



## บรรณานุกรม

หนังสือ

- โกมล สีวะบรร, เขาวุฒิ พรพิมลเทพ, สุวิทย์ ชุมนุมศิริวัฒน์ . การประปา  
เบื้องต้น. พิมพ์ครั้งที่ 2. กรุงเทพมหานคร : คณะสาธารณสุขศาสตร์  
มหาวิทยาลัยมหิดล, 2524
- มันสิน คัดหลุเวศม์ . วิศวกรรมการประปา เล่ม 1. พิมพ์ครั้งที่ 1. กรุงเทพมหานคร :  
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, 2526
- วรวิทย์ อึ้งภากรณ์ . การออกแบบระบบท่อภายในอาคาร. พิมพ์ครั้งที่ 1. กรุงเทพ-  
มหานคร : วิศวกรรมสถานแห่งประเทศไทย ในพระบรมราชูปถัมภ์, 2526
- วิจิตร พันธุ์สุทธิ, วันชัย วิจิรวนิช, ศิริจันทร์ ทองประเสริฐ . การวิจัยดำเนินงาน  
เล่มที่ 1 ภาค Deterministic. พิมพ์ครั้งที่ 1. กรุงเทพมหานคร :  
บริษัทซีเอ็ดยูเคชั่น จำกัด, 2522
- สุรินทร์ เศรษฐมานิต, ทาเคโอะ มอริมุระ . วิศวกรรมงานท่อภายในอาคาร.  
พิมพ์ครั้งที่ 1. กรุงเทพมหานคร : สมาคมส่งเสริมความรู้ด้านเทคนิคระหว่าง  
ประเทศ, 2527

เอกสารอื่น ๆ

- คณะกรรมการปฏิบัติการกิจการวิจัยเกี่ยวกับกรุงเทพมหานคร, สถาบันวิจัยสภาวะแวดล้อม,  
โครงการศูนย์นครศึกษา. " รายงานการวิจัยแหล่งน้ำดิบเพื่อการประปาในเขต  
กรุงเทพมหานคร ". กรุงเทพมหานคร, โรงพิมพ์จุฬาลงกรณ์มหาวิทยาลัย,  
2526
- ชาญชัย ไพโรกุล . " การวิเคราะห์รายงานโดยวิธีของครอฟฟอร์ด-เฮโนเวท ".  
วิทยานิพนธ์ปริญญาโทบัณฑิต ภาควิชาวิศวกรรมโยธา บัณฑิตวิทยาลัย  
จุฬาลงกรณ์มหาวิทยาลัย, 2520
- ธเนศ คาวาสุวรรณ . " การศึกษาลงทุนสำหรับการประปาขนาดกลางในประเทศไทย ".  
วิทยานิพนธ์ปริญญาโทบัณฑิต ภาควิชาวิศวกรรมสุขาภิบาล บัณฑิตวิทยาลัย  
จุฬาลงกรณ์มหาวิทยาลัย, 2526.

- ชเรศ ศรีสถิตย์, สุรภี โรจน์อารยานนท์ . " การศึกษาศักยภาพของแหล่งน้ำ  
คุณภาพน้ำและการจัดสรรการใช้น้ำของจังหวัดระยอง " . กรุงเทพมหานคร.  
จุฬาลงกรณ์มหาวิทยาลัย, 2526
- อนุชิต ธรรมธรานนท์ . " ข้อมูลการใช้น้ำของพลเมืองในเขตเทศบาลนครเชียงใหม่ " .  
วิทยานิพนธ์ปริญญาโทบัณฑิต ภาควิชาวิศวกรรมสุขาภิบาล บัณฑิตวิทยาลัย  
จุฬาลงกรณ์มหาวิทยาลัย, 2511

### ภาษาอังกฤษ

- Ernest W. Steel . Water Supply and Sewerage, Fourth Edition.  
New York : McGraw-Hill Book Co., 1960
- Ray K.Linsley, Joseph B.Franzini . Water-Resources Engineering.  
New York : McGraw-Hill Book Co., 1972
- Afifi H.H.H. " Economic Evaluation of Water Supply Pricing in  
Illinois " Journal AWWA. 61 (1), (1969)
- A.Lee Cesario . " Computer Modeling Programs : Tools for Model  
Operations " Journal AWWA. 72 (9), (1980)
- Csallany S.C. " Relationship between Water Use and Polulation  
in the Embarras River Basin Illinois " . Journal AWWA.  
57 (3), (1965)
- Frank C.Pentecost . " Design Guidelines for Distribution System".  
Jour AWWA. 66 (6), (1974)
- K.L.Kollar & P.Mac Auley . " Water Requirements for Industrial  
Development " Journal AWWA. 1 (1980)
- Thomas M.Walski . " Energy officiency through pipe design "  
Journal AWWA. 75 (10), (1983)

Nihon Suido Consultants Co. " Review of the 1970 master plan and present system and preparation of Detailed design of Stage II water improvement program ", Revises Master Plan Volume II Technical Report, Metropolitan Water Works Authority Bangkok. 2 (1984)

Shouvanavirakul P. " Demand for Potable Water in Small Communities of Thailand " Master's Thesis, Asian Institution of Technology, 1970

Somjai Vatanvanichkul . " Economic effects of pressure conditions in a looped Water distribution system ". Master's Thesis, Asian Institution of Technology, 1982



ศูนย์วิทยทรัพยากร  
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ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ข้อมูลสำหรับป้อนเข้าโปรแกรมสำเร็จรูป MPSX/370

```
//SUBC1013 JT8 CLASS=C,MSGCLASS=R
//MPSX EXEC MPSXDPL,VOL=NS0WK2,PSPACE=10,SPACE=4
//DPL.SYSPRINT DD SYSOUT=R
//DPL.SYSIN DD *
PROGRAM
INITIALZ
MOVE(XDATA,'SAMPLE')
MOVE(XPBNAM,'SAMPLE01')
CONVERT('SCRATCH','SUMMARY','CHECK')
MOVE(XOBJ,'MIN')
MOVE(XBOUND,'HEADLIM')
MOVE(XRHS,'RHS')
MOVE(XMINMAX,'MIN')
SETUP
CRASH
PRIMAL
SOLUTION
EXIT
PEND
//GC.SYSPRINT DD SYSOUT=R,OUTLIM=30000
//GC.DPLUSER1 DD DSN=SO3C1.BET1,DISP=(OLD,KEEP),
// VOL=SER=NS003,UNIT=DISK,
// SPACE=(CYL,(10,4)),DCB=(RECFM=VB,LRECL=204,
// BLKSIZE=1024)
//GC.DPLUSER2 DD DSN=SO3C1.BET2,DISP=(OLD,KEEP),
// VOL=SER=NS003,UNIT=DISK,SPACE=(CYL,(5,2)),
// DCB=(RECFM=F,LRECL=80,BLKSIZE=80)
//GC.SYSIN DD *
```

NAME SAMPLE

ROWS

R MIN  
E R101  
E R102  
E R103  
E R104  
E R105  
E R106  
E R107  
E R108  
L T101  
L T102  
L T103  
L T104  
L T105  
L T106  
L T107  
L T108  
L T109  
L T110  
L T111  
L T112  
L T113  
L T114  
E I101  
E I102

FILE: BANG P A VM/SP RELEASE 2.1 EXPRESS PUT&302+ SL0203

- E I103
- L I104
- E I105
- E I106
- E I107
- E I108
- E I109
- E I110
- E I111
- E I112
- E I113
- E I114
- E I115
- E I116
- E I117
- E I118
- E I119
- E I120
- E I121
- E I122
- E I123
- E I124
- E I125
- E I126
- E I127
- E I128
- E I129
- E I130
- E I131
- E I132
- E I133
- E I134
- E I135
- E I136
- E I137
- E I138
- E I139
- E I140
- E I141
- E I142
- E I143
- E I144
- E I145
- E I146
- E I147

COLUMNS

L10110	MIN	6600.00	T101	0.004479
L10110	T102	0.004479	T103	0.004479
L10110	T104	0.004479	T105	0.004479
L10110	T106	0.004479	T107	0.004479
L10110	T108	0.004479	T109	0.004479
L10110	T110	0.004479	T111	0.004479
L10110	T112	0.004479	T113	0.004479
L10110	T114	0.004479	T101	1.000000
L10111	MIN	6600.00	T101	0.002337

ศูนย์วิทยุวิทยากร  
จุฬาลงกรณ์มหาวิทยาลัย



FILE: BANG P A VM/SP RELEASE 2.1 EXPRESS PUT 3302+ SL0203

L10111	T102	0.002337	T103	0.002337
L10111	T104	0.002337	T105	0.002337
L10111	T106	0.002337	T107	0.002337
L10111	T108	0.002337	T109	0.002337
L10111	T110	0.002337	T111	0.002337
L10111	T112	0.002337	T113	0.002337
L10111	T114	0.002337	T101	1.000000
L10112	MIN	9650.00	T101	0.001317
L10112	T102	0.001317	T103	0.001317
L10112	T104	0.001317	T105	0.001317
L10112	T106	0.001317	T107	0.001317
L10112	T108	0.001317	T109	0.001317
L10112	T110	0.001317	T111	0.001317
L10112	T112	0.001317	T113	0.001317
L10112	T114	0.001317	T101	1.000000
L10113	MIN	12825.00	T101	0.000788
L10113	T102	0.000788	T103	0.000788
L10113	T104	0.000788	T105	0.000788
L10113	T106	0.000788	T107	0.000788
L10113	T108	0.000788	T109	0.000788
L10113	T110	0.000788	T111	0.000788
L10113	T112	0.000788	T113	0.000788
L10113	T114	0.000788	T101	1.000000
L10114	MIN	16650.00	T101	0.000324
L10114	T102	0.000324	T103	0.000324
L10114	T104	0.000324	T105	0.000324
L10114	T106	0.000324	T107	0.000324
L10114	T108	0.000324	T109	0.000324
L10114	T110	0.000324	T111	0.000324
L10114	T112	0.000324	T113	0.000324
L10114	T114	0.000324	T101	1.000000
L10210	MIN	6600.00	T102	0.004219
L10210	T103	0.004219	T104	0.004219
L10210	T105	0.004219	T106	0.004219
L10210	T107	0.004219	T108	0.004219
L10210	T109	0.004219	T110	0.004219
L10210	T111	0.004219	T112	0.004219
L10210	T113	0.004219	T114	0.004219
L10210	T102	1.000000		
L10211	MIN	8600.00	T102	0.002202
L10211	T103	0.002202	T104	0.002202
L10211	T105	0.002202	T106	0.002202
L10211	T107	0.002202	T108	0.002202
L10211	T109	0.002202	T110	0.002202
L10211	T111	0.002202	T112	0.002202
L10211	T113	0.002202	T114	0.002202
L10211	T102	1.000000		
L10212	MIN	9650.00	T102	0.001241
L10212	T103	0.001241	T104	0.001241
L10212	T105	0.001241	T106	0.001241
L10212	T107	0.001241	T108	0.001241
L10212	T109	0.001241	T110	0.001241
L10212	T111	0.001241	T112	0.001241
L10212	T113	0.001241	T114	0.001241
L10212	T102	1.000000		

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L10213	MIN	12325.00	T102	0.000743
L10213	T105	0.000743	T104	0.000743
L10213	T105	0.000743	T106	0.000743
L10213	T107	0.000743	T108	0.000743
L10213	T109	0.000743	T110	0.000743
L10213	T111	0.000743	T112	0.000743
L10213	T113	0.000743	T114	0.000743
L10213	I102	1.000000		
L10214	MIN	10820.00	T102	0.000306
L10214	T103	0.000306	T104	0.000306
L10214	T105	0.000306	T106	0.000306
L10214	T107	0.000306	T108	0.000306
L10214	T109	0.000306	T110	0.000306
L10214	T111	0.000306	T112	0.000306
L10214	T113	0.000306	T114	0.000306
L10214	I102	1.000000		
L1033	MIN	610.00	T101	0.013620
L1033	I103	1.000000		
L1034	MIN	820.00	T101	0.003335
L1034	I103	1.000000		
L1035	MIN	1020.00	T101	0.001132
L1035	I103	1.000000		
L1044	MIN	820.00	T102	0.007590
L1044	T103	0.007590	T104	1.000000
L1045	MIN	1020.00	T102	0.002560
L1045	T103	0.002560	T104	1.000000
L1046	MIN	1220.00	T102	0.001054
L1046	T103	0.001054	T104	1.000000
L1053	MIN	610.00	T102	0.009910
L1053	I105	1.000000		
L1054	MIN	820.00	T102	0.002441
L1054	I105	1.000000		
L1061	MIN	373.00	T102	0.041819
L1061	I106	1.000000		
L1062	MIN	490.00	T102	0.014107
L1062	I106	1.000000		
L1063	MIN	610.00	T102	0.001958
L1063	I106	1.000000		
L1071	MIN	373.00	T103	0.031172
L1071	I107	1.000000		
L1072	MIN	490.00	T103	0.010515
L1072	I107	1.000000		
L10810	MIN	6600.00	T104	0.003830
L10810	T105	0.003830	T106	0.003830
L10810	T107	0.003830	T108	0.003830
L10810	T109	0.003830	T110	0.003830
L10810	T111	0.003830	T112	0.003830
L10810	T113	0.003830	T114	0.003830
L10810	T108	1.000000		
L10811	MIN	8600.00	T104	0.001999
L10811	T105	0.001999	T106	0.001999
L10811	T107	0.001999	T108	0.001999
L10811	T109	0.001999	T110	0.001999
L10811	T111	0.001999	T112	0.001999
L10811	T113	0.001999	T114	0.001999



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L10811	I102	1.000000		
L10812	MIN	9610.00	T104	0.001126
L10812	T105	0.001126	T106	0.001126
L10812	T107	0.001126	T108	0.001126
L10812	T109	0.001126	T110	0.001126
L10812	T111	0.001126	T112	0.001126
L10812	T112	0.001126	T114	0.001126
L10812	I108	1.000000		
L10813	MIN	12825.00	T104	0.000674
L10813	T105	0.000674	T106	0.000674
L10813	T107	0.000674	T108	0.000674
L10813	T109	0.000674	T110	0.000674
L10813	T111	0.000674	T112	0.000674
L10813	T113	0.000674	T114	0.000674
L10813	I108	1.000000		
L10814	MIN	16650.00	T104	0.000277
L10814	T105	0.000277	T106	0.000277
L10814	T107	0.000277	T108	0.000277
L10814	T109	0.000277	T110	0.000277
L10814	T111	0.000277	T112	0.000277
L10814	T113	0.000277	T114	0.000277
L10814	I108	1.000000		
L1093	MIN	510.00	T104	0.010300
L1093	I109	1.000000		
L1094	MIN	820.00	T104	0.002537
L1094	I109	1.000000		
L11010	MIN	5500.00	T105	0.003622
L11010	T106	0.003622	T107	0.003622
L11010	T108	0.003622	T109	0.003622
L11010	T110	0.003622	T111	0.003622
L11010	T112	0.003622	T113	0.003622
L11010	T114	0.003622	T110	1.000000
L11011	MIN	8500.00	T105	0.001890
L11011	T106	0.001890	T107	0.001890
L11011	T108	0.001890	T109	0.001890
L11011	T110	0.001890	T111	0.001890
L11011	T112	0.001890	T113	0.001890
L11011	T114	0.001890	T110	1.000000
L11012	MIN	9650.00	T105	0.001065
L11012	T106	0.001065	T107	0.001065
L11012	T108	0.001065	T109	0.001065
L11012	T110	0.001065	T111	0.001065
L11012	T112	0.001065	T113	0.001065
L11012	T114	0.001065	T110	1.000000
L11013	MIN	12825.00	T105	0.000638
L11013	T106	0.000638	T107	0.000638
L11013	T108	0.000638	T109	0.000638
L11013	T110	0.000638	T111	0.000638
L11013	T112	0.000638	T113	0.000638
L11013	T114	0.000638	T110	1.000000
L11014	MIN	16650.00	T105	0.000262
L11014	T106	0.000262	T107	0.000262
L11014	T108	0.000262	T109	0.000262
L11014	T110	0.000262	T111	0.000262
L11014	T112	0.000262	T113	0.000262

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L11014	T114	3.000252	T110	1.000000
L1116	MIN	1200.00	R104	-0.008301
L1116	T105	0.008301	T106	0.008301
L1116	T107	0.008301	T111	1.000000
L1117	MIN	4180.30	R104	-0.002045
L1117	T105	0.002045	T106	0.002045
L1117	T107	0.002045	T111	1.000000
L1118	MIN	4875.00	R104	-0.000690
L1118	T105	0.000690	T106	0.000690
L1118	T107	0.000690	T111	1.000000
L1124	MIN	820.00	R102	-0.015105
L1124	T105	0.015105	T112	1.000000
L1125	MIN	1020.00	R102	-0.005095
L1125	T105	0.005095	T112	1.000000
L1126	MIN	1260.00	R102	-0.002097
L1126	T105	0.002097	T112	1.000000
L1133	MIN	610.00	R101	-0.008339
L1133	T113	1.000000		
L1134	MIN	820.00	R101	-0.002054
L1134	T113	1.000000		
L1141	MIN	373.00	R101	-0.015584
L1141	T114	1.000000		
L1142	MIN	490.00	R101	-0.005257
L1142	T114	1.000000		
L1152	MIN	490.00	R101	0.021735
L1152	T105	0.021735	T115	1.000000
L1153	MIN	610.00	R101	0.003017
L1153	T105	0.003017	T115	1.000000
L1164	MIN	820.00	R101	0.006987
L1164	R102	-0.006987	T105	0.006987
L1164	T116	1.000000		
L1165	MIN	1020.00	R101	0.002357
L1165	R102	-0.002357	T105	0.002357
L1165	T116	1.000000		
L1166	MIN	1260.00	R101	0.000970
L1166	R102	-0.000970	T105	0.000970
L1166	T116	1.000000		
L1172	MIN	490.00	R102	-0.027178
L1172	T117	1.000000		
L1173	MIN	610.00	R102	-0.003773
L1173	T117	1.000000		
L1184	MIN	820.00	R102	0.009087
L1184	R104	-0.009087	T106	0.009087
L1184	T107	0.009087	T118	1.000000
L1185	MIN	1020.00	R102	0.003065
L1185	R104	-0.003065	T106	0.003065
L1185	T107	0.003065	T118	1.000000
L1186	MIN	1260.00	R102	0.001261
L1186	R104	-0.001261	T106	0.001261
L1186	T107	0.001261	T118	1.000000
L1191	MIN	373.00	R102	0.015584
L1191	T106	0.015584	T119	1.000000
L1192	MIN	490.00	R102	0.005257
L1192	T106	0.005257	T119	1.000000
L1202	MIN	490.00	R104	-0.027929

FILE: BANG P A VM/SP RELEASE 2.1 EXPRESS PUT8302+ SLU203

L1202	T107	0.007929	I120	1.000000
L1203	MIN	610.00	R104	-0.003877
L1203	T107	0.003877	I120	1.000000
L1211	MIN	373.00	R103	-0.015584
L1211	T107	0.015584	I121	1.000000
L1212	MIN	490.00	R103	-0.005257
L1212	T107	0.005257	I121	1.000000
L1221	MIN	373.00	R103	-0.015584
L1221	R104	0.015584	I122	1.000000
L1222	MIN	490.00	R103	-0.005257
L1222	R104	0.005257	I122	1.000000
L1231	MIN	373.00	R103	0.010549
L1231	I123	1.000000		
L1232	MIN	490.00	R103	0.003558
L1232	I123	1.000000		
L1241	MIN	373.00	R103	0.044774
L1241	I124	1.000000		
L1242	MIN	490.00	R103	0.015104
L1242	I124	1.000000		
L1243	MIN	610.00	R103	0.002097
L1243	I124	1.000000		
L1253	MIN	610.00	R104	0.008581
L1253	I125	1.000000		
L1254	MIN	820.00	R104	0.002114
L1254	I125	1.000000		
L1261	MIN	373.00	T108	0.014394
L1261	I126	1.000000		
L1262	MIN	490.00	T108	0.004855
L1262	I126	1.000000		
L12710	MIN	660.00	R104	0.002573
L12710	T108	0.002573	T109	0.002573
L12710	T110	0.002573	T111	0.002573
L12710	T112	0.002573	T113	0.002573
L12710	T114	0.002573	I127	1.000000
L12711	MIN	660.00	R104	0.001343
L12711	T108	0.001343	T109	0.001343
L12711	T110	0.001343	T111	0.001343
L12711	T112	0.001343	T113	0.001343
L12711	T114	0.001343	I127	1.000000
L12712	MIN	9650.00	R104	0.000757
L12712	T108	0.000757	T109	0.000757
L12712	T110	0.000757	T111	0.000757
L12712	T112	0.000757	T113	0.000757
L12712	T114	0.000757	I127	1.000000
L12713	MIN	12825.00	R104	0.000453
L12713	T108	0.000453	T109	0.000453
L12713	T110	0.000453	T111	0.000453
L12713	T112	0.000453	T113	0.000453
L12713	T114	0.000453	I127	1.000000
L1284	MIN	820.00	R105	0.016033
L1284	T109	0.016033	T110	0.016033
L1284	T111	0.016033	I128	1.000000
L1285	MIN	1020.00	R105	0.005408
L1285	T109	0.005408	T110	0.005408
L1285	T111	0.005408	I128	1.000000

FILE: EANG P A VM/SP RELEASE 2.1 EXPRESS PUT6302+ SLU205

L1286	MIN	1280.00	R105	0.002226
L1286	T109	0.002226	T110	0.002226
L1286	T111	0.002226	T128	1.000000
L1293	MIN	610.00	T109	0.011146
L1293	T129	1.000000		
L1294	MIN	920.00	T109	0.002746
L1294	T129	1.000000		
L1302	MIN	490.00	T109	0.024466
L1302	T130	1.000000		
L1303	MIN	610.00	T109	0.003396
L1303	T130	1.000000		
L1313	MIN	610.00	R106	0.011394
L1313	T110	0.011394	T131	1.000000
L1314	MIN	820.00	R106	0.002807
L1314	T110	0.002807	T131	1.000000
L1321	MIN	373.00	T110	0.053683
L1321	T132	1.000000		
L1322	MIN	490.00	T110	0.018109
L1322	T132	1.000000		
L1323	MIN	610.00	T110	0.002514
L1323	T132	1.000000		
L1331	MIN	373.00	R106	0.015584
L1331	T133	1.000000		
L1332	MIN	490.00	R106	0.005257
L1332	T133	1.000000		
L1341	MIN	373.00	R105	0.024975
L1341	R106	-0.024975	T111	0.024975
L1341	T134	1.000000		
L1342	MIN	490.00	R105	0.008425
L1342	R106	-0.008425	T111	0.008425
L1342	T134	1.000000		
L1351	MIN	373.00	R105	-0.021844
L1351	R106	0.021844	T135	1.000000
L1352	MIN	490.00	R105	-0.007369
L1352	R106	0.007369	T135	1.000000
L1363	MIN	610.00	R105	-0.022526
L1363	R108	0.022526	T112	0.022526
L1363	T136	1.000000		
L1364	MIN	820.00	R105	-0.005549
L1364	R108	0.005549	T112	0.005549
L1364	T136	1.000000		
L1365	MIN	1020.00	R105	-0.001872
L1365	R106	0.001872	T112	0.001872
L1365	T136	1.000000		
L1372	MIN	490.00	R106	-0.035859
L1372	R107	0.035859	T137	1.000000
L1373	MIN	610.00	R106	-0.004978
L1373	R107	0.004978	T137	1.000000
L1381	MIN	373.00	R107	-0.015584
L1381	R108	0.015584	T112	0.015584
L1381	T138	1.000000		
L1382	MIN	490.00	R107	-0.005257
L1382	R108	0.005257	T112	0.005257
L1382	T138	1.000000		
L1399	MIN	2600.00	R104	0.004468



