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Computer Programming Tool in Agricultural Water Flow Management to Development of the Hydraulic Calculator for Flow Calculation through Various Waterways

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Abstract: Notches, weirs, orifices are the most commonly used devices for flow measurement and calculation and waterways are the backbone of water conveyance and distribution system where flow calculation is essential. The water measuring devices as well as waterway are having relevant equations for flow calculation that involve lot of calculations. To simplify the calculations Hydraulic calculator which is a C programme is developed for fourteen different flow measuring devices viz. Trapezoidal Waterways, Parabolic Waterways, Triangular Waterway, Rectangular Waterways. Accurate measurement of irrigation water permits intelligent use of this valuable natural resource. Flow calculation is the determination of the quantity of water that passes through a pipe, conduit or open channel. The calculator was developed for above 4 flow measuring devices using C language Version 3.0 Turbo c++ copyright (c)1990, 1992 by Borland International was developed.

Key word: Notches, weirs, orifices and Waterway

I. INTRODUCTION

Soil and water are two very precious resources that the nature has bestowed on planet earth. These are the basic assets, which human being possesses free of cost from nature and the whole agriculture based on these resources.

In case of soil and water accurate measurement of irrigation water permits intelligent use of this valuable natural resource. Flow calculation is the determination of the quantity of water that passes through a pipe, conduit or open channel. Flow may be expressed as a rate of volumetric flow in units such as gallons per minute, cubic meters per minute, cubic feet per minute.

Flow calculation through various waterways are the most commonly used devices for flow measurement and calculation and waterways are the backbone of water conveyance and distribution system where flow calculation is essential.

This paper discusses the different flow calculation through various waterways and Computer Programming Tool in Agricultural Water Management for development of the hydraulic calculator for flow calculation through various waterways .c language program for to develop the hydraulic calculator for flow calculation through various waterways.

II. MATERIALS AND METHODS

The methodology used to develop Hydraulic calculator for Flow Calculation. It includes different formulae and theoretical considerations those are used while developing the calculator. It also encapsulates the configuration of the system and information about the used to develop calculator.

Configuration of the System

Desktop System:- Intel® Pentium® 4, 2.0 GHz,1 GB DDR 2-RAM, Intel 845 Series Motherboard, Nvidia Geforce 4® – 440-8x AGP card, Microsoft® Windows™ XP Professional Version 2002 Service Pack 2,Windows Development, Microsoft® Access 2000(9.0.2720)

III. ABOUT THE PLATFORM

For the development of Hydraulic Calculator for flow measurement through Waterways, Notches, Weirs & Orifices using C language Version 3.0 Turbo c++ copyright (c)1990, 1992 by Borland International, Inc. following different formulae are used.

