Table of Contents

List of figures

Pages

Chapter I

1.0 INTRODUCTION

1.1 PipeLineDesign:Design and Drawing Package for Rural Water Supply

This software is designed for Design and Drawing of gravity flow Rural Water Supply Schemes. PipeLineDesign has been entirely developed by SOFTWEL (P) Ltd. The software can design and draw Pipeline Profile for Rural Water Supply Schemes and generate the schematic diagram in AutoCAD (AutoCAD (2000-2006 versions)).

PipeLineDesign runs in Windows platform. The main executive module is written in Visual Basic for Applications. The program has a spreadsheet developed in MS-Excel for the calculation of Water Demand, fixing of Reservoir size and for the design of Pipeline. Once the design is complete, you may draw the Pipeline profile at any scale specified by the user. The program reads the design data from the selected data range in the Design Sheet in Excel and draws Profile showing Ground Level, HGL and SPL in AutoCAD. The program also puts Block for all the commonly used structures at all the required places and draws the profile with proper sheet planning. This program can also generate the schematic diagram with proper labeling for the design discharge, length of pipe, diameter and type of pipe used. The drawing output from PipeLineDesign is just about ready to print.

This software has been specially customized according to the requirement of the CBWSSP.

1.2 Steps for Installation of program:

1. Insert the setup CD into the CD drive.
2. Open the setup folder.
3. Run the Setup.exe. This command will initialize the setup form shown as below.

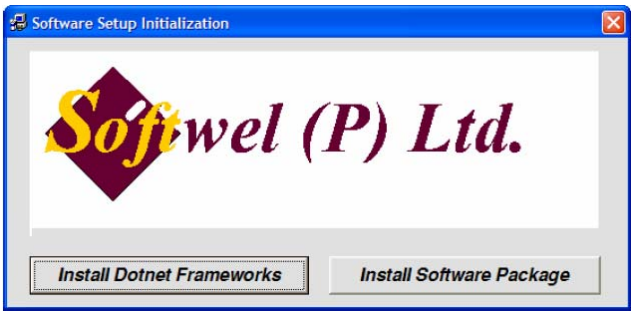

Figure 1

4. Click the button named "Install Dotnet Frameworks". This command will execute the installation of dotnet framework required for the proper working of the application file. Follow the instruction given by the dotnet framework installer and wait for the completion of the framework installation (It may take 10 to 20 minutes to complete the task). Note that, if Dotnet framework already exists in your computer, this command will show the form containing options for repair or uninstall. In that case you can skip this command and go straight for the application installations (step 5).
5. Now click the button named "Install Software Package". This command will bring the setup form for the CBWSS application. Follow all the steps that is required by the setup process.

Notes: If you face any problem during the setup process and running the applications, then please contact us without any hesitations. We all will be eagerly waiting to co-operate you in whatever way we can do. Before you install the application, confirm that you have following facilities on your personal computer.

System Requirements:
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1. Above Pentium III processor.
2. Operating System must be Windows XP with Service Pack 2.
3. At least 256 MB RAM is recommended.

Helping software requirements:

1. Microsoft Excel (Any version above 2000)
2. AutoCAD (Any version above 2000)

Chapter III

2.0 INSIDE PIPELINEDESIGN

2.1 Files related with Pipeline Design

The following files are associated with this program:

1. ***PipeLineDesign.exe****: Main executive module for Water Supply Package*
2. ***Pipe_Design_Sample.xls****: Sample Excel File for Design of Pipeline*
3. ***Pipe-des-blank.dwg****: Template Drawing File*

Note:

All these files are supplied as "Read Only" so that the format is protected. All these files should always be in the same directory.