FILE: BANG P A VM/SP RELEASE 2.1 EXPRESS P011302+ SL0283

L1389	R105	-0.004488	T108	0.004488
L1389	T112	0.004488	T113	0.004488
L1389	T114	0.004488	T139	1.000000
L13910	MIN	6600.00	R104	0.001118
L13910	R105	-0.002118	T108	0.002118
L13910	T112	0.002118	T113	0.002118
L13910	T114	0.002118	T139	1.000000
L13911	MIN	3600.00	R104	0.001106
L13911	R105	-0.001106	T108	0.001106
L13911	T112	0.001106	T113	0.001106
L13911	T114	0.001106	T139	1.000000
L13912	MIN	9650.00	R104	0.000623
L13912	R105	-0.000623	T108	0.000623
L13912	T112	0.000623	T113	0.000623
L13912	T114	0.000623	T139	1.000000
L13913	MIN	12825.00	R104	0.000373
L13913	R105	-0.000373	T108	0.000373
L13913	T112	0.000373	T113	0.000373
L13913	T114	0.000373	T139	1.000000
L1409	MIN	5600.00	R104	0.003916
L1409	R108	-0.003916	T108	0.003916
L1409	T113	0.003916	T114	0.003916
L1409	T140	1.000000		
L14010	MIN	6600.00	R104	0.001848
L14010	R105	-0.001848	T108	0.001848
L14010	T113	0.001848	T114	0.001848
L14010	T140	1.000000		
L14011	MIN	8600.00	R104	0.000965
L14011	R108	-0.000965	T108	0.000965
L14011	T113	0.000965	T114	0.000965
L14011	T140	1.000000		
L14012	MIN	9650.00	R104	0.000544
L14012	R108	-0.000544	T108	0.000544
L14012	T113	0.000544	T114	0.000544
L14012	T140	1.000000		
L14013	MIN	12825.00	R104	0.000325
L14013	R108	-0.000325	T108	0.000325
L14013	T113	0.000325	T114	0.000325
L14013	T140	1.000000		
L1412	MIN	490.00	R107	0.043706
L1412	R108	-0.043706	T141	1.000000
L1413	MIN	610.00	R107	0.006067
L1413	R108	-0.006067	T141	1.000000
L1414	MIN	820.00	R107	0.001495
L1414	R108	-0.001495	T141	1.000000
L1421	MIN	373.00	R107	-0.043655
L1421	T113	0.043655	T142	1.000000
L1422	MIN	490.00	R107	-0.014726
L1422	T113	0.014726	T142	1.000000
L1423	MIN	610.00	R107	-0.002044
L1423	T113	0.002044	T142	1.000000
L1421	MIN	373.00	R107	0.015584
L1421	T143	1.000000		
L1422	MIN	490.00	R107	0.005257
L1422	T143	1.000000		

FILE: BANG P A VAR/SP RELEASE 2.1 EXPRESS PUTE302+ SLO203

L1443	MIN	810.00	R103	-0.027552
L1443	T113	0.0017133	T144	1.000000
L1444	MIN	820.00	R103	-0.008787
L1444	T113	0.008787	T144	1.000000
L1445	MIN	1020.00	R103	-0.001240
L1445	T113	0.002290	T144	1.000000
L1459	MIN	5600.00	R104	0.003390
L1459	T108	0.003390	T114	0.003390
L1459	T145	1.000000		
L14510	MIN	6600.00	R104	0.001600
L14510	T108	0.001600	T114	0.001600
L14510	T145	1.000000		
L14511	MIN	8600.00	R104	0.000835
L14511	T108	0.000835	T114	0.000835
L14511	T145	1.000000		
L14512	MIN	9650.00	R104	0.000471
L14512	T108	0.000471	T114	0.000471
L14512	T145	1.000000		
L14513	MIN	12825.00	R104	0.000232
L14513	T108	0.000232	T114	0.000232
L14513	T145	1.000000		
L1463	MIN	810.00	R104	0.018672
L1463	T108	0.018672	T146	1.000000
L1464	MIN	820.00	R104	0.004600
L1464	T108	0.004600	T145	1.000000
L1465	MIN	1020.00	R104	0.001552
L1465	T108	0.001552	T146	1.000000
L1479	MIN	5600.00	T114	0.002990
L1479	T147	1.000000		
L14710	MIN	6600.00	T114	0.001411
L14710	T147	1.000000		
L14711	MIN	8600.00	T114	0.000737
L14711	T147	1.000000		
L14712	MIN	9650.00	T114	0.000415
L14712	T147	1.000000		
L14713	MIN	12825.00	T114	0.000248
L14713	T147	1.000000		
P101	MIN	0.356923E+05	T101	-1.000000
P101	T102	-1.000000	T103	-1.000000
P101	T104	-1.000000	T105	-1.000000
P101	T106	-1.000000	T107	-1.000000
P101	T108	-1.000000	T109	-1.000000
P101	T110	-1.000000	T111	-1.000000
P101	T112	-1.000000	T113	-1.000000
P101	T114	-1.000000		
RHS	R101	0.000000		
RHS	R102	0.000000		
RHS	R103	0.000000		
RHS	R104	0.000000		
RHS	R105	0.000000		
RHS	R106	0.000000		
RHS	R107	0.000000		
RHS	R108	0.000000		
RHS	T101	-15.000000		



FILE: BANG P A VM/SP RELEASE 2.1 EXPRESS POT8302+ SLU203

RHS	T101	-15.000000
RHS	T103	-15.000000
RHS	T104	-15.000000
RHS	T105	-15.000000
RHS	T106	-15.000000
RHS	T107	-15.000000
RHS	T108	-15.000000
RHS	T109	-15.000000
RHS	T110	-15.000000
RHS	T111	-15.000000
RHS	T112	-15.000000
RHS	T113	-15.000000
RHS	T114	-15.000000
RHS	I101	1020
RHS	I102	160
RHS	I103	100
RHS	I104	200
RHS	I105	360
RHS	I106	220
RHS	I107	152
RHS	I108	200
RHS	I109	400
RHS	I110	220
RHS	I111	180
RHS	I112	152
RHS	I113	140
RHS	I114	400
RHS	I115	140
RHS	I116	400
RHS	I117	320
RHS	I118	320
RHS	I119	552
RHS	I120	400
RHS	I121	552
RHS	I122	348
RHS	I123	340
RHS	I124	552
RHS	I125	572
RHS	I126	552
RHS	I127	330
RHS	I128	200
RHS	I129	100
RHS	I130	180
RHS	I131	164
RHS	I132	280
RHS	I133	428
RHS	I134	214
RHS	I135	214
RHS	I136	200
RHS	I137	164
RHS	I138	416
RHS	I139	428
RHS	I140	392
RHS	I141	176
RHS	I142	164

FILE: BANG P A VM/SP RELEASE 2:1 EXPRESS PUT8302+ SLU203

RHS	I143	592
RHS	I144	200
RHS	I145	284
RHS	I146	180
RHS	I147	251
BEUNDS		
OP HEADLIM	P101	50
LD HEADLIM	P101	25
ENDATA		
//		

ศูนย์วิทยุทัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ITEM NUMBER	VECTOK DOT	VECTOK IN	REDUCED COST	NUMBER RCSOPT	FUNCTION VALUE	NUMBER INFEAS	SUM INFEAS
M 63	171	103	.65070-		4747515.66	0	.
M 64	181	179	.18977-	14	42648855.79	0	.
M 65	132	103	1.4700-		47709433.70	0	.
M 66	179	178	.02111-		44436777.63	0	.
M 67	176	125	.31573-	14	41639214.49	0	.
M 68	15	101	.65995-		41526259.33	0	.
M 69	102	124	.20231-	14	41216433.04	0	.
M 70	17	193	.02967-		41127211.53	0	.
M 71	194	142	.15455-	14	40944566.48	0	.
M 72	155	154	.00749-		40896958.54	0	.
M 73	112	116	.01137-		40846844.69	0	.
M 74	178	177	.02327-	14	40347772.17	0	.
M 75	130	12	.05910-		40222047.01	0	.
M 76	22	159	.00607-		40203897.50	0	.
M 77	117	114	.00280-	8	40158344.92	0	.
M 78	21	101	.00473-		40130909.05	0	.
M 79	124	127	.00532-		40118067.92	0	.
M 80	28	90	.02021-		40106629.66	0	.
M 81	162	103	.00664-	5	40075150.27	0	.
M 82	127	124	.00180-		40057712.20	0	.
M 83	105	140	.96403-		40048010.01	0	.
M 84	19	125	.00170-		40043951.36	0	.

OPTIMAL SOLUTION

MOCSPT DEMAND SET  
MPSX/370 R1.0 P1F9 MPSOL EXECUTION

SOLUTION OPTIMAL  
TIME = 0.05 MINS. ITERATION NUMBER = 84

..NAME.. ..ACTIVITY.. ..DEFINED AS  
FUNCTIONAL 40043951.5002 MIN  
RESTRAINTS KHS  
EQUATIONS HEADLIN

MPSX/370 R1.0 P1F9 MPSOL EXECUTION  
SECTION 1 - RMS

NUMBER	..RHS..	..ACTIVITY..	..SEARCH ACTIVITY..	..LOWER LIMIT..	..UPPER LIMIT..	..DUAL ACTIVITY..
1	MIN	SS	40043951.5002	40043951.5002	NONE	1.00000
2	R101	EQ	.	.	NONE	11329.52455
3	R102	EQ	.	.	NONE	5127.10454
4	R103	EQ	.	.	NONE	16735.80518
5	R104	EQ	.	.	NONE	289971.35177
6	R105	EQ	.	.	NONE	3246.62299
7	R106	EQ	.	.	NONE	11329.52455
8	R107	EQ	.	.	NONE	15219.40507
9	R108	EQ	.	.	NONE	12027.22660
10	R101	CS	29.12012	15.12012	NONE	15.00000
11	R102	UL	15.00000		NONE	15.00000
12	R103	CS	22.55993	7.55993	NONE	4221.99764
13	R104	SS	25.72100	2.72100	NONE	15.00000
14	R105	SS	17.01000	2.01000	NONE	15.00000
15	R106	UL	15.00000		NONE	15.00000
16	R107	UL	15.00000		NONE	15.00000
17	R108	UL	15.00000		NONE	15.00000
18	R109	CS	17.55463	2.55463	NONE	15.00000

19	1110	UL	15.00000	.	NAME	15.00000	3200.91087
20	1111	ES	17.00000	2.42846	NAME	15.00000	.
21	1112	UL	15.00000	.	NAME	15.00000	.
22	1113	UL	15.00000	.	NAME	15.00000	3589.07301
23	1114	ES	20.00000	5.02433	NAME	15.00000	22140.39780
24	1101	EQ	1020.00000	.	NAME	15.00000	.
25	1102	EQ	160.00000	.	1020.00000	1020.00000	8198.05012-
26	1103	EQ	100.00000	.	160.00000	160.00000	8105.05014-
27	1104	EQ	200.00000	.	100.00000	100.00000	010.00000-
28	1105	EQ	300.00000	.	200.00000	200.00000	352.04490-
29	1106	EQ	220.00000	.	300.00000	300.00000	051.04000-
30	1107	EQ	152.00000	.	220.00000	220.00000	549.55972-
31	1108	EQ	200.00000	.	152.00000	152.00000	373.00000-
32	1109	EQ	400.00000	.	200.00000	200.00000	7950.04484-
33	1110	EQ	220.00000	.	400.00000	400.00000	010.00000-
34	1111	EQ	180.00000	.	220.00000	220.00000	7077.48003-
35	1112	EQ	152.00000	.	180.00000	180.00000	1430.02175-
36	1113	EQ	140.00000	.	152.00000	152.00000	097.44499-
37	1114	EQ	400.00000	.	140.00000	140.00000	704.47091-
38	1115	EQ	140.00000	.	400.00000	400.00000	549.55931-
39	1116	EQ	400.00000	.	140.00000	140.00000	245.75278-
40	1117	EQ	320.00000	.	400.00000	400.00000	770.00373-
41	1118	EQ	520.00000	.	320.00000	320.00000	029.34450-
42	1119	EQ	552.00000	.	520.00000	520.00000	460.28010-
43	1120	EQ	400.00000	.	552.00000	552.00000	549.55931-
44	1121	EQ	552.00000	.	400.00000	400.00000	029.34450-
45	1122	EQ	340.00000	.	552.00000	552.00000	1752.02745-
46	1123	EQ	340.00000	.	340.00000	340.00000	1420.39928-
47	1124	EQ	552.00000	.	340.00000	340.00000	549.55931-
48	1125	EQ	572.00000	.	552.00000	552.00000	045.09490-
49	1126	EQ	552.00000	.	572.00000	572.00000	1432.99544-
50	1127	EQ	552.00000	.	552.00000	552.00000	549.55931-



NUMBER	REL	AT	ACTIVITY	SLACK	ACTIVITY	LOWER LIMIT	UPPER LIMIT	DUAL ACTIVITY
50	1127	EQ	550.00000	.	550.00000	550.00000	7452.31957-	
51	1128	EQ	200.00000	.	200.00000	200.00000	429.78434-	
52	1129	EQ	100.00000	.	100.00000	100.00000	010.00000-	
53	1130	EQ	180.00000	.	180.00000	180.00000	490.00000-	
54	1131	EQ	164.00000	.	164.00000	164.00000	770.00254-	
55	1132	EQ	280.00000	.	280.00000	280.00000	549.55903-	
56	1133	EQ	428.00000	.	428.00000	428.00000	549.55931-	
57	1134	EQ	214.00000	.	214.00000	214.00000	171.12953-	
58	1135	EQ	214.00000	.	214.00000	214.00000	549.55290-	
59	1136	EQ	200.00000	.	200.00000	200.00000	880.03934-	
60	1137	EQ	164.00000	.	164.00000	164.00000	029.34450-	
61	1138	EQ	410.00000	.	410.00000	410.00000	3790.24745-	
62	1139	EQ	428.00000	.	428.00000	428.00000	7057.34173-	
63	1140	EQ	592.00000	.	592.00000	592.00000	0223.16244-	
64	1141	EQ	170.00000	.	170.00000	170.00000	029.34470-	
65	1142	EQ	164.00000	.	164.00000	164.00000	591.57738-	
66	1143	EQ	592.00000	.	592.00000	592.00000	009.46741-	
67	1144	EQ	200.00000	.	200.00000	200.00000	080.03000-	
68	1145	EQ	280.00000	.	280.00000	280.00000	0024.00271-	
69	1146	EQ	180.00000	.	180.00000	180.00000	1409.07150-	
70	1147	EQ	552.00000	.	552.00000	552.00000	000.00000-	

SECTION 2 - COLUMNS

NUMBER	COLUMNS	AT	ACTIVITY	INPUT COST	LOWER LIMIT	UPPER LIMIT	REDUCED COST
71	L1010	BS	1020.00000	8600.00000	.	NONE	.
72	L1011	LL	.	8600.00000	.	NONE	1235.47193
73	L1012	LL	.	9650.00000	.	NONE	1521.40947
74	L1013	LL	.	12025.00000	.	NONE	4907.09721
75	L1014	LL	.	16650.00000	.	NONE	8500.96494
76	L1020	BS	160.00000	8600.00000	.	NONE	.
77	L1021	LL	.	8600.00000	.	NONE	1280.08631
78	L1022	LL	.	9650.00000	.	NONE	1967.08331
79	L1023	LL	.	12025.00000	.	NONE	4964.33565
80	L1024	LL	.	16650.00000	.	NONE	8653.36030
81	L1033	BS	100.00000	10.00000	.	NONE	.
82	L1034	LL	.	10.00000	.	NONE	210.00000
83	L1035	LL	.	120.00000	.	NONE	410.00000
84	L1044	BS	100.00000	20.00000	.	NONE	.
85	L1045	LL	.	120.00000	.	NONE	170.76355
86	L1046	LL	.	160.00000	.	NONE	412.40602
87	L1053	BS	360.00000	610.00000	.	NONE	.
88	L1054	LL	.	620.00000	.	NONE	176.46590
89	L1061	BS	202.72575	373.00000	.	NONE	.
90	L1062	BS	17.27425	490.00000	.	NONE	.
91	L1063	LL	.	610.00000	.	NONE	.
92	L1071	BS	152.00000	175.00000	.	NONE	68.70695
93	L1072	LL	.	180.00000	.	NONE	.
94	L10810	BS	200.00000	600.00000	.	NONE	117.00000
95	L10811	LL	.	300.00000	.	NONE	.
96	L10812	LL	.	900.00000	.	NONE	1354.20446
97	L10813	LL	.	12025.00000	.	NONE	2096.29049
98	L10814	LL	.	16650.00000	.	NONE	5111.07564
99	L1093	BS	400.00000	610.00000	.	NONE	8790.65334
100	L1094	LL	.	620.00000	.	NONE	.
101	L11010	BS	220.00000	600.00000	.	NONE	210.00000
102	L11011	LL	.	600.00000	.	NONE	.
103	L11012	LL	.	9650.00000	.	NONE	1384.12166
104	L11013	LL	.	12025.00000	.	NONE	2146.14354
105	L11014	LL	.	16650.00000	.	NONE	5172.54021
106	L1110	BS	180.00000	1260.00000	.	NONE	8664.92463
107	L1117	LL	.	4150.00000	.	NONE	.
108	L1118	LL	.	4675.00000	.	NONE	2755.63492
109	L1120	BS	152.00000	620.00000	.	NONE	3451.77565
110	L1125	LL	.	1020.00000	.	NONE	.
111	L1126	LL	.	1260.00000	.	NONE	146.67763
112	L1133	BS	140.00000	610.00000	.	NONE	373.30656
113	L1134	LL	.	620.00000	.	NONE	.
114	L1141	BS	248.61431	373.00000	.	NONE	138.79394
115	L1142	BS	151.78569	490.00000	.	NONE	.
116	L1152	BS	140.00000	490.00000	.	NONE	.
117	L1150	LL	.	610.00000	.	NONE	.
118	L1164	BS	400.00000	620.00000	.	NONE	232.06404
119	L1165	LL	.	1020.00000	.	NONE	.

MPSX/370 NLS6 PIFS MPSX EXECUTION

NUMBER	COLUMNS	AT	ACTIVITY	INPUT COST	LOWER LIMIT	UPPER LIMIT	REDUCED COST
120	L1166	LL	.	100.00000	.	NONE	477.21593
121	L1172	BS	190.21703	492.00000	.	NONE	.



123	1117	SS	224.70497	110.00000	NONE	.
123	1118	SS	220.00000	220.00000	NONE	.
124	1118	LL	.	1120.00000	NONE	.
125	1118	LL	.	1.00.00000	NONE	101.72370
125	1119	SS	470.39179	370.00000	NONE	312.28974
127	1119	SS	73.00221	490.00000	NONE	.
128	1120	SS	139.63743	490.00000	NONE	.
129	1120	SS	200.00255	610.00000	NONE	.
130	1121	LL	.	370.00000	NONE	.
131	1121	SS	592.00000	490.00000	NONE	2750.22688
132	1122	LL	.	370.00000	NONE	.
133	1122	SS	340.00000	490.00000	NONE	2704.70351
134	1123	SS	332.13840	370.00000	NONE	.
135	1123	SS	7.00154	490.00000	NONE	.
136	1124	LL	.	370.00000	NONE	.
137	1124	LL	.	491.00000	NONE	477.23387
138	1125	SS	552.00100	610.00000	NONE	97.00259
139	1125	LL	.	610.00000	NONE	.
140	1125	SS	372.00100	220.00000	NONE	1005.24473
141	1126	SS	337.40350	370.00000	NONE	.
142	1126	SS	214.39850	490.00000	NONE	.
143	1127	SS	330.00000	600.00000	NONE	.
144	1127	LL	.	800.00000	NONE	.
145	1127	LL	.	950.00000	NONE	1592.55013
146	1127	LL	.	12525.00000	NONE	2448.44000
147	1128	SS	200.00000	620.00000	NONE	522.00245
148	1128	LL	.	1020.00000	NONE	.
149	1128	LL	.	1200.00000	NONE	130.35987
150	1129	SS	100.00000	610.00000	NONE	340.70377
151	1129	LL	.	620.00000	NONE	.
152	1130	SS	180.00100	490.00000	NONE	210.00000
153	1130	LL	.	610.00000	NONE	.
154	1131	SS	164.00000	610.00000	NONE	120.00000
155	1131	LL	.	620.00000	NONE	.
156	1122	SS	34.00747	370.00000	NONE	84.47143
157	1132	SS	240.01253	490.00000	NONE	.
158	1132	LL	.	610.00000	NONE	.
159	1133	SS	91.05126	370.00000	NONE	66.70931
160	1133	SS	326.74072	490.00000	NONE	.
161	1134	SS	214.00000	370.00000	NONE	.
162	1134	LL	.	490.00000	NONE	.
163	1135	SS	140.02470	370.00000	NONE	250.77202
164	1135	SS	70.47330	490.00000	NONE	.
165	1136	SS	109.41330	610.00000	NONE	.
166	1136	SS	40.00070	620.00000	NONE	.
167	1136	LL	.	1020.00000	NONE	.
168	1137	SS	02.71774	490.00000	NONE	154.51670
169	1137	SS	81.28221	610.00000	NONE	.
170	1138	SS	4100.00000	370.00000	NONE	.

MPSA/370 K1.0 PTF9 MPSCL EXCLUSION

NUMBR COLUMNS AT ...ACTIVITY...

171 1138 LL ... 490.00000

172 1139 SS ... 420.00000

173 1139 LL ... 610.00000

174 1139 LL ... 800.00000

..INPUT COST..

..LOWER LIMIT..

..UPPER LIMIT..

..REDUCED COST..

..

..REDUCED COST..

..

..

..

..



175	LI4912	LL	.	9650.00000	.	NCNE	2794.95861
176	LI4913	LL	.	12625.00000	.	NCNE	5888.77170
177	LI4909	ES	592.00000	5700.00000	.	NCNE	.
178	LI4010	LL	.	6000.00000	.	NCNE	354.06028
179	LI4011	LL	.	3500.00000	.	NCNE	2070.25327
180	LI4012	LL	.	9650.00000	.	NCNE	2996.75194
181	LI4013	LL	.	12625.00000	.	NCNE	6105.35130
182	LI412	ES	35.79457	490.00000	.	NCNE	.
183	LI413	BS	140.20543	610.00000	.	NCNE	.
184	LI414	LL	.	620.00000	.	NCNE	195.42363
185	LI421	LL	.	373.00000	.	NCNE	83.33300
186	LI422	BS	164.00000	490.00000	.	NCNE	.
187	LI423	LL	.	110.00000	.	NCNE	32.17729
188	LI431	LL	.	773.00000	.	NCNE	40.12953
189	LI432	ES	592.00000	490.00000	.	NCNE	.
190	LI443	BS	162.20120	610.00000	.	NCNE	.
191	LI444	BS	37.79880	620.00000	.	NCNE	.
192	LI445	LL	.	1620.00000	.	NCNE	154.52107
193	LI459	BS	284.00000	5200.00000	.	NCNE	.
194	LI4510	LL	.	6600.00000	.	NCNE	456.99615
195	LI4511	LL	.	8600.00000	.	NCNE	2227.78501
196	LI4512	LL	.	9650.00000	.	NCNE	3167.77081
197	LI4513	LL	.	12625.00000	.	NCNE	6285.64206
198	LI463	LL	.	11.00000	.	NCNE	476.29382
199	LI464	LL	.	620.00000	.	NCNE	721.21773
200	LI465	ES	180.00000	1620.00000	.	NCNE	.
201	LI479	ES	252.00000	5700.00000	.	NCNE	.
202	LI4710	LL	.	6600.00000	.	NCNE	1600.00000
203	LI4711	LL	.	8600.00000	.	NCNE	3600.00000
204	LI4712	LL	.	9650.00000	.	NCNE	4050.00000
205	LI4713	LL	.	12625.00000	.	NCNE	7225.00000
206	PI01	ES	34.65670	356723.00000	25.00000	50.00000	.