Flow calculation through waterways

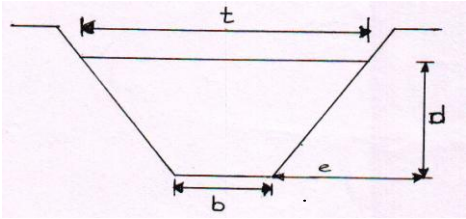
3.3.1 Trapezoidal waterway

- The cross sectional area of waterway

$A = bd + zd^2$ Where, A= Cross sectional area of waterway, m^2

b= Bottom width, m, d= Depth of water level, m

$$z = \frac{e}{d}$$



Trapezoidal waterway

- The wetted perimeter

$$P = b + 2d.\sqrt{z^2 + 1}$$

Where,

P= Wetted perimeter, m

- The hydraulic radius

$$R = \frac{A}{P}$$

Where, R= Hydraulic radius, m , A= Cross sectional area of waterway, m^2

P= Wetted perimeter, m

- The velocity of flow

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

Where,

V= Velocity of flow, m/ s

R= Hydraulic radius, m

S= Slope, m/m

n= Manning's roughness coefficient

- The expected runoff flow through Trapezoidal waterway

$$Q = A \times V$$

Where, Q= Flow rate, m^3/s A= Cross sectional area of waterway, m^2

V= Velocity of flow, m/s

Parabolic waterway

- The cross sectional area of waterway

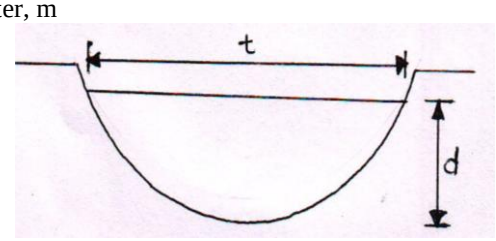
$$A = \frac{2}{3} \times t \times d$$

Where,

A= Cross sectional area of waterway, m^2

t= Top width of water surface level, m

d= Depth of water, m



Parabolic waterway

- The wetted perimeter

$$P = t + \frac{8d^2}{3t}$$

Where,

P= Wetted perimeter, m

t= Top width of water surface level, m

d= Depth of water, m

- The hydraulic radius

$$R = \frac{A}{P}$$

Where,

R= Hydraulic radius, m

A= Cross sectional area of waterways, m^2

P= Wetted perimeter, m

- The velocity of flow

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

Where,

V= Velocity of flow, m/s

R= Hydraulic radius, m

S= Slope, m/m

n= Manning's roughness coefficient

- The expected runoff flow through Parabolic waterways

$$Q = A \times V$$

Where,

Q= Flow rate, m^3/s

A= Cross sectional area of grass waterways, m^2

V= Velocity of flow, m/s

Triangular waterway

- The cross sectional area of waterways

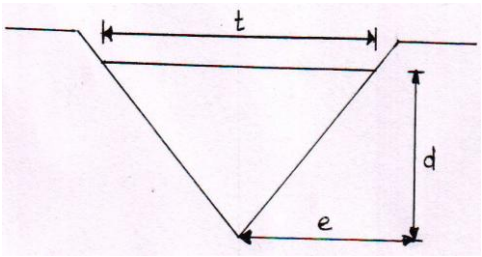
$$A = zd^2$$

Where,

A=Cross sectional area of Grass waterways, m^2

z= e/d

d= Depth of water, m



Triangular Waterway

- The wetted perimeter

$$P = zd\sqrt{z^2 + 1}$$

Where,

P= Wetted perimeter, m

- The velocity of flow

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

- The hydraulic radius

