OFWMP IN PAKISTAN
WATER COURSE DESIGN PROGRAM
OPERATING MANUAL

BY W.MARVIN REDDITT

ON FARM WATER MANAGEMENT - PAKISTAN

WATERCOURSE DESIGN MANUAL

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OFWM WATERCOURSE DESIGN MANUAL

Errata Sheet

I. QUANTITY & TITLES OF PROGRAM DISKS REVISED

The WC Design Program now contains 4 diskettes labeled:

1. **SYSTEM DISKETTE**
2. **OPERATING DISK #1 FOR NON-COLOR MONITORS**
3. **OPERATING DISK #1 FOR COLOR MONITORS ONLY**
4. **ADMINISTRATIVE DISK #0**

II. PROGRAM START-UP PROCEDURES REVISED

A. NON-COLOR MONITORS

For OFWM computer systems which use a monitor showing ONLY the colors GREEN & BLACK or AMBER & BLACK or WHITE & BLACK, perform the following steps:

1. Insert the SYSTEM DISK in Drive A and boot the system by either switching on the unit or using the CTRL-ALT-DEL key combination.
2. When requested, insert the OPERATING DISK #1 FOR NON-COLOR MONITORS and follow the directions given on the screen.

B. COLOR MONITORS

For OFWM computer systems with MULTI-COLOR monitors, perform the following steps:

1. Insert your regular DOS SYSTEM DISK (Version 3.0 or 3.1) into Drive A and get the A> symbol by either switching on the unit or using the CTRL-ALT-DEL key combination.
2. Insert the OPERATING DISK #1 FOR COLOR MONITORS ONLY into Drive A and start the program by typing the word AUTOEXEC and pressing the return key.
1. Follow the directions as shown on the screen.

OFWMP - PAKISTAN WATERCOURSE DESIGN PROGRAM

OPERATING MANUAL

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1. WHAT THE PROGRAM DOES, AND WHEN IT CAN BE USED.

Scope: This is a custom-written program for calculating the engineering design of rehabilitation works on existing watercourses in Pakistan. It is essentially an implementation of the standard design procedures which have been published in Volume III and Volume V of the OFWMP Watercourse Design Manuals.

The program assumes than an existing unlined ('katcha') watercourse is to be improved, by partial lining, and installation of new turnout structures, ('nakkas'), and by adjusting elevations, so as to increase its efficiency and to improve water delivery conditions to the fields served in the Command Area.

It begins with the data collected by the field survey team, and produces the reports customarily used to seek approval of the cost estimates. These are basically estimates of quantities of materials needed, and the cost estimate for those materials. The reports also may serve as construction plans, since they specify the final layout, grades and elevations at the control structures.

Technical Limitations: The program solves the open-channel flow problem, considering the most economic cross-section which satisfies the required hydraulic conditions. Following the standards set out in Volume III of the Design Manual, it uses Mannings equation for open-channel flow, with certain fixed values of 'n' (the roughness coefficient) appropriate to the channel material, and other fixed parameters. It uses established limiting velocities (maximum for avoiding scour, minimum for reducing siltation), which also vary according to the surface material type.

It assumes that there is a single water-source at the head of the watercourse, and that this source is at the edge of the command area. However, with care in defining the conditions and interpreting the results, it tolerates multiple water-sources. In any case, it permits that the watercourse layout include a large number of branches and sub-branches, spreading in any direction from the source. It also assumes that the full discharge goes through the entire watercourse. This supposes that no water is lost, and that the flow is never divided (split) along the watercourse. This is not necessarily true in real life, but is the 'safe' assumption since it results in a design which is always big enough.

Hardware Limitations: The program is written in IBM BASICA, version 3.10, for the IBM PC,AT and XT, with 128k minimum RAM, two floppy drives, graphics board, and printer. It operates under PC-DOS version 3.0. It may run on color or monochrome monitors. It has not been tested on compatibles. It may use two virtual-disks, created by IBM VDISK.SYS, to improve execution speed and reduce disk drive wear, since normal operation uses frequent chaining between programs. To use the vdisks, the CONFIG.SYS file must call them, and the WCSTART.BAT file must copy needed files to the C: and D: drives.

2. GETTING STARTED: USING THE PROGRAM FOR THE FIRST TIME.

The program set is supplied on three diskettes:

Disk 1 is the everyday operating disk.
Disk 0 is an administrative-functions disk.
Disk 2 is an unlocked version of disk 1.

Disk 1 contains the actual data-entry and hydraulic calculations programs, and the report-printing functions. The programs are saved in the locked (protected) mode, to prevent accidental changes during regular operation. This also prevents listing of the source code. Changes may be done with the open copy on disk 2, then saved in the protected mode to disk 1.

Disk 0 contains a group of utility functions which would be needed by a manager, to permit the 'housekeeping' of the program. Examples are the printing of blank data forms and blank sample reports, and the changing of data-screen messages and the values of 'normal' data limits.

The user is expected to provide data diskettes.

As is always recommended practice, the first thing to do upon receiving the program disks is to make a copy of each, for everyday use, and store the originals supplied to you in a safe place away from the computer. The operating copies should be clearly visually identified with an adhesive ticket, and identifiable to the computer by use of the DOS command LABEL. **The originals should be used only to make copies for** regular use, never for routine use themselves.

3. RUNNING THE PROGRAM AS A DAILY ROUTINE.

3.1 Getting the program into operation:

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+  Insert the Operating Diskette  (1)  in drive A:.     +
+                                                       +
+  Insert a formatted data diskette in drive B:.        +
+                                                       +
+  Perform a boot of the system.                        +
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

If the computer is already in operation, the fastest way is with the '**Ctrl-Alt-Del**' key combination. This 'almost' always starts the program correctly regardless of the previous condition of operation. A more sure but slower way is power off-power on. If the computer was off, power-on with the program disk already in drive A: will correctly start the program.

The program automatically executes a series of initializing activities which do not require any operator intervention. These transfer the programs and support files to the virtual disks, when those are being used.

For machines which do not have automatic date and time, the first reply asked of the operator is to supply the current date and time, so that data-files may be have a date-time stamp incorporated, to assist in future files management. The program includes a technique for saving on disk the last date it was used, and supposing that the present date is one day later. It also supposes that the present time is 8:00 am. If either of these are not true, the suggested date and time may be corrected by use of the '+' and '-' keys. The '+' key (on the far right on standard IBM keyboards) advances each value by one unit(one day, one hour, or one minute). The '-' key subtracts one. The '**enter**' key registers the value shown. (Also, after a few seconds of inactivity, the program will assume that the shown value is correct, and proceed by itself).

Next, the program asks whether a color monitor screen is being used (or else a mono-chrome monitor). Reply '**y**' for color, '**n**' if mono-chrome.

The final introductory activity is a screen which gives the program title, and displays the different ways that text will be shown: normal, bright, and reverse (black-on-white, or highlighted), so that the screen brightness and contrast may be adjusted to give the clearest, sharpest images. Striking any key begins the program.

The first screens are informative messages, which briefly describe the program activities, and instruct the operator how to use the keyboard. After the last informative screen, the Main Menu is presented.

3.2 THE MAIN MENU:

The **Main Menu** offers nine options. The choices are:

1. Begin Basic-Data Input
2. Begin Engineering Data Input
3. Do Engineering Calculations
4. Print Reports
5. Print Basic Data File (for confirmation)
6. Print Engineering Data File (for confirmation)
7. Edit Engineering-data file. (make changes)
8. Interrupt - (exit to BASIC)
9. Quit - (exit to DOS)

A normal complete design procedure starts with the first, then proceeds in sequential order up to the fourth.