MPSX/STC R1:0-PIF4 MPSCL-EXCLUSION  
 EXIT - TIME = 0.00

ED OPTIONS (EXECUTE): NOCHECK,NOLIST, SOURCE, SRCFLG, OPT(0), METRMFLG

S IN EFFECT: NOLIST NCMAP NOXREF NOSESTMT NOCHECK SOURCE TERM OBJECT FILE  
OPT(0) LANGVL(77) NOFIPS PLS(1) NAME(MAIN ) LINECOUNT(100

\*.....+...1.....2.....3.....4.....5.....6.....7

PROGRAM TO GENERATE TABLE OF RESULT GIVEN

SUBROUTINE USED : 1.SLOPE1 FORTRAN FOR GIVEN ICODE = 1  
2.SLOPE2 FORTRAN FOR GIVEN ICODE = 2

SLOPE COMPUTED BY :

- "HAZEN WILLIAMS" FORMULA USING SLOPE1 FORTRAN  
- "PRANDTL-CELEBRICK" FORMULA USING SLOPE2 FORTRAN

XX  
DIMENSION IHEAD(9,20), IPIPE(200), NCD1(200), NCD2(200), MI(50),  
\*DOLD(200,10), U(200,10), XL(200,10), PL(200), QI(200), NDOLD(200),  
\*ISTAT(200), SPIPE(200,10), ISLOPE(200), HPIPE(200), HDEJ(200),  
\*AK1(200,10), VEL(200,10), HLOSS(200,10), DEQ(200), PL1(200), CL(200),  
\*CGST01(200), AK(200), VEL1(200), D2(200), CGST02(200), SCLD(200),  
\*CR(200,10), CR1(200), ISS(30), GLS(30), HGL(30), MTP(30), QS(30),  
\*PS(30), VOL3(30), INN(200), JND(200), NPND(200), GLN(200), NSC(200),  
\*IPNS(200,100), SUMHN(200), HPIEZ(200), HDYN(200), HSTAT(200),  
\*ELOSS(200), PL2(200), CGSTPI(200,10), DELTAH(200), BOLDQ(200)

INTEGER D,D1,D2

A. TIME INITIALIZATION :

ITM = 0  
TIME0 = CMSTIM(ITM)

B. READING THE NAME OF PROBLEM

READ(5,100) ((IHEAD(I,J),J=1,20),I=1,9)  
WRITE(6,100) ((IHEAD(I,J),J=1,20),I=1,9)  
PI = 3.14159

C. READING THE PHYSICAL & HYDRAULIC PROPERTIES.

READ (5,\*) NSOURC,NPIPE,NNODE,NS,NER,NPM,PK,ICDGE,QSYST,ITRS,IALT  
IF(NPIPE.GT.200.OR.NPM.GT.20) STOP

DO 8 I = 1,NPIPE  
READ(5,\*) IPIPE(I),NCD1(I),NCD2(I),MI(I),QI(I),PL(I),NDOLD(I)  
IF(NDOLD(I).EQ.0) GO TO 46  
NDL = NDOLD(I)

READ(5,\*) (DOLD(I,NL),NL = 1,NDL)  
CALL EQP1(NDL,DOLD(I,NL),DOLDQ(I))

46 M = MI(I)  
READ(5,\*) (D(I,J),XL(I,J),CGSTPI(I,J),J=1,M)  
HPIPE(I) = 0.0  
HDEJ(I) = 0.0  
ISLOPE(I) = ICODE  
DO 3 J = 1,M  
IF(ISLOPE(I).NE.1) GO TO 1  
CR(I,J) = 130.

\*.....1.....2.....3.....4.....5.....6.....

```

23 CALL SLOPE1(QI(I),J(I,J),CR(I,J),SPIPE(I,J))
24 AK1(I,J) = (SPIPE(I,J)*XL(I,J))/(QI(I)/1000.)*1.852
25 GO TO 2
26 1 CR(I,J) = 25.
27 CALL SLOPE2(QI(I),J(I,J),CR(I,J),SPIPE(I,J))
28 AK1(I,J) = (SPIPE(I,J)*XL(I,J))/(QI(I)/1000.)*2.
29 2 VEL(I,J) = 4*QI(I)/PI/D(I,J)**2*1.0E03
30 HLOSS(I,J) = XL(I,J)*SPIPE(I,J)
31 HPIPE(I) = HPIPE(I) + HLOSS(I,J)
32 HDEQ(I) = HDEQ(I) + (HLOSS(I,J)*(D(I,J)/1000.)*1.32)
33 3 CONTINUE
34 DEJ(I) = (HDEQ(I)/HPIPE(I))*1.32
35 IF(IALT.EQ.1) GO TO 8
36 IF(IALT.EQ.2) GO TO 6
37 GO TO 7
38 6 CALL SOLVEL(QI(I),DCLDQ(I),DEQ(I),HPIPE(I),ISLOPE(I),PL(I),
39 *PL1(I),D1(I),COSTD1(I),AK(I),VEL(I),CR(I))
40 GO TO 8
40 7 CALL SOLVE2(QI(I),DCLDQ(I),DEQ(I),HPIPE(I),ISLOPE(I),PL(I),
41 *D1(I),D2(I),PL1(I),PL2(I),COSTD1(I),COSTD2(I),
42 *AK(I),SOLD(I),VEL(I),CR(I))
43 8 CONTINUE
44 DO 9 IS = 1,NSOURC
45 READ(5,*) ISS(IS),GLS(IS),HGL(IS),MTYP(IS),QS(IS)
46 9 CONTINUE
47 DO 10 N = 1,NNODE
48 READ(5,*) INN(N),JND(N),NPND(N),GLN(N),NSC(N)
49 IF(NPND(N).EQ.0) GO TO 10
50 LKN = NPND(N)
51 READ(5,*) (IPNS(N,IK),IK=1,IKN)
52 10 CONTINUE
53 WRITE(6,201)
54 WRITE(6,200)
55 IX = 14
56 DO 20 I = 1,NPIPE
57 M = MI(I)
58 IF(IALT.EQ.1) GO TO 11
59 IF(IALT.EQ.2) GO TO 16
60 GO TO 18
61 11 DO 15 J = 1,M
62 IF(J.NE.1) GO TO 12
63 WRITE(6,300) HPIPE(I),NOD1(I),NOD2(I),D(I,J),XL(I,J),PL(I),
64 *CR(I,J),AK1(I,J),QI(I),HLOSS(I,J),SPIPE(I,J),VEL(I,J)
65 GO TO 13
66 12 WRITE(6,400) D(I,J),XL(I,J),CR(I,J),AK1(I,J),HLOSS(I,J),
67 *SPIPE(I,J),VEL(I,J)
68 13 IX = IX + 1
69 IF(IX.EQ.55) GO TO 14
70 GO TO 15
71 14 WRITE(6,200)
72 IX = 7
73 15 CONTINUE
74 GO TO 20
75 16 NDL = NDCLD(I)
76 DO 48 NL = 1,NDL
77 IF(NL.NE.1) GO TO 47

```



\*.....#.....1.....2.....3.....4.....5.....6.....7

```

74      WRITE(6,301) IPIPE(I),NOD1(I),NOD2(I),DCLD(I,NL),PL(I),
      *CR1(I),AK(I),QI(I),HPIPE(I),SLOJ(I),VEL1(I),D1(I),PL1(I)
75      GO TO 43
76      47  WRITE(6,302) DCLD(I,NL),PL(I)
77      48  IX = IX + 1
78      IF(IX.EQ.55) GO TO 17
79      GO TO 20
80      17  WRITE(6,200)
81      IX = 4
82      GO TO 20
83      18  NDL = NDCLD(I)
84      DO 50 NL = 1,NDL
85      IF(NL.NE.1) GO TO 49
86      WRITE(6,303) IPIPE(I),NOD1(I),NOD2(I),DCLD(I,NL),PL(I),
      *CR1(I),AK(I),QI(I),HPIPE(I),SLOJ(I),VEL1(I),D1(I),PL1(I),
      *D2(I),PL2(I)
87      GO TO 50
88      49  WRITE(6,304) DCLD(I,NL),PL(I)
89      50  IX = IX + 1
90      IF(IX.EQ.55) GO TO 19
91      GO TO 20
92      19  WRITE(6,200)
93      IX = 4
94      20  CONTINUE
      C
      C-D. COMPUTE THE PRESSURE SURFACE.
      C
95      WRITE(6,501)
96      WRITE(6,500)
97      SHDYN = 0.0
98      DO 26 N = 1,NNODE
99      SUMHN(N) = 0.0
100     IF (NPND(N).EQ.0) GO TO 25
101     IKM = NPND(N)
102     DO 24 IK = 1,IKM
103     IF(IPNS(N,IK)) 21,22,22
104     21  I = -IPNS(N,IK)
      C
105     GO TO 23
106     IF(QI(I)) 60,23,23
107     22  L = IPNS(N,IK)
108     IF(QI(I)) 23,60,60
109     60  SUMHN(N) = SUMHN(N) + HPIPE(I)
110     GO TO 24
111     23  SUMHN(N) = SUMHN(N) - HPIPE(I)
112     24  CONTINUE
113     25  IS = NSC(N)
114     HPIEZ(N) = HGL(IS) - SUMHN(N)
115     HSTAT(N) = HGL(IS) - GLN(N)
116     HDYN(N) = HPIEZ(N) - GLN(N)
117     BLJSS(N) = -(HDYN(N) - PK)*(QND(N)/100.)
118     DELTAH(N) = HSTAT(N) - HDYN(N)
119     SHDYN = SHDYN + HDYN(N)
120     WRITE(6,600) INN(N),QND(N),HPIEZ(N),GLN(N),HSTAT(N),HDYN(N),
      *DELTAH(N)
120     26  CONTINUE
      C

```

\*.....#.....1.....2.....3.....4.....5.....6.....7

C E. COMPUTE COST OF STRUCTURE.

```

121      SUMCP = 0.0
122      SUMCR = 0.0
123      WRITE(6,701)
124      DO 37 IS = 1, NSOJRC
125      M = MTYP(IS)
126      PS(IS) = HGL(IS) - GLS(IS)
127      CPUH = 350923.00
128      VOLR(IS) = REVOL
129      GO TO (30,28,27,27,27,28,28), M
130  27  SUMCP = SUMCP + (PS(IS)*CPUH)
131      GO TO 29
132  28  SUMCR = SUMCR + (PS(IS)*CPUH)
133  29  GO TO (30,31,32,33,34,35,36), M
134  30  WRITE(6,700) IS, ISS(IS), GLS(IS), QS(IS)
135      GO TO 37
136  31  WRITE(6,800) IS, ISS(IS), GLS(IS)
137      GO TO 37
138  32  WRITE(6,900) IS, ISS(IS), PS(IS), QS(IS)
139      GO TO 37
140  33  WRITE(6,1000) IS, ISS(IS), PS(IS), QS(IS)
141      GO TO 37
142  34  WRITE(6,1100) IS, ISS(IS), PS(IS), QS(IS)
143      GO TO 37
144  35  WRITE(6,1200) IS, ISS(IS), PS(IS), VOLR(IS)
145      GO TO 37
146  36  WRITE(6,1300) IS, ISS(IS), HGL(IS), VOLR(IS)
147  37  CONTINUE

```

C F. INITIALIZE FOR COMPUTING OTHER PARAMETERS.

```

148      SUMCPI = 0.0
149      SUMV1 = 0.0
150      SUMV2 = 0.0
151      SUML1 = 0.0
152      SUML2 = 0.0
153      SUML = 0.0
154      SUMLQ = 0.0

```

C G. COMPUTE OTHER PARAMETERS.

```

155      DO 40 I = 1, NPIPE
156      M = MI(I)
157      IF(IALT.EQ.1) GO TO 38
158      SUMLQ = SUMLQ + PL(I)*(QI(I)/1000.)
159      SUMV1 = SUMV1 + (PL(I)/VEL1(I))*ABS(QI(I)/1000.)
160      IF(VEL1(I).GE.0.2) GO TO 51
161      SUMV2 = SUMV2 + (PL(I)/VEL1(I))*ABS(QI(I)/1000.)
162  51  SUMCPI = SUMCPI + (PL1(I)*COSTD1(I) + PL2(I)*COSTD2(I))
163      SUML2 = SUML2 + PL1(I) + PL2(I)
164      GO TO 40
165  38  DO 39 J = 1, M
166      SUML = SUML + XL(I, J)
167      SUMLQ = SUMLQ + XL(I, J)*(QI(I)/1000.)
168      SUMV1 = SUMV1 + (XL(I, J)/VEL(I, J))*ABS(QI(I)/1000.)

```

1.3.0 (MAY 1983)

VS FORTRAN

DATE: APR 05, 1980

TIME: 16:2

\*.....1.....2.....3.....4.....5.....6.....7

```

169      SUMCPI = SUMCPI + XL(I,J)*COSTPI(I,J)
170      SUML1 = SUML1 + XL(I,J)
171      IF(VEL(I,J).GE.J.2) GO TO 52
172      SUMV2 = SUMV2 + (XL(I,J)/VEL(I,J))*ABS(QI(I)/1000.)
173      52  IF (M.EQ.1) GO TO 39
174      SUML2 = SUML2 + XL(I,J)
175      39  CONTINUE
176      40  CONTINUE

```

```

C
C H. CHECK AND ASSIGN THE NEXT STEP OF EXECUTION FOR GIVEN
C NETWORK ARRANGEMENT TO COMPUTE TOTAL COST OF SYSTEM
C

```

```

177      IF (NS.GE.1.AND.NPM.EQ.0.AND.NER.EQ.0) LABEL = 1
179      IF (NS.GE.1.AND.NPM.EQ.C.AND.NER.GE.1) LABEL = 2
181      IF (NS.GE.1.AND.NPM.GE.1.AND.NER.EQ.C
*OR.NS.EQ.0.AND.NPM.GE.1.AND.NER.EQ.0) LABEL = 3
183      IF (NS.EQ.0.AND.NPM.GE.1.AND.NER.GE.1
*OR.NS.GE.1.AND.NPM.GE.1.AND.NER.GE.1) LABEL = 4
185      GO TO (41,42,+3,+4),LABEL
186      41  TOCOST = SUMCPI
187      GO TO 45
188      42  TOCOST = SUMCPI + SUMCR
189      GO TO 45
190      43  TOCOST = SUMCPI + SUMCP
191      GO TO 45
192      44  TOCOST = SUMCPI + SUMCR + SUMCR
193      45  WRITE(6,1400) SUMCPI
194      WRITE(6,1500) SUMCP
195      WRITE(6,1600) SUMCR
195      WRITE(6,1700) TOCOST

```

```

C
C L. COMPUTE AVERAGE VELOCITY; PIPES WITH TWO DIAMETERS; COST PER
C UNIT FLOW (SUPPLY); AVERAGE PRESSURE SURFACE.
C

```

```

196      VMEAN1 = SUMLQ/SUMV1
197      IF(SUMV2.EQ.0) GO TO 53
198      VMEAN2 = SUMLQ/SUMV2
199      GO TO 54
200      53  VMEAN2 = 0.0
201      54  QMEAN = (SUMV1/(QSYST/1000.))/3600.
202      XMEAN = (SUML2/SUML)*100.
203      PMEAN = SHDYN/FLUAT(INNDE)
204      CMEAN = TOCOST/QSYST
205      QLR = QSYST/SUML
C      ITM = 1
C      TIME1 = CMSTIM(ITM)
C      TIME = TIME1 - TIME0
206      WRITE(6,1800) VMEAN1
207      WRITE(6,2000) PMEAN
208      WRITE(6,1900) XMEAN
209      WRITE(6,2100) CMEAN
210      WRITE(6,2101) ITR5
C      WRITE(6,2200) TIME
211      WRITE(6,2222)
212      100 FORMAT(20A4)
213      201 FORMAT(/, ' L. COMPUTED PIPE LINES :', /)

```



\*.....\*.....1.....2.....3.....4.....5.....6.....7

214 200 FORMAT(132(' ')) PIPE',4X,'MODE',7X,'PIPE',4X,'PIPE-LENGTH',  
\*7X,'ROUGHNES - COEF',6X,'PIPE',11X,'PIES',9X,'PIPE',4X,  
\*'PARALLEL PIPE TO EXISTING'/2X,'NO',4X,'FROM-TO',4X,'SIZE',4X,  
\*'SERIES',2X,'TOTAL',5X,'C/RK',2X,'K-VALUE',3X,'FLOW',9X,  
\*'HEADLOSS',5X,'VEL.',4X,'PIPE1',1X,'LENGTH1',1X,'PIPE2',1X,  
\*'LENGTH2',/19X,'(MM)',5X,'(M)',5X,'(M)',26X,'(L/S)',7X,'(M)',4X,  
\*' (M/M)',5X,'(M/S)',4X,'(MM)',4X,'(M)',4X,'(MM)',4X,'(M)',  
\*/132(' '))

215 300 FORMAT(14,4X,13,1X,13,4X,14,4X,F6.0,2X,F6.0,4X,F4.0,2X,E9.3,  
\*4X,F8.2,4X,F6.2,2X,F7.5,4X,F5.1,5X,'--',5X,'--',5X,'--',5X,'--')

216 301 FORMAT(14,4X,13,1X,13,4X,14,4X,F6.0,2X,F6.0,4X,F4.0,2X,E9.3,  
\*4X,F8.2,4X,F6.2,2X,F7.5,4X,F5.2,4X,14,2X,F6.0,3X,'--',5X,'--')

217 302 FORMAT(19X,14,4X,F6.0)

218 303 FORMAT(14,4X,13,1X,13,4X,14,4X,F6.0,2X,F6.0,4X,F4.0,2X,E9.3,  
\*4X,F8.2,4X,F6.2,2X,F7.5,4X,F5.2,4X,14,2X,F6.0,2X,14,2X,F6.0)

219 304 FORMAT(19X,14,4X,F6.0)

220 400 FORMAT(19X,14,4X,F6.0,12X,F4.0,2X,E9.3,16X,F6.2,2X,F7.5,4X,F5.1)

221 501 FORMAT(/, ' II. COMPUTED PRESSURE SURFACE AT NODES', /)

222 500 FORMAT(132(' ')) NODE',11X,'NODAL',12X,'PIEZOMETRIC',10X,  
\*'GROUND',11X,'STATIC',11X,'DYNAMIC',12X,'DELTA-H',12X,' ',  
\*/,1X,'NO',12X,'FLOW',16X,'HEAD',13X,'ELEV.',13X,'HEAD',13X,  
\*'HEAD',34X,' ',/15X,'(L/S)',16X,'(M)',14X,'(M-ASL)',12X,  
\*' (M)',14X,'(M)',16X,'(M)',11X,' ',/132(' '))

223 600 FORMAT(14,10X,F8.2,12X,F7.2,10X,F7.2,10X,F7.2,10X,F7.0,12X,F7.2)

224 701 FORMAT(/, ' III. ADDITIONAL INFORMATION :', /)

225 700 FORMAT(/, ' 1) ',12, ' GRAVITY SOURCE FROM NODE :',13, ' ', ' ',3X,  
\*'ELEVATION : +',F8.1,1X,'(M-ASL)',/,37X,'CAPACITY :',F8.2,  
\*1X,'L/S',/)

226 800 FORMAT(/, ' 1) ',12, ' BREAK PRESSURE TANK AT NODE :',13, ' ', ' ',  
\*'ELEVATION : +',F8.2,1X,'(M-ASL)',/,37X,'CAPACITY :',F8.2,1X,  
\*1X,'M3',/)

227 900 FORMAT(/, ' 1) ',12, ' PUMP SUPPLY FROM NODE :',13, ' ', ' ',  
\*' PUMPING HEAD :',F8.2,1X,'M',/,37X,'CAPACITY :',F8.2,  
\*1X,'L/S',/)

228 1000 FORMAT(/, ' 1) ',12, ' OFF LINE BOOSTER PUMP AT NODE :',13,1X,' ', ' ',  
\*' PUMPING HEAD :',F8.2,1X,'M',/37X,'CAPACITY :',F8.2,  
\*1X,'L/S',/)

229 1100 FORMAT(/, ' 1) ',12, ' IN-LINE BOOSTER PUMP AT NODE :',13,1X,' ', ' ',  
\*' PUMPING HEAD :',F8.2,1X,'M',/,37X,'CAPACITY :',F8.2,  
\*1X,'L/S',/)

230 1200 FORMAT(/, ' 1) ',12, ' ELEVATED TANK AT NODE :',13,1X,' ', ' ', ' HEIGHT :',  
\*F8.2,1X,'M (AGL)',/,37X,'VOLUME =',F8.2,1X,'M3',/)

231 1300 FORMAT(/, ' 1) ',12, ' GROUND TANK AT NODE :',13,1X,' ', ' ', ' ELEVATION :',  
\*F7.2,1X,'(M-ASL)',/35X,'VOLUME =',F8.0,1X,'M3',/)

232 1400 FORMAT(' 2). COST OF PIPE LINE ',29X,' :',1X,'B.',E15.6,1X,  
\*/)

233 1500 FORMAT(' 3). COST OF PUMPING STATION',23X,' :',1X,'B.',E15.6,1X,  
\*/)

1600 FORMAT(' 4). COST OF RESERVOIR',29X,' :',1X,'B.',E15.6,1X,  
\*/)

234 1700 FORMAT(' 4). TOTAL COST OF THE SYSTEM',22X,' :',1X,'B.',E15.6,1X,  
\*/)

235 1800 FORMAT(' 5). THE WEIGHTED MEAN VELOCITY',20X,' :',1X,F10.1,1X,  
\*'M/S',/)

236 2000 FORMAT(' 6). THE AVERAGE PRESSURE SURFACE',19X,' :',F8.0,1X,  
\*'M-AGL',/)

\*.....\*1.....2.....2.....4.....5.....6.....7

```

237 1000 FORMAT(' 7). PIPE LINES WITH TWO DIAMETER IN SERIES',8X,' ',F8.4
      *IX,' % TOTAL LENGTH',/)
238 2100 FORMAT(' 8). COST OF SYSTEM PER L/S OF SUPPLY',14X,' ',IX,' D.',
      *E13.5,1X,/)
239 2101 FORMAT(' 9). NUMBER ITERATION OF THIS PROGRAM',14X,' ',18,1X,
      *'ITRS',/)
02200 FORMAT(' 10). TOTAL CPU TIME USED',26X,' ',F8.4,1X,' SECONDS',/)
240 2222 FORMAT('***** GOOD LUCK & THANKS.... ***** ')
241 STOP
242 END

```

STICS\* SOURCE STATEMENTS = 237, PROGRAM SIZE = 199290 BYTES, PROGRAM NAME = M

STICS\* NO DIAGNOSTICS GENERATED.

