TO POINT -B-
*------------------------------
*------------------
* SUBAREA 4A
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=89.43 CKK=1.0
                    XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=810 MNI=0.013
                    SLP=1 LGP=810 MNP=0.25
                    -1
   UNIT PEAK =    .132 CMS
   PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
   STORAGE COEFF. SC =   10.17 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =    .022 CMS
   PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
   STORAGE COEFF. SC =   74.91 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

   TOTAL RAINFALL =    48.34 MM

   PEAK DISCHARGE =    11.741 CMS  RUNOFF VOLUME =   38.54 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .80

ADD HYD             ID=3 HYD=342 IDI=6 IDII=2
   PEAK FLOW =      29.585 CMS    RUNOFF VOLUME =    23.11 MM     TIME TO PEAK=  1.17 HOURS
0           ADD HYD       ID=3     HYD NO=342     ID I=6          ID II=2
*------------------------------
* INFLOW TO THE POINT -B-
*------------------------------
PRINT HYD           ID=3 1
0                                        HYDROGRAPH FROM AREA 342

0       RUNOFF VOLUME =    23.11 MM
        PEAK DISCHARGE RATE =     29.585 CMS


*------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  C
*------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=1300  SLP=0.0043
0                                       TRAVEL TIME TABLE
                                              REACH  1.0

                                       WATER     FLOW      TRAVEL
                                       DEPTH     RATE       TIME
                                      METRES     CMS        HRS
                                         .13        0.      .5027
                                         .26        1.      .3327
                                         .39        2.      .2643
                                         .53        3.      .2254
                                         .66        5.      .1997
                                         .79        7.      .1810
                                         .92       10.      .1667
                                        1.05       13.      .1654
                                        1.18       18.      .1672
                                        1.32       24.      .1618
                                        1.45       31.      .1546
                                        1.58       39.      .1473
                                        1.71       48.      .1405
                                        1.84       58.      .1343
                                        1.97       68.      .1287
                                        2.11       80.      .1237
                                        2.24       93.      .1192
                                        2.37      106.      .1151
                                        2.50      121.      .1114
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.08330
PRINT HYD           ID=6 1
0                                        HYDROGRAPH FROM AREA 201

0       RUNOFF VOLUME =    23.11 MM
        PEAK DISCHARGE RATE =     25.272 CMS


*------------------------------
* GET  INFLOW TO POINT -C-
*------------------------------
```

```
*--- -- - ----
* SUBAREA 3A
*-----------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=98.36 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.17 H NI=36

   SHAPE CONSTANT, N1=   3.00
   UNIT PEAK =        3.21 CMS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
   PEAK DISCHARGE =      1.288 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.499 HRS
   TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*-----------------
* SUBAREA 2B
*-----------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=23.23 CKK=1.0
                    XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=395 MNI=0.013
                    SLP=1 LGP=395 MNP=0.25
                    -1
   UNIT PEAK =     .180 CMS
   PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
   STORAGE COEFF. SC =    6.61 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =     .033 CMS
   PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
   STORAGE COEFF. SC =   48.69 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   TOTAL RAINFALL =    48.34 MM

   PEAK DISCHARGE =     1.880 CMS  RUNOFF VOLUME =   23.95 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .50

ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
   PEAK FLOW =       2.048 CMS     RUNOFF VOLUME =    14.[illegible] MM      TIME TO PEAK=  1.17 HOURS
0          ADD HYD       ID=3      HYD NO=312     ID I=1           ID II=2
ADD HYD             ID=1 HYD=163 IDI=6 IDII=3
   PEAK FLOW =      26.834 CMS     RUNOFF VOLUME =    21.60 MM      TIME TO PEAK=  1.25 HOURS
0          ADD HYD       ID=1      HYD NO=163     ID I=6           ID II=3
*-----------------
* SUBAREA 4B
*-----------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=191 CKK=1.0
                    XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=1128 MNI=0.013
                    SLP=1 LGP=1128 MNP=0.25
                    -1
   UNIT PEAK =     .113 CMS
   PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
   STORAGE COEFF. SC =   12.40 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =     .018 CMS
   PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
   STORAGE COEFF. SC =   91.38 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