An Option is chosen by typing its number, then the 'Y' key to confirm that the correct choice is being made. At the end of normal activities, the MAIN MENU reappears automatically. (Not so for 8 and 9, obviously). The Options are briefly discussed below, then the two Data-Entry activities (which require almost all of the operators' time) are explained in more detail.

Option 1.

Enter data from the "Basic-Data" worksheet.

This is general identification, and certain technical data which must be pre-defined once, before entry of the engineering description of the watercourse. It creates a data-file identified by the watercourse name (perhaps abbreviated) preceded by "wc" and followed by the filename extension ".wcd".

Option 2.

Enter data from the "Engineering-Data" worksheet.

This is the detailed description of the existing layout and controlling data, which permit the program to design the proposed watercourse. It cannot be done unless Option 1 has been completed, and its data file is available on the diskette in drive B:. It creates a data-file whose name is identical to the basic-data file except for the final letter, "d" or "e").

Option 3.

Does the actual calculations for the engineering design of the proposed watercourse, and for the list of materials quantities and costs. It cannot be done, unless the data-files from Options 1 and 2 are available on the data diskette in drive B:, and the materials-costs file is available. It creates a data-file whose name is identical to the other data files except for the final letter, which is "r").

Option 4.

Prints the final reports, including the Materials Quantities and Watercourse Profile data. It cannot be done, unless Option 3 has been completed, and its data-file (ending in "r") is available on the data diskette in drive B:.

Option 5.

Review the data saved in Basic-Data files, generated by Option 1. The complete dataset is shown on the screen, and may be quickly printed. This option first shows the names of the watercourse files available, so it may be used just to see this list without printing any file.

Option 6.

Review the data saved in Engineering-Data files, generated by Option 2. The complete dataset is shown on the screen a few items at a time, and must be printed since there is usually too much data to be able to see it on the screen. Printing takes a while. It also first shows the names of the files.

Option 7.

Edit an Engineering-Data file. Any single file record may be called to the screen, and any item in the record changed. The changed record is then recorded in the disk-file. Asking for the record '-1', (which does not exist) ends the option.

Option 8.

Interrupt the operation of the Watercourse Program, but remain in the BASIC language system. This is useful for shifting from the Operating Diskette (Disk 1) to the Administrative Diskette (Disk 0). There are two ways to return to the Operating Program if no changes have been made in the computer memory allocation, and the BASIC prompt 'Ok' is present:

Put disk 1 in drive A:.

Strike the F2 function key, then the <enter> key

Or,

type the BASIC command:

```
run"A:wcmenu1"
```

To get to the Administrative Menu:

Put Disk 0 in drive A:

type the BASIC command:

```
run"A:wcmenu0"
```

Option 9.

Quits the operation of this program and of the BASIC language system, and return to the DOS. This is useful to perform files maintenance on the data disks, such as deleting and copying files.

To return to the program, the choice of the best and simplest way will depend on what has changed since the program was stopped:

If no changes have been made in the computer memory allocation, restart may be done by typing the DOS command:

BASICA WCMENU1

The next surest way (a bit slower) is to type the DOS 'command' (actually a batch file).

WCSTART

Even more sure, but taking yet more time, is a 'warm boot', using the

<Ctrl+Alt+Del> keys.

The surest (and slowest) way is:

power off, then **power on.**

3.3 Entering your Watercourse Data -- Step 1. - Basic-Data.

Actually, the program explains itself at this point, by giving messages on the screen telling you what to do, and asking you what you want to do. But for completeness' sake, and for those who do not have the computer readily available, the following instructions explain the general steps to be taken.

First, have your worksheet filled out and ready, at least as well as you could before beginning. (See the next chapter). With just a little experience, the way to answer the questions will become very easy, if the information is available to the engineer either in the watercourse study file, or by his personal knowledge of the area.

When the MAIN MENU is operating, touch the 1 key, then confirm with the Y key (for 'yes'). This automatically brings the Group 1 set of questions to the screen. There will be seven Groups in all.

The first question is the identification of the watercourse. They all have numbers or names, so just type it in. You may use as many as 20 characters (each touch of a key is counted, even the space bar). But normally just four or five numbers and a letter or two are used. Dashes, obliques, and other special keys may be used. Capital or lower-case letters are all valid, just follow your preference. Finish your reply (as always when typing words) with the 'return' key, and two things will happen:

1: Your answer will appear next to the item on the screen, and
2: the next question down will be highlighted and its explanation will appear at mid-screen, replacing the one just finished.

The next few questions are identification of the location, and of the people who have collected the data.

After entering something for every blank space in each Group, a bottom line will appear, asking you to either confirm that all the answers are correct (strike '**PgDn**'), or that you want to make a change (strike '**PgUp**'). If you go back to make a change, the program will automatically put the highlight at the first question, and will now show you the presently-registered answer next to the place for typing. If the present answer is correct, just touch 'return' to move to the next question. If you want to change the answer, just type the new answer before touching 'return'. Touching 'PgDn' will jump directly past the end of the group, then 'PgDn' again will finish the group and move to the next.

One special action is required after the first group. Since the program automatically uses the Watercourse name to create a data-file name, it gives the experienced operators a chance to make any adjustments to its automatic abbreviation. Rarely is this required, so just accept the suggested name with 'PgDn' again.

For the data items which need numerical values as replies, the program incorporates a safety feature called the 'Normal Data Range'. These are high and low values which have been chosen to try to represent the usual cases. These values are shown at the time the program is waiting for your reply. If your reply is between the limits, it is registered immediately, no questions asked. But if you give a value just a little OUTSIDE THE NORMAL RANGE, you may get a special CAUTION!! message. This protects from some accidental typing mistakes. At this moment it reminds you what reply you just gave, and requires that you now type in the really desired value, (note that this second try does not need to be the same as the first, NOR does it need to be in the normal range). So the safety device will still let you enter unusual answers when they are correct.

But, if you reply was MUCH outside the 'normal' limits, it may exceed the 'extreme' limits. Then you don't get just a friendly CAUTION! message, but an absolute refusal, and you must again type in the required answer. If the TRULY correct answer IS beyond the 'extreme' limit, then get there by replying with a 'dummy' answer to fool the machine into giving you the CAUTION! routine. The 'dummy' may be any number between the 'normal' and 'extreme' limits.

After finishing the seventh group, the data gets saved onto the disk, in a file whose name is 'wc'+ the w-c name abbreviation + '.wcd'. Then you see the answers, 20 at a time, just for confirmation. To print them onto paper, go on to the MAIN MENU and choose Option 5, then type the abbreviated name of the watercourse, as will be shown on the screen for you.

At that point Step 1 is done.

3.4 Entering your Watercourse Data - Step 2. - Engineering-Data.

Again, have your worksheet filled out and ready, at least as well as you could before beginning. (See the next chapter). With just a little experience, the way to answer the questions will become very easy, if the information is available to the engineer either in the watercourse study file, or by his personal knowledge of the area.

When the MAIN MENU is operating, touch the 2 key, then confirm with the Y key (for 'yes'). After the explanations, this automatically brings up the first question, the identification of the watercourse, to the screen. Now you must type it exactly the way it was registered for the Basic-Data, so the program can find that file to verify.