2.2 Brief description about Data File

The spreadsheet **Pipe_Design_Sample.xls** has been developed for easy calculation of water demand, fixing of reservoir size and design of pipeline from the Survey Data. The spreadsheet **Pipe_Design_Sample.xls** contains all the sheets necessary for pipe line design. These sheets are linked with each other and most of the Cells in most of these Sheets contain formulae so,

- ***Do not ever insert Column before the end of Column with DATA.***
- ***Do not ever move the cells.***
- ***Do not overwrite the cell with the formula.***
- ***Neither delete nor rename the sheets provided.***

a. SOFTWEL

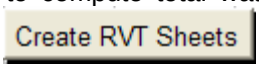
This Sheet is for Introduction. You may also use this sheet to put your Project Name and other information regarding the project.

b. Input_Data

This Sheet is used for data input which include population growth rate, design periods etc. Name of source can also be entered along with the source name. This will be used for generation of scheme layout.

c. Water_Demand

This Sheet is used for calculating the water demand for each tap stands depending upon the number of population to be served, other institutional and livestock demands. This also determines the total discharge required to be tapped from each source. This sheet is linked with the Input data for population growth rate, unit rate of consumption and design period. User can modify this sheet as per requirement for multiple RVTs etc. Different water demand

tables are introduced into this sheet to compute total water demand for multiple reservoir tanks. We can use the button named 

to produce number of RVT sizing sheets, according to the number of water demand table defined in the water_demand sheet.

d. RVT_Size_Calculation

This Sheet is for design of the RVT or fixing of the RVT size. You may choose intermittent supply system or the continuous supply system as the case may be and Fix the required Size of the RVT. User have to supply the total daily demand and intended abstraction from the source. The sheet is not linked to any other sheets. User can copy the sheet for multiple reservoir schemes and rename the sheets as per requirements.

e. PD-CW_Sample

This Sheet is for the design of Pipeline using **Colebrook-White** method. All the data from the survey such as distance and RL need to be entered here.

The shortcut name for the structure used in the water supply scheme should either begin with or matched with any of first letter listed below.

Beginning letters for the short cut name for the structures.

"IN"	-	Intake
"CC"	-	Collection Chamber
"IC"	-	Interruption Chamber
"ST"	-	Sedimentation Tank
"DT"	-	Distribution Tank
"BP"	-	Break Pressure Tank
"RVT" or "RT"	-	Reservoir Tank
"J"	-	Junction
"T"	-	Public Tap Stand

User can specify taps as "T1" "T2" etc and junctions as "J1", "J2" etc

Then, enter the discharge for each pipe segment depending upon your transmission network. Choose appropriate Pipe for the design discharge and run the Macro "***CTRL+e***" at column "U" to find the actual friction factor and the head loss and go through the bottom of the branch in the same way checking the velocity and the residual head. The design is a hit and trial process you should continue the process changing the pipe size until you are satisfied with the design. The whole design steps are linked so naming convention should be strictly followed in order to provide correct designs. E.g. Name of Junctions should be totally matched.

f. Pipe_Estimate

This Sheet is for calculating the total length of pipe required for the project. The total length of HDPE is calculated looking the length of individual pipe segment from the pipe design sheet and then similarly total length of the GI pipe is calculated, so that the sum of two gives the aggregate length of the pipe required in the project as shown below.

HDP Pipe Length	3,920.00
GI Pipe Length	111.00
Total	4,031.00

g. GroundProfile

For the correct design of the pipe line profile, we should be able to draw the existing ground only. So we can visualize the ground conditions according to which we can decide where to provide important structure along the pipe line profile. To draw the existing ground profile along the pipe line, we enter all the data required to draw the existing ground profile in this sheet as shown in the table below.

SN	PipeLength	RL	Branch Point(1/0)
Intake to Reservoir			
INT	0	1700	1
1	30	1698.343	
2	23	1697.34	
3	21	1696.912	
4	21	1694.899	
5	30	1694.114	
6	30	1693.939	

Figure 2

If we enter all the ground profile data into the "PD-CW-Sample" sheet, it may be over crowded and we get all of pages related with the pipe line design data.

h. AbneySurvey

This is the sheet provided for the processing of the data collected by Abney Level survey method. Enter all the data required for the RL calculation.

Station	Distance	Cumulative	Angle						Average	Rise/Fall	RL	Remarks	Reference
			ForeSight			BackSight							
Name	(m)	Distance(m)	Degree	Minute	Second	Degree	Minute	Second	Angle		(m)		RL
Intake to Reservoir													
INT												Basakhola Stream[Q=1.2L/s)	1700
1	30		-3	10	0							Rocky area	
2	23		-2	-30	0							" " SS'	
3	21		-1	10	0							B.M. soil	

Figure 3

i. LevelSurvey

This is the sheet provided for the processing of the data collected by Level survey method. Enter all the data required for the RL calculation.