   TOTAL RAINFALL =    48.34 MM

   PEAK DISCHARGE =    24.005 CMS  RUNOFF VOLUME =   38.54 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .80

ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
   PEAK FLOW =      49.177 CMS     RUNOFF VOLUME =    25.37 MM      TIME TO PEAK=  1.17 HOURS
0          ADD HYD       ID=3      HYD NO=312     ID I=1           ID II=2
*----------------------------
*  INFLOW TO POINT -C-
*----------------------------
PRINT HYD           ID=3 1
0                                         HYDROGRAPH FROM AREA 312

0     RUNOFF VOLUME =    25.37 MM
      PEAK DISCHARGE RATE =     49.177 CMS


*------------------------------------------------------
* ROUTING FROM THE POINT C TO POINT  D
```

```
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=750  SLP=0.008
0                                            TRAVEL TIME TABLE
                                                   REACH  1.0
```

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.2900
.26	1.	.1920
.39	2.	.1525
.53	3.	.1301
.66	5.	.1152
.79	7.	.1044
.92	10.	.0962
1.05	13.	.0954
1.18	18.	.0964
1.32	24.	.0933
1.45	31.	.0892
1.58	39.	.0850
1.71	48.	.0810
1.84	58.	.0775
1.97	68.	.0743
2.11	80.	.0714
2.24	93.	.0688
2.37	106.	.0664
2.50	121.	.0643

```
ROUTE               ID=6    HYD=201
                    INDI=3  DT= 0.08330
PRINT HYD           ID=6 1
0                                        HYDROGRAPH FROM AREA 201

0     RUNOFF VOLUME =    25.37 MM
      PEAK DISCHARGE RATE =     46.767 CMS


*-----------------------------------------
* GET  INFLOW TO POINT -D- ( S W M  POND )
*-----------------------------------------
*------------------
* SUBAREA 3B
*------------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=95.17 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.50 H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       2.42 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
    PEAK DISCHARGE =     1.038 CMS   RUNOFF VOLUME =   12.71 MM TIME TO PEAK =    2.916 HRS
    TOTAL RAINFALL =    48.34 MM  RUNOFF VOL. COEFFICIENT =    .26
*------------------
* SUBAREA 4C
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=77.71 CKK=1.0
                    XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=719 MNI=0.013
                    SLP=1 LGP=719 MNP=0.25
                    -1
    UNIT PEAK =    .139 CMS
    PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
    STORAGE COEFF. SC =    9.47 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .024 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   69.74 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =     6.824 CMS  RUNOFF VOLUME =   27.31 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .57

ADD HYD             ID=3 HYD=216 IDI=1 IDII=2
    PEAK FLOW =      6.911 CMS     RUNOFF VOLUME =   .19.27 MM     TIME TO PEAK=  1.17 HOURS
0           ADD HYD        ID=3      HYD NO=216      ID I=1          ID II=2
ADD HYD             ID=1 HYD=216 IDI=6 IDII=3
    PEAK FLOW =     51.997 CMS     RUNOFF VOLUME =    24.35 MM     TIME TO PEAK=  1.25 HOURS
0           ADD HYD        ID=1      HYD NO=216      ID I=6          ID II=3
*--------------------------
*   INFLOW TO  S W M  POND )
```

```
      *
      PRINT HYD         .  ID=1 1
  0                                                  HYDROGRAPH FROM AREA 216

  0        RUNOFF VOLUME =    24.35 MM
           PEAK DISCHARGE RATE =     51.997 CMS


      ROUTE RESERVOIR       ID=5 500 1
                            DISCHARGE    STORAGE
                              0.0          0.0
                              3.0          4.2
                              6.2          7.7
                              9.0         23.1
                             13.0         29.56
         PEAK DISCHARGE =      7.6418 CMS  RUNOFF VOLUME= 24.2581 MM
      *
      PRINT HYD             ID=5 1
  0                                                  HYDROGRAPH FROM AREA 500