Strike 'PgDn' to move ahead, to the ENGINEERING DATA MAIN MENU. Here's where a bit of work begins.

This part of the data entry is a continuous cycle; each time around describes one piece of the entire watercourse. The cycle starts at the MAIN MENU, progresses thru sub-menus to a data screen appropriate for the type of component, then returns to the MAIN MENU for the selection of the next component. The most important thing to keep right is that the components **MUST BE GIVEN IN SEQUENTIAL ORDER;** you can't back up to insert a forgotten piece. Start at the Mogha, then move down the Main branch (first, if there are any other branches) to the end of the Main. DO DEFINE the branching points as you go by them, including their "names", then come back after the end of the Main, to give the data about each branch.

An ordinary simple watercourse might have:
a channel reach starting at the mogha,
a nukka box (with 1 or more turnouts) maybe called M-1,
another channel reach between nukkas,
the next nukka box, usually called M-2,
another channel reach between nukkas,
the next nukka box, usually called M-3,
..... etc.....
until the end of the Main.

And that kind of step-by-step sequence is the method you will follow to describe it to the computer, so that the computer can 'understand' the field survey.

The ENGINEERING DATA MAIN MENU will appear again and again, until you finish Step 2. It offers seven choices, but only rarely will you use any but the first two or three. They are:

1. A TURNOUT box: where the flow can BRANCH or leave the W-C.
2. The next CHANNEL reach begins. (define lining type)
3. Some STRUCTURE along the W-C.
4. Where MORE WATER can enter the W-C.
5. An external CONSTRAINT may affect the design.
6. END of the BRANCH or MAIN W-C.
7. QUIT - All data for all branches are done.

Equally as important as these choices, is the information at the top of the screen, in the **'header'**. (On most of the previous screens, the header is little more than generally informative). But in the Engineering-Data Segment the header gives vital information to help you keep track of your progress through the description of the watercourse.

The header will look like this:

```
                    ENGINEERING  DATA    MAIN  MENU
-------------------------------------------------------------------------------
W-C No.: _______      Branch: Main   Map No.: Mogha   Station:     0.00
Data registry starts at head of the W-C.  The Mogha is right behind you.
            The next segment is to be described.  What happens here?
-------------------------------------------------------------------Sl.No.= 0
```

The items on the top line tell you where you are, and keep changing as you progress, piece by piece, down the watercourse. The program adds up your DISTANCES and LENGTHS, to calculate the Station itself.

The second line always is a reminder of the 'choice' which you just completed. At the first appearance, the special "Data registry starts....." message is shown. (That IS in fact the choice you just made, to start the data registry for a new w-c.)

The third line asks some suitable general question to guide your response. (The serial number tucked away in the bottom line is the computer registry number, and just keeps going up by one each time an item is completed.)

Operation of Step 2. consists of touching the number keys for the correct choice and subchoice to tell the computer the type of each component, then replying to the dimensions questions which appear after the choice is completed and confirmed by the usual 'PgDn' key. The dimensions screens are too varied to show in this manual, since the way they appear depends on the answers you give to each question. All of the questions, however, relate to ordinary engineering requirements, things that must be considered by the design engineer as he transforms the field survey data into a profile and then a hydraulic design which meets all the limiting criteria and critical elevation needs.

Read carefully before you answer, during the first few times you use the program, as it may not always be immediately clear what is being asked, and the sequence in which the screen proforma presents the questions and blank spaces may not be the one you would ordinarily use. Our experience in the training courses shows that by the third time through, however, everybody has adapted to the sequence.

Here follows the complete list of the choices, for all seven options on the MAIN MENU, and their sub-choices:

Choice 1:

" A TURNOUT box: where the flow can BRANCH or leave the W-C." has these sub-choices:

1.	NAKKA	a farm turnout.
2.	BRANCH	a turnout to a BRANCH, not a field.
3.	OVERFLOW	an outlet not for irrigating.
4.	PUMP INTAKE	where water may be lifted out.

Choice 2:
" The next CHANNEL reach begins. (define lining type)"
has these sub-choices:

1. KATCHA (unlined)
2. PAKKA (BRICK - lined)
3. PAKKA (CONCRETE - lined)
4. PAKKA (other-type lining)
5. AQUEDUCT (elevated-flume)

Choice 3:
" Some STRUCTURE along the W-C."
has these sub-choices (at two sub-levels):

1. FLOW-RATE measuring device.
   1. Open Flume: Trapezoidal, Rect. or Vee.
   2. Weir, any shape, (free fall discharge)
   3. Orifice (rectangular)

2. DROP (or a RISE) in bed-level.
   1. Plain drop (rapids) without check.
   2. Check drop, with fixed or adjustable lip.
   3. Dragons'-tooth chute.
   4. Inclined-pipe or vertical-pipe drop.

3. CULVERT, bridge, or similar.
   1. Box culvert or slab crossing.
   2. Arch culvert.
   3. Pipe culvert.
   4. Syphon; any pipe that flows full.

4. BUFFALO WALLOW

Choice 4:
" Where MORE WATER can enter the W-C."
has these sub-choices:

1. A WELL (Tubewell, or any pipe).
2. Another MOGHA or other canal.
3. A STORM-WATER or DRAINAGE DITCH.
4. Irrigation EXCESS from cropped fields.

Choice 5:
" An external CONSTRAINT may affect the design."
has these sub-choices:

1. A VILLAGE, Building or Wall starts.
2. The VILLAGE, Building or Wall ends.
3. Especially HIGH terrain starts.
4. Especially LOW terrain starts.
5. The terrain returns to normal.
6. Available Construction Width (r-o-w) changes.
7. The SOIL-TYPE changes.

Choice 6:
" END of the BRANCH or MAIN W-C."
has these sub-choices:

1. Right at the last NAKKA.
2. Dead-end with no outlet.
3. With an OVERFLOW outlet, not for irrigating.
4. It INTERCONNECTS to a different W-C or canal.

Choice 7 has NO subchoices.
However, if any Branches have been defined, but not yet completed, the program will not terminate normally until they have been done.

4. GETTING DATA READY FOR THE PROGRAM.

4.1 Basic-data.

The present field teams collect data on a data proforma which is already called the Basic Data Sheet. The computer program follows very closely that Data Sheet, but with some adjustments to item sequence, and some additional questions which better define the general characteristics of the command area.

The only change needed is to substitute the new Proforma for the old one, in the hands of the Field Teams, and insist that all items be answered, with at least an estimate if measurements are not available. Typical items which are new are water and field salinity, and silt.

4.2 Engineering-data.

The present field teams collect survey data in a variety of methods, varying by province and perhaps even by region. No fundamental change in these methods is required. What is required is organization of the data in the sequence and manner to make its entry into the program easy and sure, following the above description of method.

The first step in arranging the survey data is the preparation of a sketch map of the command area, to assist in defining the elements which compose the watercourse works. These elements are the channel reaches, turnouts, branch outlets, culverts and similar structures, as shown. The program requires that these elements be entered in the exact sequence in which water flows through them, starting at the Mogha. So the sketch map (which does not have to be drawn to scale) should clearly identify each channel reach, each Branch turnout, each Nakka turnout, and each special structure. The required dimensions and types must also be shown. Data entry may easily be done from this sketch map, IF all

the required information is on it. Knowing which information is required for each element and each different type of structure needs some experience in both engineering and program use.

