**Channel Characterization (Outfall 002)**

**Data Collection**

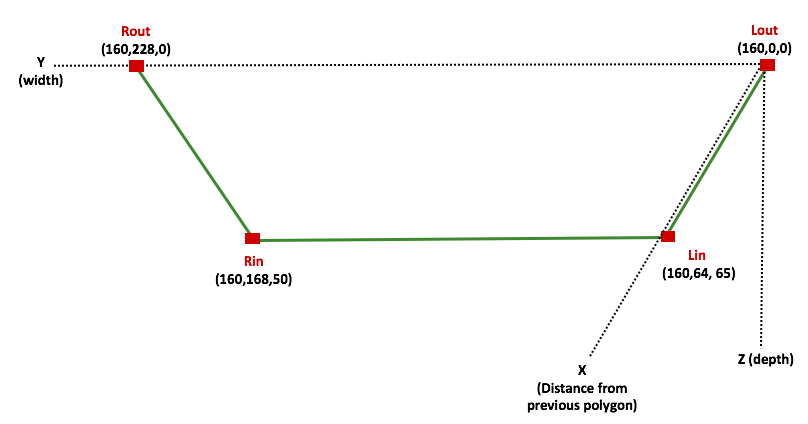
The channel located at Outfall 002 was divided into 20 cross-sections separated 20 feet apart from each other. For each cross-section, the following measurements were taken:

1. Distance from the previous cross-section. The reference point was the bridge located at the beginning of the channel. The first cross-section was located at 13 feet and 4 inches from the bridge (160 in).
2. Channel width and geometry (Positions). Four measurements were taken: Lout (starting point at the left bank of the channel), Lin, Rout (total width of the channel), Rin. See Figure 1.
3. Sediment grain type, size and depth
4. Vegetation description and other observations

**Data entry**

The excel file named ChannelDescription.xlsx contains all the data gathered during the channel characterization. Each column has one measurement:

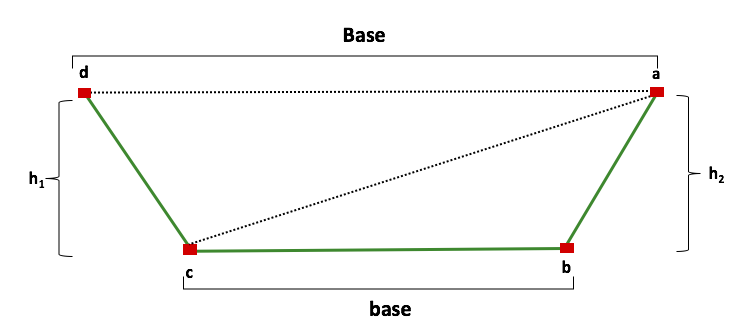
1. Section: Refers to each cross section (1,2…20)
2. Position: Refers to the four geometry measurements (Lout, Lin, Rout, Rin)
3. Column X: Is the X coordinate for each position and it represents the distance from the previous polygon (inches).
4. Column Y: Is the Y coordinate for each position and it represents the distance of the channel with respect to point Lout (inches).
5. Column Z: Is the Z coordinate for each position and it represents the depth (cm).



**Figure 1.** Cross section 1 (rough representation). Each position (Rout, Rin, Lout, Rin) has X, Y and Z coordinates. X, Y (inches) Z (cm).[[1]](#footnote-1) All positions from each cross section has the same X coordinate because they are located at the same distance from the previous cross section.

**Channel Geometry: Calculating area and perimeter**

*Area of a trapezoid*



**Figure 2.** Notations used to calculate the area of each cross section.

*rd*

*Perimeter of a trapezoid*

The distances between each point is calculated by:

P= L1 + L2 + L3 + L4

**Model’s Calculations**

**Discharge (Q):** The *volume of water per unit time* that passes a specified point on a stream. Discharge is conventionally measured in cubic feet per second (ft3/s) or cubic meters per second (m3/sec or cms).

Q = WdV

Where,

w = water width

d = mean water depth

v = mean water velocity

Re-writing this equation,

**Manning’s Equation**

Q= AV

Where,

Q = Flow Rate, (ft3/s)

v = Velocity, (ft/s)

A = Flow Area, (ft2)

n = Manning’s Roughness Coefficient

R = Hydraulic Radius, (ft)

S = Channel Slope, (ft/ft)

Trapezoidal open channel

If we know the discharge Q and the area A, we can calculate a quantity V = Q/A with the dimensions of a velocity. If the velocity were uniform over the cross-section A, then this would be the velocity that would give the observed discharge. The velocity is actually zero at the wetted boundary of the channel, and increases to a maximum at the centre of the channel and a little distance beneath the surface. The region near the wetted boundary is called the *boundary layer*, and most of the change in velocity takes place across it. This means that the quantity V is close to the velocity of most of the water, and we use it as if this were true.

It's clear that water flows more rapidly the steeper the slope. On a constant slope, the velocity reaches a steady value when the gravitational force is equal to the resistance to flow.

the channel may change width or shape, there may be humps and hollows in the channel, or weirs and sudden drops, and other factors that change the flow conditions. The resulting flow will be steady, although the elements of the water will experience acceleration from point to point. We can usually make a good approximation to the flow by using Bernoulli's theorem and dividing the problem into lengths of approximately uniform conditions.

On a steep slope, the normal depth is less than the critical depth, so the water profiles are different from those on a mild slope.

Desert environments typically produce more runoff and erosion per unit area than in temperate regions for a given intensity of rainfall due to sparse vegetation cover and poorly developed soils with little organic matter

Water content in the soil is held by two principal forces: adsorption and capillarity. Adsorption is responsible for moisture held on the surface of soil particles while capillarity holds water in the pores between the soil particles or between aggregates of the particles [1]. The relationship between combined effect of these forces (also often expressed in the form of potential head) and soil water content forms a basic property of soil referred to as the Soil Water Retention Characteristics (SWRC)

* Clapp and Hornberger model equation

These models contain shape parameters known as hydraulic parameters. Applications of water retention models require knowing these hydraulic parameters. Soil hydraulic parameters are traditionally obtained by curve-fitting the water retention functions using experimental data

* Field capacity
* Wilting point
* Water available to plants
* Results

Soil moisture curves

WAP tables

**Channel Drying**

1. In the R code all X, Y and Z values are converted to cm. [↑](#footnote-ref-1)