$$R = \frac{A}{P}$$

- The expected runoff flow through Triangular waterway

$$Q = A \times V$$

Rectangular waterway

- The cross sectional area of waterway

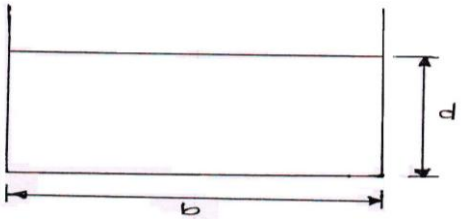
$$A = b \times d$$

Where,

A= Cross sectional area of Grass waterway, m^2

b= Width, m

d= Depth of water, m



Rectangular Waterway

- The wetted perimeter

$$P = 2(b + d)$$

Where,

P= Wetted perimeter, m

- The velocity of flow

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

- The hydraulic radius

$$R = \frac{A}{P}$$

- The expected runoff flow through Triangular waterway

$$Q = A \times V$$

C language program

The hydraulic calculator for flow calculation through various waterways. The programme is prepared in the C language Version 3.0 Turbo c++.

```
include <stdio.h>
#include<math.h>
#include<conio.h>
#define  g 9.81
#define   tan45 1
void main()
{
   float b,d,e,R,A,s,n,t,z,P,d1,V,Q;    /* This parameter for various waterway*/
                                          int kk, choice = 0 ;
   clrscr();
   // while statement start
          while (choice!=4)
          {
     clrscr();
          printf("\n\t\t\t**** DEPARTMENT OF SWCE***\n");
          printf("\t\t\t~~~~~~~~~~~~~~~~~~~~~~~~~~~~~\n");
          printf("\tDevelopment of Hydraulic calculator for Flow  measuring devices \n\n");
          printf("\tTo calculate flow through various Waterway \n");
          printf("\t\t  1.Trapezoidal Waterways  \n");
          printf("\t\t  2.Parabolic Waterways \n");
          printf("\t\t  3.Triangular Waterway\n");
          printf("\t\t  4.Rectangular Waterway \n\n");
scanf("%d",&choice);
switch (choice)
{
  case 1:              /*Trapezoidal waterway*/
    {
    clrscr();
          printf("\n\t\t **** 1.Trapezoidal Waterway  ***\n\ ");
          printf("\n\t\t Input value for Trapezoidal Waterway==>\n");
          printf("\n\t\t\tEnter the value for Bottom width(m) \tb=");
          scanf("%f",&b);
          printf("\t\t\tEnter value of Manning's coe.\n\t\t\t between.01-0.9  \t\t\tn=");
          scanf("%f",&n);
          printf("\t\t\tEnter value of Depth of water level(m) \td=");
          scanf("%f",&d);
          printf("\t\t\tEnter value of Horizontal distance(m) \te=");
```