Station	Distance	Cumulative	Staff Reading			Level difference		RL	Remarks	Reference
Name	(m)	Distance(m)	B.S.	I.S.	F.S.	Rise	Fall	(m)		RL
Intake to Reservoir										
IN	0		1.215						Dumpekyu source[Q=2.00 L/s)	2870
1	50		0.085		3.912					
2	237		2.015		4.225				Cable crossing- 50 m span	
3	148		0.500		0.200				B.M. soil	

Figure 4

j. Other sheets

You are free to add extra sheets as required per your design.

2.3 Running PipeLineDesign.exe

1. Run PipeLineDesign.exe application by using command as below.
   Start menu →
   Program Files→
   Softwel→
   PipeLineDesign.exe

   Above command pop up the form shown below.

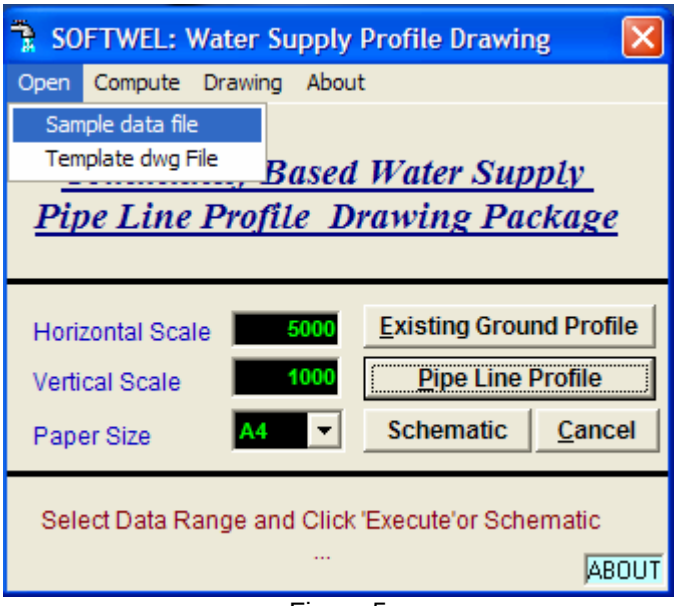


Figure 5

2.4 Computation:

Use open command as shown in the above figure, to open the sample data file that contains all the sheets required for the pipe line design. Make this file as own file with proper name by using "Save As" command of the Excel application.

2.4.1 Water Demand Calculation:

Open the sheet named "Water Demand" and enter the data required as in the table shown below. If you want to compute for multiple RVT, you should have to enter data in separate table as shown in the sample file.

Description of Tap		Domestic Water Demand					Institutional Water Demand		
Tap No	Cluster Name or Locality	Nos of HH	Present Population (P)	Base Population (Po)	Design Population (Pn)	Total Domestic Demand	No. of Pupil in School	Other Institutional Demand	Total Institutional Demand
		(Nos)	(Nos)	P(1+r)^n1	P(I+r)^(n1+n)	(lpd)	(Nos)	(lpd)	(lpd)
[1]	[2]	[3]	[4]	[5]	[6]	[8]=[6]*[7]	[9]	[10]	[11]=[9]*10+[10]
	For RVT1								
1	cluster1	8	48	49	60	2,366			
2	cluster 2	7	42	43	52	2,070			
3	cluster3	9	63	64	78	3,106			
4	cluster 4	6	36	37	45	1,775			
5	cluster 5	7	5	6	7	246			
6							10		60

Figure 6

To compute the water demands use the command as shown below.