END OF COMPILATION 1 \*\*\*\*\*

3.0 (MAY 1985)

VS FORTRAN

DATE: APR 03, 1986

TIME: 16:

IN EFFECT: NOLIST NOMAP NOXREF NOGOSTMT NOCHECK SOURCE TERM OBJECT FIX  
OPT(0) LANGLVL(77) NOFIPS FLAG(1) NAME(MAIN ) LIRECCOUNT(6

\*.....\*...1.....2.....3.....4.....5.....6.....

```

1 CXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  SUBROUTINE EQP1(NDL,DCLD,DCLDQ)
2 C
  DIMENSION DCLD(200,10)
3 C
  SDO = 0.0
4   DO 1 NL = 1,NDL
5     DQ = (DCLD(1,NL))**2.67
6     SDO = SDO +DQ
7   1 CONTINUE
8   DCLDQ = (SDO)**0.375
9   RETURN
10  END

```

STATICS\* SOURCE STATEMENTS = 10, PROGRAM SIZE = 852 BYTES, PROGRAM NAME = EQP1

STATICS\* NO DIAGNOSTICS GENERATED.

-END OF COMPILATION 2. \*\*\*\*



..3.0 (MAY 1983)

VS FORTRAN

DATE: APR 09, 1980

TIME: 16:2

11 EFFECT: NOLIST NOMAP NOXREF NOGOSTMT NODECLR SOURCE TERM OBJECT FIXE  
OPT(10) LARGVL(77) NOFIPS FLAG(1) NAME(MAIN ) LINECOUNT(00

\*....\*...1.....2.....3.....4.....5.....6.....7.....

C\*\*\*\*\*  
C PROGRAM TO CALCULATE THE HYDRAULIC GRADIENT OF PIPE,  
C TO BE USEA FOR THE HARDY CROSS INPUT DATA WHICH IS BASED ON  
C THE "HAZEN- WILLIAMS" FORMULA  
C-----

1 SUBROUTINE SLOPE1(QA,D,CHW,SPIPE)

2 INTEGER D,DOLD,DNEW

3 PI = 3.14159

4 Q = QA/1000.

5 S1 = 88.714\*Q\*\*1.852

6 S2 = (PI\*CHW)\*\*1.852\*ID/1000.1\*\*4.87

7 SPIPE = S1/S2

8 RETURN

9 END

STICS\* SOURCE STATEMENTS = 9, PROGRAM SIZE = 810 BYTES, PROGRAM NAME = SLOPE1

STICS\* NO DIAGNOSTICS GENERATED.

END OF COMPILATION 3 \*\*\*\*\*

.3.U (MAY 1983)

VS FORTRAN

DATE: APR 03, 1986

TIME: 16:

IN EFFECT: NOLIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIX  
 OPT(0) LANGVL(77) NOFIPS FLAG(1) NAME(MAIN ) LINECOUNT(0)

\*.....\*.....1.....2.....3.....4.....5.....6.....7.....8.....9.....0.....

C\*\*\*\*\*

C SUBROUTINE TO CALCULATE THE HYDRAULIC GRADIENT OF PIPE,  
 C TO BE USED FOR THE HARDY CROSS INPUT DATA WHICH IS BASE ON  
 C "PRANDTL-CELEBRUK" FORMULA

1 SUBROUTINE SLOPE2(QA,D,RK,SPIPE)

2 INTEGER D,DOLD,ONE

3 PI = 3.141593

4 G = 9810.

5 VIS = 1.31

6 RS = RK/100.

7 Q = QA/1000.

8 C = 130.

9 S1 = 88.714\*Q\*\*1.852

10 S2 = (PI\*C)\*\*1.852\*(D/1000)\*\*4.87

11 S = S1/S2

12 10 B = SQRT(2.\*G\*S\*D)

13 A1 = 2.51\*VIS/D/B

14 A2 = RS/3.71/D

15 A = A1 + A2

16 Q1 = 1.255\*VIS/A/D/S

17 Q2 = G\*D\*ALOG(A)/3

18 CONST = PI\*D\*\*2/4.606

19 F = Q\*1.0E09 + CONST\*ALOG(A)\*B

20 DF = -CONST\*(Q1-Q2)

21 SPIPE = S-F/DF

22 IF (ABS(SPIPE - S)/S) .LT. 0.005) GO TO 11

23 S = SPIPE

24 GO TO 10

25 11 RETURN

26 END

STICS\* SOURCE STATEMENTS = 26, PROGRAM SIZE = 2050 BYTES, PROGRAM NAME = SLO

STICS\* NO DIAGNOSTICS GENERATED.

END OF COMPILATION - \*\*\*\*\*

1.3.0 (MAY 1963)

VS FORTRAN

DATE: APR 03, 1966

TIME: 10:00

S IN EFFECT: NOLIST NCMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIX  
 OPT(0) LANSVLV(77) NCFIPS FLAG(1) NAME(MAIN ) LIRECOUNT(5)

\*.....1.....2.....3.....4.....5.....6.....

CXX  
 C SUB PROGRAM TO SOLVE THE ADDITIONAL PIPE WHICH IS PARALLELED  
 C TO THE EXISTING WITHOUT ANY MODIFICATION (THE LENGTH OF ADDITIONAL  
 C PIPES IS EQUAL TO THE LENGTH OF EXISTING)  
 C MODIFIED : TO CHANGE COST FUNCTIONS  
 C

1 SUBROUTINE SOLVEL (C,DOLD,DEQ,HPIPE,ISL,PL,PL1,L,COSTPI,AKOLD,  
 #SOLD,VOLD)

C

2 INTEGER D,DOLD,DNEW

3 DATA C80/373./,C100/490./,C150/610./,C200/820./,C250/1020./,  
 \*C300/1260./,C400/1500./,C500/1875./,C600/2500./,C700/3600./,  
 \*C800/5600./,C900/7650./,C1000/12825./,C1200/16650./,C1500/22350

C

4 PI = 3.14159

5 G = 9810.0

6 VIS = 1.31

7 S1 = 88.714\*(Q/1000.)\*\*1.852

8 PDEQ = (DEQ/1000.)\*\*4.87

9 IF (ISL.NE.1) GO TO 1

10 CR1 = 130

11 CR2 = 100

12 S2 = (PI\*CR1)\*\*1.352\*PDEQ

13 S3 = (PI\*CR2)\*\*1.852\*PDEQ

14 SE1 = S1/S2

15 SOLD = S1/S3

16 AKOLD = (SOLD\*PL)/(Q/1000.)\*\*1.952

17 VOLD = 4.\*Q/PI/DOLD\*\*2\*1.0E03

18 GO TO 2

19 1 RK1 = 0.25

20 3 KM = 1

21 4 S2 = (PI\*130.)\*\*1.852\*PDEQ

22 S = S1/S2

23 5 B = SQRT(2.\*G\*S\*DEQ)

24 A1 = 2.51\*VIS/DEQ/S

25 A2 = RK/3.71/DEQ

26 A = A1 + A2

27 Q1 = 1.255\*VIS/A/DEQ/S

28 Q2 = G\*DEQ\*ALOG(A)/B

29 CONST = PI\*DEQ\*\*2./4.606

30 F = Q\*1.0E09 + CONST\*ALOG(A) \* B

31 DF = -CONST\*(Q1-Q2)

32 SPIPE = S - F/DF

33 IF (ABS(SPIPE - S)/S).LT.0.00005) GO TO 6

34 S = SPIPE

35 GO TO 5

36 6 IF (KM.NE.1) GO TO 7

37 SEQ = SPIPE

38 KM = 2

39 RK = 0.40

40 GO TO 4

41 7 SOLD = SPIPE

42 AKOLD = (SOLD\*PL)/(Q/1000.)\*\*2.



\*.....1.....2.....3.....4.....5.....6.....

```

43      VOLU = 4.*Q/PI/DJLD**2*1.0E03
44      2  PL1 = (HPIPE - SCLD*PL)/(SEQ - SCLD)
45      PL2 = PL - PL1
46      IF(DJLD.NE.0) GO TO 171
47      D = DEQ
48      GO TO 172
49      171 D = (JSEQ**(16/3)-DJLD**(16/3))**(3/8)
50      172 IF(D.LE.80) GO TO 20
51      IF (D.LE.100) GO TO 30
52      IF (D.LE.150) GO TO 40
53      IF(D.LE.200) GO TO 50
54      IF(D.LE.250) GO TO 60
55      IF(D.LE.300) GO TO 70
56      IF(D.LE.400) GO TO 80
57      IF(D.LE.500) GO TO 90
58      IF(D.LE.600) GO TO 100
59      IF(D.LE.700) GO TO 110
60      IF(D.LE.800) GO TO 120
61      IF(D.LE.900) GO TO 130
62      IF(D.LE.1000) GO TO 140
63      IF(D.LE.1200) GO TO 150
64      IF(D.LE.1500) GO TO 160
65      D = 1500
66      COSTPI = C1500
67      GO TO 170
68      20 D = 30
69      COSTPI = C80
70      GO TO 170
71      30 D = 100-D
72      IF (D.GT.10) GO TO 20
73      31 D = 100
74      COSTPI = C100
75      GO TO 170
76      40 D = 150-D
77      IF(D.GT.25) GO TO 31
78      41 D = 150
79      COSTPI = C150
80      GO TO 170
81      50 D = 200-D
82      IF(D.GT.25) GO TO 41
83      51 D = 200
84      COSTPI = C200
85      GO TO 170
86      60 D = 250-D
87      IF(D.GT.25) GO TO 51
88      61 D = 250
89      COSTPI = C250
90      GO TO 170
91      70 D = 300-D
92      IF(D.GT.25) GO TO 61
93      71 D = 300
94      COSTPI = C300
95      GO TO 170
96      80 D = 400-D
97      IF(D.GT.50) GO TO 71
98      81 D = 400

```

1.3.0 (MAY 1968)

VS FORTRAN

DATE: Apr 03, 1968

TIME: 1

\*.....1.....2.....3.....4.....5.....6.....7.....8.....9.....0.....

```

99      COSTPI = 6400
100     GO TO 170
101     90 D = 500-D
102     IF(D.GT.500) GO TO 91
103     91 D = 500
104     COSTPI = 6500
105     GO TO 170
106     100 D = 600-D
107     IF(D.GT.500) GO TO 91
108     101 D = 600
109     COSTPI = 6600
110     GO TO 170
111     110 D = 700-D
112     IF(D.GT.500) GO TO 101
113     111 D = 700
114     COSTPI = 6700
115     GO TO 170
116     120 D = 800-D
117     IF(D.GT.500) GO TO 111
118     121 D = 800
119     COSTPI = 6800
120     GO TO 170
121     130 D = 900-D
122     IF(D.GT.500) GO TO 121
123     131 D = 900
124     COSTPI = 6900
125     GO TO 170
126     140 D = 1000-D
127     IF(D.GT.500) GO TO 131
128     141 D = 1000
129     COSTPI = 7000
130     GO TO 170
131     150 D = 1200-D
132     IF(D.GT.1000) GO TO 141
133     151 D = 1200
134     COSTPI = 71200
135     GO TO 170
136     160 D = 1500-D
137     IF(D.GT.1500) GO TO 151
138     D = 1500
139     COSTPI = 71500
140     170 RETURN
141     END

```

STICS\* SOURCE STATEMENTS = 141, PROGRAM SIZE = 6770 BYTES, PROGRAM NAME =

STICS\* NO DIAGNOSTICS GENERATED.

END OF COMPILATION 5 \*\*\*\*\*



.....3.....

```

45      D2 = 100.
46      GO TO 10
47      5      D1 = 100.
48      D2 = 200.
49      GO TO 10
50      7      D1 = 100.
51      D2 = 300.
52      GO TO 10
53      3      D1 = 500.
54      D2 = 400.
55      GO TO 10
56      9      D1 = 500.
57      D2 = 500.
58      GO TO 10
59      10     D1 = 700.
60      D2 = 600.
61      GO TO 10
62      11     D1 = 800.
63      D2 = 700.
64      GO TO 10
65      12     D1 = 900.
66      D2 = 800.
67      GO TO 10
68      13     D1 = 1000.
69      D2 = 900.
70      GO TO 10
71      14     D1 = 1200.
72      D2 = 1000.
73      GO TO 10
74      15     D1 = 1500.
75      D2 = 1200.
76      16     ASL = HP1PE/PL
77      1F(1SL.NE.1) GO TO 17
78      CR1 = 100
79      CDEF = 27.69*(DDEL/1000.)**2.63
80      QDEL = (CDEF*ASL**0.54)*1000.
81      QNEW = QTOT - QDEL
82      VEL1 = 4.*QDEL/PI/QCLS**2*1.0E03
83      AK = (ASL*PL)/(QDEL/1000.)**1.352
84      CR1 = 130
85      S1 = 38.714*(QNEW/1000.)**1.852
86      S2 = (PI*130)**1.352*S1**4.37
87      S3 = (PI*130)**1.352*S2**4.87
88      S01 = S1/S2
89      S02 = S1/S3
90      GO TO 10
91      17     S = SQRT(2.*S*ASL*(DDEL/1000.))
92      AK = 0.40
93      A1 = 2.91*V13/(QDEL/1000.)*S
94      A2 = 0.10/8/(QCLS/1000.)
95      A = A1 + A2
96      AREA = PI*(DDEL/1000.)*S**2/4.
97      QDEL = (-2.*S*AK/S/(A)*AREA)*1000.
98      QNEW = QTOT - QDEL
99      VEL1 = 4.*QDEL/PI/QCLS**2*1.0E03
100     AK = (ASL*PL)/(QDEL/1000.)**1.352

```



3.0 (MAY 1983)

VS FORTRAN

DATE: APR 03, 1986

TIME: 16

#.....1.....2.....3.....4.....5.....6.....

```

101      RK      = 0.25
102      S1      = 88.714*(DNEW/1000.0)**1.852
103      KM      = 1
104      J        = D1
105      23      S2 = (P1*130)**1.852*D**4.87
106      S        = S1/S2
107      24      B = SQRT(2.*G*S*J)
108      A1       = 2.51*VIS/D/S
109      A2       = RK/3.71/D
110      A        = A1 + A2
111      Q1       = 1.255*VIS/A/D/S
112      Q2       = G*D*ALOG(A)/B
113      CONST    = PI*D**2./4.606
114      F        = Q*1.0E09 + CONST*ALOG(A)*B
115      DF       = -CONST*(Q1-Q2)
116      SPIPE    = S - F/DF
117      IF(ABS(SPIPE - S)/S).LT.0.00005) GO TO 25
118      S        = SPIPE
119      GO TO 24
120      25      IF(KM.NE.1) GO TO 26
121      SD1      = SPIPE
122      KM       = 2
123      D        = D2
124      GO TO 23
125      26      SD2 = SPIPE
126      18      PL1 = (HPIPE - SD2*PL1)/(SD1 - SD2)
127      PL2     = PL - PL1
128      19      RETURN
129      END

```

CS\* SOURCE STATEMENTS = 129, PROGRAM SIZE = 7580 BYTES, PROGRAM NAME = SO

CS\* NO DIAGNOSTICS GENERATED.

OF COMPILATION 6 \*\*\*\*\*



ข้อมูลสำหรับป้อนเข้าโปรแกรม Generate table

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP , 47 PIPES , 40 NODES.  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P. MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : MPSX/37) OUT PUT  
 CONDITION : FLAT

1	47	40	0	0	1	15.	1	765.	34	1
1	1	2	1	765.00	1020.	0				
	700	1020.		6600.						
2	2	4	1	740.72	160.	0				
	700	160.		6600.						
3	2	3	1	24.28	100.	0				
	150	100.		610.						
4	4	5	1	37.73	200.	0				
	200	200.		820.						
5	5	6	1	20.45	360.	0				
	150	360.		610.						
6	6	7	2	8.52	220.	0				
	100	17.4	490.	80	202.6	373.				
7	5	8	1	7.27	152.	0				
	80	152.	373.							
8	4	9	1	702.99	200.	0				
	700	200.		6600.						
9	9	10	1	20.38	400.	0				
	150	400.		610.						
10	9	11	1	82.11	220.	0				
	700	220.		6600.						
11	11	12	1	115.01	180.	0				
	300	180.		1260.						
12	12	13	1	54.71	152.	0				
	200	152.		820.						
13	13	14	1	18.63	140.	0				
	150	140.		610.						
14	14	15	2	5.00	400.	0				
	100	151.4	490.	80	248.6	373.				
15	16	15	1	10.76	140.	0				
	100	140.		490.						
16	13	16	1	36.08	400.	0				
	200	400.		320.						
17	16	13	2	12.14	320.	0				
	150	129.8	610.	100	190.2	490.				
18	12	17	1	41.58	320.	0				
	200	320.		820.						
19	17	18	2	5.00	552.	0				
	100	75.7	490.	80	478.3	373.				
20	17	19	2	12.32	408.	0				

150	208.4	010.	100	139.6	490.
21	19	20	1	5.00	552. 0
100	552.	490.			
22	21	19	1	5.00	340. 0
100	340.	490.			
23	22	20	2	4.05	340. 0
100	7.9	490.	80	332.1	373.
24	21	22	1	8.84	552. 0
150	552.	610.			
25	23	21	1	13.92	572. 0
200	572.	820.			
26	23	24	2	4.79	552. 0
100	214.7	490.	80	337.3	373.
27	11	25	1	567.1	336. 0
700	336.	6030.			
28	25	26	1	56.50	200. 0
200	200.	820.			
29	26	27	1	21.79	100. 0
150	100.	610.			
30	27	28	1	11.47	180. 0
100	180.	490.			
31	26	29	1	22.05	164. 0
150	164.	610.			
32	29	30	2	9.75	280. 0
100	245.4	490.	80	34.6	373.
33	29	34	2	5.	428. 0
100	336.9	490.	80	31.1	373.
34	26	31	1	6.45	214. 0
80	214.	373.			
35	32	31	2	6.	214. 0
100	70.6	490.	80	143.4	373.
36	33	32	2	31.86	200. 0
200	90.4	820.	150	109.6	610.
37	32	34	2	14.1	164. 0
150	81.4	610.	100	82.0	490.
38	32	35	1	5.	416. 0
80	416.	373.			
39	25	33	1	510.6	428. 0
600	428.	5600.			
40	33	33	1	474.38	592. 0
600	592.	5600.			
41	36	35	2	15.69	176. 0
150	140.3	610.	100	35.7	490.
42	36	37	1	8.72	164. 0
100	164.	490.			
43	34	37	1	5.	592. 0
100	592.	490.			
44	38	36	2	35.52	200. 0
200	37.3	820.	150	162.2	610.
45	38	37	1	433.80	284. 0
600	284.	5600.			
46	39	23	1	23.79	180. 0
250	180.	1020.			

47	39	40	1	410.07	252.	0			
	600	252.	5600.						
1	2.5	36.5507	3	765.					
1	765.00	0	2.5	1					
2	-0.0	1	2.5	1					
1									
3	-24.28	2	2.5	1					
1	5								
4	-0.0	2	2.5	1					
1	2								
5	-10.01	3	2.5	1					
1	2	4							
6	-11.93	4	2.5	1					
1	2	4	5						
7	-8.52	5	2.5	1					
1	2	4	5	6					
8	-7.27	4	2.5	1					
1	2	4	7						
9	-0.0	3	2.5	1					
1	2	8							
10	-20.88	4	2.5	1					
1	2	8	9						
11	-0.0	4	2.5	1					
1	2	8	10						
12	-18.72	5	2.5	1					
1	2	8	10	11					
13	-0.0	6	2.5	1					
1	2	8	10	11	12				
14	-13.63	7	2.5	1					
1	2	8	10	11	12	13			
15	-15.76	8	2.5	1					
1	2	8	10	11	12	16	15		
16	-13.18	7	2.5	1					
1	2	8	10	11	12	16			
17	-24.26	6	2.5	1					
1	2	8	10	11	18				
18	-17.14	3	2.5	1					
1	2	8	10	11	12	16	17		
19	-12.32	7	2.5	1					
1	2	8	10	11	18	20			
20	-9.05	8	2.5	1					
1	2	8	10	11	18	20	21		
21	-5.08	10	2.5	1					
1	2	8	10	27	39	40	45	46	25
22	-4.79	9	2.5	1					
1	2	8	10	11	18	20	-22	25	
23	-5.08	9	2.5	1					
1	2	8	10	27	39	40	45	46	
24	-4.77	10	2.5	1					
1	2	8	10	27	39	40	45	46	26
25	-0.0	5	2.5	1					
1	2	8	10	27					
26	-0.21	5	2.5	1					
1	2	8	10	27	28				
27	-10.32	7	2.5	1					
1	2	8	10	27	28	29			

28	-11.47	8	2.5	1				
1	2	8	10	27	28	29	30	
29	-7.30	7	2.5	1				
1	2	8	10	27	28	31		
30	-9.75	8	2.5	1				
1	2	8	10	27	28	31	32	
31	-12.45	7	2.5	1				
1	2	8	10	27	28	34		
32	-5.76	7	2.5	1				
1	2	8	10	27	39	36		
33	-4.36	6	2.5	1				
1	2	8	10	27	39			
34	-14.1	8	2.5	1				
1	2	8	10	27	39	36	37	
35	-20.69	9	2.5	1				
1	2	8	10	27	39	40	44	41
36	-11.11	8	2.5	1				
1	2	8	10	27	39	40	44	
37	-13.72	9	2.5	1				
1	2	8	10	27	39	40	44	42
38	-0.0	7	2.5	1				
1	2	8	10	27	39	40		
39	-0.0	8	2.5	1				
1	2	8	10	27	39	40	45	
40	-410.07	9	2.5	1				
1	2	8	10	27	39	40	45	47