  0        RUNOFF VOLUME =    24.26 MM
           PEAK DISCHARGE RATE =      7.642 CMS


      *------------------------------------------
      *    OUTFLOW FROM  S W M POND ( POINT -D-)
      *------------------------------------------
      *---------------------------------------------------------
      * ROUTING FROM THE POINT D TO POINT  E
      *---------------------------------------------------------
      *---------------------------------------------------------
      * ROUTING - X SECTION #2
      *---------------------------------------------------------
      COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=90.58
                                             MAXEL=92.84
                                             CHSLP=0.0041
                                             FPSLP=0.0041
                            N=0.03 DIST=18
                            0.0   92.84  1.0  92.84
                            2.0   92.24  4.0  92.24
                            7.4   90.96  8.0  90.58
                            10    90.58  10.4 91.28
                            14    92.32  16   92.32
                            17    92.84  18   92.84
  0                                          RATING CURVE VALLEY SECTION  1.0
                                                WATER      FLOW       FLOW
                                               SURFACE     AREA       RATE
                                                ELEV    SQ METRES     CMS
                                                90.58       .0          .0
                                                90.70       .3          .1
                                                90.82       .5          .4
                                                90.94       .9          .8
                                                91.06      1.2         1.2
                                                91.17      1.6         1.8
                                                91.29      2.0         2.6
                                                91.41      2.5         3.3
                                                91.53      3.1         4.3
                                                91.65      3.8         5.6
                                                91.77      4.6         7.0
                                                91.89      5.5         8.8
                                                92.01      6.4        10.8
                                                92.13      7.4        13.1
                                                92.25      8.6        14.1
                                                92.36     10.1        16.3
                                                92.48     11.8        20.8
                                                92.60     13.6        25.8
                                                92.72     15.4        31.2
                                                92.84     17.3        34.4
      COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                            L=1350  SLP=0.0041
  0                                             TRAVEL TIME TABLE
                                                       REACH  1.0

                                                WATER      FLOW      TRAVEL
                                                DEPTH      RATE       TIME
                                               METRES      CMS        HRS
                                                  .12        0.       .7780
                                                  .24        0.       .5181
                                                  .36        1.       .4140
                                                  .48        1.       .3606
                                                  .59        2.       .3245
                                                  .71        3.       .2987
                                                  .83        3.       .2856
                                                  .95        4.       .2716
                                                 1.07        6.       .2579
```

```
*----------------------
PRINT HYD          ID=2 1
0                                            HYDROGRAPH FROM AREA 201

0        RUNOFF VOLUME =     24.59 MM
         PEAK DISCHARGE RATE =     12.573 CMS

*-------------------------------------------------------
* ROUTING FROM THE POINT  F  TO POINT  G
*-------------------------------------------------------
* ARTIFITIAL CHANNEL
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=84.30
                                       MAXEL=87.00
                                       CHSLP=0.0004
                                       FPSLP=0.0004
                     N=0.035 DIST=24.
                     0.0   87.00   4.0   85.3
                     6.5   85.3    8.   84.3
                     16.0  84.3   17.5   85.3
                     20.0  85.3   24.0   87.00
0                                    RATING CURVE VALLEY SECTION  1.0
```

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
84.30	.0	.0
84.44	1.2	.2
84.58	2.4	.6
84.73	3.7	1.1
84.87	5.0	1.8
85.01	6.4	2.6
85.15	7.9	3.6
85.29	9.4	4.7
85.44	11.7	5.2
85.58	14.1	6.9
85.72	16.7	8.8
85.86	19.3	10.9
86.01	22.0	13.3
86.15	24.7	15.8
86.29	27.6	18.6
86.43	30.6	21.6
86.57	33.7	24.8
86.72	36.9	28.2
86.86	40.1	31.8
87.00	43.5	35.7

```
 COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                     L=600  SLP=0.0004
0                                        TRAVEL TIME TABLE
                                              REACH  1.0
```

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.14	0.	1.0967
.28	1.	.7062
.43	1.	.5499
.57	2.	.4625
.71	3.	.4055
.85	4.	.3649
.99	5.	.3342
1.14	5.	[illegible]
1.28	7.	.3428
1.42	9.	.3157
1.56	11.	.2939
1.71	13.	.2760
1.85	16.	.2609
1.99	19.	.2479
2.13	22.	.2367
2.27	25.	.2268
2.42	28.	.2181
2.56	32.	.2102
2.70	36.	.2032