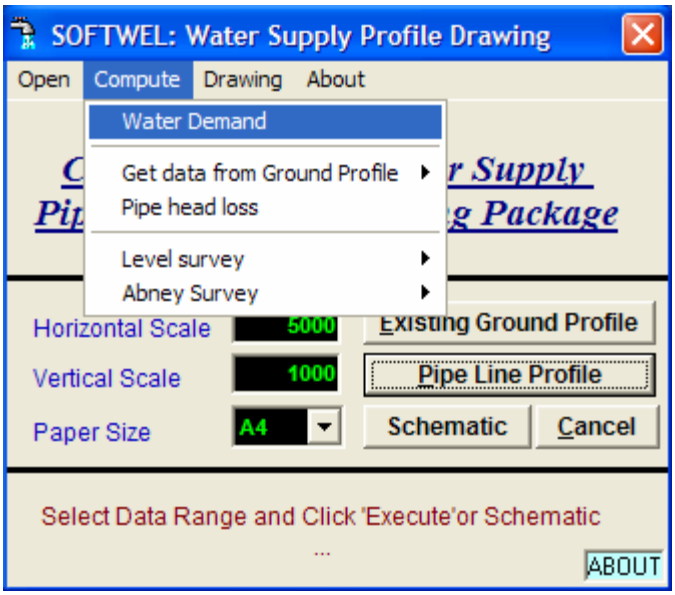


Figure 7

This command will execute the necessary computation for the total water demands for the cluster defined and it writes the output in the same file. This command executes well also for multiple water demand tables.

2.4.2 Get Ground Profile Data:

Survey can be done in different way to get longitudinal section of the ground along the pipe line alignment. Normally we get survey data either by Level survey or by Abney level survey. So, there are two computation options to get ground profile.

2.4.2.1 Level Survey:

Input data as required in the sheet named "LevelSurvey" and use the command as shown below. If you know starting RL for a branch, enter the RL value in the first row of the branch in the column titled "Reference RL".

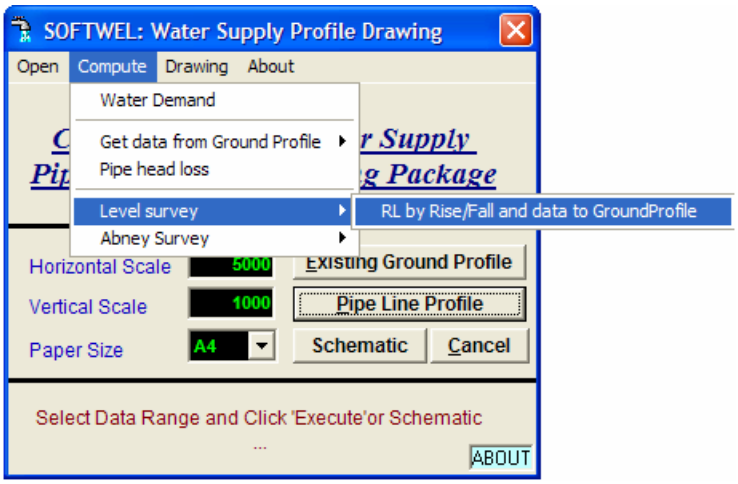


Figure 8

2.4.2.2 Abney Survey:

Input data as required in the sheet named "AbneySurvey" and use the command as shown below. If you know starting RL for a branch, enter the RL value in the first row of the branch in the column titled "Reference RL".

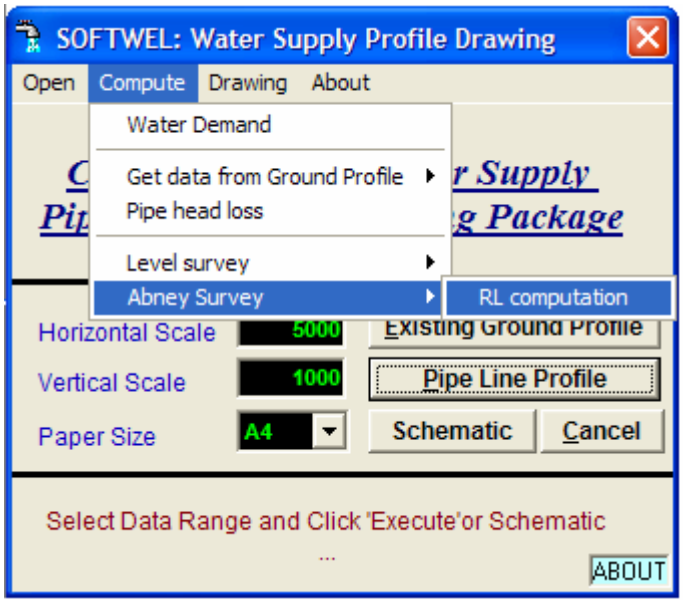


Figure 9

Any one of the above command computes and transfers the ground profile data for each branch to the ground profile data in the sheet named "GroundProfile". And ultimately we can transfer the necessary information like actual pipe length and branch control points to the design sheet named "PD-CW-Sample" for the pipe line profile design.