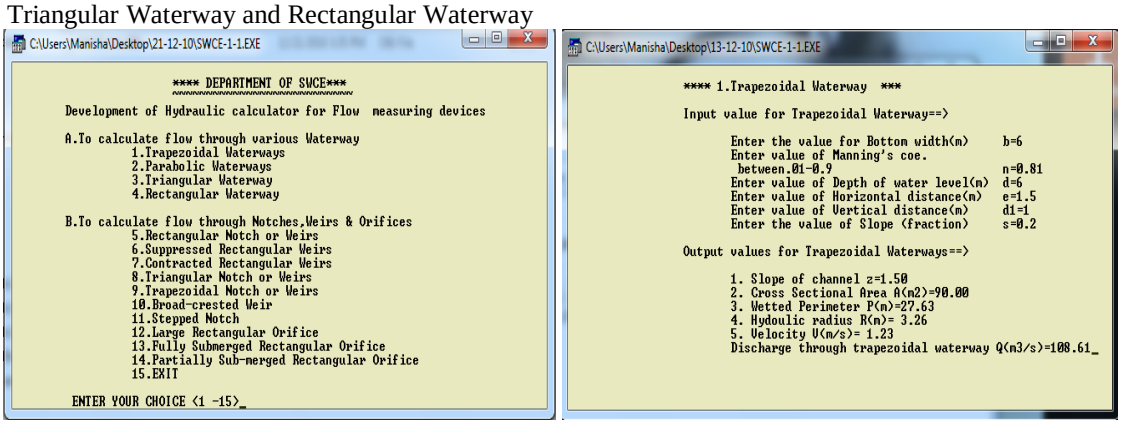


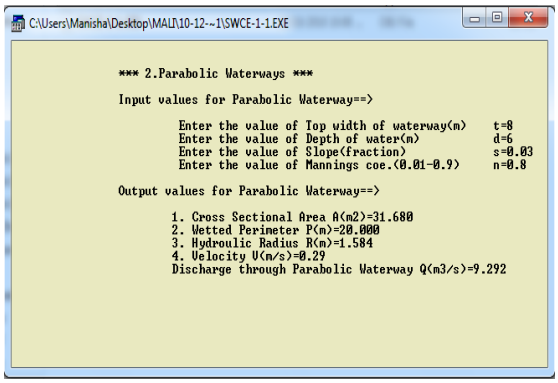
```
        scanf("%f",&e);
        printf("\t\t\tEnter value of Vertical distance(m) \td1=");
        scanf("%f",&d1);
        printf("\t\t\tEnter the value of Slope (fraction) \ts=");
        scanf("%f",s);
        printf(" \n\t\t Output values for Trapezoidal Waterways==>\n");
        z=e/d1;
        printf("\n\t\t\t1. Slope of channel z=%3.2f\t",z);
        A=(b*d)+(z*pow(d,2));
        printf("\n\t\t\t2. Cross Sectional Area A(m2)=%5.2f",A);
        P=(b)+(2*d*sqrt((z*z)+1));
        printf("\n\t\t\t3. Wetted Perimeter P(m)=%5.2f",P);
        R=A/P;
        printf("\n\t\t\t4. Hydoulic radius R(m)=%5.2f",R);
        V = (pow(R,2/3) * pow(s,1/2))/n;
        printf("\n\t\t\t5. Velocity V(m/s)=%5.2f",V);
        Q=(A*V)-2.5;
        printf("\n\t\t\tDischarge through trapezoidal waterway Q(m3/s)=%5.2f",Q);/*For print press print key*/
   getch();
   clrscr();
   break;
  }
 case 2 :            /* Parabolic Waterways */
  {
     clrscr();
        printf("\n\n\t\t*** 2.Parabolic Waterways ***\n");
        printf("\n\t\tInput values for Parabolic Waterway==>\n");
        printf("\n\t\t\t Enter the value of Top width of waterway(m) \tt=");
        scanf("%f",&t);
        printf("\t\t\t Enter the value of Depth of water(m) \t\td=");
        scanf("%f",&d);
        printf("\t\t\t Enter the value of Slope(fraction) \t\ts=");
        scanf("%f",&s);
        printf("\t\t\t Enter the value of Mannings coe.(0.01-0.9) \tn=");
        scanf("%f",&n);
        printf("\n\t\tOutput values for Parabolic Waterway==>\n");
        A=0;
        A=0.66*t*d;
        printf("\n\t\t\t1. Cross Sectional Area A(m2)=%5.2f",A);
        P=t+8*(d*d)/(3*t);
        printf("\n\t\t\t2. Wetted Perimeter P(m)=%5.2f",P);
        R=0;
        R=A/P;
        printf("\n\t\t\t3. Hydroulic Radius R(m)=%5.2f",R);
        V=0;
        V= (pow(R,0.66) * pow(s,0.5))/n;
        printf("\n\t\t\t4. Velocity V(m/s)=%5.2f",V);
        Q=0;
        Q=A*V;
        printf("\n\t\t\tDischarge through Parabolic Waterway Q(m3/s)=%5.2f",Q);/*For print press print key*/
    getch();
    break;
   }
case 3:    /* Triangular Waterways */
  {
   clrscr();
        printf("\n\n\t\t*** 3.Triangular Waterways  ***\n\n");
        printf("\n\t\tInput values for Triangular Waterway==>\n");
        printf("\n\t\t\t Enter the value Top width of waterway (m) t=");
        scanf("%f",&t);
        printf("\t\t\t Enter the value of Depth of water(m) \td=");
        scanf("%f",&d);
        printf("\t\t\t Enter value of Horizontal distance(m) \te=");
        scanf("%f",&e);
```

