



## Activity 1 - Stream flow

### Introduction

In this activity we will measure and calculate stream flow.

Stream flow, also referred to as discharge, is the amount of water flowing in a stream at a given time interval. Discharge is usually expressed in cubic meters per second

( $m^3/s$ ) or cubic feet per second (cfs).

The discharge is calculated by multiplying the area of the stream cross section by the average water velocity.

To calculate the cross section we will measure the depth of the stream at equally spaced points along the cross section. We will then integrate over the whole width of the stream.

To get the average velocity we will measure the velocity at the same points that were used to measure the depth. We will then take the average. As the velocity varies with depth we will measure the velocity at points of 40% of the full depth. This is approximately the right position to measure average flow rate for a stream water column.

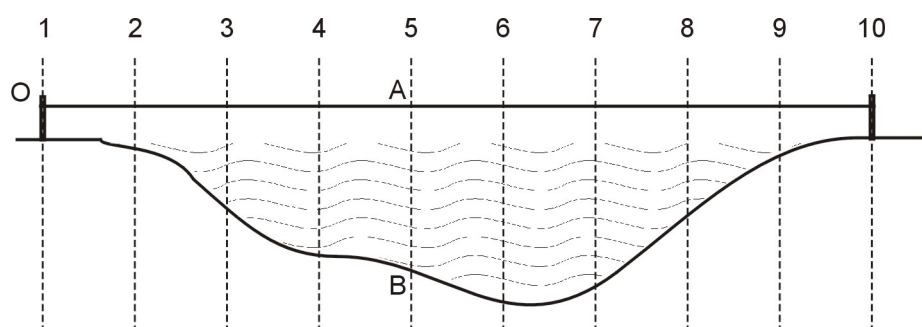
### Equipment

- MultiLogPRO
- Flow rate sensor
- A measuring tape
- A meter stick
- 2 pegs
- A rope
- Masking tape

### Equipment Setup Procedure

1. Place the rope horizontally across the stream at right angle to the flow and secure it in both ends with a peg

2. Measure the width of the stream. Record the result on your data sheet
3. Divide the width into 9 equally spaced sections and use the masking tape to mark the division points on the rope



4. Turn on MultiLogPRO
5. Plug the Flow rate sensor into input 1 (I/O-1) of MultiLogPRO
6. Set MultiLogPRO up according to the setup specified below

### MultiLogPRO Setup

<b>Sensors</b>
Input 1: Flow rate
<b>Rate:</b>
Every 10 seconds
<b>Samples:</b>
50
<b>Display:</b>
Numeric

### Experimental Procedure

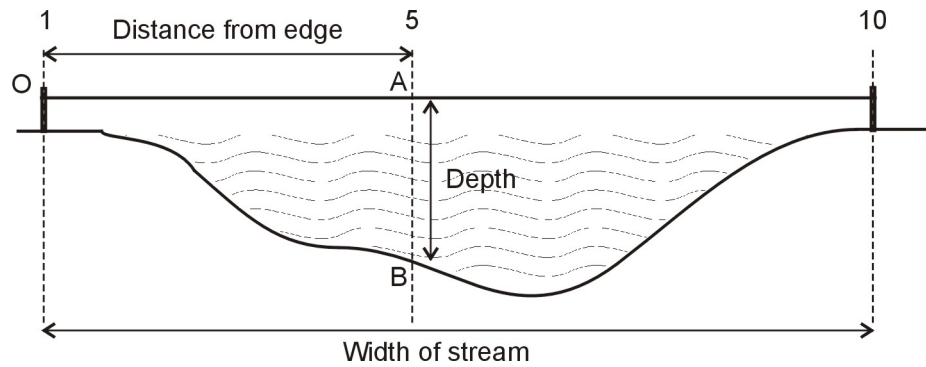
#### Preparing a data sheet

Prepare a table for recording the data that you are going to measure. You will need a table of 5 columns and 10 rows:

Point	Exp. number	Distance	Depth	Velocity
1		0	0	0
2				

## Measuring the stream cross section

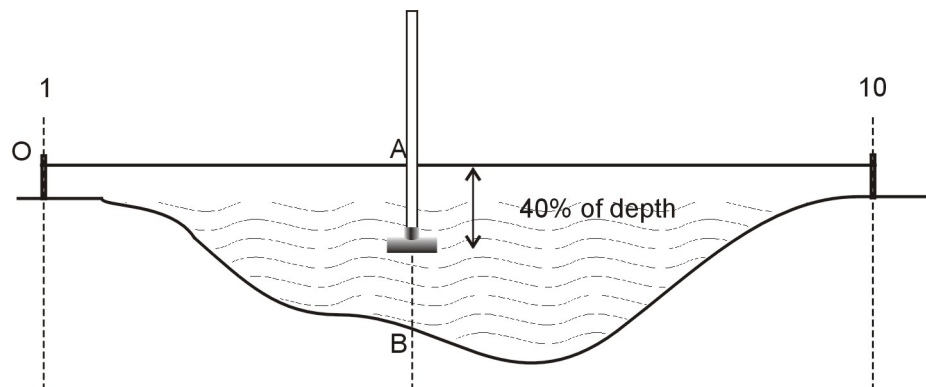
1. Use the meter stick to measure the depth of the stream at each of the division points. Record your measurements



## Measuring the stream velocity


Measure the stream velocity at the same points where the depth measurements were made.

1. At each point, submerge the flow rate sensor to 40% of the depth measured for this point



2. Position the sensor's propeller so that it is pointing upstream

3. Push **Enter**  on MultiLogPRO's keypad to begin recording

4. Wait at least 20 seconds, then push **Escape**  to stop

5. Record the velocity as well as the experiment number in your data sheet
6. Push Escape a second time to return to MultiLogPRO's main menu
7. Repeat steps 2 to 6 for each division points


## Data Analysis

### Entering your data to MultiLab

1. Connect MultiLogPRO to the computer and turn it on
2. Open MultiLab
3. Click **Table** on the menu toolbar, and then click **Capture mode** to open the Capture dialog box
4. Click **Insert manual column** to open the dialog box
5. Enter **Distance** in the column title edit box and **m** in the column unit edit box, and then click **OK**. The new column is added to the Current Columns list.
6. Repeat this procedure to add a second column for the depth data and a third column for the velocity data
7. Click **OK**
8. MultiLab opens a new table with the columns you defined
9. Enter your data into the columns by clicking a cell and typing the number, then press Enter or the down arrow key to move to the next cell:




		Capture 1	Capture 1	Capture 1
	Samples	Distance (m)	Depth (m)	Velocity (m/s)
0	1	0	0	0
1	2	0.5	-0.3	0.032
2	3	1	-0.3	0.055
3	4	1.5	-0.78	0.067
4	5	2	-0.96	0.34
5	6	2.5	-1.33	0.7
6	7	3	-1.45	0.84
7	8	3.5	-1.24	0.68
8	9	4	-0.88	0.22
9	10	4.5	-0.33	0.044
10	11	4.88	0	0

10. Click **save**  on the main toolbar and save your project

### Calculating the cross section area

Display a graph of **Depth vs. Distance**:


1. Click **Edit graph**  on the graph toolbar
2. Select **Capture 1: Distance** from the **X–Axis** list
3. Select **Capture 1: Depth** from the **Y–Axis** list
4. Click **OK**

Calculate the cross section:

5. Click **Analysis** on the menu bar, then click **Statistics**
6. Record the area in your data sheet

### Calculating the average velocity

Display a graph of **Velocity vs. Distance**:

1. Click **Edit graph**  on the graph toolbar
2. Select **Capture 1: Distance** from the **X–Axis** list
3. Select **Capture 1: Velocity** from the **Y–Axis** list
4. Click **OK**

**Calculate the Average velocity:**

5. Click **Analysis** on the menu bar, then click **Statistics**
6. Record the average velocity in your data sheet

**Calculating the discharge**

Multiply the average stream velocity by the cross section area