2.4.3 Compute Pipe Length:

There are three options to get pipe length for design sheet.

1. If you have computed actual pipe length for each segment in the branch, you can enter directly in the pipe line design sheet as in figure 12.
2. If you have done computation for the ground profile, you can enter the ground profile for all the branches in the sheet named "GroundProfile" as in the required columns. But before using the command to compute, you have to fill the table below. Put 1 for the branch control point and leave empty for intermediate points. Then you can use the command given below to transfer the branch control points for the segments in the branch and the length of the segments.

SN	Pipe Length	RL	Branch Point(1/0)
Intake to Reservoir			
INT	0	1700	1
1	30	1698.343	
2	23	1697.34	
3	21	1696.912	
4	21	1694.899	
5	30	1694.114	1

Figure 10

3. If you have survey data either in the level survey format or abney level survey format, you have to process the data first and compute using proper option to get the ground profile data as in the second condition. Then mark the control points for the branches and use the command as shown below.

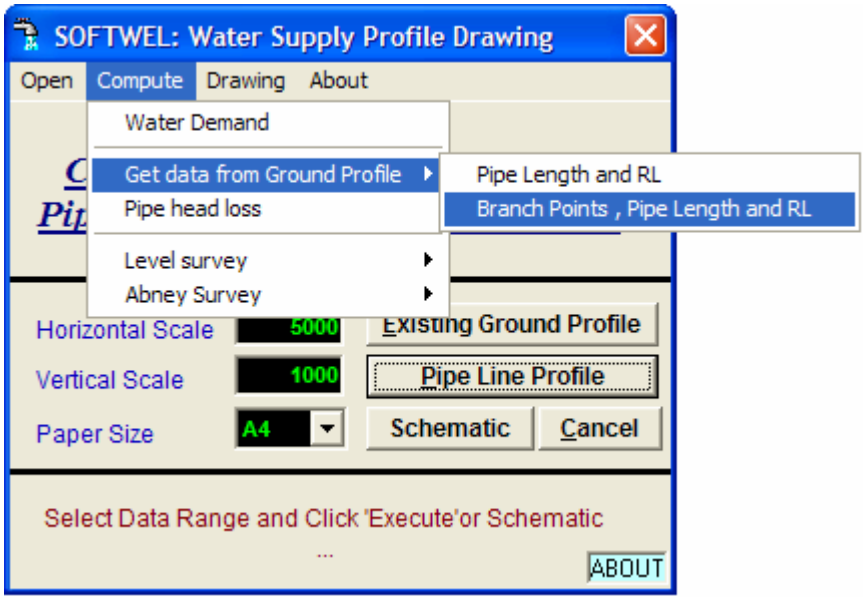


Figure 11

2.4.4 Compute Pipe head loss:

Before computing the head loss in the each pipe, you have to check all the data for its correctness and then use command "Compute→Pipe head loss".

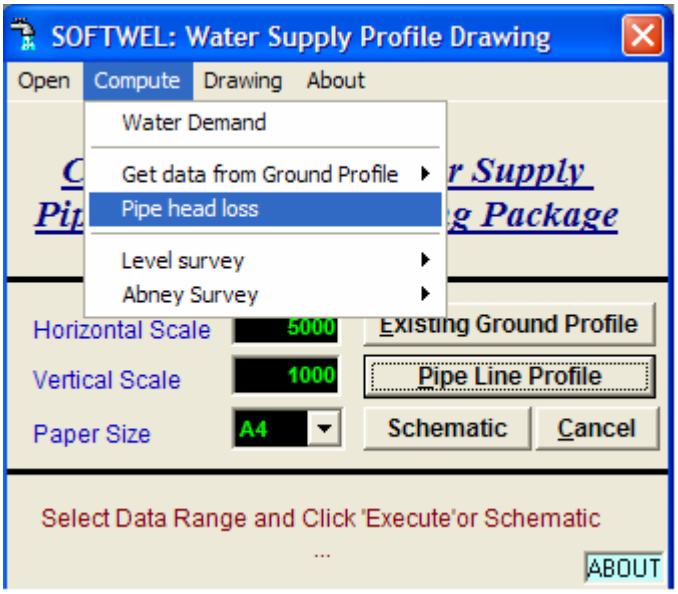


Figure 12

This command uses Colebrook and White's equation to compute friction factor and Darcy Weisbach's equation to get the head loss for each pipe segment.