Another method is use of the engineering-data proforma, done in the style of a worksheet table, which the program can prepare. This has the identical format to that which the program itself uses when printing out the data after entry, so use of the blank proforma will become easier after having completed a few examples. Both the sketch-map and the worksheet may be used for greater completeness, the map mostly for reviewers, and the worksheet mostly for keyboard data-entry.

For each element, it is necessary to tell what kind it is, identify its location (Map-Number), and in some cases tell its size. Channel reach lengths are always required, then the program calculates Station by summing the lengths. Structures may also have lengths, which should be remembered when measuring reaches so as not to include the length twice. There may be multiple turnouts at one station (up to three). Data about the fields to be irrigated are required for each Nakka, especially the critical highest field elevation. If any channel reach has previously been lined ('pakka') and will remain without being reconstructed, its dimensions and elevations are required. Similarly for any turnouts, culverts or other special structures which must remain, their dimensions are required. At the end of every element, the angle at which the watercourse leaves may be given. These angles are not needed for the hydraulic calculations (since the entire watercourse is considered as a single path and head losses at curves are ignored), but will be absolutely required to draw the field map.

After each component has been typed into the program, tick it off on your control page (map or worksheet). A green pencil may serve well. This becomes very useful when you return from tea-break.

By the way, this segment automatically saves your replies at the end of each component, so you can interrupt the data entry, without losing the data for the components which have been completely finished. When the Step 2. Option is again selected, and the watercourse name is correctly given (with the same data-disk in drive B:), the program will find the partly-done data-file, discover where you left off, and pick up again just as though you never quit.

4.3 Materials Costs data.

It was assumed that materials costs are relatively constant, at any given location over a reasonable period of time. If this is so, then it would not be necessary to enter these into the computer for every watercourse (avoiding repetitive work). The program uses a separate data-file to save these costs, and use the same costs for every watercourse. But of course it is necessary to make changes, and this is done by generating a new file, one of the options on the Administrative Menu. The old file is lost when this is done, but it could be kept by copying it to another disk first. Details of this are discussed under the management section below.

5. THINGS A MANAGER NEED TO TAKE CARE OF.

The program was written considering that future changes may be needed in the program, and in the messages which appear on the menu screens and data-entry screens. The ADMINISTRATIVE MENU and PRINTING FUNCTIONS MENU, on disk 0, permit many such functions to be easily done.

The **ADMINISTRATIVE MENU** has the following options:

1. Generate Basic-Data Input Messages. (used in Step 1)
2. Generate Engineering-Data Input Messages (used in Step 2)
3. See Basic-Data Messages (for confirmation)
4. Change Basic-Data Messages on Disk B: (local adjustments)
5. Generate Materials Costs File on Disk B:
6. Go to Printing Functions Menu, (Menu2)
7. Interrupt - (Exit to BASIC)
8. Quit - (Exit to DOS)

The **PRINTING FUNCTIONS MENU** has the following options:

1. Print a Blank Basic-Data Input Proforma
2. Print a Blank Engineering-Data Input Proforma
3. Print a Blank Set of Reports Pages (3 to 6)
4. Go to Administrative Menu, (Menu0)
5. Interrupt - (Exit to BASIC)
6. Quit - (Exit to DOS)

5.1 Printing blank data proformas for field use.

Copies of the blank Basic-Data proformas (two pages) and the blank Engineering-Data proforma (one page) can be obtained simply by selecting the options 1 and 2 on the PRINTING-FUNCTIONS MENU. This can be done many times, but it would be usual to take a copy to the photo-copy machine to prepare a supply for distribution. However, any time that a modification in the texts is made, **a new master copy** would be prepared for printing future supplies.

5.2 Printing blank reports.

A copy of the final reports, but without any data values inserted, may be used if desired to submit reports of watercourse designs prepared by the present manual process. These copies may be produced by selecting Option 3 on the PRINTING-FUNCTIONS MENU. Values of materials, costs, etc may be copied by hand from the regular worksheets, to permit that all reports from the field are submitted in a uniform format. Also, adjustments to the computed results, for special cases, may be submitted this way.

5.3 Changes to Basic-Data Entry-Screen texts. (For Step 1).

There are two ways to make changes in the text messages ('*.TTL' files) which appear on the several data-entry screens of Step 1. The most probable (and recommended) is a permanent change which would remain for all future work, but there is a provision for a 'local' or temporary change, which might be needed for only a special case or special uses.

The permanent changes may be made by editing the BASIC programs which generate the .TTL files, then choosing Option 1 on the ADMINISTRATIVE MENU.

There are seven programs for Step 1, named **WCD$n.BAS**, with the number 'n' being from 1 to 7, corresponding to the seven groups of questions on the Basic-Data proforma. These seven programs are structurally the same, and each generates one '.TTL' file with the corresponding number. The manner in which it does this is shown within the program listing, clearly enough for any experienced programmer. There is also the opportunity to change the "normal" data ranges, which appear together with each question. If the number of questions in a group is changed (some blank spaces have been left to accomodate future new questions), be sure to also modify the count variable at the beginning of the WCD$n.BAS program which gets changed.

After the modifications to the 'WCD$n.BAS' programs have been made and saved, return to the ADMINISTRATIVE MENU (by executing WCMENUO) and choose Option 1 to actually generate the revised 'WCA$n.TTL' files.

Option 3 on the ADMINISTRATIVE MENU will display (and print, if you chose) the titles and normal-range values from these seven '.TTL' files. It would be routine to do this just before making any changes, and again just after, for confirmation that they were properly done. After selecting Option 3, and confirming with 'Y', then type the number of the group you want to see.

The temporary, or 'local' changes may be done by selecting Option 4, on the ADMINISTRATIVE MENU. Then type the number of the group for which you want to make a change. Each line in the coded data file will appear, one at a time, with a question if it should be changed. Up to this point, this activity is easy and safe. But to make this safer, it is recommended that the previous option, Option 3, be run to print a complete list of the file before starting any changes.

Note!! This method of changes is delicate, because the file is in coded format, and your retyping of any line must include all the commas, quotation marks, and other punctuations precisely correctly, else it will not work when called later by the operating program. DO NOT try to change the number of lines, or remove any. Do this only by the permanent method first described above.

5.4 Changes to Engineering-Data Entry-Screens. (For Step 2).

There is only one program for generating the Step 2 '.TTL' files; it is called 'WCMKENG$.BAS'. Similarly, it may be modified by an experienced programmer, but it is more complicated due to the nature of the heirarchical three-level tree of choices. Care must be taken to adjust the DATA statements which define the Options Array, if any new items are added or existing ones removed. To only change wording may safely be done, by simply editing the proper line in the program. Don't forget to 'save' the new version. Then return to the ADMINISTRATIVE

MENU (by executing WCMENU0) and choose Option 2 to actually generate the revised 'WCE$n.TTL', WCOPTARY.TTL and WCOPTSIZ.TTL files.

For both Basic-Data and Engineering-Data text modifications, and after these modifications have been saved, any time these options are run, the new files generated will incorporate the changes onto whatever disk is in drive B:. Of course, any program disks which had the previous '.TTL' files still have them, and if they are also to be changed, this may be done either by repeating the 'Generation' Option, or by simply copying the files with the DOS command 'COPY' from one disk to the other.