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



TOTAL LENGTH 47338

NET JACK : HANG-PLIEE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP, 47 PIPES, 40 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P.AIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : MPSX/370 OUT PUT  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	TOTAL (M)	ROUGHNESS - COEF C/RK	K-VALUE	PIPE FLD (L/S)	PIPES HEADLOSS (M)	PIPE VEL (M/S)	PARALLEL PIPE TO EXISTING PIPE1 (MM)	LENGTH (M)	PIPE2 (MM)	LENGTH (M)
1	1 2	700	1020.	1020.	130.	0.750E+01	755.00	4.57	0.00448	2.0	--	--	--
2	2 4	700	100.	100.	130.	0.118E+01	70.72	0.68	0.00422	1.9	--	--	--
3	2 3	150	100.	100.	130.	0.133E+04	24.28	1.36	0.01362	1.4	--	--	--
4	4 5	200	200.	200.	130.	0.657E+04	37.73	1.52	0.00759	1.2	--	--	--
5	5 6	150	300.	300.	130.	0.480E+04	20.45	3.57	0.00951	1.2	--	--	--
6	6 7	100	17.	223.	130.	0.107E+04	8.52	0.25	0.01411	1.1	--	--	--
7	5 8	80	203.	152.	130.	0.577E+05	8.47	0.04182	1.7	--	--	--	--
8	4 9	700	200.	200.	130.	0.147E+01	702.99	4.74	0.03117	1.4	--	--	--
9	9 10	150	400.	400.	130.	0.533E+04	20.88	4.12	0.01030	1.2	--	--	--
10	9 11	700	220.	220.	130.	0.102E+01	692.11	0.60	0.00302	1.8	--	--	--
11	11 12	300	180.	180.	130.	0.320E+02	115.01	1.45	0.00320	1.6	--	--	--
12	12 13	200	150.	150.	130.	0.499E+03	54.71	2.10	0.01511	1.7	--	--	--
13	13 14	150	140.	140.	130.	0.187E+04	18.63	1.17	0.00634	1.1	--	--	--
14	14 15	100	151.	400.	130.	0.145E+05	5.00	0.80	0.00526	0.6	--	--	--
15	16 15	80	249.	130.	130.	0.707E+05	3.87	0.01558	1.0	--	--	--	--
16	13 16	100	140.	140.	130.	0.134E+05	10.76	3.04	0.02174	1.4	--	--	--
17	15 18	200	400.	400.	130.	0.131E+04	36.08	2.79	0.00659	1.1	--	--	--
18	12 17	150	130.	320.	130.	0.173E+04	12.14	0.49	0.00377	0.7	--	--	--
19	17 18	100	190.	130.	130.	0.183E+05	5.17	0.02718	1.5	--	--	--	--
20	17 19	80	476.	130.	130.	0.105E+04	41.58	2.91	0.00904	1.3	--	--	--
21	19 20	100	74.	552.	130.	0.707E+04	5.00	0.35	0.00526	0.6	--	--	--
22	21 19	80	476.	130.	130.	0.133E+06	7.45	0.01558	1.0	--	--	--	--
23	22 20	100	268.	408.	130.	0.338E+04	12.34	1.04	0.00388	0.7	--	--	--
24	21 22	100	140.	130.	130.	0.134E+05	5.00	3.90	0.02793	1.0	--	--	--
25	23 21	100	552.	552.	130.	0.530E+05	5.00	2.90	0.00526	0.6	--	--	--
26	23 24	100	340.	340.	130.	0.320E+05	5.00	1.79	0.00526	0.6	--	--	--
27	22 20	80	8.	340.	130.	0.758E+04	4.05	0.03	0.00356	0.5	--	--	--
28	21 22	150	332.	130.	130.	0.945E+05	3.90	0.01059	0.6	--	--	--	--
29	23 21	200	552.	552.	130.	0.730E+04	8.84	1.16	0.00210	0.5	--	--	--
30	23 24	100	572.	572.	130.	0.188E+04	18.92	1.21	0.00211	0.0	--	--	--
31	23 24	80	215.	552.	130.	0.206E+05	4.79	1.04	0.00490	0.6	--	--	--
32	21 25	700	337.	130.	130.	0.960E+05	4.86	0.01439	1.0	--	--	--	--
33	25 26	200	336.	130.	130.	0.247E+01	507.10	0.86	0.00257	1.5	--	--	--
34	25 26	200	200.	200.	130.	0.575E+03	56.50	3.21	0.01603	1.8	--	--	--
35	25 27	150	100.	100.	130.	0.133E+04	21.79	1.11	0.01115	1.2	--	--	--

30	27	28	100	180.	193.	130.	0.173E+03	11.47	4.40	0.02447	1.5	--	--	--	--
31	28	29	150	104.	154.	130.	0.214E+03	22.09	1.67	0.01139	1.2	--	--	--	--
32	29	30	100	245.	250.	130.	0.230E+03	9.75	4.44	0.01311	1.2	--	--	--	--
			80	35.		130.	0.948E+04		1.00	0.05368	1.4	--	--	--	--
33	29	34	100	327.	423.	130.	0.325E+03	5.00	1.77	0.00526	0.6	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS - COEF C/RA	COEF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE 1C EXISTING PIPE1 LENGTH (M)	PARALLEL PIPE 1C EXISTING PIPE2 LENGTH (M)	PARALLEL PIPE 1C EXISTING PIPE3 LENGTH (M)
34	26-31	80	91.	214.	130.	0.259E+03	6.45	1.42	0.01558	1.0	--	--	--
35	32-31	100	71.	214.	130.	0.678E+04	6.00	5.34	0.02497	1.3	--	--	--
36	33-32	200	153.	200.	130.	0.468E+03	31.86	0.52	0.00737	0.8	--	--	--
		150	90.	200.	130.	0.297E+03		3.13	0.02184	1.2	--	--	--
37	32-34	150	110.	104.	130.	0.146E+04	14.10	0.50	0.00555	1.0	--	--	--
		100	81.	104.	130.	0.108E+04		2.47	0.02253	1.8	--	--	--
		100	82.		130.	0.793E+04		0.41	0.00498	0.8	--	--	--
38	32-35	80	416.	416.	130.	0.118E+06	5.00	2.90	0.035E0	1.8	--	--	--
39	25-33	100	428.	428.	130.	0.887E+01	510.80	6.48	0.01558	1.0	--	--	--
40	33-33	800	592.	592.	130.	0.923E+01	474.38	1.92	0.00449	1.8	--	--	--
41	30-35	150	140.	170.	130.	0.187E+04	15.89	2.32	0.00352	1.7	--	--	--
		100	36.		130.	0.343E+04		0.85	0.00667	0.9	--	--	--
42	30-37	100	164.	164.	130.	0.157E+03	8.72	1.56	0.00371	2.0	--	--	--
43	34-37	100	592.	592.	130.	0.568E+03	5.00	2.42	0.01473	1.1	--	--	--
44	38-30	200	38.	200.	130.	0.124E+03	32.52	3.11	0.00526	0.6	--	--	--
		150	162.		130.	0.216E+04		0.28	0.00155	0.8	--	--	--
45	35-39	100	284.	284.	130.	0.443E+01	413.80	4.47	0.02755	2.0	--	--	--
46	37-23	200	180.	180.	130.	0.199E+03	28.79	0.96	0.00339	1.6	--	--	--
47	37-40	200	252.	252.	130.	0.393E+01	410.07	0.28	0.00155	0.8	--	--	--
								0.75	0.00299	1.5	--	--	--

11. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	30.55	2.50	34.05	34.05	0.00
2	-0.60	31.08	2.50	34.05	29.1	4.57
3	-24.28	30.82	2.50	34.05	28.1	5.93
4	-0.30	31.31	2.50	34.05	29.1	5.24
5	-10.01	29.79	2.50	34.05	27.1	6.76
6	-11.93	28.22	2.50	34.05	24.1	10.23
7	-8.92	17.50	2.50	34.05	15.1	19.05
8	-7.27	25.05	2.50	34.05	23.1	11.50
9	3.00	30.34	2.50	34.05	28.1	0.01
10	-20.84	28.42	2.50	34.05	24.1	10.12
11	0.00	29.74	2.50	34.05	27.1	0.81
12	-18.72	28.25	2.50	34.05	24.1	8.20
13	0.00	25.75	2.50	34.05	23.1	10.00
14	-13.63	24.79	2.50	34.05	22.1	11.76
15	-15.76	20.12	2.50	34.05	18.1	16.43
16	-13.18	23.18	2.50	34.05	21.1	13.35
17	-24.28	25.34	2.50	34.05	23.1	11.21
18	-17.14	17.50	2.50	34.05	15.1	19.05
19	-12.32	20.40	2.50	34.05	18.1	16.15
20	-3.00	17.50	2.50	34.05	15.1	19.05

21	-3.00	22.27	2.50	34.05	20.	14.76
22	-4.79	22.33	2.50	34.05	19.	15.52
23	-3.00	22.93	2.50	34.05	21.	13.15
24	-4.79	17.50	2.50	34.05	15.	19.05
25	0.00	28.30	2.50	34.05	26.	7.67
26	-6.21	25.37	2.50	34.05	23.	10.88
27	-10.32	24.35	2.50	34.05	22.	11.95
28	-11.47	20.15	2.50	34.05	18.	16.40
29	-7.30	23.80	2.50	34.05	21.	12.75
30	-4.75	17.50	2.50	34.05	15.	19.05
31	-12.45	25.33	2.50	34.05	18.	15.22
32	-3.70	22.17	2.50	34.05	21.	12.56
33	-4.30	20.75	2.50	34.05	24.	9.55
34	-14.10	29.02	2.50	34.05	18.	15.92
35	-23.05	17.50	2.50	34.05	15.	19.05
36	-11.11	17.92	2.50	34.05	17.	10.64
37	-13.72	17.50	2.50	34.05	15.	19.05
38	3.00	24.34	2.50	34.05	22.	11.95
39	3.30	23.63	2.50	34.05	21.	12.67
40	-410.67	22.42	2.50	34.05	20.	13.02

111. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE 1, PUMPING HEAD : 34.05 M  
CAPACITY : 765.00 L/S
- 2). COST OF PIPE LINE : B. 0.273905E+03
- 3). COST OF PUMPING STATION : B. 0.121335E+02
- 4). TOTAL COST OF THE SYSTEM : B. 0.400440E+02
- 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
- 6). THE AVERAGE PRESSURE SURFACE : 20. M-AGL
- 7). PIPE LINES WITH TWO DIAMETER IN SERIES : 30.2004 X TOTAL LENGTH
- 8). COST OF SYSTEM PER L/S LF SUPPLY : B. 0.52345E+03
- 9). NUMBER ITERATION OF THIS PROGRAM : 34 ITRS

\*\*\*\*\* GOOD LUCK & THANKS..... \*\*\*\*\*

จุฬาลงกรณ์มหาวิทยาลัย

ENTRY ADDRESS 00

TOTAL LENGTH 47F50

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP, 47 PIPES, 40 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P.MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA :  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH		ROUGHNESS C/RK	COEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING	
			SERIES (M)	TOTAL (M)				(M)	(M/M)		PIPE1 LENGTH1 (MM)	PIPE2 LENGTH2 (M)
1	1 2	700	1020.	1020.	130.	0.750E+01	765.00	4.57	0.00448	2.0		
2	2 4	700	160.	160.	130.	0.118E+01	740.72	0.68	0.00422	1.9		
3	2 3	150	100.	100.	130.	0.133E+04	24.28	1.36	0.01362	1.4		
4	4 5	200	200.	200.	130.	0.657E+03	37.73	1.52	0.00759	1.2		
5	5 6	150	360.	360.	130.	0.480E+04	20.45	3.57	0.00991	1.2		
6	6 7	80	220.	220.	130.	0.626E+05	8.52	9.20	0.04182	1.7		
7	5 8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.03117	1.4		
8	4 9	700	200.	200.	130.	0.147E+01	702.99	0.77	0.00385	1.8		
9	9 10	150	400.	400.	130.	0.533E+04	20.86	4.12	0.01030	1.2		
10	9 11	700	220.	220.	130.	0.162E+01	682.11	0.80	0.00362	1.8		
11	11 12	300	180.	180.	130.	0.320E+02	115.01	1.49	0.00830	1.6		
12	12 13	200	152.	152.	130.	0.499E+03	54.71	2.30	0.01511	1.7		
13	13 14	150	140.	140.	130.	0.187E+04	18.63	1.17	0.00834	1.1		
14	14 15	80	400.	400.	130.	0.114E+06	5.00	6.23	0.01558	1.0		
15	16 15	100	140.	140.	130.	0.134E+05	10.76	3.04	0.02174	1.4		
16	13 16	200	400.	400.	130.	0.131E+04	36.08	2.79	0.00699	1.1		
17	16 18	100	320.	320.	130.	0.307E+05	12.14	8.70	0.02718	1.5		
18	12 17	200	320.	320.	130.	0.105E+04	41.58	2.91	0.00909	1.2		
19	17 18	80	552.	552.	130.	0.157E+06	5.00	8.60	0.01558	1.0		
20	17 19	100	408.	408.	130.	0.392E+05	12.32	11.40	0.02793	1.6		
21	19 20	100	552.	552.	130.	0.530E+05	5.00	2.90	0.00528	0.6		
22	21 19	100	340.	340.	130.	0.326E+05	5.00	1.79	0.00526	0.6		
23	22 20	80	340.	340.	130.	0.968E+05	4.05	5.59	0.01055	0.8		
24	21 22	80	552.	552.	130.	0.157E+06	8.84	24.72	0.04477	1.8		
25	23 21	150	572.	572.	130.	0.762E+04	18.92	4.91	0.00858	1.1		
26	23 24	80	552.	552.	130.	0.157E+06	4.79	7.95	0.01429	1.0		
27	11 25	700	335.	335.	130.	0.247E+01	567.10	0.86	0.00257	1.5		
28	25 26	200	200.	200.	130.	0.657E+03	56.50	3.21	0.01603	1.8		
29	26 27	150	100.	100.	130.	0.133E+04	21.79	1.11	0.01115	1.2		
30	27 29	100	180.	180.	130.	0.173E+05	11.47	4.40	0.02447	1.5		
31	26 29	150	164.	164.	130.	0.219E+04	22.05	1.37	0.01139	1.2		
32	29 30	80	280.	280.	130.	0.777E+05	9.75	15.03	0.05368	1.9		
33	29 34	80	428.	428.	130.	0.124E+06	5.00	6.67	0.01558	1.0		
34	26 31	80	214.	214.	130.	0.609E+05	6.45	5.34	0.02497	1.3		
35	32 31	80	214.	214.	130.	0.609E+05	6.00	4.67	0.02184	1.2		
36	33 32	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8		



37	32	34	100	164.	164.	130.	0.1157E+05	14.10	5.88	0.03520	1.8	--	--	--	--
38	32	35	80	416.	416.	130.	0.118E+C6	5.00	6.48	0.01558	1.0	--	--	--	--
39	25	33	600	428.	428.	130.	0.067E+C1	510.60	1.92	0.00449	1.8	--	--	--	--
40	33	38	600	592.	592.	130.	0.923E+C1	474.36	2.32	0.00352	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+05	15.69	7.09	0.04371	2.0	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS C/RK	CCEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE 1C LENGTH1 (MM)	PARALLEL PIPE 1C LENGTH2 (MM)	PARALLEL PIPE 1C EXISTING PIPE2 LENGTH2 (MM)
42	36 37	80	164.	164.	130.	0.467E+05	8.72	7.16	0.04366	1.7	--	--	--
43	34 37	80	592.	592.	130.	0.168E+C6	5.00	9.23	0.01558	1.0	--	--	--
44	38 36	150	200.	200.	130.	0.267E+04	35.52	5.51	0.02755	2.0	--	--	--
45	38 39	600	284.	284.	130.	0.443E+C1	438.86	0.96	0.00339	1.6	--	--	--
46	39 23	150	180.	180.	130.	0.240E+04	28.79	3.36	0.01867	1.6	--	--	--
47	39 40	600	252.	252.	130.	0.393E+C1	410.07	0.75	0.00259	1.5	--	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	27.50	2.50	25.00	25.	0.00
2	0.00	22.93	2.50	25.00	20.	4.57
3	-24.28	21.57	2.50	25.00	19.	5.93
4	0.00	22.26	2.50	25.00	20.	5.24
5	-10.01	20.74	2.50	25.00	18.	6.76
6	-11.93	17.17	2.50	25.00	15.	10.23
7	-8.52	17.97	2.50	25.00	5.	19.53
8	-7.27	16.00	2.50	25.00	14.	11.50
9	0.00	21.49	2.50	25.00	19.	6.01
10	-20.88	17.37	2.50	25.00	15.	10.13
11	0.00	20.59	2.50	25.00	18.	6.81
12	-18.72	19.20	2.50	25.00	17.	8.30
13	0.00	16.90	2.50	25.00	14.	10.60
14	-13.63	15.74	2.50	25.00	12.	11.74
15	-15.76	9.50	2.50	25.00	7.	18.00
16	-13.18	14.11	2.50	25.00	12.	13.29
17	-24.26	16.29	2.50	25.00	14.	11.21
18	-17.14	7.69	2.50	25.00	5.	19.81
19	-12.32	4.57	2.50	25.00	2.	22.93
20	-9.05	1.67	2.50	25.00	-1.	25.82
21	-5.08	6.68	2.50	25.00	4.	20.82
22	-4.79	-18.36	2.50	25.00	-21.	45.86
23	-5.08	11.27	2.50	25.00	9.	16.22
24	-4.79	3.32	2.50	25.00	1.	24.18
25	0.00	19.83	2.50	25.00	17.	7.67
26	-6.21	16.62	2.50	25.00	14.	10.88
27	-10.32	15.51	2.50	25.00	13.	11.95
28	-11.47	11.10	2.50	25.00	9.	16.40
29	-7.30	14.75	2.50	25.00	12.	12.75
30	-9.75	-0.29	2.50	25.00	-3.	27.78
31	-12.45	8.73	2.50	25.00	6.	18.77
32	-6.76	13.40	2.50	25.00	11.	14.10
33	-4.36	17.91	2.50	25.00	15.	9.55
34	-14.10	7.32	2.50	25.00	5.	19.93

35	-20.89	8.92	2.50	25.00	4.	20.58
36	-11.11	10.08	2.50	25.00	8.	17.42
37	-13.72	-1.70	2.50	25.00	4.	29.20
38	0.00	15.59	2.50	25.00	13.	11.51
39	0.00	14.83	2.50	25.00	12.	12.87
40	-410.07	13.37	2.50	25.00	11.	13.63

III. ADDITIONAL INFORMATION :

1). 1 PUMP SUPPLY FROM NODE : 1, PUMPING HEAD : 25.00 M  
CAPACITY : 765.00 L/S

2). COST OF PIPE LINE : B. 0.27245248E+08

3). COST OF PUMPING STATION : B. 0.8923075E+07

4). TOTAL COST OF THE SYSTEM : B. 0.36168320E+08

5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S

6). THE AVERAGE PRESSURE SURFACE : 10. M-AGL

7). PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 % TOTAL LENGTH

8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.47279E+05

\*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ENTRY ADDRESS 00

TOTAL LENGTH 47FSJ

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT PJINT 1  
 DETAIL : 8 LCCP , 47 PIPES , 43 NODES.  
 14 CRITICAL NODES.

SLOPE BY : HAZEN WILLIAMS  
 P.MIN. : 15 X ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONCITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NG	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH		ROUGHNES - COEF		PIPE FLOW (L/S)	PIPES HEADLOSS		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE LENGTH			
			SERIES	TOTAL	C/RK.	K-VALUE		(M)	(M/M)		(M)	(M)	(M)	(M)
1	1 2	800	1020.	1020.	130.	0.192E+C1	755.00	2.38	0.00234	1.5				
2	2 4	800	160.	160.	130.	0.614E+C0	740.72	0.35	0.00220	1.5				
3	2 3	150	100.	100.	130.	0.133E+C4	24.29	1.36	0.01362	0.4				
4	4 5	200	200.	200.	130.	0.657E+C0	37.73	1.52	0.00759	1.2				
5	5 6	150	360.	360.	130.	0.480E+C4	20.45	3.57	0.00991	1.2				
6	6 7	150	220.	220.	130.	0.293E+C4	8.52	0.42	0.00196	0.5				
7	5 8	80	152.	152.	130.	0.433E+C5	7.27	4.74	0.03117	1.4				
8	4 9	800	200.	200.	130.	0.768E+C0	732.59	0.40	0.00200	1.4				
9	9 10	150	400.	400.	130.	0.333E+C4	20.89	4.2	0.00200	1.2				
10	9 11	800	220.	220.	130.	0.845E+C0	682.11	0.42	0.00189	1.4				
11	11 12	400	180.	180.	130.	0.200E+C2	115.31	0.37	0.00205	0.9				
12	12 13	250	152.	152.	130.	0.109E+C3	54.71	0.77	0.00510	0.6				
13	13 14	200	140.	140.	130.	0.460E+C3	18.53	0.29	0.00205	0.6				
14	14 15	100	400.	400.	130.	0.384E+C5	5.00	2.10	0.00526	0.6				
15	16 15	150	140.	140.	130.	0.187E+C4	10.76	0.42	0.00202	0.6				
16	13 16	200	400.	400.	130.	0.131E+C4	36.08	2.79	0.00699	1.1				
17	16 18	150	320.	320.	130.	0.426E+C4	12.14	1.21	0.00377	0.7				
18	12 17	250	320.	320.	130.	0.354E+C3	41.59	0.98	0.00307	0.8				
19	17 18	100	552.	552.	130.	0.530E+C5	5.00	2.90	0.00526	0.6				
20	17 19	150	408.	408.	130.	0.544E+C4	12.52	1.58	0.00388	0.7				
21	19 20	100	552.	552.	130.	0.330E+C5	5.00	2.90	0.00526	0.6				
22	21 19	100	340.	340.	130.	0.326E+C5	5.00	1.79	0.00526	0.6				
23	22 20	100	340.	340.	130.	0.326E+C5	4.35	1.21	0.00356	0.5				
24	21 22	150	552.	552.	130.	0.736E+C4	8.34	1.6	0.00210	0.5				
25	23 21	200	572.	572.	130.	0.188E+C4	18.32	1.21	0.00211	0.6				
26	23 24	100	552.	552.	130.	0.530E+C5	4.79	2.53	0.00486	0.6				
27	11 25	300	336.	336.	130.	0.129E+C1	507.50	0.45	0.00134	1.1				
28	25 26	250	290.	290.	130.	0.221E+C3	36.53	1.08	0.00541	1.2				
29	26 27	150	180.	180.	130.	0.133E+C4	21.79	1.11	0.01115	1.2				
30	27 23	150	180.	180.	130.	0.240E+C4	11.47	0.8	0.00340	0.5				
31	26 29	200	164.	164.	130.	0.538E+C3	22.35	0.46	0.00281	0.7				
32	29 30	150	290.	290.	130.	0.375E+C4	9.75	0.70	0.00251	0.6				
33	29 31	100	428.	428.	130.	0.111E+C5	5.00	2.25	0.00526	0.6				
34	26 31	100	214.	214.	130.	0.205E+C5	6.45	1.30	0.00842	0.8				

35	32	31	100	214.	214.	130.	0.205E+05	6.00	1.58	0.00737	0.8
36	33	32	200	200.	200.	130.	0.657E+03	31.86	1.11	0.00555	1.0
37	32	34	150	164.	164.	130.	0.219E+04	14.10	0.12	0.00498	0.8
38	32	35	100	416.	416.	130.	0.399E+05	5.00	2.19	0.00526	0.6
39	25	33	700	428.	428.	130.	0.315E+01	510.00	0.91	0.00212	0.3
40	33	38	700	592.	592.	130.	0.435E+01	474.38	1.09	0.00185	1.2
41	36	35	150	176.	176.	130.	0.235E+04	15.69	1.07	0.00607	0.9

PIPE NC	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS C/RK	CEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE LOSS (M)	PIPE LOSS (M)	PIPE LOSS (M)	PIPE LOSS (M)
42	36 37	100	164.	164.	130.	0.157E+05	8.72	2.42	0.01473	1.1				
43	34 37	100	592.	592.	130.	0.568E+05	5.00	2.11	0.00526	0.6				
44	38 36	200	200.	200.	130.	0.657E+03	35.52	1.16	0.00679	1.1				
45	38 39	700	284.	284.	130.	0.209E+01	438.86	0.73	0.00160	1.1				
46	39 23	250	190.	190.	130.	0.199E+03	28.79	0.78	0.00155	0.6				
47	39 40	600	252.	252.	130.	0.393E+01	410.07	0.75	0.00259	1.5				