```
 ROUTE               ID=6    HYD=201
                     INDI=2  DT= 0.08330
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
               OUTFLOW NUMBER =  108RATE =     185.20
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
               OUTFLOW NUMBER =  109RATE =     182.82
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
               OUTFLOW NUMBER =  110RATE =     180.09
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
               OUTFLOW NUMBER =  111RATE =     177.09
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
               OUTFLOW NUMBER =  112RATE =     173.89
     PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
```

```
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  114RATE =     167.06
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  115RATE =     163.50
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  116RATE =     159.89
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  117RATE =     156.25
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  118RATE =     152.64
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
                OUTFLOW NUMBER =  119RATE =     149.05
PRINT HYD            ID=6 1
0                                            HYDROGRAPH FROM AREA 201

0      RUNOFF VOLUME =    24.55 MM
       PEAK DISCHARGE RATE =      9.214 CMS



*------------------------
* GET INFLOW TO POINT -6-
*------------------------
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD       ID=1 HYD=102 DT=0.0833  DA=45.5 CKK=1.0
                     XIMP=0.30 TIMP=0.30 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                     F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                     SLI=1 LGI=550 MNI=0.013
                     SLP=1 LGP=550 MNP=0.25
                     -1
    UNIT PEAK =     .157 CMS
    PEAK INTENSITY(RAIN EXCESS) =    72.96 MM/HR
    STORAGE COEFF. SC =    8.06 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .027 CMS
    PEAK INTENSITY(RAIN EXCESS) =    41.75 MM/HR
    STORAGE COEFF. SC =   59.39 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    48.34 MM

    PEAK DISCHARGE =     3.109 CMS  RUNOFF VOLUME =   21.70 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .45

ADD HYD              ID=2 HYD=261 IDI=1 IDII=6
    PEAK FLOW =      11.794 CMS     RUNOFF VOLUME =    24.44 MM     TIME TO PEAK=  1.17 HOURS
0          ADD HYD        ID=2     HYD NO=261      ID I=1          ID II=6
*----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -6-
*-----------------------------------
PRINT HYD            ID=2 1
0                                            HYDROGRAPH FROM AREA 261

0      RUNOFF VOLUME =    24.44 MM
       PEAK DISCHARGE RATE =     11.794 CMS



*------------------
FINISH
```

```
*****************************************************************************************
**                                                                                     **
**                         M I C R O H Y M O --- 3                                     **
**                                                                                     **
**                         (P . C . O T T H Y M O)                                     **
**                                                                                     **
**                         V E R S I O N  2.0+                                         **
**                                                                                     **
**                                                                                     **
**                         ADAPTED FOR MICROCOMPUTER BY                                **
**                                                                                     **
**                         ANDREW  BRODIE  ASSOCIATES  INC.                            **
**                                                                                     **
**                                                                                     **
**                                                                                     **
**ANDREW BRODIE & ASSOCIATES INC                                                       **
**                                                                                     **
*****************************************************************************************
 THE METRIC UNITS OPTION HAS BEEN SPECIFIED

START               RAINFALL BEGINS AT 0.0 HRS
* COMMENTS
* RUISSEEAU DES FEES
* 100  STROM
* POST-DEV COND.ALTERNATIVE -GAMA- R E V I S E D
* DT=0.0833 NI=36
* FILE NAME FEES100F.OT8
*------------------------------
* GET INFLOW TO THE POINT -A-
*------------------------------
* SUBAREA 1
*------------------
COMPUTE NASHYD      ID=1 HYD=101 DT=0.0833 H  DA=156.64 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.57 H NI=36
                    4.92 4.92 6.35 6.35 8.95 8.95 18.54 18.54 78.42 78.42
                    107.19 107.19 99.64 99.64 31.1 31.1 17.51 17.51 12.65
                    12.65 9.85 9.85 8.05 8.05 6.81 6.81 5.89 5.89 5.2 5.2
                    4.65 4.65 4.21 4.21 3.85 3.85
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       3.81 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
    PEAK DISCHARGE =     3.423 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =    2.916 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
PRINT HYD           ID=1 1
```