6. SPECIAL WORDS USED, AND WHAT THEY MEAN. (GLOSSARY).

PAKISTANI TECHNICAL WORDS:

watercourse	- the lowest-order set of water delivery channels under the management of the government departments.
farmers ditch	- the channels not controlled by the government, which receive the flow from the 'watercourse'.
channel	- a reach of the watercourse.
canal	- the parent canal, one level upstream from the watercourse itself.
mogha	- the turnout from the parent canal into the watercourse.
nakka/nakka	- a farmers' turnout from the watercourse to a farmers' ditch.
katcha	- earth (unpaved) channel or canal.
pakka	- lined (paved) channel or canal.

AMERICAN ENGLISH TECHNICAL WORDS and ABBREVIATIONS:

branch	- a division in the watercourse, where flow sometimes goes one way and sometimes the other.
wye	- same as branch. (From the shape of the letter 'Y').
drop	- a sudden break in the bed-level of the watercourse. May be vertical or on a steep slope.
S	- slope or grade of a watercourse, (meters fall/meter run).
S-avail	- the slope available, as observed in the field survey.
S-reqd	- the slope required to meet limiting conditions of non-silting or non-scouring flow.
rufN	- coefficient of surface roughness, used in Manning's equation for hydraulic flow.
B	- channel Bed-width (inside dimension).
Z	- channel wall slope, always expressed as 'Z' units horizontally for each one unit vertically.
D	- flow depth in the channel.
Fbd	- freeboard. The extra wall height above flow depth.
H	- wall height as to be constructed. (measured vertically)
V	- flow velocity, meters per second.

A	- cross-sectional flow area.
R	- hydraulic radius (as in Mannings' equation).
P	- hydraulic perimeter (as in Mannings' equation).
Tb	- thickness of the channel bed.
Tw	- thickness of the channel wall (measured perpendicularly to the wall face).
Vol	- volume of construction material (masonry,brick,concrete)

COMPUTER WORDS:

computer	- a communications device which can also calculate, using complex stored (remembered) programs.
input device	- a piece of equipment which can transmit data to the computer. Keyboards and disks are common.
output device	- a piece of equipment which can receive data from the computer. Screens, printers, and disks are common.
drive	- the piece of equipment which holds the disks while they are being read from or written to.
OS	- Operating System. The general operating instructions for the computer itself. Some are built into the machine, and some are on a disk.
DOS	- Disk Operating System. The special operating instructions for the computer, to let it use disks. Part of the DOS is itself on a disk, so it can be changed by the manufacturer as improvements come along.
BASIC	- the BASIC-Language. The programming language which was used to write the Watercourse Engineering programs.
disk	- the magnetically-recorded disks, used to save programs and data for permanent (or semi-permanent) future use.
file	- anything recorded on a disk. A file may be a program or a set of data. The name may tell its type, but not always.
filename	- the first eight characters of the complete file identification, as recorded on a disk.
extension	- the last three characters of the complete file identification, as recorded on a disk. It often tells the type of file.
label	- the name of the DISK itself, as different from the filenames which may be recorded on the disk.
program	- any set of instructions FOR THE COMPUTER, written in a 'programming language' especially set up for that computer.

DOS commands - a special set of instructions FOR THE COMPUTER, which make it do activities of general use for all users. The five essential DOS commands taught in the watercourse training are:

DIR - look at the contents of the directory (catalogue) of the disk.

COPY - creates an exact duplicate of any file on another disk.

FORMAT B:/s - prepares a factory-new (unused) disk, to be usable.

CAUTION! DANGEROUS as is destroys everything if the disk was not really new. Always try DIR B: just before FORMAT B:/s, to be sure.

LABEL B: - records the chosen label-name on the disk.

ERASE - removes (destroys, deletes) files from a disk.

CAUTION! DANGEROUS as is may destroy things which you did not want destroyed.

A> - the 'A-prompt'. The (cryptic) message from DOS telling you that:
* the computer is operating normally, in DOS;
* but no program is operating; so
* it is ready for a DOS-command; and
* it expects to find the files on drive A:

B> - same as A>, except that it will look on drive B:

Ok - the 'BASIC-prompt'. The (cryptic) message from BASIC telling you that:
* the computer is operating normally, in BASIC;
* but no program is operating; so
* it is ready for a BASIC-command; and
* it doesn't tell you on which drive it expects to find the files (but it knows).

7. APPENDICES.

APPENDIX A

Images of screens: Instructions, Menus and usual prompts.

APPENDIX B

Sample Data Proformas:

Basic-Data Proforma. 7 groups	(2 pages).
Engineering-Data Proforma.	(1 page).
Materials Costs Data Proforma.	(1 page).

APPENDIX C

Program Example: An imaginary case of a typical watercourse.

Data Proformas:
As they would be filled out by the field survey team:

Basic Data Proformas
Field Map
Engineering Data Proforma
Materials Costs Data Proforma

Data Listings:
As they would be printed by the computer for verification:

Basic Data
(The results of Options 1 and 6).

Engineering Data
(The results of Options 2 and 7).

Materials Costs Data
(The results of Menu 0, Option 5).

Sample Output:
The record of the engineering calculations.
(The results of Option 3).
The Reports needed for approval of the proposed works
(The results of Option 4).
The Reports needed for the execution of the construction.
(The results of Option 5).

Welcome to the Watercourse Design Program

by w. marvin redditt for Sheladia Associates and OFWMP-Pakistan

The program has four major steps, (plus some helping functions)

After these instructions, you will see an 'Opening Menu' screen. Just as you do at some restaurants, you choose what you need, either by saying its number, or by pointing to the item.

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Engineering Segment

In this program, you use the number keys along the TOP of the keyboard.
(You can't use those on the right side for numbers, as they have special uses)
Just touch the number for the activity you need,
and wait a second for the program to respond.

You may point to a choice, by touching the 'space-bar' to move the marked line
(it is the big bar at the bottom of the keyboard)
then selecting with the 'enter' key. (Find 'enter' on the right, between the punctuation keys and the special keypad; on most machines it has a bent arrow).

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Engineering Segment

As you proceed through the steps, you will be asked questions, or shown blank spaces (with a flashing box) to be filled in. Always read carefully the line where a box is blinking and the last new line on the screen, because they will tell you what to do next, and often suggest normal replies.

Anytime you are not sure, just make your best guess, since the program will protect you from serious misteaks.

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Engineering Segment

```
                    OPENING  MENU  -  ENGINEERING  SEGMENTS
-------------------------------------------------------------------------------
          Either type the number, or move the high-lighted line, to

               Select the program segment you now want to do.
-------------------------------------------------------------------------------


          1.  Begin    Basic-   Data Input for a New Watercourse.
          2.  Begin Engineering-Data Input (Basic-Data Input is done).
          3.  Do Engineering Calculations  (All   Data Input is done).
          4.  Print Reports.              (Calculations have been done).
          5.        Print    Basic-   Data file,  for confirmation.
          6.        Print Engineering-Data file,  for confirmation.
          7.          Edit Engineering-data file  (make changes)
          8.               Interrupt  -  (Exit to BASIC)
          9.               Quit  -       (Exit to DOS)


08:04:37  20/11/1986
 active keys:                          SPC  TAB  RET  1- 9          /

 wm/r:sheladia     WaterCourse Design Program     Engineering Segment Main Menu
```

```
oooooooooooooooooooooooooooooooooooooooooooooo
oo                                            oo
oo   WATERCOURSE  DESIGN -- BASIC DATA        oo
oo                                            oo
oooooooooooooooooooooooooooooooooooooooooooooo
```

This is the Data-Entry Segment
of the
Watercourse Design Program
==========

It is the FIRST STEP in the
design procedure.