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NC	NCDAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DIFF. P (M)
1	765.00	27.50	2.50	25.00	25.	0.00
2	0.00	25.12	2.50	25.00	23.	2.26
3	-24.28	23.75	2.50	25.00	21.	3.75
4	0.00	24.75	2.50	25.00	22.	2.74
5	-10.01	23.25	2.50	25.00	21.	4.24
6	-11.93	19.08	2.50	25.00	17.	7.92
7	-8.52	19.25	2.50	25.00	17.	8.25
8	-7.27	18.31	2.50	25.00	16.	8.99
9	0.00	24.30	2.50	25.00	22.	3.74
10	-20.88	20.24	2.50	25.00	16.	7.36
11	0.00	23.75	2.50	25.00	21.	3.55
12	-13.72	23.53	2.50	25.00	21.	3.02
13	0.00	22.31	2.50	25.00	20.	4.65
14	-13.63	22.32	2.50	25.00	20.	4.98
15	-15.76	20.41	2.50	25.00	18.	7.09
16	-13.18	20.01	2.50	25.00	18.	7.49
17	-24.26	22.60	2.50	25.00	20.	4.90
18	-17.14	19.70	2.50	25.00	17.	7.00
19	-12.32	17.77	2.50	25.00	15.	9.73
20	-9.05	17.13	2.50	25.00	15.	10.31
21	-5.08	22.30	2.50	25.00	20.	4.70
22	-4.75	18.40	2.50	25.00	16.	9.10
23	-5.08	20.76	2.50	25.00	18.	6.74
24	-4.75	18.33	2.50	25.00	16.	7.42
25	0.00	23.30	2.50	25.00	21.	4.00
26	-6.21	22.42	2.50	25.00	20.	5.08
27	-10.32	21.30	2.50	25.00	19.	6.00
28	-11.47	20.57	2.50	25.00	18.	6.81
29	-7.30	21.75	2.50	25.00	19.	5.55
30	-9.75	21.25	2.50	25.00	19.	5.25
31	-12.45	19.30	2.50	25.00	17.	7.60
32	-6.76	21.43	2.50	25.00	19.	5.00



33	-4.36	22.59	2.50	25.00	20.	4.91
34	-14.10	20.55	2.50	25.00	18.	6.84
35	-20.65	19.29	2.50	25.00	17.	9.21
36	-11.11	20.14	2.50	25.00	18.	7.36
37	-13.72	17.55	2.50	25.00	15.	9.95
38	0.00	21.53	2.50	25.00	19.	6.00
39	0.00	21.54	2.50	25.00	19.	6.46
40	-410.67	20.29	2.50	25.00	18.	7.21

III. ADDITIONAL INFORMATION :

1) 1 PUMP SUPPLY FROM NODE : 1, PUMPING HEAD : 25.00 M  
CAPACITY : 765.00 L/S

2) COST OF PIPE LINE : B. 34286528.00

3) COST OF PUMPING STATION : B. 8523075.00

4) TOTAL COST OF THE SYSTEM : B. 43209603.00

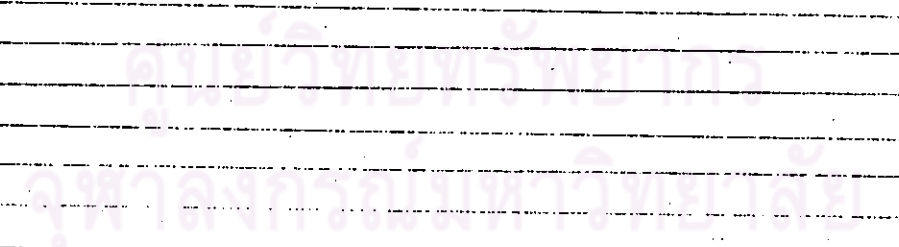
5) THE WEIGHTED MEAN VELOCITY : 1.3 M/S

6) THE AVERAGE PRESSURE SURFACE : 19. M AGL

7) PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 1 TOTAL LENGTH

8) COST OF SYSTEM PER L/S OF SUPPLY : B. 0.56783E+05

\*\*\*\*\* GOOD LUCK & THANKS \*\*\*\*\*



ENTRY ADDRESS 00

TOTAL LENGTH 47F90

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LGJP , 47 PIPES , 43 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P.MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

I. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS - C/RFK	CCEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	(M/M)	PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH1 (M)	PIPE2 LENGTH2 (M)	(4)
1	1 2	700	1020.	1020.	130.	0.750E+01	705.00	4.57	0.00448	2.0	--	--	--
2	2 4	700	160.	160.	130.	0.118E+01	740.72	0.68	0.00422	1.9	--	--	--
3	2 3	150	100.	100.	130.	0.133E+04	24.28	1.36	0.01362	1.4	--	--	--
4	4 5	200	200.	200.	130.	0.657E+03	37.73	1.52	0.00759	1.2	--	--	--
5	5 6	150	360.	360.	130.	0.480E+04	20.45	3.57	0.00951	1.2	--	--	--
6	6 7	80	220.	220.	130.	0.626E+05	3.52	9.20	0.04182	1.7	--	--	--
7	5 8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.03117	1.4	--	--	--
8	4 9	700	200.	200.	130.	0.147E+01	702.99	0.77	0.00383	1.8	--	--	--
9	3 10	150	400.	400.	130.	0.533E+04	20.88	4.12	0.01030	1.2	--	--	--
10	9 11	700	220.	220.	130.	0.162E+01	632.11	0.30	0.00362	1.8	--	--	--
11	11 2	300	180.	180.	130.	0.320E+02	119.01	1.49	0.00930	1.6	--	--	--
12	12 3	200	152.	152.	130.	0.499E+03	54.71	2.30	0.01511	1.7	--	--	--
13	13 14	150	140.	140.	130.	0.187E+04	13.63	1.17	0.00824	1.1	--	--	--
14	14 15	80	400.	400.	130.	0.114E+06	5.00	6.23	0.01558	1.0	--	--	--
15	16 5	100	140.	140.	130.	0.134E+05	10.76	3.34	0.02174	1.4	--	--	--
16	13 6	200	400.	400.	130.	0.131E+04	35.08	2.79	0.00679	1.1	--	--	--
17	14 7	100	320.	320.	130.	0.307E+05	12.14	8.70	0.02718	1.5	--	--	--
18	12 7	200	320.	320.	130.	0.105E+04	41.58	2.91	0.00909	1.3	--	--	--
19	17 8	80	552.	552.	130.	0.157E+06	5.00	8.50	0.01558	1.0	--	--	--
20	17 19	100	408.	408.	130.	0.392E+05	12.92	11.40	0.02793	1.0	--	--	--
21	19 20	100	552.	552.	130.	0.530E+05	5.00	2.90	0.00526	0.6	--	--	--
22	21 19	100	340.	340.	130.	0.325E+05	5.00	1.79	0.00526	0.6	--	--	--
23	22 20	80	340.	340.	130.	0.938E+05	4.05	3.59	0.01755	0.8	--	--	--
24	21 2	80	552.	552.	130.	0.157E+06	3.04	24.72	0.04477	1.3	--	--	--
25	23 1	150	572.	572.	130.	0.762E+04	13.92	4.91	0.00858	1.1	--	--	--
26	23 4	80	552.	552.	130.	0.157E+06	4.79	7.25	0.01439	1.0	--	--	--
27	11 25	700	335.	335.	130.	0.247E+01	507.10	0.86	0.0257	1.5	--	--	--
28	25 6	200	200.	200.	130.	0.657E+03	50.50	3.21	0.01603	1.8	--	--	--
29	25 7	150	100.	100.	130.	0.133E+04	21.79	1.11	0.01115	1.2	--	--	--
30	27 8	100	160.	160.	130.	0.173E+05	11.47	4.40	0.02447	1.5	--	--	--
31	26 19	150	164.	164.	130.	0.219E+04	22.25	1.87	0.01139	1.2	--	--	--
32	29 30	80	280.	280.	130.	0.797E+05	9.75	15.03	0.05368	1.9	--	--	--
33	29 14	80	428.	428.	130.	0.122E+06	5.00	6.67	0.01558	1.0	--	--	--
34	26 1	80	214.	214.	130.	0.509E+05	6.45	5.34	0.02457	1.3	--	--	--

35	32	1	80	214.	214.	130.	0.509E+05	8.00	4.87	0.02184	1.2	--	--	--	--
36	33	2	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8	--	--	--	--
37	32	4	100	164.	164.	130.	0.157E+05	14.10	5.88	0.03586	1.8	--	--	--	--
38	32	35	80	416.	416.	130.	0.118E+06	5.00	6.48	0.01558	1.0	--	--	--	--
39	25	3	600	428.	428.	130.	0.567E+01	510.60	1.92	0.00449	1.8	--	--	--	--
40	33	8	600	592.	592.	130.	0.923E+01	474.38	2.32	0.00392	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+05	15.69	7.59	0.04171	2.0	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS C/RK	COEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	(M/M)	PIPE VEL. (M/S)	PASALLEL PIPE TO EXISTING PIPE1 LENGTH1 (M)	PIPE2 LENGTH2 (M)	PIPE3 LENGTH3 (M)	PIPE4 LENGTH4 (M)
42	36 37	80	164.	164.	130.	0.467E+05	8.72	7.16	0.04366	1.7	--	--	--	--
43	34 17	80	592.	592.	130.	0.168E+06	5.00	9.23	0.01558	1.0	--	--	--	--
44	38 36	150	200.	200.	130.	0.267E+04	35.52	5.51	0.02755	2.0	--	--	--	--
45	38 9	600	284.	284.	130.	0.443E+01	438.86	0.96	0.00335	1.5	--	--	--	--
46	39 3	150	180.	180.	130.	0.240E+04	28.79	3.36	0.01867	1.6	--	--	--	--
47	39 10	600	252.	252.	130.	0.393E+01	410.07	0.75	0.00259	1.5	--	--	--	--

11. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	32.50	2.50	30.00	30.	0.00
2	0.00	27.93	2.50	30.00	25.	4.57
3	-24.28	25.57	2.50	30.00	24.	5.93
4	0.00	27.26	2.50	30.00	25.	5.24
5	-10.01	25.74	2.50	30.00	23.	6.76
6	-11.93	22.17	2.50	30.00	20.	10.33
7	-3.52	12.97	2.50	30.00	10.	19.53
8	-7.27	21.00	2.50	30.00	19.	11.50
9	0.00	26.49	2.50	30.00	24.	6.01
10	-20.88	22.37	2.50	30.00	20.	10.33
11	0.00	25.59	2.50	30.00	23.	6.81
12	-18.72	24.20	2.50	30.00	22.	8.30
13	0.00	21.70	2.50	30.00	19.	10.60
14	-13.63	23.74	2.50	30.00	18.	11.76
15	-15.76	16.07	2.50	30.00	14.	16.42
16	-13.13	19.11	2.50	30.00	17.	13.29
17	-24.20	21.27	2.50	30.00	19.	11.27
18	-17.14	10.41	2.50	30.00	5.	22.09
19	-12.32	3.33	2.50	30.00	7.	22.67
20	-9.05	5.79	2.50	30.00	4.	25.51
21	-5.78	11.35	2.50	30.00	9.	21.14
22	-4.77	10.53	2.50	30.00	3.	21.82
23	-5.03	15.27	2.50	30.00	14.	15.23
24	-4.75	8.32	2.50	30.00	5.	24.18
25	0.00	24.33	2.50	30.00	22.	7.67
26	-6.21	21.52	2.50	30.00	15.	14.55
27	-17.32	20.91	2.50	30.00	13.	17.56
28	-11.47	16.10	2.50	30.00	14.	13.40
29	-7.30	19.75	2.50	30.00	17.	12.75
30	-9.75	4.72	2.50	30.00	2.	27.78
31	-12.45	16.28	2.50	30.00	14.	15.27
32	-6.70	18.40	2.50	30.00	16.	14.10

33	-4.36	22.71	2.50	30.00	20.	9.59
34	-14.10	12.52	2.50	30.00	10.	19.58
35	-20.65	7.37	2.50	30.00	5.	25.11
36	-11.11	15.08	2.50	30.00	13.	17.42
37	-13.72	7.32	2.50	30.00	5.	14.58
38	0.00	20.59	2.50	30.00	18.	11.51
39	0.00	19.53	2.50	30.00	17.	12.87
40	-410.07	18.97	2.50	30.00	16.	13.63

III. ADDITIONAL INFORMATION :

- 1). 1 SUPPLY FROM NODE : 1. PUMPING HEAD : 30.00 M  
CAPACITY : 765.00 L/S
- 2). COST OF PIPE LINE : B. 0.272452E+08
- 3). COST OF PUMPING STATION : B. 0.107077E+08
- 4). TOTAL COST OF THE SYSTEM : B. 0.379529E+08
- 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
- 6). THE AVERAGE PRESSURE SURFACE : 16. M-AGL
- 7). PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 & TOTAL LENGTH
- 8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.49512E+05

\*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



ENTRY ADDRESS 00

TOTAL LENGTH 47F50

NETWORK : BANG-PLEE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP , 47 PIPES , 49 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P.MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO		PIPE SIZE (MM)	PIPE-LENGTH SERIES TOTAL (M)		ROUGHNESS - COEF C/FR K-VALUE		PIPE FLOW (L/S)	PIPES HEADLOSS (M) (M/M)		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH2 PIPE2 LENGTH3 PIPE2 LENGTH4			
													(MM)	(M)	(MM)
1	1	2	600	1020.	1020.	130.	0.392E+01	755.00	2.38	0.00234	1.5	--	--	--	--
2	2	4	700	160.	160.	130.	0.118E+01	740.72	0.58	0.00422	1.9	--	--	--	--
3	2	3	150	100.	100.	130.	0.133E+01	24.23	1.36	0.01362	1.4	--	--	--	--
4	4	5	200	200.	200.	130.	0.557E+01	37.75	1.52	0.00759	1.2	--	--	--	--
5	5	6	150	360.	360.	130.	0.480E+01	20.45	3.57	0.00991	1.2	--	--	--	--
6	5	7	100	120.	220.	130.	0.211E+01	8.52	3.10	0.01411	1.1	--	--	--	--
7	5	8	80	152.	152.	130.	0.433E+01	7.27	4.74	0.03117	1.4	--	--	--	--
8	4	9	700	200.	200.	130.	0.147E+01	702.39	0.77	0.00389	1.3	--	--	--	--
9	9	10	150	400.	400.	130.	0.533E+01	22.48	4.12	0.01020	1.2	--	--	--	--
10	9	11	700	220.	220.	130.	0.162E+01	632.21	0.90	0.00262	1.3	--	--	--	--
11	11	12	300	180.	180.	130.	0.820E+01	115.21	1.49	0.00830	1.6	--	--	--	--
12	12	13	200	152.	152.	130.	0.499E+01	54.71	2.30	0.01511	1.7	--	--	--	--
13	13	14	150	140.	140.	130.	0.147E+01	19.53	1.17	0.00634	1.1	--	--	--	--
14	14	15	100	400.	400.	130.	0.384E+01	5.00	2.10	0.00526	1.6	--	--	--	--
15	15	16	150	140.	140.	130.	0.137E+01	10.76	0.42	0.00302	1.6	--	--	--	--
16	15	16	200	400.	400.	130.	0.131E+01	16.05	2.74	0.00694	1.1	--	--	--	--
17	16	17	150	300.	300.	130.	0.320E+01	12.14	1.21	0.00377	1.7	--	--	--	--
18	16	17	250	300.	300.	130.	0.354E+01	41.54	0.93	0.00307	1.8	--	--	--	--
19	17	18	100	552.	552.	130.	0.530E+01	4.37	2.90	0.00526	1.6	--	--	--	--
20	17	18	150	436.	436.	130.	0.504E+01	10.16	1.53	0.00388	1.7	--	--	--	--
21	19	20	100	532.	532.	130.	0.530E+01	5.77	2.90	0.00526	1.6	--	--	--	--
22	21	18	100	343.	343.	130.	0.320E+01	5.17	1.79	0.00526	1.6	--	--	--	--
23	21	20	150	340.	340.	130.	0.320E+01	4.75	1.71	0.00496	1.5	--	--	--	--
24	21	22	100	352.	352.	130.	0.744E+01	3.89	1.15	0.00217	1.5	--	--	--	--
25	22	21	100	572.	572.	130.	0.138E+01	14.12	1.21	0.00211	1.6	--	--	--	--
26	21	24	100	552.	552.	130.	0.304E+01	4.79	2.44	0.00430	1.6	--	--	--	--
27	11	25	700	376.	376.	130.	0.247E+01	597.10	0.36	0.00267	1.5	--	--	--	--
28	25	26	200	200.	200.	130.	0.557E+01	34.97	3.71	0.01002	1.4	--	--	--	--
29	25	27	100	100.	100.	130.	0.132E+01	11.79	1.11	0.01116	1.3	--	--	--	--
30	27	28	100	140.	140.	130.	0.204E+01	11.97	1.57	0.00240	1.6	--	--	--	--
31	26	29	150	164.	164.	130.	0.114E+01	12.09	1.37	0.01139	1.2	--	--	--	--
32	29	30	100	280.	280.	130.	0.374E+01	4.75	0.70	0.00251	1.6	--	--	--	--
33	29	34	100	403.	403.	130.	0.411E+01	5.07	2.25	0.00526	1.6	--	--	--	--

35	32	31	100	219.	219.	130.	0.209E+03	0.00	1.38	0.00131	0.0	--	--	--	--
36	33	32	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8	--	--	--	--
37	32	34	150	164.	164.	130.	0.219E+04	14.10	0.82	0.00458	0.8	--	--	--	--
38	32	35	100	416.	416.	130.	0.399E+05	5.00	2.19	0.00526	0.6	--	--	--	--
39	29	33	700	428.	428.	130.	0.415E+01	510.60	0.31	0.00212	1.3	--	--	--	--
40	33	33	700	592.	592.	130.	0.435E+01	474.38	1.29	0.00155	1.2	--	--	--	--
41	36	35	150	176.	176.	130.	0.235E+04	15.69	1.07	0.00607	0.9	--	--	--	--

PIPE NO.	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES TOTAL (M)	ROUGHNESS - COEF C/RK K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH1 (MM)	PIPE2 LENGTH2 (MM)	PIPE3 LENGTH3 (MM)	PIPE4 LENGTH4 (MM)		
42	36 37	150	164.	164.	130.	0.219E+04	8.72	0.34	0.00204	0.5	--	--	--	--
43	34 37	100	592.	592.	130.	0.568E+05	5.00	3.11	0.00526	0.6	--	--	--	--
44	33 36	200	200.	200.	130.	0.657E+03	35.52	1.30	0.00679	1.1	--	--	--	--
45	28 39	600	284.	284.	130.	0.442E+01	433.86	0.26	0.00339	1.6	--	--	--	--
46	37 23	250	180.	180.	130.	0.199E+03	23.79	0.28	0.00155	0.6	--	--	--	--
47	37 40	600	252.	252.	130.	0.393E+01	410.37	0.75	0.00299	1.5	--	--	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	HYDRAULIC FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	32.50	2.50	30.00	30.	0.00
2	0.00	30.12	2.50	30.00	29.	2.38
3	-24.28	28.75	2.50	30.00	26.	3.75
4	0.00	29.44	2.50	30.00	27.	3.06
5	-10.01	27.12	2.50	30.00	25.	4.58
6	-11.93	24.35	2.50	30.00	22.	8.15
7	-9.52	21.25	2.50	30.00	19.	11.25
8	-7.27	23.19	2.50	30.00	21.	9.32
9	0.00	28.57	2.50	30.00	26.	3.83
10	-20.33	24.55	2.50	30.00	22.	7.55
11	0.00	27.43	2.50	30.00	25.	4.02
12	-18.72	26.33	2.50	30.00	24.	6.17
13	0.00	24.09	2.50	30.00	22.	8.41
14	-18.63	22.12	2.50	30.00	20.	9.58
15	-15.75	20.32	2.50	30.00	18.	11.69
16	-13.10	21.21	2.50	30.00	19.	11.01
17	-24.28	25.40	2.50	30.00	23.	7.17
18	-17.14	22.50	2.50	30.00	20.	10.00
19	-12.42	20.77	2.50	30.00	18.	11.73
20	-9.05	17.17	2.50	30.00	15.	14.67
21	-5.33	25.51	2.50	30.00	27.	6.89
22	-4.75	21.10	2.50	30.00	19.	11.17
23	-3.05	23.77	2.50	30.00	21.	9.72
24	-4.77	21.20	2.50	30.00	19.	11.41
25	0.00	27.51	2.50	30.00	27.	8.49
26	-18.21	23.11	2.50	30.00	23.	9.70
27	-10.42	22.31	2.50	30.00	22.	8.81
28	-11.17	22.13	2.50	30.00	21.	10.40
29	-7.10	21.74	2.50	30.00	20.	10.56
30	-9.79	21.39	2.50	30.00	19.	11.07
31	-12.43	20.78	2.50	30.00	18.	12.49
32	-11.75	21.00	2.50	30.00	18.	11.00

33	-79.59	20.11	2.50	30.00	29.	16.29
34	-14.10	20.79	2.50	30.00	18.	11.71
35	-20.69	19.41	2.50	30.00	17.	13.07
36	-11.11	23.66	2.50	30.00	21.	8.84
37	-13.72	17.67	2.50	30.00	15.	14.83
38	0.00	25.01	2.50	30.00	23.	7.49
39	0.00	24.05	2.50	30.00	22.	9.45
40	-410.97	23.30	2.50	30.00	21.	9.20

III. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE : 1. PUMPING HEAD : 30.00 M  
CAPACITY : 765.00 L/S
  - 2). COST OF PIPE LINE : B. 0.314187E+08
  - 3). COST OF PUMPING STATION : B. 0.107077E+09
  - 4). TOTAL COST OF THE SYSTEM : B. 0.421264E+09
  - 5). THE WEIGHTED MEAN VELOCITY : 1.4 M/S
  - 6). THE AVERAGE PRESSURE SURFACE : 21.4-AGL
  - 7). PIPE LINES WITH THE DIAMETER IN SERIES : 0.0000 % TOTAL LENGTH
  - 8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.55047E+09
- \*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ENTRY ADDRESS 00

TOTAL LENGTH 47F90

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP , 47 PIPES , 40 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P.MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