```
     RUNOFF VOLUME =    25.71 MM
     PEAK DISCHARGE RATE =      3.423 CMS


*------------------
* SUBAREA 2A
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=299.12 CKK=1.0
                    XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=1235 MNI=0.013
                    SLP=1 LGP=1235 MNP=0.25
                    -1
    UNIT PEAK =     .122 CMS
    PEAK INTENSITY!RAIN EXCESS! =   107.19 MM/HR
    STORAGE COEFF. SC =   11.[illegible] MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =     .022 CMS
    PEAK INTENSITY!RAIN EXCESS! =    81.48 MM/HR
    STORAGE COEFF. SC =   73.85 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    38.319 CMS  RUNOFF VOLUME =   45.90 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .64

ADD HYD             ID=4 HYD=412 IDI=1 IDII=2
    PEAK FLOW =     38.626 CMS     RUNOFF VOLUME =    38.96 MM     TIME TO PEAK=  1.17 HOURS

        ADD HYD       ID=4     HYD NO=412     ID I=1         ID II=2
*-----------------------------
* INFLOW TO THE POINT -A-
*-----------------------------
PRINT HYD           ID=4 1

                                        HYDROGRAPH FROM AREA 412


     RUNOFF VOLUME =    38.97 MM
     PEAK DISCHARGE RATE =      38.626 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT A TO POINT  B
*-------------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=3 NINEL=0.0
                                       MAXEL=2.5
                                       CHSLP=0.0035
                                       FPSLP=0.0035
                    N=0.03  DIST=9.5 N=-0.02 DIST=16.5 N=0.03 DIST=26
                      0   2.5       4.5 1.0
                      9.5 1.0      11.5 0.0
                     14.5 0.0      16.5 1.0
                     21.5 1.0      26.0 2.5
                    126 102.40 226 102.98
```

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
.00	.0	.0
.13	.4	.3
.26	.9	1.0
.39	1.5	2.0
.53	2.1	3.4
.66	2.8	5.1
.79	3.6	7.2
.92	4.5	9.7
1.05	5.9	12.9
1.18	8.2	17.8
1.32	10.7	23.8
1.45	13.2	30.8
1.58	15.8	38.9
1.71	18.6	47.8
1.84	21.4	57.7
1.97	24.4	68.4
2.11	27.5	80.1
2.24	30.6	92.8
2.37	33.9	106.3
2.50	37.2	120.7

COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
L=750 SLP=0.0035

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.2900
.26	1.	.1920
.39	2.	.1525
.53	3.	.1301
.66	5.	.1152
.79	7.	.1044
.92	10.	.0962
1.05	13.	.0954
1.18	18.	.0964
1.32	24.	.0933
1.45	31.	.0892
1.58	39.	.0850
1.71	48.	.0810
1.84	58.	.0775
1.97	68.	.0743
2.11	80.	.0714
2.24	93.	.0688
2.37	106.	.0664
2.50	121.	.0643

ROUTE ID=6 HYD=201
INDI=4 DT= 0.08330
PRINT HYD ID=6 1

HYDROGRAPH FROM AREA 201

RUNOFF VOLUME = 38.97 MM
PEAK DISCHARGE RATE = 35.115 CMS

*------------------------------
* GET INFLOW TO POINT -B-

```
*-------------------
* SUBAREA 4A
*-------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=89.43 CKK=1.0
                    XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=810 MNI=0.013
                    SLP=1 LGP=810 MNP=0.25
                    -1
   UNIT PEAK =    .148 CMS
   PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
   STORAGE COEFF. SC =    8.72 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =    .028 CMS
   PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
   STORAGE COEFF. SC =   57.34 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

   TOTAL RAINFALL =    72.27 MM

   PEAK DISCHARGE =    19.604 CMS  RUNOFF VOLUME =   61.71 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .85

ADD HYD             ID=3 HYD=342 IDI=6 IDII=2
   PEAK FLOW =     54.719 CMS     RUNOFF VOLUME =    42.69 MM     TIME TO PEAK=  1.17 HOURS

        ADD HYD       ID=3     HYD NO=342     ID I=6        ID II=2
*-----------------------------
* INFLOW TO THE POINT -B-
*-----------------------------
PRINT HYD           ID=3 1

                              HYDROGRAPH FROM AREA 342


    RUNOFF VOLUME =    42.70 MM
    PEAK DISCHARGE RATE =     54.719 CMS


*--------------------------------------------------------
* ROUTING FROM THE POINT B TO POINT  C
*--------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=1300  SLP=0.0043