2.5 Instruction for drawing Ground Profile:

Once you have correct data in the "GroundProfile" sheet, you can draw the existing ground profile for each branch. Use the command "Existing Ground Profile" button. This command will pop up the following form as shown below.

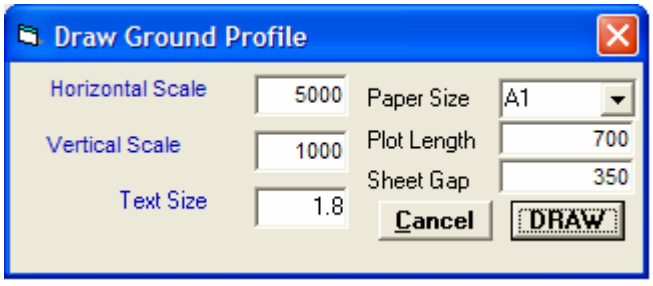


Figure 13

In the form, you can enter the scale for the drawing and define the sheet size, plot length. To avoid the overlapping between the sheets, give proper value for sheet gap. Then click "Draw" button to draw the existing ground profile for each branch to the AutoCAD application. Give a reference point to start drawing in the AutoCAD application.

2.6 Step by Step Instruction for design drawing

1. Now open AutoCAD application by using command Open->Template dwg file as shown in the above figure.

2. If necessary, enter the branch data as shown below in the data sheet. Assure that all the data entered are correct. Assure that the entire short cut name used for the structures in the scheme should be either matched or begin with any of reserved key words listed in page 6.

Branch table sample

	Reservoir to J1							
1	RVT	P20	40	44	1.00	D	983.00	981.00
3	P21	P22	50	55	1.00	D	981.00	975.00
4	P22	P23	60	66	1.00	D	975.00	969.00
5	P23	P24	55	61	1.00	D	969.00	965.00
6	P24	P25	65	72	1.00	D	965.00	961.00
7	P25	P26	85	94	1.00	D	961.00	959.00
8	P26	J1	15	17	1.00	D	959.00	954.00

Figure 14

2.6.1 Draw pipe line design profile drawing

For Pipeline Profile drawing, you should enter all the data in the cell with blue colored text except for the direction, and then select the first column and the required no of rows starting from the Branch Title as shown in figure above. The Program is supplied with options for the Horizontal Scale Vertical Scale and Paper Size, Enter a scale you want and appropriate Paper Size then click on "***Execute***". This will read the selected data and starts plotting the Profile. Then, save the drawing with "*SAVE AS*" to the appropriate file name in your working directory. You can generate the drawing in this way as long as you are not satisfied with your design and output correcting your design data.

The final profile output on the AutoCAD screen will look like:

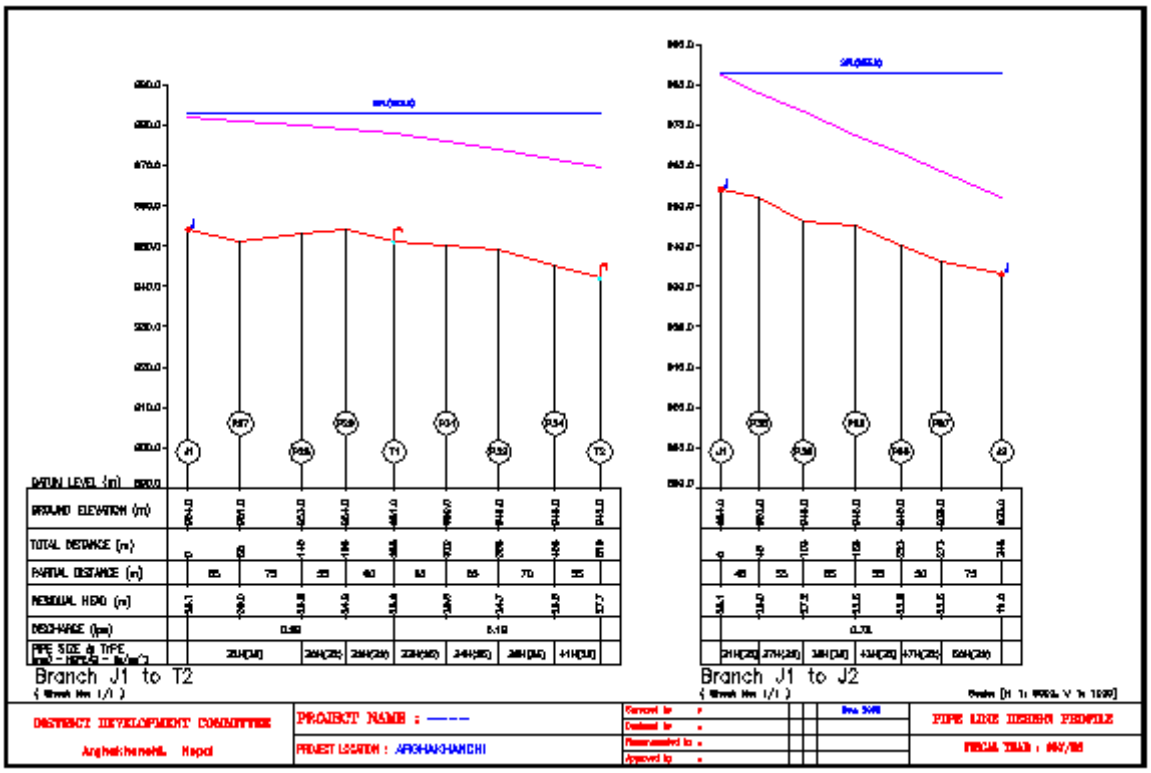


Figure 15

2.6.2 Generating Schematic Diagram

Once the design is complete, you can draw the Schematic Diagram by entering the direction in the form of "L", "R", "U" & "D" as the case is. Select the data range as in the earlier case and click on "***Schematic***". You will now get your schematic drawing of pipe layout with structures in their approximate positions with the proper labeling for the design discharge in the branch and the length, diameter and type of pipe used in the design making no mistake. This Schematic diagram is drawn in AutoCAD and is ready to print. The schematic diagram will also provide the reduced level data for the individual structures. A Schematic drawing will looks as shown below.