Always read the Highlighted Boxes to see which data item to enter.

(If you are already experienced, you may use the 'Advanced Mode'.)

Press any key to continue

wm/r:sheladia WaterCourse Design Program Data-Entry Segment

Directorate General Agriculture, On-Farm Water Management Program
Punjab Province
Watercourse Improvement Program --- Basic Data

HEADWORKS and BENCHMARKS

1. Watercourse Number
2. Village Name or Number
3. Tehsil Name
4. Parent Canal or Well
5. Field Team Name
6. Engineer in Charge

The Identification (number) of the WATERCOURSE is?
0 ?)
Data entry may contain up to 20 characters

wm/r:sheladia WaterCourse Design Program Data-Entry Segment Group 1

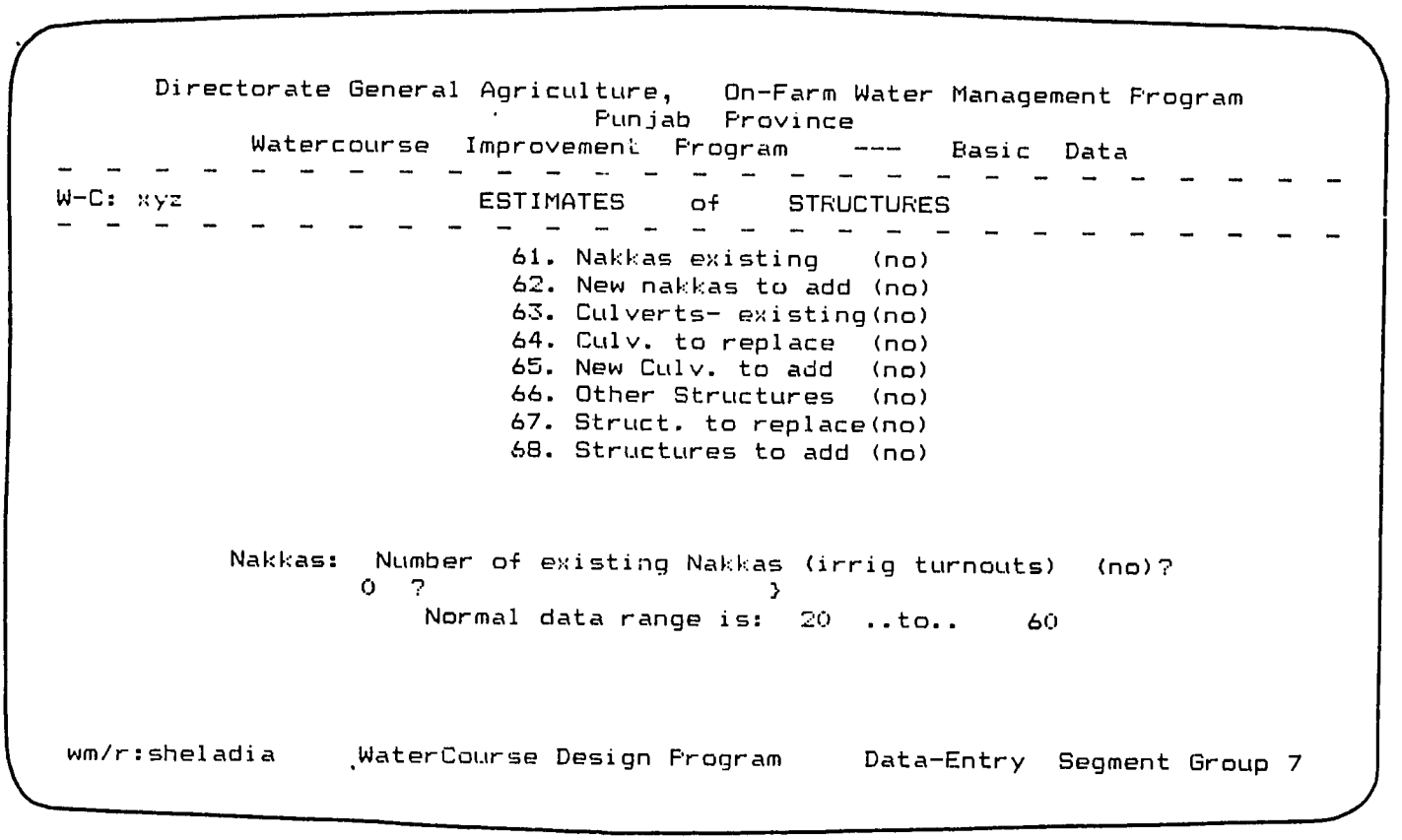
```
      Directorate General Agriculture,   On-Farm Water Management Program
                                 Punjab  Province
            Watercourse  Improvement  Program    ---   Basic  Data
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
W-C: xyz              HEADWORKS          and          BENCHMARKS
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                              11. Benchmark- Number
                              12. Benchmark- Location
                              13. BM- Assumed Elev.   (M)
                              14. BM- True Elevation  (M)
                              15. Water Source FSL    (M)
                              16. Source: Bed Level   (M)
                              17. Mogha:  type      (code)
                              18. Mogha:  bed elev.   (M)
                              19. Mogha:roof-block el (M)
                              20. Mogha:throat width  (M)

          P.BM:  Assumed Bench-Mark:  Identification Number of BM? ?
                  0  ?                          }
                      Data entry may contain up to  20  characters


wm/r:sheladia      WaterCourse Design Program      Data-Entry  Segment Group 2
```

```
      Directorate General Agriculture,   On-Farm Water Management Program
                                  Punjab Province
            Watercourse  Improvement  Program    ---   Basic  Data
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
W-C: xyz          DISCHARGE:      MOGHA     and      WELLS
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                              21. Q: meas: at head (L/s)
                              22. Q: meas:  middle (L/s)
                              23. Q: meas: at tail (L/s)
                              24. Efficiency before  (%)
                              25. Available Q (san)(L/s)
                              26. Sanct. addl. Q   (L/s)
                              27. Well source  Q   (L/s)
                              28. Well location    (Sta)
                              29. Well diameter     (cm)
                              30. TOTAL design Q   (L/s)


        Measured Flow Rate in the WaterCourse at its head.  (L/s)?
                0  ?                        )
                    Normal data range is:  0  ..to..    200


wm/r:sheladia      WaterCourse Design Program      Data-Entry  Segment Group 3
```

```
      Directorate General Agriculture,   On-Farm Water Management Program
                                  Punjab Province
            Watercourse  Improvement  Program    ---   Basic  Data
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
W-C: xyz              QUALITY    of    WATER    and     SOILS
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                              31. Canal water salinity
                              32. Well  water salinity
                              33. Soil-water  salinity
                              34. Source Suspended, silt
                              35. Source Bed-Load,  sand
                              36. Silt/Sand added in W-C
                              37. Soil type,banks of W-C
                              38. Soil type, croplands


          Quality of Canal water  (salinity)                    (mmho)?
                  0  ?                        )
                      Normal data range is:  0  ..to..    200


wm/r:sheladia      WaterCourse Design Program      Data-Entry  Segment Group 4
```

```
      Directorate General Agriculture,   On-Farm Water Management Program
                                  Punjab  Province
            Watercourse  Improvement  Program    ---    Basic  Data
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
W-C: xyz                 CULTIVATED      COMMAND       AREA
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                              41. Area W-C serves    (ha)
                              42. Number of  Water-users
                              43. Users with    <2.2  ha
                              44. Users with 2.2-<5   ha
                              45. Users with  5-<10   ha
                              46. Users with    >10   ha
                              47. Crop intensity (300 %)
                              48. Peak Evaporation(mm/d)


          Size of Command Area  (Cultivable Land)                (ha)?
                 0  ?                          }
                      Normal data range is:  30  ..to..    600


wm/r:sheladia      WaterCourse Design Program      Data-Entry  Segment Group 5
```

```
      Directorate General Agriculture,   On-Farm Water Management Program
                                  Punjab  Province
            Watercourse  Improvement  Program     ---    Basic  Data
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
W-C: xyz                 WATERCOURSE     LENGTH    and    LAYOUT
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                              51. W-C  Length, Total  (m)
                              52. Length of MAIN      (m)
                              53. Number of Branches
                              54. Total Len. Branches(m)
                              55. Est. Len. of Lining(m)
                              56. Width avail f/works(m)
                              57. Number trees to remove


          Total Length of WaterCourse, Main & Branches      (Meters)?
                 0  ?                          }
                      Normal data range is:  500  ..to..    5000


wm/r:sheladia      WaterCourse Design Program      Data-Entry  Segment Group 6
                   .
```