                              TRAVEL TIME TABLE
                                    REACH  1.0
```

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.13	0.	.5027
.26	1.	.3327
.39	2.	.2643
.53	3.	.2254
.66	5.	.1997
.79	7.	.1810
.92	10.	.1667
1.05	13.	.1654
1.18	18.	.1672

65

```
                                         1.45       31.      .1546
                                         1.58       39.      .1473
                                         1.71       48.      .1405
                                         1.84       58.      .1343
                                         1.97       68.      .1287
                                         2.11       80.      .1237
                                         2.24       93.      .1192
                                         2.37      106.      .1151
                                         2.50      121.      .1114
ROUTE              ID=6    HYD=201
                   INDI=3  DT= 0.08330
PRINT HYD          ID=6 1

                                          HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    42.70 MM
     PEAK DISCHARGE RATE =     48.297 CMS



*------------------------------
* SET  INFLOW TO POINT -C-
*------------------------------
*------------------
* SUBAREA 3A
*------------------
COMPUTE NASHYD      ID=1 HYD=103 DT=0.0833 H  DA=98.38 HECT AA=0.0 AB=0.0
                    CN=68 IA=2.5 MM N=3 TP=1.17 H NI=36
                    -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       3.21 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =     12.00
    PEAK DISCHARGE =     2.719 CMS   RUNOFF VOLUME =   25.71 MM TIME TO PEAK =    2.416 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
*------------------
* SUBAREA 2B
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=23.23 CKK=1.0
                    XIMP=0.36 TIMP=0.36 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=395 MNI=0.013
                    SLP=1 LGP=395 MNP=0.25
                    -1
    UNIT PEAK =    .199 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    5.67 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .043 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   37.26 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =     3.721 CMS  RUNOFF VOLUME =   45.92 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .64

ADD HYD             ID=3 HYD=312 IDI=1 IDII=2
    PEAK FLOW =     4.124 CMS     RUNOFF VOLUME =    29.57 MM     TIME TO PEAK=  1.17 HOURS
```

```
        ADD HYD       ID=3     HYD NO=312     ID I=1         ID II=2
ADD HYD           ID=1 HYD=163 IDI=6 IDII=3
   PEAK FLOW =     51.591 CMS     RUNOFF VOLUME =    40.30 MM     TIME TO PEAK=  1.25 HOURS

        ADD HYD       ID=1     HYD NO=163     ID I=6         ID II=3
*------------------
* SUBAREA 4B
*------------------
COMPUTE URBHYD      ID=2 HYD=102 DT=0.0833  DA=191 CKK=1.0
                    XIMP=0.75 TIMP=0.75 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=1128 MNI=0.013
                    SLP=1 LGP=1128 MNP=0.25
                    -1
   UNIT PEAK =    .127 CMS
   PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
   STORAGE COEFF. SC =   10.63 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

   UNIT PEAK =    .023 CMS
   PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
   STORAGE COEFF. SC =   69.94 MINS

   SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   11.99

   TOTAL RAINFALL =    72.27 MM

   PEAK DISCHARGE =    40.276 CMS  RUNOFF VOLUME =   61.70 MM  TIME TO PEAK =   1.166 HRS

   RUNOFF VOLUMETRIC COEFFICIENT =   .85

ADD HYD           ID=3 HYD=312 IDI=1 IDII=2
   PEAK FLOW =     89.047 CMS     RUNOFF VOLUME =    45.07 MM     TIME TO PEAK=  1.17 HOURS

        ADD HYD       ID=3     HYD NO=312     ID I=1         ID II=2
*-----------------------------
*  INFLOW TO POINT -C-
*-----------------------------
PRINT HYD          ID=3 1

                                 HYDROGRAPH FROM AREA 312


    RUNOFF VOLUME =    45.07 MM
    PEAK DISCHARGE RATE =     89.047 CMS


*-------------------------------------------------------
* ROUTING FROM THE POINT C TO POINT  D
*-------------------------------------------------------
COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
                    L=750  SLP=0.008

                              TRAVEL TIME TABLE
                                   REACH  1.0

                              WATER     FLOW     TRAVEL
                              DEPTH     RATE      TIME
                             METRES     CMS       HRS
                                .13       0.     .2900
                                .26       1.     .1920
                                .39       2.     .1525
```