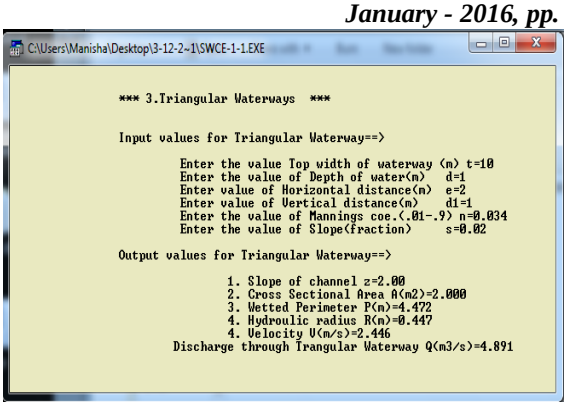


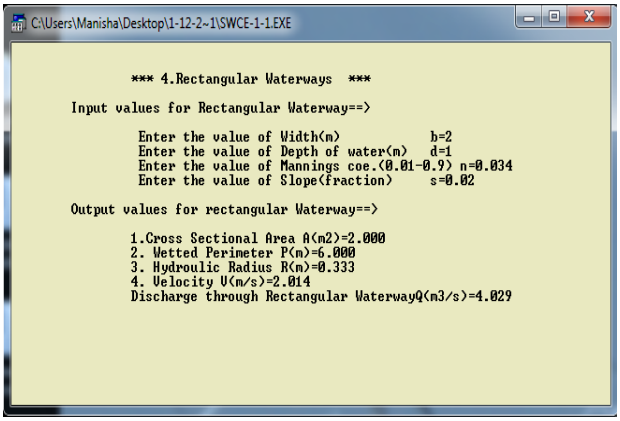
```
            printf("\t\t\t Enter value of Vertical distance(m) \td1=");
            scanf("%f",&d1);
            printf("\t\t\t Enter the value of Mannings coe.(.01-.9) n=");
            scanf("%f",&n);
            printf("\t\t\t Enter the value of Slope(fraction) \ts=");
            scanf("%f",&s);
            printf("\n\t\tOutput values for Triangular Waterway==>\n");
            z=e/d1;
            printf("\n\t\t\t\t1. Slope of channel z=%5.2f",z);
            A=z*pow(d,2);
            printf("\n\t\t\t\t2. Cross Sectional Area A(m2)=%5.2f",A);
            P= z*d * sqrt(pow(z,2)+1);
            printf("\n\t\t\t\t3. Wetted Perimeter P(m)=%5.2f",P);
            R=A/P;
            printf("\n\t\t\t\t4. Hydroulic radius R(m)=%5.2f",R);
            V= (pow(R,0.66) * pow(s,0.5))/n;
            printf("\n\t\t\t\t4. Velocity V(m/s)=%5.2f",V);
            Q=A*V;
            printf("\n\t\t\tDischarge through Trangular Waterway Q(m3/s)=%5.2f",Q);/*For print press print key*/
     getch();
     break;
    }
case 4:   /* Rectangular Waterways */
   {
   clrscr();
            printf("\n\n\t\t*** 4.Rectangular Waterways  ***\n");
            printf("\n\tInput values for Rectangular Waterway==>\n");
            printf("\n\t\t Enter the value of Width(m) \t\tb=");
            scanf("%f",&b);
            printf("\t\t Enter the value of Depth of water(m) \td=");
            scanf("%f",&d);
            printf("\t\t Enter the value of Mannings coe.(0.01-0.9) n=");
            scanf("%f",&n);
            printf("\t\t Enter the value of Slope(fraction) \ts=");
            scanf("%f",&s);
            printf("\n\tOutput values for rectangular Waterway==>\n");
            A=b*d;
            printf("\n\t\t1.Cross Sectional Area A(m2)=%5.2f",A);
            P=2*(b+d);
            printf("\n\t\t2. Wetted Perimeter P(m)=%5.2f",P);
            R=A/P;
            printf("\n\t\t3. Hydroulic Radius R(m)=%5.2f",R);
            V=pow(R,0.66) * pow(s,0.5)/n;
            printf("\n\t\t4. Velocity V(m/s)=%5.2f",V);
            Q=A*V;
            printf("\n\t\tDischarge through Rectangular WaterwayQ(m3/s)=%5.2f",Q);/*For print press print key*/
   getch();
    break;
    }
```

Output screen of program for Trapezoidal Waterways, Parabolic Waterways, Triangular Waterway and Rectangular Waterway









IV. CONCLUSIONS

1. System is platform independent.
2. The Hydraulic calculator was developed to calculate the flow through flow measuring devices. Calculator is user friendly.

REFERANCE

[1] E balagurusamy, 1989 Programming in ANSI C (4E) Tata Mc Graw-Hill Publisher, New Delhi

[2] A M Michel, 2008 Irrigation Theory and Practice Second Edition. UBS Publishers Distributors New Delhi-110 00

[3] Anonyous.1990.Runoff International Institute for Land Reclamation and Improvement, Netherlands