Directorate General Agriculture, On-Farm Water Management Program
Punjab Province
Watercourse Improvement Program --- Basic Data
W-C: xyz ESTIMATES of STRUCTURES
61. Nakkas existing (no)
62. New nakkas to add (no)
63. Culverts- existing(no)
64. Culv. to replace (no)
65. New Culv. to add (no)
66. Other Structures (no)
67. Struct. to replace(no)
68. Structures to add (no)
Nakkas: Number of existing Nakkas (irrig turnouts) (no)?
0 ?
Normal data range is: 20 ..to.. 60
wm/r:sheladia WaterCourse Design Program Data-Entry Segment Group 7

Welcome to the Watercourse Design Program

by w. marvin redditt for Sheladia Associates and OFWMP-Pakistan

The administrative program set has several functions, some of which must be done just once to set up the operating program diskette, plus copies of everything.

After these instructions, you will see an 'Opening Menu' screen. Just as you do at some restaurants, you choose what you need, either by saying its number, or by pointing to the item.

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Administrative Segment

In this program, you use the number keys along the TOP of the keyboard.
(You can't use those on the right side for numbers, as they have special uses)
Just touch the number for the activity you need,
and wait a second for the program to respond.

You may point to a choice, by touching the 'space-bar' to move the marked line
(it is the big one at the bottom of the keyboard)
then selecting with the 'enter' key. (Find IT on the right side, between the punctuation keys and the special keypad; on most machines it has a bent arrow).

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Administrative Segment

As you proceed through the steps, you will be asked questions, or shown blank spaces (with a flashing box) to be filled in. Always read carefully the line where a box is blinking, and the last new line on the screen, because they will tell you what to do next, and often suggest normal replies.

Anytime you are not sure, just make your best guess, since the program will protect you from serious 'misteaks'.

(When you have finished reading, touch the 'PgDn' key)

wm/r:sheladia WaterCourse Design Program Administrative Segment

OPENING MENU - ADMINISTRATIVE SEGMENT

Either type the number, or move the high-lighted line, to

Select the function you now want to do.

1. Generate Basic-Data Input Messages (.TTL for Step 1)
2. Generate Engineering-Data Input Messages (.TTL for Step 2)
3. See Basic-Data Messages (for confirmation)
4. Change some Basic-Data Messages (local adjustments)
5. Generate Materials Costs File on Disk B:
6. Go to Printing Functions Menu, menu2
7. Interrupt - (Exit to BASIC)
8. Quit - (Exit to DOS)

08:01:38 23/11/1986
active keys: SPC TAB RET 1- 8 /

wm/r:sheladia WaterCourse Design Program Administrative Segment Main Menu

PRINTING FUNCTIONS MENU

Either type the number, or move the high-lighted line, tL

Select the program segment you now want to do.

1. Print a Blank Basic-Data Input Form.
2. Print a Blank Engineering-Data Input Form.
3. Print a Blank Set of Reports Pages (3 to 6).
4. Go to Administrative Menu - (menu 0)
5. (-------not in use----------)
6. (-------not in use----------)
7. Interrupt - (Exit to BASIC)
8. Quit - (Exit to DOS)

08:02:11 23/11/1986
active keys: SPC TAB RET 1- 8 /

wm/r:sheladia . WaterCourse Design Program Print-Forms Utility

Directorate General Agriculture, On-Farm Water Management Program
Punjab Province
Watercourse Improvement Program --- Basic Data

HEADWORKS and BENCHMARKS

Group 1

1. The Identification (number) of the WATERCOURSE is _____
2. The Identification (name) of the VILLAGE (chak) is _____
3. The Identification (name) of the TEHSIL is _____
4. The name or number of the DIST'Y or parent Canal/Well is _____
5. The name of the FIELD TEAM in charge of this W-C is _____
6. If not you, then the person responsible for this data is _____
7
8
9
10

HEADWORKS and BENCHMARKS

Group 2

11. P.BM: Assumed Bench-Mark: Identification Number of BM? _____
12. P.BM: Is the Assumed BM on a structure? What is it? _____
13. P.BM: Arbitrary Elevation used for survey. (100.0 ?) (M) _____
14. P.BM: True Sea-level, or FID Elev. (0 if not known) (M) _____
15. FSL = Full Supply Level of the Water Source, (ref:P.BM) (M) _____
16. Water Source: actual Bed-Level Elevation, (ref:P.BM) (M) _____
17. Mogha: Code of type. 1=flume 2=orifice 3=well _____
18. Mogha: Sill elevation (bed). (referenced to P.BM) (M) _____
19. Mogha: Roof Block elevation. (if open flume, say 0) (M) _____
20. Mogha: Throat width at narrowest part. (10-in = .254) (M) _____

DISCHARGE: MOGHA and WELLS

Group 3

21. Measured Flow Rate in the WaterCourse at its head. (L/s) _____
22. Measured Flow Rate in the WaterCourse at its middle. (L/s) _____
23. Measured Flow Rate in the WaterCourse at its tail. (L/s) _____
24. Delivery Efficiency, before improvements. (%) _____
25. Available Regular Discharge, (sanctioned Q) (L/s) _____
26. Sanctioned Additional Discharge (if any) (L/s) _____
27. Wells: Estimated or measured Discharge (if any) (L/s) _____
28. Wells: Location. (station = distance from head). (M) _____
29. Wells: Boring diameter (not the delivery) (centimeters) _____
30. Total Design Discharge = Sanct. + Add'l + Wells (L/s) _____

QUALITY of WATER and SOILS

Group 4

31. Quality of Canal water (salinity) (mmho) _____
32. Quality of Well-water in the area (salinity) (mmho) _____
33. Quality of Soil-water-table in the area (salinity) (mmho) _____
34. Water as it enters W-C: Suspended-load quantity (ppm) _____
35. Water as it enters W-C: Bed-load quantity (ppm) _____
36. Probability Silt might enter W-C from its own banks? (%) _____
37. Soil type: 1=Sand 2=Sandy Loam 3=silt 4=si+C+L 5=Clay _____
38. Soil type in Cultivated fields. (1=S 2=SL 3=Si 4=SCL 5=Cl) _____
39
40

Directorate General Agriculture, On-Farm Water Management Program
Punjab Province
Watercourse Improvement Program --- Basic Data