```
                                     .79        7.     .1044
                                     .92       10.     .0962
                                    1.05       13.     .0954
                                    1.18       18.     .0964
                                    1.32       24.     .0933
                                    1.45       31.     .0892
                                    1.58       39.     .0850
                                    1.71       48.     .0810
                                    1.84       58.     .0775
                                    1.97       68.     .0743
                                    2.11       80.     .0714
                                    2.24       93.     .0688
                                    2.37      106.     .0664
                                    2.50      121.     .0643
ROUTE             ID=6    HYD=201
                  INDI=3  DT= 0.08330
PRINT HYD         ID=6 1

                                       HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =    45.07 MM
     PEAK DISCHARGE RATE =     85.277 CMS



*----------------------------------------
* GET  INFLOW TO POINT -D- ( S W M  POND )
*----------------------------------------
*-------------------
* SUBAREA 3B
*-------------------
COMPUTE NASHYD    ID=1 HYD=103 DT=0.0833 H  DA=95.17 HECT AA=0.0 AB=0.0
                  CN=68 IA=2.5 MM N=3 TP=1.50 H NI=36
                  -1
    SHAPE CONSTANT, N =   3.00
    UNIT PEAK =       2.42 CMS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =      12.00
    PEAK DISCHARGE =     2.157 CMS   RUNOFF VOLUME =    25.71 MM TIME TO PEAK =    2.832 HRS
    TOTAL RAINFALL =    72.27 MM  RUNOFF VOL. COEFFICIENT =    .36
*-------------------
* SUBAREA 4C
*-------------------
COMPUTE URBHYD    ID=2 HYD=102 DT=0.0833  DA=77.71 CKK=1.0
                  XIMP=0.45 TIMP=0.45 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                  F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                  SLI=1 LGI=719 MNI=0.013
                  SLP=1 LGP=719 MNP=0.25
                  -1
    UNIT PEAK =    .156 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    8.12 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .030 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   53.38 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    12.551 CMS  RUNOFF VOLUME =   49.56 MM  TIME TO PEAK =   1.166 HRS
```

```
    RUNOFF VOLUMETRIC COEFFICIENT =   .59

ADD HYD             ID=3 HYD=216 IDI=1 IDII=2
    PEAK FLOW =      12.760 CMS     RUNOFF VOLUME =    36.43 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD       ID=3     HYD NO=216     ID I=1         ID II=2
ADD HYD             ID=1 HYD=216 IDI=6 IDII=3
    PEAK FLOW =      95.043 CMS     RUNOFF VOLUME =    43.62 MM     TIME TO PEAK=  1.25 HOURS

          ADD HYD       ID=1     HYD NO=216     ID I=6         ID II=3
*-------------------------
*  INFLOW TO  S W M  POND
*-------------------------
*
PRINT HYD           ID=1 1

                                             HYDROGRAPH FROM AREA 216


      RUNOFF VOLUME =    43.62 MM
      PEAK DISCHARGE RATE =     95.043 CMS



ROUTE RESERVOIR     ID=5 500 1
                    DISCHARGE    STORAGE
                      0.0         0.00
                      3.0         4.20
                      6.2         7.70
                      9.0        23.10
                     13.0        29.56

RAGE-DISCHARGE TABLE EXCEEDED.
    PEAK DISCHARGE =    13.0348 CMS  RUNOFF VOLUME= 43.3402 MM
*
PRINT HYD           ID=5 1