I. COMPUTED PIPE LINES :

PIPE NC	NODE FROM-TO		PIPE SIZE (MM)	PIPE-LENGTH SERIES TOTAL (M)		ROUGHNESS - CCEF C/RK K-VALUE		PIPE FLOW (L/S)	PIPES HEADLOSS (M) (M/M)		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH1 PIPE2 LENGTH2			
													(M)	(M)	(M)
1	1	2	700	1020.	1020.	130.	0.750E+01	755.01	4.57	0.00448	2.0	--	--	--	--
2	2	4	700	160.	160.	130.	0.118E+01	740.72	0.68	0.03422	1.6	--	--	--	--
3	2	3	150	100.	100.	130.	0.133E+04	24.23	1.36	0.01362	1.4	--	--	--	--
4	4	5	200	200.	200.	130.	0.657E+03	37.73	1.52	0.00759	1.2	--	--	--	--
5	5	6	150	360.	360.	130.	0.480E+04	20.45	3.57	0.00391	1.2	--	--	--	--
6	6	7	80	220.	220.	130.	0.626E+05	8.52	9.20	0.04182	1.7	--	--	--	--
7	5	8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.03117	1.4	--	--	--	--
8	4	9	700	200.	200.	130.	0.147E+01	702.99	0.77	0.03383	1.8	--	--	--	--
9	9	10	150	400.	400.	130.	0.533E+04	20.33	4.12	0.01030	1.2	--	--	--	--
10	9	11	700	220.	220.	130.	0.162E+01	692.11	0.80	0.03342	1.8	--	--	--	--
11	11	2	300	180.	180.	130.	0.320E+02	115.01	1.49	0.00330	1.6	--	--	--	--
12	12	3	200	152.	152.	130.	0.499E+03	54.71	2.30	0.01511	1.7	--	--	--	--
13	13	4	150	140.	140.	130.	0.187E+04	14.63	1.17	0.00334	1.1	--	--	--	--
14	14	5	60	400.	400.	130.	0.114E+06	5.00	6.23	0.01553	1.0	--	--	--	--
15	15	15	100	140.	140.	130.	0.134E+05	10.76	3.04	0.02174	1.4	--	--	--	--
16	13	6	200	400.	400.	130.	0.131E+04	36.03	2.79	0.00599	1.1	--	--	--	--
17	16	8	100	320.	320.	130.	0.307E+05	12.14	8.70	0.02718	1.5	--	--	--	--
18	12	7	200	320.	320.	130.	0.105E+04	41.58	2.21	0.00709	1.3	--	--	--	--
19	17	8	80	552.	552.	130.	0.157E+06	5.00	8.60	0.01553	1.0	--	--	--	--
20	17	19	100	400.	400.	130.	0.392E+05	12.32	11.40	0.02792	1.6	--	--	--	--
21	19	20	100	552.	552.	130.	0.530E+05	5.00	2.30	0.00526	0.6	--	--	--	--
22	21	19	100	340.	340.	130.	0.326E+05	5.00	1.79	0.00526	0.5	--	--	--	--
23	22	20	80	340.	340.	130.	0.968E+05	4.05	3.59	0.01055	0.3	--	--	--	--
24	21	22	80	552.	552.	130.	0.157E+06	4.34	24.72	0.04477	1.8	--	--	--	--
25	23	21	150	572.	572.	130.	0.762E+04	13.92	4.91	0.00359	1.1	--	--	--	--
26	23	4	80	552.	552.	130.	0.157E+06	4.79	7.95	0.01429	1.0	--	--	--	--
27	11	5	700	336.	336.	130.	0.247E+01	567.10	0.35	0.00457	1.5	--	--	--	--
28	25	5	200	200.	200.	130.	0.557E+03	36.50	3.21	0.01603	1.0	--	--	--	--
29	26	7	150	100.	100.	130.	0.153E+04	11.79	1.11	0.01115	1.2	--	--	--	--
30	27	28	100	180.	180.	130.	0.173E+05	11.47	4.40	0.02447	1.5	--	--	--	--
31	26	19	150	164.	164.	130.	0.219E+04	22.05	1.87	0.01130	1.1	--	--	--	--
32	29	0	80	280.	280.	130.	0.797E+05	9.75	15.33	0.05368	1.5	--	--	--	--
33	29	14	80	428.	428.	130.	0.122E+05	5.00	6.57	0.01559	1.0	--	--	--	--
34	26	1	80	214.	214.	130.	0.509E+05	6.45	5.34	0.02497	1.1	--	--	--	--



35	32	1	80	214.	214.	130.	0.509E+05	6.00	4.51	0.02184	1.2	--	--	--	--
36	33	2	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8	--	--	--	--
37	32	4	100	164.	164.	130.	0.157E+05	14.10	5.88	0.03586	1.8	--	--	--	--
38	32	5	80	416.	416.	130.	0.118E+06	5.00	6.48	0.01558	1.0	--	--	--	--
39	25	3	600	428.	428.	130.	0.667E+01	510.60	1.92	0.00449	1.8	--	--	--	--
40	33	38	600	592.	592.	130.	0.923E+01	474.38	2.32	0.00392	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+05	15.69	7.59	0.04371	2.0	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS C/RK	CEEF K-VALUE	PIPE FLOW (L/S)	PIPES HEAD LOSS (M)	PIPES HEAD LOSS (M/M)	PIPE VELOCITY (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH (M)	EXISTING PIPE2 LENGTH (M)	EXISTING PIPE1 LENGTH (M)	EXISTING PIPE2 LENGTH (M)
42	36 37	80	164.	164.	130.	0.467E+05	8.72	7.16	0.04366	1.7	--	--	--	--
43	34 37	80	592.	592.	130.	0.168E+06	5.00	9.23	0.01558	1.0	--	--	--	--
44	38 6	150	200.	200.	130.	0.267E+04	35.52	5.51	0.02755	2.0	--	--	--	--
45	38 9	600	284.	284.	130.	0.443E+01	438.86	0.96	0.00339	1.6	--	--	--	--
46	39 3	150	180.	180.	130.	0.240E+04	28.79	3.36	0.01867	1.6	--	--	--	--
47	39 40	600	252.	252.	130.	0.393E+01	410.07	0.75	0.00259	1.5	--	--	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	37.50	2.50	35.00	35.	0.00
2	0.00	32.93	2.50	35.00	30.	4.57
3	-24.28	31.57	2.50	35.00	29.	5.93
4	0.00	32.26	2.50	35.00	30.	5.24
5	-10.01	30.74	2.50	35.00	28.	6.76
6	-11.93	27.17	2.50	35.00	25.	10.23
7	-8.52	17.37	2.50	35.00	15.	19.53
8	-7.27	26.00	2.50	35.00	24.	11.50
9	0.00	31.69	2.50	35.00	29.	6.01
10	-20.88	27.37	2.50	35.00	25.	10.23
11	0.00	30.69	2.50	35.00	26.	6.01
12	-18.72	29.20	2.50	35.00	27.	9.20
13	0.00	26.30	2.50	35.00	24.	10.00
14	-13.62	25.74	2.50	35.00	23.	11.76
15	-15.76	21.07	2.50	35.00	19.	16.43
16	-13.18	24.11	2.50	35.00	22.	13.29
17	-24.26	25.39	2.50	35.00	24.	11.21
18	-17.14	15.41	2.50	35.00	13.	22.09
19	-12.32	14.30	2.50	35.00	12.	22.00
20	-9.05	11.39	2.50	35.00	9.	25.51
21	-5.08	15.39	2.50	35.00	14.	21.54
22	-4.75	13.33	2.50	35.00	13.	21.62
23	-5.08	21.27	2.50	35.00	19.	16.23
24	-4.79	13.32	2.50	35.00	11.	24.16
25	0.00	29.43	2.50	35.00	27.	7.07
26	-6.21	20.52	2.50	35.00	24.	10.88
27	-10.32	25.51	2.50	35.00	25.	11.09
28	-11.47	21.10	2.50	35.00	19.	16.40
29	-7.30	24.75	2.50	35.00	22.	12.75
30	-9.75	9.72	2.50	35.00	7.	27.78
31	-12.45	21.24	2.50	35.00	19.	16.21
32	-6.76	23.40	2.50	35.00	21.	14.10

33	-4.36	27.71	2.50	35.00	25.	9.59
34	-14.10	17.52	2.50	35.00	15.	19.98
35	-20.69	12.39	2.50	35.00	10.	25.11
36	-11.11	20.09	2.50	35.00	18.	17.42
37	-13.72	12.72	2.50	35.00	10.	24.58
38	0.00	25.59	2.50	35.00	23.	11.91
39	0.00	24.63	2.50	35.00	22.	12.87
40	-410.07	23.87	2.50	35.00	21.	13.63

III. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE : 1. PUMPING HEAD : 35.00 M  
CAPACITY : 765.00 L/S
  - 2). COST OF PIPE LINE : B. 0.272452E+08
  - 3). COST OF PUMPING STATION : B. 0.124923E+08
  - 4). TOTAL COST OF THE SYSTEM : B. 0.397376E+08
  - 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
  - 6). THE AVERAGE PRESSURE SURFACE : 21. M-AGL
  - 7). PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 % TOTAL LENGTH
  - 8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.51745E+05
- \*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ENTRY ADDRESS 00

TOTAL LENGTH 47F50

NETWORK : BANG-PLIEE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUPPING STATION AT POINT 1  
 DETAIL : 8 LGCP , 47 PIPES , 43 NODES,  
 14 CRITICAL NODES.  
 SLCPE BY : HAZEN WILLIAMS  
 P-PIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO		PIPE SIZE (MM)	PIPE-LENGTH		ROUGHNESS - CCEP		PIPE FLOW (L/S)	PIPES HEADLOSS		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING			
				SERIES	TOTAL	C/RK	K-VALUE		(M)	(M/M)		PIPE1 LENGTH1 (MM)	PIPE2 LENGTH2 (M)	(MM)	(M)
1	1	2	100	1020.	1020.	130.	C.750E+C1	755.00	4.57	0.C044E	2.0	--	--	--	--
2	2	4	100	160.	160.	130.	0.118E+C1	749.72	0.68	0.C0422	1.9	--	--	--	--
3	2	3	150	100.	100.	130.	0.133E+C4	24.28	1.36	0.C1362	1.4	--	--	--	--
4	4	5	200	200.	200.	130.	C.657E+C3	37.73	1.52	0.C0755	1.2	--	--	--	--
5	5	6	150	360.	360.	130.	C.480E+C4	20.45	3.57	0.C0991	1.2	--	--	--	--
6	6	7	80	220.	220.	130.	C.326E+C5	3.52	9.20	0.04182	1.7	--	--	--	--
7	5	8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.C2117	1.4	--	--	--	--
8	4	9	700	200.	200.	130.	C.147E+01	732.99	0.77	0.C0383	1.8	--	--	--	--
9	9	10	150	400.	400.	130.	C.533E+C4	29.88	4.12	0.C1030	1.2	--	--	--	--
10	9	11	700	220.	220.	130.	C.162E+C1	432.11	C.30	0.C0362	1.8	--	--	--	--
11	11	12	300	180.	180.	130.	0.820E+02	115.01	1.45	0.C0830	1.6	--	--	--	--
12	12	13	200	152.	152.	130.	C.499E+C3	54.71	2.30	0.C1511	1.7	--	--	--	--
13	13	14	150	140.	140.	130.	0.187E+C4	19.63	1.17	0.C0824	1.1	--	--	--	--
14	14	15	100	400.	400.	130.	0.394E+C5	5.00	2.10	0.C0526	0.6	--	--	--	--
15	16	15	100	140.	140.	130.	C.134E+C5	10.75	3.04	0.C2174	1.4	--	--	--	--
16	13	15	200	400.	400.	130.	C.131E+C4	36.08	2.75	0.C0695	1.1	--	--	--	--
17	16	18	150	320.	320.	130.	C.426E+C4	12.14	1.21	0.00377	0.7	--	--	--	--
18	12	17	200	320.	320.	130.	0.105E+C4	41.53	2.91	0.00905	1.3	--	--	--	--
19	17	19	100	552.	552.	130.	C.530E+C5	5.00	2.90	0.C0526	0.6	--	--	--	--
20	17	19	150	408.	408.	130.	C.544E+C4	12.32	1.58	0.C0383	0.7	--	--	--	--
21	19	20	100	552.	552.	130.	0.530E+C5	5.00	2.90	0.C0526	0.6	--	--	--	--
22	21	19	100	340.	340.	130.	0.326E+C5	5.00	1.75	0.C0526	0.6	--	--	--	--
23	22	20	100	340.	340.	130.	0.326E+C5	4.05	1.21	0.C0356	0.5	--	--	--	--
24	21	22	150	552.	552.	130.	0.736E+C4	3.34	1.16	0.C0210	0.5	--	--	--	--
25	23	21	200	572.	572.	130.	C.138E+C4	18.92	1.21	0.C0211	0.6	--	--	--	--
26	21	24	100	552.	552.	130.	C.530E+C5	4.77	2.68	0.C0486	0.6	--	--	--	--
27	11	25	700	336.	336.	130.	C.217E+C1	537.13	0.36	0.C0257	1.5	--	--	--	--
28	25	26	200	200.	200.	130.	C.537E+C3	36.50	2.21	0.C1603	1.8	--	--	--	--
29	25	27	150	100.	100.	130.	0.133E+C4	21.79	1.11	0.C1115	1.2	--	--	--	--
30	27	28	100	100.	100.	130.	C.173E+C5	11.47	4.40	0.C2647	1.5	--	--	--	--
31	26	29	150	164.	164.	130.	C.219E+C4	22.75	1.37	0.C1135	1.2	--	--	--	--
32	29	30	100	280.	280.	130.	C.269E+C5	9.75	5.07	0.C1911	1.2	--	--	--	--
33	29	34	100	424.	424.	130.	0.411E+C5	5.00	2.25	0.C0526	0.6	--	--	--	--
34	29	31	100	210.	210.	130.	0.205E+C5	4.45	1.80	0.C0526	0.6	--	--	--	--

36	33	32	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8	--	--	--	--
37	32	34	150	164.	164.	130.	0.219E+C4	14.10	0.82	0.00498	0.8	--	--	--	--
38	32	35	100	416.	416.	130.	0.199E+05	5.30	2.19	0.00526	0.6	--	--	--	--
39	25	33	600	428.	423.	130.	0.667E+C1	510.60	1.92	0.00449	1.8	--	--	--	--
40	33	39	600	592.	592.	130.	0.923E+C1	474.38	2.32	0.00392	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+C5	15.69	7.69	0.04371	2.0	--	--	--	--

PIPE NC	NODE FROM-TO	PIPE SIZE (MM)	PIPE-SERIES	LENGTH TOTAL (M)	ROUGHNESS - COEF C/RK	K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	(M/M)	PIPE VEL. (M/S)	PARALLEL PIPE LENGTH1 (MM)	EXISTING PIPE2 LENGTH2 (MM)
42	36 37	100	164.	164.	130.	0.157E+C5	8.72	2.42	0.01473	1.1	--	--
43	34 37	100	592.	592.	130.	0.568E+C5	5.00	3.11	0.00526	0.6	--	--
44	33 36	150	200.	200.	130.	0.267E+C4	35.52	5.51	0.02755	2.0	--	--
45	33 39	600	284.	284.	130.	0.443E+C1	438.86	0.96	0.00339	1.6	--	--
46	33 23	250	180.	180.	130.	0.199E+C3	28.79	0.28	0.00155	0.6	--	--
47	39 40	600	252.	252.	130.	0.393E+C1	410.07	0.75	0.00299	1.5	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	37.50	2.50	35.00	25.	0.00
2	0.00	32.93	2.50	35.00	30.	4.57
3	-24.28	31.57	2.50	35.00	29.	5.92
4	0.00	32.20	2.50	35.00	30.	5.24
5	-10.01	30.74	2.50	35.00	28.	6.76
6	-11.93	27.17	2.50	35.00	25.	10.22
7	-3.52	17.77	2.50	25.00	15.	19.52
8	-7.27	20.00	2.50	25.00	24.	11.50
9	0.00	31.49	2.50	35.00	29.	6.01
10	-20.66	27.17	2.50	35.00	25.	10.12
11	0.00	30.59	2.50	35.00	28.	6.81
12	-13.72	23.20	2.50	35.00	27.	8.30
13	0.00	26.70	2.50	35.00	24.	10.00
14	-13.63	25.74	2.50	35.00	23.	11.76
15	-15.76	23.63	2.50	35.00	21.	13.87
16	-13.18	24.11	2.50	25.00	22.	13.29
17	-24.26	26.29	2.50	35.00	24.	11.21
18	-17.14	23.33	2.50	35.00	21.	14.11
19	-12.32	21.33	2.50	35.00	19.	16.55
20	-9.05	13.45	2.50	35.00	16.	19.05
21	-5.03	26.50	2.50	35.00	24.	11.00
22	-0.73	21.33	2.50	35.00	19.	16.52
23	-5.03	24.35	2.50	35.00	22.	13.15
24	-4.79	21.07	2.50	35.00	19.	16.02
25	0.00	29.31	2.50	35.00	27.	7.67
26	-5.21	26.52	2.50	35.00	24.	10.88
27	-10.32	25.51	2.50	35.00	23.	11.99
28	-11.47	21.13	2.50	35.00	19.	16.40
29	-7.30	24.75	2.50	35.00	22.	12.75
30	-7.75	17.63	2.50	35.00	17.	17.82
31	-12.45	18.73	2.50	35.00	16.	19.77
32	-6.76	23.40	2.50	35.00	21.	14.10
33	-6.14	27.51	2.50	35.00	25.	6.50



34	-14.10	22.59	2.50	35.00	20.	14.51
35	-20.69	21.22	2.50	35.00	19.	16.28
36	-11.11	20.03	2.50	35.00	18.	17.42
37	-13.72	19.47	2.50	35.00	17.	18.02
38	0.00	25.59	2.50	35.00	23.	11.51
39	0.00	24.63	2.50	35.00	22.	12.87
40	-410.07	23.37	2.50	35.00	21.	13.62

III. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE : 1. PUMPING HEAD : 35.00 M  
CAPACITY : 765.00 L/S
  - 2). COST OF PIPE LINE : B. 0.28137792E+08
  - 3). COST OF PUMPING STATION : B. 0.1249231E+08
  - 4). TOTAL COST OF THE SYSTEM : B. C. 40630096E+08
  - 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
  - 6). THE AVERAGE PRESSURE SURFACE : 23. M-AGL
  - 7). PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 & TOTAL LENGTH
  - 8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.53111E+05
- \*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ENTRY ADDRESS 00

TOTAL LENGTH 7750

NETWORK : BAUG-PLÉE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP , 47 PIPES , 43 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P-MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

I. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS - CGEF C/RK	K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPE HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE 1G EXISTING PIPE1 LENGTH1 (M)	PIPE2 LENGTH2 (M)
1	1 2	700	1020.	1020.	130.	0.750E+01	755.00	4.57	0.00448	2.0		
2	2 4	700	160.	160.	130.	0.110E+01	740.72	0.66	0.00422	1.9		
3	2 3	150	160.	100.	130.	0.133E+04	24.28	1.36	0.01362	1.4		
4	4 5	200	200.	200.	130.	0.057E+05	37.75	1.52	0.00759	1.2		
5	5 6	150	360.	360.	130.	0.480E+04	20.45	3.57	0.00991	1.2		
6	6 7	80	220.	220.	130.	0.620E+05	8.52	4.20	0.04102	1.7		
7	5 8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.03117	1.4		
8	4 9	700	200.	200.	130.	0.147E+01	702.99	0.77	0.00382	1.8		
9	9 10	150	400.	400.	130.	0.533E+04	20.88	4.12	0.01030	1.2		
10	9 11	700	220.	220.	130.	0.162E+01	682.11	0.80	0.00362	1.8		
11	11 12	300	180.	180.	130.	0.320E+02	115.01	1.49	0.00830	1.6		
12	12 13	200	152.	152.	130.	0.499E+03	54.71	2.30	0.01511	1.7		
13	13 14	150	140.	140.	130.	0.107E+04	18.03	1.17	0.00834	1.1		
14	14 15	80	400.	400.	130.	0.114E+06	5.00	6.23	0.01558	1.0		
15	15 15	100	140.	140.	130.	0.134E+05	10.76	3.04	0.02174	1.4		
16	15 16	200	400.	400.	130.	0.131E+04	36.08	2.79	0.00695	1.1		
17	16 13	130	320.	320.	130.	0.507E+05	12.14	6.70	0.02718	1.5		
18	12 17	200	320.	320.	130.	0.105E+04	41.58	2.91	0.00909	1.3		
19	17 18	80	552.	552.	130.	0.157E+06	5.00	8.60	0.01558	1.0		
20	17 19	100	400.	400.	130.	0.592E+05	12.92	11.40	0.02793	1.6		
21	19 20	100	552.	552.	130.	0.530E+05	5.00	2.90	0.00526	0.6		
22	21 19	100	340.	340.	130.	0.326E+05	5.00	1.73	0.00526	0.6		
23	22 20	80	340.	340.	130.	0.908E+05	4.05	3.59	0.01055	0.8		
24	21 22	150	552.	552.	130.	0.736E+04	6.84	1.16	0.00210	0.5		
25	23 21	150	572.	572.	130.	0.702E+04	18.92	4.91	0.00696	1.1		
26	23 24	80	552.	552.	130.	0.157E+06	4.79	7.95	0.01439	1.0		
27	11 25	700	536.	536.	130.	0.247E+01	527.10	0.66	0.00257	1.5		
28	25 26	200	200.	200.	130.	0.057E+05	36.50	3.21	0.01603	1.8		
29	26 27	150	100.	100.	130.	0.133E+04	21.79	1.11	0.01115	1.2		
30	27 28	100	180.	180.	130.	0.175E+05	11.47	4.40	0.02447	1.5		
31	26 29	150	164.	164.	130.	0.219E+04	22.05	1.07	0.01134	1.2		
32	29 30	100	280.	280.	130.	0.209E+05	9.75	5.07	0.01811	1.2		
33	29 34	80	428.	428.	130.	0.122E+06	5.00	6.67	0.01598	1.0		
34	26 31	80	214.	214.	130.	0.009E+05	6.45	5.54	0.02457	1.3		

32	34	31	80	417.	417.	130.	0.007E+02	0.00	7.00	0.02207	1.8	--	--	--	--
36	33	32	150	200.	200.	130.	0.267E+C4	31.86	4.51	0.C2253	1.8	--	--	--	--
37	32	34	100	164.	164.	130.	0.157E+C5	14.10	5.88	0.03586	1.8	--	--	--	--
38	32	35	80	416.	416.	130.	0.118E+06	5.00	6.48	0.C1558	1.0	--	--	--	--
39	25	33	800	428.	428.	130.	0.667E+C1	510.00	1.92	0.C0449	1.8	--	--	--	--
40	35	38	600	592.	592.	130.	0.923E+C1	474.38	2.32	0.C0392	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+C5	15.69	7.69	0.04371	2.0	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS C/RK	CEFF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE1 LENGTH1 (MM)	PIPE IC LENGTH1 (M)	EXISTING PIPE2 LENGTH2 (MM)	EXISTING PIPE2 LENGTH2 (M)	
42	36	37	80	164.	164.	130.	0.467E+C5	8.72	7.16	0.C4366	1.7	--	--	--	--
43	34	37	100	592.	592.	130.	0.568E+C5	5.00	3.11	0.C0526	0.6	--	--	--	--
44	38	36	150	200.	200.	130.	0.267E+C4	35.52	5.51	0.C2755	2.0	--	--	--	--
45	38	39	800	284.	284.	130.	0.443E+01	438.86	0.90	0.C0335	1.0	--	--	--	--
46	39	23	200	180.	180.	130.	0.591E+C3	28.79	0.83	0.C0460	0.9	--	--	--	--
47	39	40	800	252.	252.	130.	0.393E+01	410.07	0.75	0.C0299	1.5	--	--	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	42.50	2.50	40.00	40.	0.00
2	0.00	37.33	2.50	40.00	35.	4.57
3	-24.28	36.57	2.50	40.00	34.	5.93
4	0.00	37.25	2.50	40.00	35.	5.24
5	-19.31	35.74	2.50	40.00	33.	6.76
6	-11.93	32.17	2.50	40.00	30.	10.33
7	-8.52	22.37	2.50	40.00	20.	19.53
8	-7.27	31.00	2.50	40.00	29.	11.50
9	0.00	36.33	2.50	40.00	34.	6.01
10	-20.88	32.37	2.50	40.00	30.	10.13
11	0.00	35.89	2.50	40.00	33.	6.81
12	-13.72	34.20	2.50	40.00	32.	8.20
13	0.00	31.30	2.50	40.00	29.	10.60
14	-13.63	30.74	2.50	40.00	28.	11.76
15	-15.76	24.30	2.50	40.00	22.	18.00
16	-13.18	29.11	2.50	40.00	27.	13.35
17	-24.20	31.29	2.50	40.00	29.	11.21
18	-17.14	22.59	2.50	40.00	20.	19.81
19	-12.32	22.10	2.50	40.00	20.	20.40
20	-9.55	19.20	2.50	40.00	17.	23.30
21	-5.06	21.53	2.50	40.00	19.	20.82
22	-4.75	22.73	2.50	40.00	20.	19.77
23	-5.04	28.50	2.50	40.00	26.	13.70
24	-4.79	20.55	2.50	40.00	18.	21.65
25	0.00	34.33	2.50	40.00	32.	7.67
26	-6.21	31.32	2.50	40.00	29.	10.68
27	-10.32	30.31	2.50	40.00	28.	11.99
28	-11.47	20.10	2.50	40.00	24.	18.40
29	-7.30	29.73	2.50	40.00	27.	12.75
30	-9.75	24.38	2.50	40.00	22.	17.82
31	-12.45	23.73	2.50	40.00	21.	18.77