CULTIVATED COMMAND AREA

Group 5

41. Size of Command Area (Cultivable Land)	(ha)	
42. Total Number of Water-Users	(no)	
43. Number of Water-Users with lands less than 2.2 ha	(no)	
44. Number of Water-Users with lands 2.2 upto <5 ha	(no)	
45. Number of Water-Users with lands 5 upto <10 ha	(no)	
46. Number of Water-Users with lands over 10 ha	(no)	
47. Cropping Intensity (3 harvests per year is 300 %)	(%)	
48. Dry-Season usual Maximum Daily Evaporation	(mm/d)	
49		
50		

WATERCOURSE LENGTH and LAYOUT

Group 6

51. Total Length of WaterCourse, Main & Branches	(Meters)	
52. Total Length of Main Branch only	(M)	
53. Number of Branches and Sub-branches, existing	(no)	
54. Total of Lengths of Branches and Sub-branches	(M)	
55. Estimated Length of Lining to be constructed	(M)	
56. Width of land available for W-C construction. (r/o/way)	(M)	
57. Estimated Number of Trees to be removed	(no)	
58		
59		
60		

ESTIMATES of STRUCTURES

Group 7

61. Nakkas: Number of existing Nakkas (irrig turnouts)	(no)	
62. Nakkas: Number which must be added to serve fields	(no)	
63. Culverts: Total Number existing (all types)	(no)	
64. Culverts: Number known to need replacement	(no)	
65. Culverts: Estimated number, new to be added	(no)	
66. Other Structures: Total Number existing (all types)	(no)	
67. Other Structures: Number known to need replacement	(no)	
68. Other Structures: Estimated number new to be added	(no)	
69		
70		

wm/r + SHELADIA ASSOCIATES, INC --- WATERCOURSE ENGINEERING DATA WORKSHEET --- W-C Number: _____

-Place-		--Descript.--			----------Dimensions--------				--Thickness--		-External-		------- Farm	Land	Served	--------	--W-C Path--	
Sl No	Branch no.	What type code	Sub-type code	Map no.	Bed-lvl Elev. E	Bed width B	Side slope Z	Roof ht/dia Y/d	Bed thick. Tb	Wall thick. Tz	R/W width R/W	Soil type code	---Irrig. name	Sq--- area CCA	elev. EF	field dist. LF	area haf	Dist-ance L	Defl. angle a
-	-	-	-	-	m	m	m	m	m	m	m	-	-	ha	m	m	-	m	deg
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
																		sta.=	

Directorate General Agriculture, Water Management Program
Province

Watercourse No: _____ Village: _____

CERTIFICATE NO. I

Certified that:-

1. The Mogha will not be submerged after improvement.
2. Watercourse material will be used according to standards fixed by the department.
3. Material will be purchased at lowest competitive rates and will be of good quality.
4. The construction of lining, nakka structures, culverts etc. will be accomplished according to pre-designed drawings.
5. Quantities of materials actually used will be entered in the store books and will never be more than higher permissible limits.
6. After completion of the works, detailed completion report will be submitted to the W.M.C. with cost analysis.
7. The volumes will be measured carefully keeping in view the size (average) of bricks used.
8. Weekly Account book will be maintained regularly.

Water Management Officer
or Supervisor

Water Management Specialist

Field Team:

CERTIFICATE NO. II

1. Certified that the Revenue Department has been consulted regarding path of Watercourse. In case any dispute regarding alignment of Watercourse arises, the Khal. Executive Committee will seek help from the Revenue Department and will get their decision.
2. Certified that the Irrigation Department has been consulted regarding sanctioned nakkas points. We will not change the route or the positions of nakkas. If any change is required according to topography etc., the Committee will apply for the said change to the Irrigation Department and only with their approval will change be done.

Water Management Officer
or Supervisor

Water Management Specialist

Field Team:

Directorate General Agriculture, Water Management Program
Province

ESTIMATES OF MATERIALS

For Watercourse No._____ Village: _____ F.T._____

Total Length = _____meters	Lining Percentage = _____%
Length of Lining = _____meters	YEAR OF IMPROVEMENT __19_____

TYPE OF STRUCTURE DESCRIPTION & DIMENSIONS (m)	Masonry volume (m3) per unit	Total masonry volume (m3)	Bricks thou. \1 (1000)	Cement bags \2 (no)	Sand \3 (m3)	Others	Remarks
LINING- Section I L= D= B= Z= Wall: H= T= Floor: W= T=							
LINING- Section II L= D= B= Z= Wall: H= T= Floor: W= T=							
PANEL NAKKAS- Standard design w/cutoff walls & toe walls Size: No:							
ARCHED CULVERTS- Number: Size: Std. Length:							
SLAB / PIPE CULVERTS Number: Size: Std. Length:							
OTHER STRUCTURES- Drops, Syphons, etc Details:							

Rates: \1 thousands @ 500/m3
\2 bags @ 2.25/m3
\3 m3 @ 0.24/m3

Directorate General Agriculture, Water Management Program
Province

Estimated Cost of Materials

For W-C No. _____

Sl. no.	TYPES OF MATERIALS	QUANTITY	RATE	TOTAL COST (Rupees)
1.	BRICKS			
2.	CEMENT			
3.	SAND			
4.	NAKKAS			
5.	IRON BARS			
6.	BENCH MARKS			
7.	ANY OTHER			
	TOTAL COST TO BE INCURRED ON MATERIALS			

Submitted to the On-Farm Water Management Coordinator/Project Director for approval of Cost Estimates amounting to Rs _____.
It is certified that A Class bricks, good quality sand and good quality nakkas and cement will be purchased at lowest rates and will be used on this watercourse. Works will be carried out according to standards and approved drawings with 1:3 cement:sand mortar both for masonry and plaster work.

Water Management Officer
or
Supervisor

Water Management Specialist
On Farm Water Management Project
F.T._____

It is certified that all the documents in the Watercourse file are complete and correct. Design, design sheets and Topo Maps are correct. Estimates have been found correct.

Approved: { Project Director, On Farm Water Management Project
{ Asstt. Agri. Engineer, O. F. W. M.

Submitted to: { Director (Field) for kind approval as the amount has exceeded Rs. /-

Directorate General Agriculture, Water Management Program
Province

EXPLANATORY MEMORANDUM

Cost Estimates of Watercourse No._____ Village _____

The estimates contain the following civil works:-

1. Lining _____meters. (_____% of total length)
2. Nakkas :
3. Culverts :
4. Buffalo Wallow :
5. Bench Marks :
6. Others :

Estimated Materials to be used with Costs.

1. _____thousands bricks
   @ Rs _____/1000
   including transportation charges from
   kiln to site (_____km distance) Rs _____

2. _____bags of cement
   @ Rs _____/bag Rs _____

3. _____cu meters sand
   @ Rs _____/cu meter
   including transportation charges from
   source to site(_____km distance) Rs _____

4. a) _____ nos. Nakkas of _____cm size
   @ Rs _____each. Rate fixed by the
   Water Management Coordinator/Project
   Director. Rs _____

   b) _____ nos. Nakkas of _____cm size
   @ Rs _____each. Rate fixed by the
   Water Management Coordinator/Project
   Director. Rs _____

5. _____bench marks
   @ Rs _____/bench mark. Rs _____

Total: Rs _____

Water Management Officer/Supervisor
On Farm Water Management Project
Field Team _____

Water Management Specialist

Project Director
On Farm Water Management Project