                                             HYDROGRAPH FROM AREA 500


      RUNOFF VOLUME =    43.34 MM
      PEAK DISCHARGE RATE =     13.035 CMS



*----------------------------------------
*   OUTFLOW FROM  S W M POND ( POINT -D-)
*----------------------------------------
*----------------------------------------------------
* ROUTING FROM THE POINT D TO POINT  E
*----------------------------------------------------
*----------------------------------------------------
* ROUTING - X SECTION #2
*----------------------------------------------------
COMPUTE RATING CURVEID=1 VSN=1  NSEG=1 NINEL=90.58
                                       MAXEL=92.84
                                       CHSLP=0.0041
                                       FPSLP=0.0041
                    N=0.03 DIST=18
                    0.0   92.84  1.0  92.84
                    2.0   92.24  4.0  92.24
                    7.4   90.96  8.0  90.58
                    10    90.58  10.4 91.28
                    14    92.32  16   92.32
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ METRES	FLOW RATE CMS
90.58	.0	.0
90.70	.3	.1
90.82	.5	.4
90.94	.9	.8
91.06	1.2	1.2
91.17	1.6	1.8
91.29	2.0	2.6
91.41	2.5	3.3
91.53	3.1	4.3
91.65	3.8	5.6
91.77	4.6	7.0
91.89	5.5	8.8
92.01	6.4	10.8
92.13	7.4	13.1
92.25	8.6	14.1
92.36	10.1	16.3
92.48	11.8	20.8
92.60	13.6	25.8
92.72	15.4	31.2
92.84	17.3	34.4

COMPUTE TRAVEL TIME ID=6 REACH=1 NVS=1
L=1350 SLP=0.0041

TRAVEL TIME TABLE
REACH 1.0

WATER DEPTH METRES	FLOW RATE CMS	TRAVEL TIME HRS
.12	0.	.7780
.24	0.	.5181
.36	1.	.4140
.48	1.	.3606
.59	2.	.3245
.71	3.	.2987
.83	3.	.2856
.95	4.	.2716
1.07	6.	.2579
1.19	7.	.2450
1.31	9.	.2331
1.43	11.	.2223
1.55	13.	.2123
1.67	14.	.2278
1.78	16.	.2313
1.90	21.	.2126
2.02	26.	.1977
2.14	31.	.1853
2.26	34.	.1883

ROUTE ID=6 HYD=201
INDI=5 DT= 0.08330
PRINT HYD ID=6 1

HYDROGRAPH FROM AREA 201

RUNOFF VOLUME = 43.29 MM
PEAK DISCHARGE RATE = 12.993 CMS

*--------------------------

```
PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  166RATE =     168.68
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  167RATE =     165.17
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  168RATE =     161.56
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  169RATE =     157.90
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  170RATE =     154.23
    PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERGENCE WAS FORCED.
          OUTFLOW NUMBER =  171RATE =     150.58
PRINT HYD          ID=6 1

                                        HYDROGRAPH FROM AREA 201


     RUNOFF VOLUME =     43.92 MM
     PEAK DISCHARGE RATE =     18.140 CMS



*------------------------
* GET INFLOW TO POINT -G-
*------------------------
*------------------
* SUBAREA 5C
*------------------
COMPUTE URBHYD      ID=1 HYD=102 DT=0.0833  DA=45.5 CKK=1.0
                    XIMP=0.30 TIMP=0.30 NI=36 FO=76.12 FC=13.2 DCAY=4.14
                    F/DD=0.0 DPSI=1.57 DPSP=4.67 STI=0.0 STP=0.0
                    SLI=1 LGI=550 MNI=0.013
                    SLP=1 LGP=550 MNP=0.05
                    -1
    UNIT PEAK =    .175 CMS
    PEAK INTENSITY(RAIN EXCESS) =   107.19 MM/HR
    STORAGE COEFF. SC =    6.91 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    UNIT PEAK =    .035 CMS
    PEAK INTENSITY(RAIN EXCESS) =    81.48 MM/HR
    STORAGE COEFF. SC =   45.45 MINS

    SUM OF THE UNIT HYDROGRAPH CO-ORDINATES =   12.00

    TOTAL RAINFALL =    72.27 MM

    PEAK DISCHARGE =    6.339 CMS  RUNOFF VOLUME =   43.49 MM  TIME TO PEAK =   1.166 HRS

    RUNOFF VOLUMETRIC COEFFICIENT =   .60

ADD HYD             ID=2 HYD=261 IDI=1 IDII=6
    PEAK FLOW =     24.005 CMS    RUNOFF VOLUME =    43.90 MM     TIME TO PEAK=  1.17 HOURS

          ADD HYD        ID=2     HYD NO=261     ID I=1         ID II=6
*----------------------------------
* TOTAL OUTLET FROM SIDE  POINT -G-
*----------------------------------
PRINT HYD          ID=2 1

                                        HYDROGRAPH FROM AREA 261


     RUNOFF VOLUME =     43.90 MM
     PEAK DISCHARGE RATE =     24.005 CMS
```