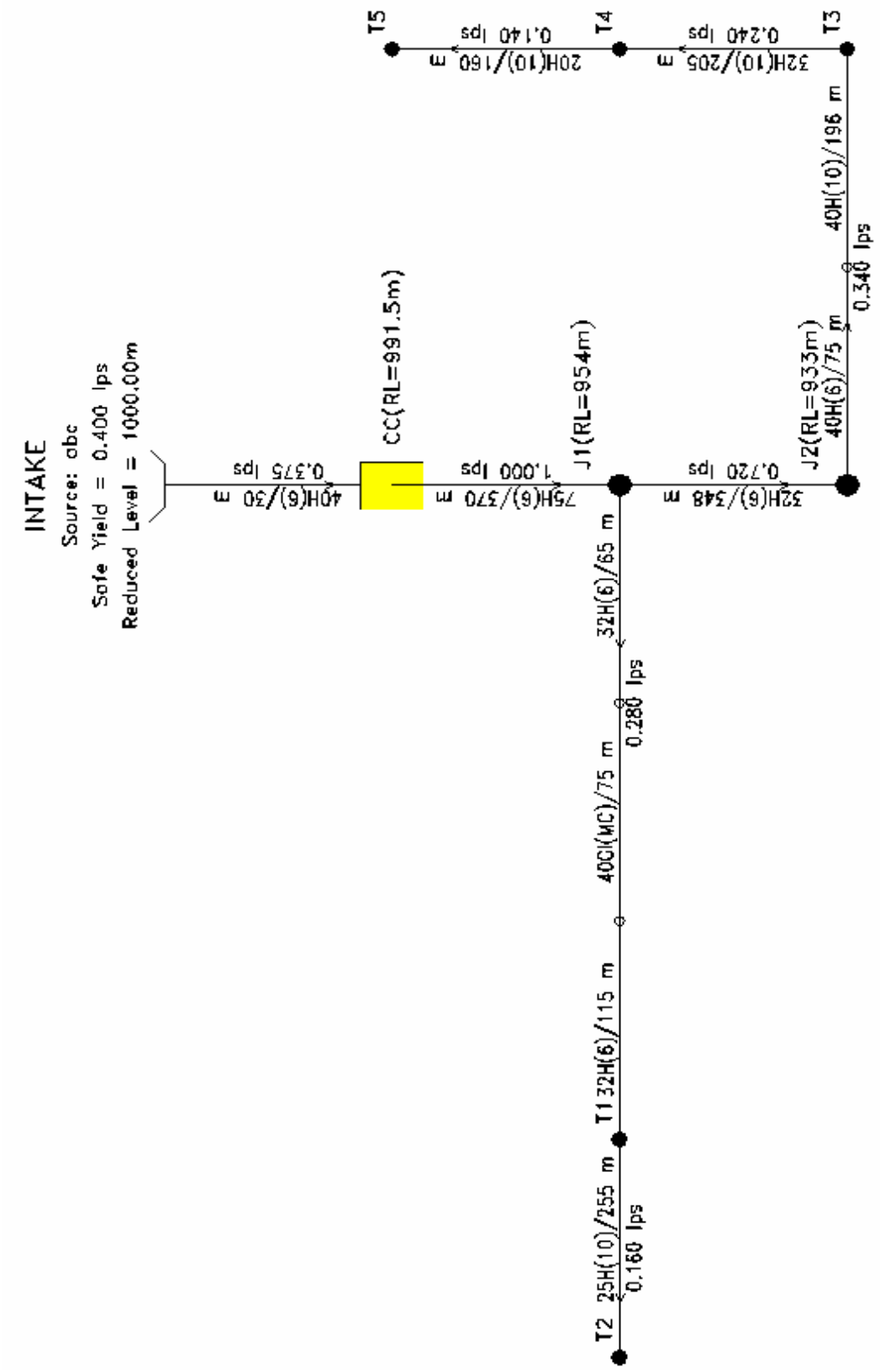

INTAKE
Source: obc
Safe Yield = 0.400 lps
Reduced Level = 1000.00m
40H(6)/30 m
0.375 lps
CC(RL=991.5m)
75H(6)/370 m
1.000 lps
J1(RL=954m)
32H(6)/348 m
0.720 lps
J2(RL=933m)
40H(6)/75 m
0.340 lps
40H(10)/196 m
32H(10)/205 m
0.240 lps
T3
20H(10)/160 m
0.140 lps
T4
T5
32H(6)/65 m
0.280 lps
40CI(MC)/75 m
T1 32H(6)/115 m
25H(10)/255 m
0.160 lps
T2

Figure 16

Chapter IV

3.0 TROUBLESHOOTING

3.1 Problem with Macros

The previous version uses "solver" for solving the pipe flow equation. Present version has standalone solving arrangement so the problem associated with the "solver" add-in is eliminated.

3.2 Formula in Worksheets

The formula in worksheet may get corrupted from moving the cells and copying, over writing it or wrongly dragging it. In such cases the results will be wrong and will have very serious impact in designs. It will be difficult to correct the formulas as these are linked at many places. In such circumstances, use the originally supplied "pipe_design_sample" sheet and copy the formula from the first row from it. In case the "pipe_design_sample.xls" also has been corrupted, re-copy this sheet from the setup CD.

3.3 AutoCAD Not Responding

This happens when the drawing of profile or schematic is carried out while there is active command in AutoCAD. Always make sure that the command prompt in the AutoCAD is empty while preparing drawings.

3.4 Missing Object in AutoCAD

While preparing drawing, the "pipe_design_blank.dwg" should be used as template i.e this drawing should be opened first. If other than this drawing is used for drawing works, the program will halt giving the "object not found message".

3.5 Error with Old Design Sheet

Old "pipe_design_sample" file for the design work will not function with this version of water supply as in older version there is no column specified for the direction of the pipe line schematic diagram.

Older version design file does not contains sheets named "**GroundProfile**", "**AbneySurvey**" and "**LevelSurvey**". So Level data computation and existing ground profile drawing is not possible in the old design file.