33	-4.38	32.91	2.50	40.00	20.	9.39
34	-14.10	22.52	2.50	40.00	20.	19.98
35	-20.69	21.92	2.50	40.00	15.	20.58
36	-11.11	25.08	2.50	40.00	23.	17.42
37	-13.72	19.41	2.50	40.00	17.	23.09
38	0.00	30.59	2.50	40.00	28.	11.91
39	0.00	29.63	2.50	40.00	27.	12.87
40	-410.07	28.87	2.50	40.00	26.	13.63

III. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE 1, PUMPING HEAD : 40.00 M  
CAPACITY : 765.00 L/S
- 2). COST OF PIPE LINE : B. 0.275159E+08
- 3). COST OF PUMPING STATION : B. 0.142709E+08
- 4). TOTAL COST OF THE SYSTEM : B. 0.417928E+08
- 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
- 6). THE AVERAGE PRESSURE SURFACE : 27. M-AGL
- 7). PIPE LINES WITH TWO DIAMETER IN SERIES : 0.0000 & TOTAL LENGTH
- 8). COST OF SYSTEM PER L/S OF SUPPLY : B. 0.54031E+05

\*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



ENTRY ADDRESS 00

TOTAL LENGTH 47F90

NETWORK : BANG-PLIE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP, 47 PIPES, 43 NODES,  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P. MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS - COEF (R/K)	K-VALUE	PIPE FLOW (L/S)	PIPES HEAD LOSS (M)	PIPES HEAD LOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH (M)	PIPE2 LENGTH (M)	PIPE3 LENGTH (M)	PIPE4 LENGTH (M)
1	1 2	700	1200.	1200.	130.	0.750E+01	755.00	4.07	0.00448	2.0	--	--	--	--
2	2 4	700	100.	1300.	130.	0.118E+01	733.72	0.55	0.00422	2.9	--	--	--	--
3	2 3	150	100.	1300.	130.	0.133E+04	24.23	1.56	0.01202	1.4	--	--	--	--
4	4 5	200	200.	200.	130.	0.557E+05	37.75	1.52	0.00759	1.2	--	--	--	--
5	5 6	150	350.	350.	130.	0.460E+04	20.45	3.57	0.00991	1.2	--	--	--	--
6	5 7	80	220.	220.	130.	0.926E+05	9.92	0.29	0.04182	1.7	--	--	--	--
7	5 8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.01117	1.4	--	--	--	--
8	5 9	700	200.	200.	130.	0.147E+01	707.99	0.77	0.00383	1.8	--	--	--	--
9	9 10	150	400.	400.	130.	0.553E+04	20.82	4.12	0.01030	1.2	--	--	--	--
10	9 11	700	220.	220.	130.	0.162E+01	682.21	0.80	0.00362	1.5	--	--	--	--
11	11 12	300	180.	180.	130.	0.520E+02	115.51	1.49	0.00330	1.6	--	--	--	--
12	12 13	200	152.	152.	130.	0.499E+03	54.71	2.50	0.01511	1.7	--	--	--	--
13	13 14	150	140.	140.	130.	0.187E+04	13.54	1.17	0.00854	1.1	--	--	--	--
14	14 15	80	400.	400.	130.	0.114E+05	5.07	5.23	0.01558	1.0	--	--	--	--
15	15 15	100	140.	140.	130.	0.134E+05	10.75	3.04	0.02174	1.4	--	--	--	--
16	13 16	200	400.	400.	130.	0.131E+04	36.93	2.79	0.00694	1.1	--	--	--	--
17	15 18	100	320.	320.	130.	0.307E+05	12.14	3.70	0.00716	1.5	--	--	--	--
18	12 17	200	320.	320.	130.	0.105E+04	41.56	2.91	0.00709	1.2	--	--	--	--
19	17 18	80	552.	552.	130.	0.157E+06	8.00	8.00	0.01558	1.0	--	--	--	--
20	17 19	100	400.	400.	130.	0.392E+05	12.52	11.43	0.02792	1.0	--	--	--	--
21	17 20	100	592.	592.	130.	0.530E+05	5.80	2.00	0.00525	1.0	--	--	--	--
22	21 19	100	340.	340.	130.	0.329E+05	8.00	1.79	0.00520	1.0	--	--	--	--
23	22 20	80	340.	340.	130.	0.963E+05	4.25	3.59	0.01055	1.8	--	--	--	--
24	21 22	80	592.	592.	130.	0.157E+06	1.44	24.72	0.04477	1.1	--	--	--	--
25	25 21	150	572.	572.	130.	0.762E+04	19.02	4.91	0.00858	1.1	--	--	--	--
26	23 24	80	592.	592.	130.	0.157E+06	4.75	7.75	0.01440	1.0	--	--	--	--
27	11 25	700	340.	340.	130.	0.247E+01	577.10	0.55	0.00257	1.5	--	--	--	--
28	25 26	200	200.	200.	130.	0.557E+03	50.50	3.21	0.01505	1.4	--	--	--	--
29	26 27	150	100.	100.	130.	0.133E+04	21.79	1.21	0.01115	1.2	--	--	--	--
30	27 23	150	130.	130.	130.	0.173E+05	11.47	4.03	0.00647	1.5	--	--	--	--
31	25 29	150	164.	164.	130.	0.219E+04	22.05	1.37	0.01130	1.0	--	--	--	--
32	29 30	80	230.	230.	130.	0.797E+05	7.75	10.75	0.05304	1.0	--	--	--	--
33	29 34	80	424.	424.	130.	0.122E+06	5.00	4.57	0.01353	1.0	--	--	--	--
34	29 31	80	214.	214.	130.	0.309E+05	8.45	5.14	0.02194	1.0	--	--	--	--
35	32 27	80	214.	214.	130.	0.309E+05	8.45	4.57	0.02194	1.2	--	--	--	--
36	33 32	150	200.	200.	130.	0.267E+04	31.06	4.51	0.02253	1.4	--	--	--	--

37	36	37	100	104.	104.	100.	0.467E+05	3.77	7.15	0.004355	1.7	--	--	--	--
38	37	38	100	104.	104.	100.	0.115E+05	5.00	9.23	0.01558	1.0	--	--	--	--
39	38	39	100	104.	104.	100.	0.007E+01	31.00	1.72	0.03144	1.0	--	--	--	--
40	39	40	100	104.	104.	100.	0.723E+01	474.00	0.00	0.07592	1.7	--	--	--	--
41	40	41	100	104.	104.	100.	0.107E+05	15.00	7.07	0.04371	2.0	--	--	--	--

PIPE NO	FROM-NODE	TO-NODE	PIPE-LENGTH (M)	PIPE-LOSS		HEAD LOSS - USER		PIPE LOSS (L/S)	PIPE HEAD LOSS (M)	PIPE HEAD LOSS (M)	PIPE LOSS (M)	AVAILABLE PIPE TO EXISTING HEAD LOSS (M)			
				FRIC	TOTAL	USER	AVAILABLE					(1)	(2)	(3)	(4)
42	39	47	30	104.	104.	100.	0.467E+05	3.77	7.15	0.004355	1.7	--	--	--	--
43	39	37	30	104.	104.	100.	0.115E+05	5.00	9.23	0.01558	1.0	--	--	--	--
44	41	39	100	104.	104.	100.	0.257E+05	33.52	6.51	0.02755	2.0	--	--	--	--
45	39	29	100	104.	104.	100.	0.945E+01	418.00	0.00	0.00316	1.0	--	--	--	--
46	37	25	100	104.	104.	100.	0.240E+04	28.77	3.30	0.01967	1.0	--	--	--	--
47	39	43	100	104.	104.	100.	0.333E+01	40.00	7.75	0.00290	1.5	--	--	--	--

II. COMPUTED PRESSURE DIFFERENCE AT NODES

NODE NO	NODAL HEAD (L/S)	PIEZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELT-H (M)
1	763.00	47.33	2.50	45.00	45.	0.00
2	0.00	42.33	2.50	45.00	40.	4.57
3	-24.38	41.37	2.50	45.00	39.	3.00
4	0.00	42.33	2.50	45.00	40.	5.34
5	-10.01	40.74	2.50	45.00	34.	6.76
6	-11.93	37.17	2.50	45.00	25.	10.33
7	-3.52	27.37	2.50	45.00	25.	14.53
8	-7.27	36.39	2.50	45.00	34.	11.50
9	0.00	41.44	2.50	45.00	39.	5.01
10	-20.83	37.37	2.50	45.00	35.	13.13
11	0.00	40.69	2.50	45.00	38.	6.21
12	-18.72	39.23	2.50	45.00	37.	8.20
13	0.00	35.33	2.50	45.00	24.	10.60
14	-13.03	35.74	2.50	45.00	33.	11.76
15	-15.70	31.07	2.50	45.00	29.	16.43
16	-13.19	34.21	2.50	45.00	32.	13.29
17	-24.26	35.29	2.50	45.00	34.	11.21
18	-17.14	25.41	2.50	45.00	23.	22.09
19	-12.32	24.33	2.50	45.00	22.	22.60
20	-9.05	21.99	2.50	45.00	19.	25.51
21	-5.03	26.35	2.50	45.00	24.	21.14
22	-4.79	25.53	2.50	45.00	23.	21.92
23	-5.38	31.27	2.50	45.00	29.	16.23
24	-4.79	21.32	2.50	45.00	21.	24.18
25	0.00	39.33	2.50	45.00	37.	7.67
26	-5.21	36.02	2.50	45.00	34.	10.30
27	-13.32	35.31	2.50	45.00	33.	11.99
28	-11.47	31.23	2.50	45.00	29.	16.40
29	-7.30	34.75	2.50	45.00	32.	12.75
30	-9.75	19.72	2.50	45.00	17.	27.78
31	-12.45	31.23	2.50	45.00	25.	15.22
32	-6.76	33.43	2.50	45.00	31.	14.10
33	-4.36	37.91	2.50	45.00	35.	9.59
34	-14.10	27.32	2.50	45.00	25.	19.90
35	-10.40	33.33	2.50	45.00	33.	12.17

35	-20.07	22.92	2.50	45.00	29.	17.42
36	-21.11	33.33	2.50	45.00	29.	17.42
37	-13.72	22.92	2.50	45.00	29.	17.42
38	0.00	33.33	2.50	45.00	33.	18.01
39	0.00	33.33	2.50	45.00	32.	18.87
40	-410.07	33.37	2.50	45.00	31.	13.63

III. ADDITIONAL INFORMATION :

11. 1 PUMP SUPPLY HEAD NODE : 1. PUMPING HEAD : 45.00 M  
CAPACITY : 765.00 L/S
21. COST OF PIPE LINE : B. 0.272452E+09
31. COST OF PUMPING STATION : B. 0.160615E+08
41. TOTAL COST OF THE SYSTEM : B. 0.433063E+08
51. THE WEIGHTED MEAN VELOCITY : 1.7 M/S
61. THE AVERAGE PRESSURE SURFACE : 31. 4-45 M
71. PIPE LINES WITH THE DIAMETER IN SERIES : 0.0000 M TOTAL LENGTH
81. COST OF SYSTEM PER L/S OF SUPPLY : B. 0.565106E+06

\*\*\*\*\* GOOD LUCK & THANKS... \*\*\*\*\*



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

ENTRY ADDRESS 33

TOTAL LENGTH 49338

NETWORK : BANG-PIEE  
 METHOD : LINEAR PROGRAMING MODEL  
 COMPONENT : 1 PUMPING STATION AT POINT 1  
 DETAIL : 8 LOOP , 47 PIPES , 43 NODES.  
 14 CRITICAL NODES.  
 SLOPE BY : HAZEN WILLIAMS  
 P-MIN : 15 M ABOVE GROUND LEVEL  
 SOURCE DATA : -  
 CONDITION : FLAT

1. COMPUTED PIPE LINES :

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH		ROUGHNES - COEF		PIPE FLOW (L/S)	PIPE HEADLOSS		PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING			
			SERIES	TOTAL (M)	C/RK	K-VALUE		(M)	(M/M)		PIPE1 LENGTH1 (MM)	PIPE2 LENGTH2 (MM)	(M)	(L)
1	1 2	700	1020.	1020.	130.	0.750E+01	765.00	4.57	0.00448	2.0	--	--	--	--
2	2 4	700	160.	160.	130.	0.118E+01	740.72	0.63	0.00422	1.9	--	--	--	--
3	2 3	150	100.	100.	130.	0.135E+04	24.26	1.36	0.01362	1.4	--	--	--	--
4	4 5	200	200.	200.	130.	0.557E+03	37.73	1.52	0.00759	1.2	--	--	--	--
5	5 6	150	360.	360.	130.	0.480E+04	20.45	3.57	0.00991	1.2	--	--	--	--
6	5 7	30	220.	220.	130.	0.526E+05	8.52	9.20	0.06182	1.7	--	--	--	--
7	5 8	80	152.	152.	130.	0.433E+05	7.27	4.74	0.03117	1.4	--	--	--	--
8	4 9	700	200.	200.	130.	0.147E+01	702.99	0.77	0.00363	1.8	--	--	--	--
9	9 10	150	400.	400.	130.	0.533E+04	20.88	4.12	0.01030	1.2	--	--	--	--
10	9 11	700	220.	220.	130.	0.162E+01	632.11	0.30	0.00362	1.9	--	--	--	--
11	11 12	300	180.	180.	130.	0.820E+02	115.01	1.49	0.00830	1.6	--	--	--	--
12	12 13	200	152.	152.	130.	0.499E+03	54.71	2.30	0.01511	1.7	--	--	--	--
13	13 14	150	140.	140.	130.	0.167E+04	13.63	1.17	0.00834	1.1	--	--	--	--
14	14 15	80	400.	400.	130.	0.114E+06	5.00	6.23	0.01556	1.3	--	--	--	--
15	16 15	100	140.	140.	130.	0.134E+05	10.76	3.04	0.02174	1.4	--	--	--	--
16	13 16	200	400.	400.	130.	0.131E+04	36.08	2.79	0.00669	1.1	--	--	--	--
17	15 18	100	320.	320.	130.	0.307E+05	12.14	8.70	0.02716	1.5	--	--	--	--
18	12 17	200	320.	320.	130.	0.135E+04	41.58	2.01	0.00409	1.7	--	--	--	--
19	17 19	80	552.	552.	130.	0.157E+06	5.00	8.40	0.01556	1.0	--	--	--	--
20	17 19	100	400.	400.	130.	0.397E+05	12.12	11.47	0.02773	1.8	--	--	--	--
21	19 20	100	552.	552.	130.	0.390E+05	5.00	7.90	0.00526	1.4	--	--	--	--
22	21 19	100	340.	340.	130.	0.326E+05	5.00	1.79	0.00526	0.4	--	--	--	--
23	22 20	80	340.	340.	130.	0.906E+05	4.05	2.59	0.01055	1.5	--	--	--	--
24	21 22	80	552.	552.	130.	0.157E+06	5.00	8.40	0.01556	1.0	--	--	--	--
25	21 21	100	572.	572.	130.	0.700E+04	18.92	4.91	0.00858	1.1	--	--	--	--
26	23 24	80	552.	552.	130.	0.157E+06	4.79	7.95	0.01556	1.0	--	--	--	--
27	11 25	700	330.	330.	130.	0.247E+01	557.10	0.16	0.00257	1.5	--	--	--	--
28	25 26	200	200.	200.	130.	0.557E+03	51.50	2.21	0.01556	1.9	--	--	--	--
29	25 27	150	100.	100.	130.	0.135E+04	21.74	1.31	0.01115	1.2	--	--	--	--
30	27 28	100	150.	150.	130.	0.170E+05	11.47	4.40	0.02447	1.5	--	--	--	--
31	26 29	100	160.	160.	130.	0.214E+04	22.05	1.37	0.01135	1.7	--	--	--	--
32	29 30	80	230.	230.	130.	0.797E+05	9.75	15.33	0.05368	1.0	--	--	--	--
33	29 34	30	428.	428.	130.	0.122E+06	5.00	6.07	0.01556	1.0	--	--	--	--
34	26 31	80	210.	210.	130.	0.307E+05	6.45	5.14	0.02497	1.3	--	--	--	--
35	32 31	30	214.	214.	130.	0.307E+05	6.00	4.57	0.02164	1.2	--	--	--	--



36	33	32	150	200.	200.	130.	0.267E+04	31.86	4.51	0.02253	1.8	--	--	--	--
37	32	34	100	164.	164.	130.	0.157E+05	14.10	5.58	0.03586	1.8	--	--	--	--
38	32	35	80	416.	416.	130.	0.118E+06	5.00	6.48	0.01558	1.0	--	--	--	--
39	25	33	500	428.	428.	130.	0.607E+01	510.60	1.92	0.00449	1.9	--	--	--	--
40	33	33	600	592.	592.	130.	0.325E+01	474.38	2.32	0.03392	1.7	--	--	--	--
41	36	35	100	176.	176.	130.	0.169E+05	15.69	7.59	0.04371	2.0	--	--	--	--

PIPE NO	NODE FROM-TO	PIPE SIZE (MM)	PIPE-LENGTH SERIES (M)	PIPE-LENGTH TOTAL (M)	ROUGHNESS - COEF C/RS	ROUGHNESS - COEF K-VALUE	PIPE FLOW (L/S)	PIPES HEADLOSS (M)	PIPES HEADLOSS (M/M)	PIPE VEL. (M/S)	PARALLEL PIPE TO EXISTING PIPE1 LENGTH1 (M)	PARALLEL PIPE TO EXISTING PIPE2 LENGTH2 (M)	PARALLEL PIPE TO EXISTING PIPE3 LENGTH3 (M)	PARALLEL PIPE TO EXISTING PIPE4 LENGTH4 (M)	
42	35	37	80	164.	164.	130.	0.467E+05	8.72	7.15	0.04366	1.7	--	--	--	--
43	34	37	30	592.	592.	130.	0.169E+06	5.00	5.23	0.01558	1.0	--	--	--	--
44	38	36	150	200.	200.	130.	0.267E+04	35.52	5.51	0.02755	2.0	--	--	--	--
45	33	39	600	234.	234.	130.	0.443E+01	438.86	0.75	0.00339	1.8	--	--	--	--
46	37	23	150	180.	180.	130.	0.240E+04	28.79	3.35	0.01367	1.5	--	--	--	--
47	39	40	600	252.	252.	130.	0.393E+01	410.07	0.75	0.00299	1.5	--	--	--	--

II. COMPUTED PRESSURE SURFACE AT NODES

NODE NO	NODAL FLOW (L/S)	PIE ZOMETRIC HEAD (M)	GROUND ELEV. (M-ASL)	STATIC HEAD (M)	DYNAMIC HEAD (M)	DELTA-H (M)
1	765.00	52.50	2.50	50.00	53.	3.50
2	0.00	47.93	2.50	50.00	45.	4.57
3	-24.28	45.57	2.50	50.00	44.	5.00
4	0.00	47.25	2.50	50.00	45.	5.24
5	-10.01	45.74	2.50	50.00	43.	6.76
6	-11.93	42.17	2.50	50.00	40.	11.20
7	-8.52	32.77	2.50	50.00	30.	19.50
9	-7.27	41.00	2.50	50.00	39.	11.50
9	0.00	46.49	2.50	50.00	44.	5.00
10	-20.33	42.37	2.50	50.00	40.	10.10
11	0.00	45.80	2.50	50.00	43.	6.00
12	-19.72	44.20	2.50	50.00	42.	5.50
13	0.00	41.70	2.50	50.00	39.	10.80
14	-13.53	40.74	2.50	50.00	38.	11.76
15	-15.76	35.37	2.50	50.00	34.	15.40
16	-13.13	39.11	2.50	50.00	37.	13.26
17	-24.25	41.29	2.50	50.00	39.	11.21
18	-17.14	30.11	2.50	50.00	23.	27.06
19	-12.52	29.00	2.50	50.00	27.	27.00
20	-9.05	26.19	2.50	50.00	24.	25.01
21	-5.03	31.36	2.50	50.00	25.	21.14
22	-4.79	20.91	2.50	50.00	23.	21.00
23	-5.05	25.77	2.50	50.00	34.	16.23
24	-4.77	23.37	2.50	50.00	26.	24.77
25	0.00	44.32	2.50	50.00	42.	7.67
26	-6.21	41.32	2.50	50.00	39.	10.60
27	-10.32	40.41	2.50	50.00	38.	11.50
28	-11.07	35.10	2.50	50.00	35.	14.60
29	-7.30	39.75	2.50	50.00	37.	12.70
30	-9.75	24.72	2.50	50.00	22.	27.71
31	-12.45	25.23	2.50	50.00	34.	15.20
32	-6.76	30.40	2.50	50.00	35.	14.10
33	-4.35	42.91	2.50	50.00	40.	7.50

34	-14.10	32.52	2.50	50.00	34.	19.58
35	-20.65	27.33	2.50	50.00	25.	25.11
36	-11.11	35.38	2.50	50.00	33.	17.42
37	-13.72	27.92	2.50	50.00	25.	24.58
38	0.00	40.59	2.50	50.00	38.	11.91
39	0.00	39.53	2.50	50.00	37.	12.07
40	-410.07	38.37	2.50	50.00	36.	13.63

III. ADDITIONAL INFORMATION :

- 1). 1 PUMP SUPPLY FROM NODE : 1. PUMPING HEAD : 50.00 M  
CAPACITY : 765.00 L/S
- 2). COST OF PIPE LINE : 8. 0.272452E+08
- 3). COST OF PUMPING STATION : 3. 0.178461E+06
- 4). TOTAL COST OF THE SYSTEM : 3. 0.450914E+08
- 5). THE WEIGHTED MEAN VELOCITY : 1.7 M/S
- 6). THE AVERAGE PRESSURE SURFACE : 50. 4-431
- 7). PIPE LINES WITH THE DIAMETER IN SERIES : 0.0000 & TOTAL LENGTH
- 8). COST OF SYSTEM PER L/S OF SUPPLY : 3. 0.58943E+05
- 9). NUMBER ITERATION OF THIS PROGRAM : 32 ITRS

\*\*\*\*\* GOOD LUCK & THANKS.... \*\*\*\*\*

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## ประวัติผู้เขียน

นายประเชิด บุญเขียว เกิดเมื่อวันที่ 6 กุมภาพันธ์ พ.ศ. 2499  
ที่อำเภอเมือง จังหวัดนนทบุรี ได้รับปริญญาอุตสาหกรรมศาสตรบัณฑิตจากคณะวิศวกรรมศาสตร์  
สถาบันเทคโนโลยีพระจอมเกล้า พระนครเหนือ เมื่อปีการศึกษา 2522

ปัจจุบันทำงานอยู่ที่การประปานครหลวง ตำแหน่ง นายช่าง 1 กองมาตรฐานวิศวกรรม



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย