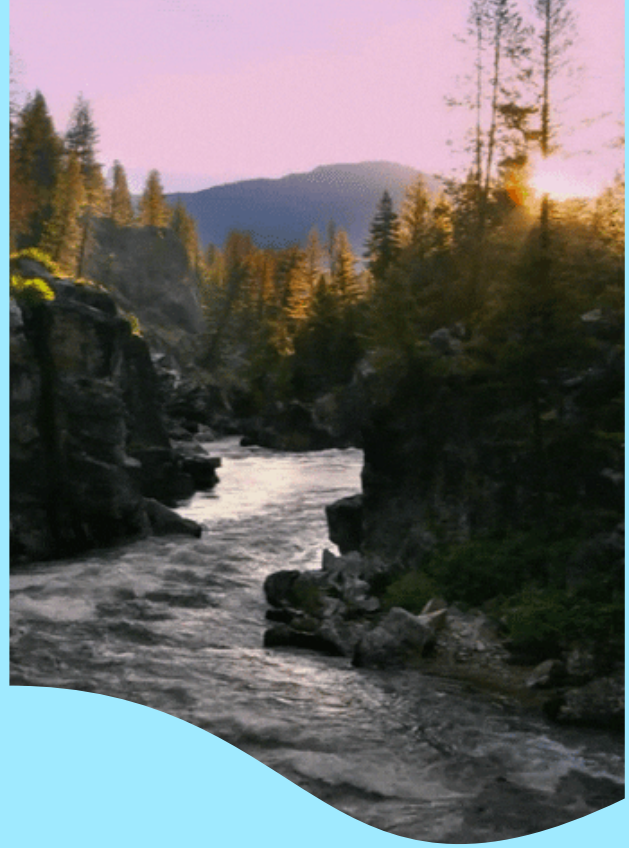


Rubber ducky stream measurements

How *fast* is a river moving?
How *much water* flows through it?
And how can these be measured?



Key terms to remember...

Flow velocity

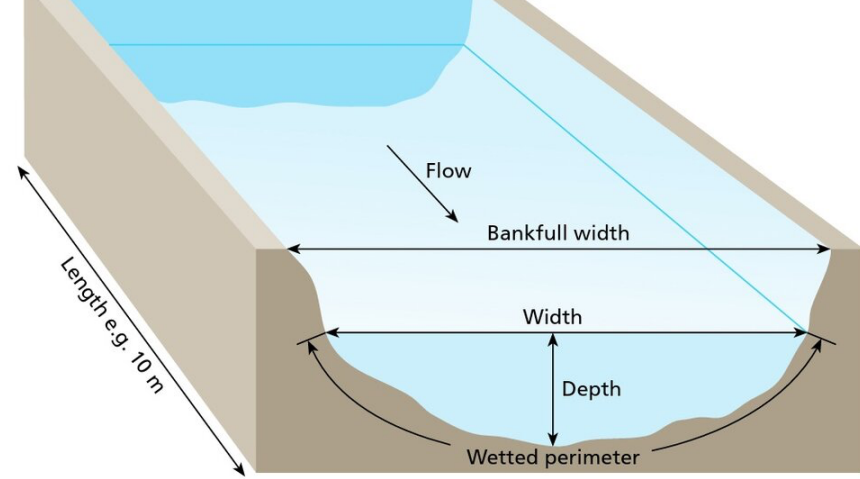
How fast the water in your stream or river is moving

Discharge

Amount of water that is moving through your stream

Cross-sectional area

The width of the river multiplied by the average depth



How can we measure?

We are particularly interested in measurements using tools we already have...



Rubber duck science

In 1992, 29,000 Rubber Ducks fell off a container ship in the Pacific Ocean.

A group of oceanographers figured they could use this incident to learn more about ocean currents...

Where did the friendly floaties end up?

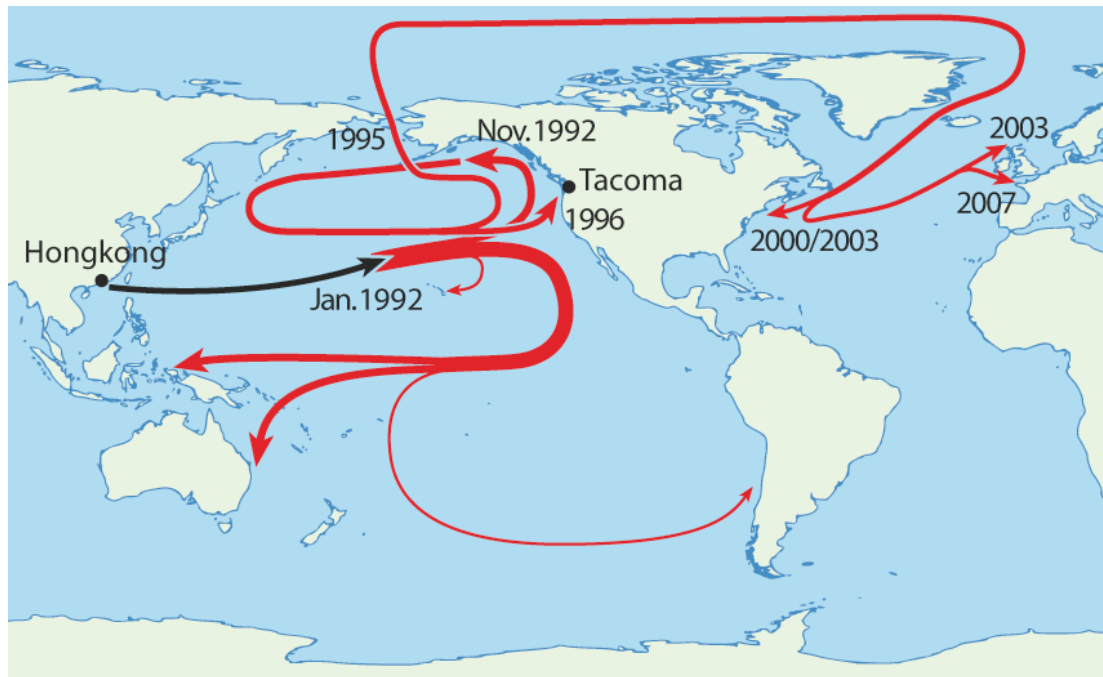


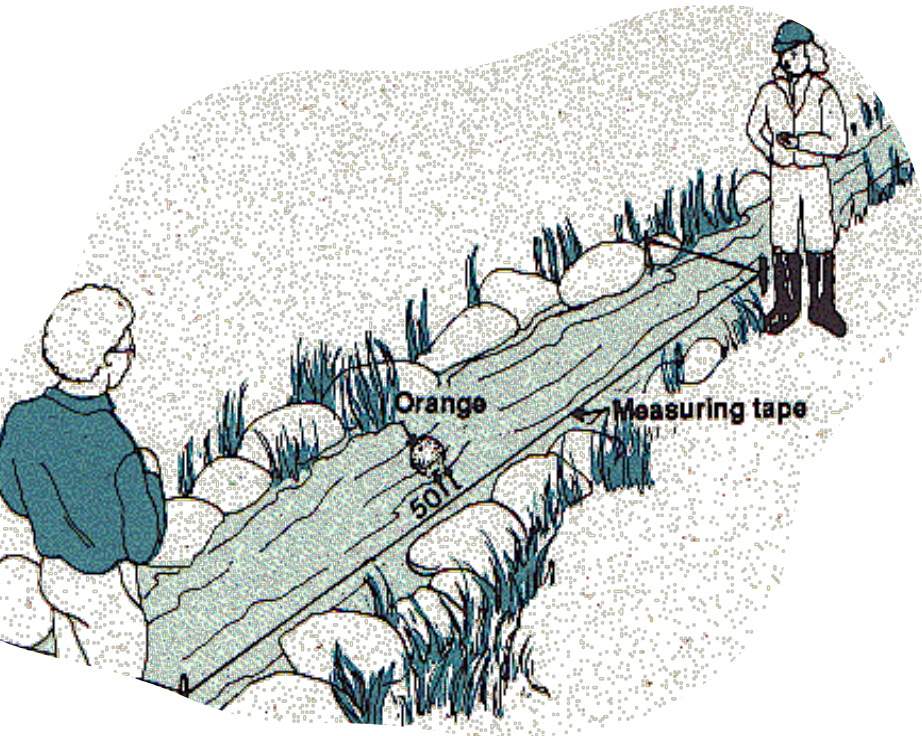
Rubber duck science

Beachgoers around the world reported sightings of Floatees...

Allowing scientists to create *models* of ocean currents!

This is a great example of **citizen science!**



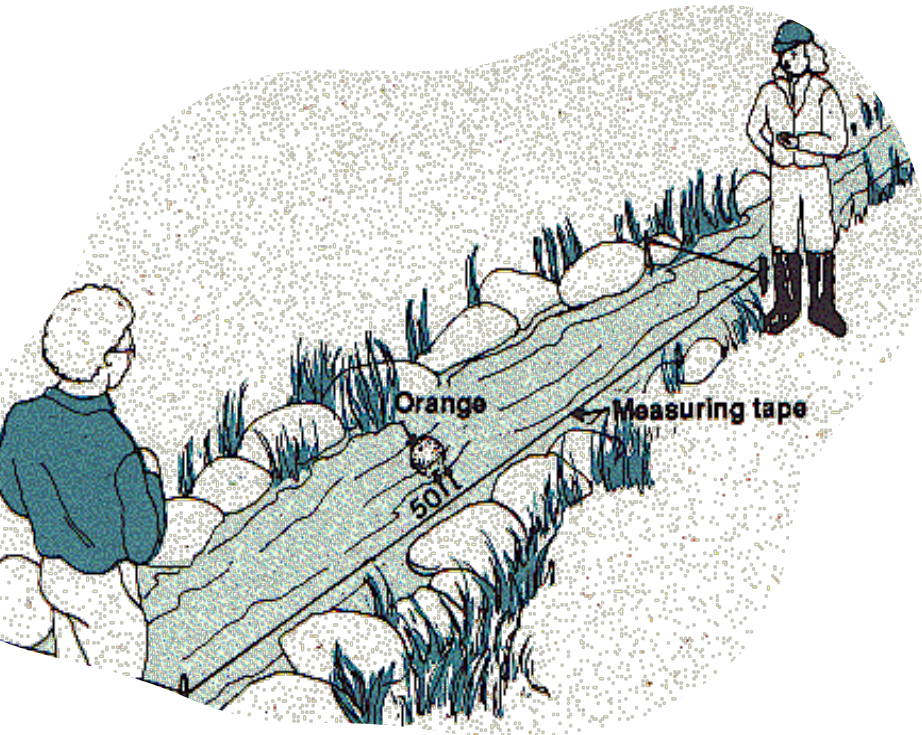


River float

With some tools we have on hand as well as some creative math, we can use a similar method to measure:

- **Flow Rate**
- **Discharge**

It all starts with releasing a rubber duck (or, another floater) and measuring how fast it flows down your river.



River float

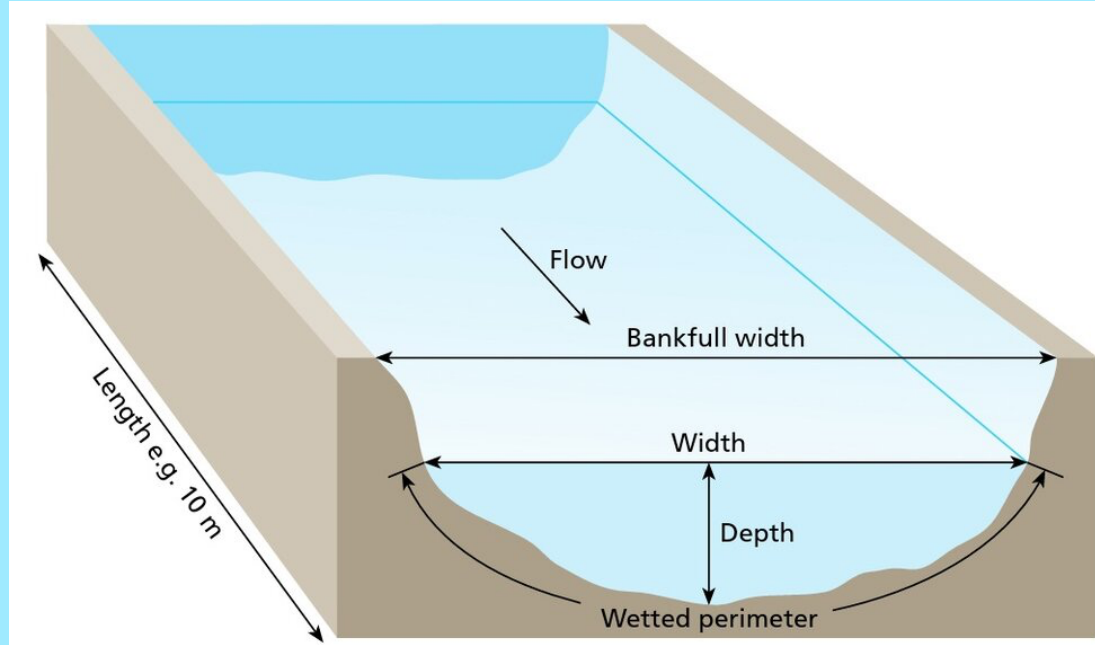
Materials you will need:

- Flowing water (stream or river)
- Measuring tape
- Calculator, paper and pencils
- Timer
- Rubber duck, orange, or other floater

01

Measure the stream

- Measure a **length** of the stream long enough to measure the ducks travel time (about 50 feet)
- Measure the **width** of your stream (where water reaches up the banks)
- Measure the **depth** of your stream, in the middle

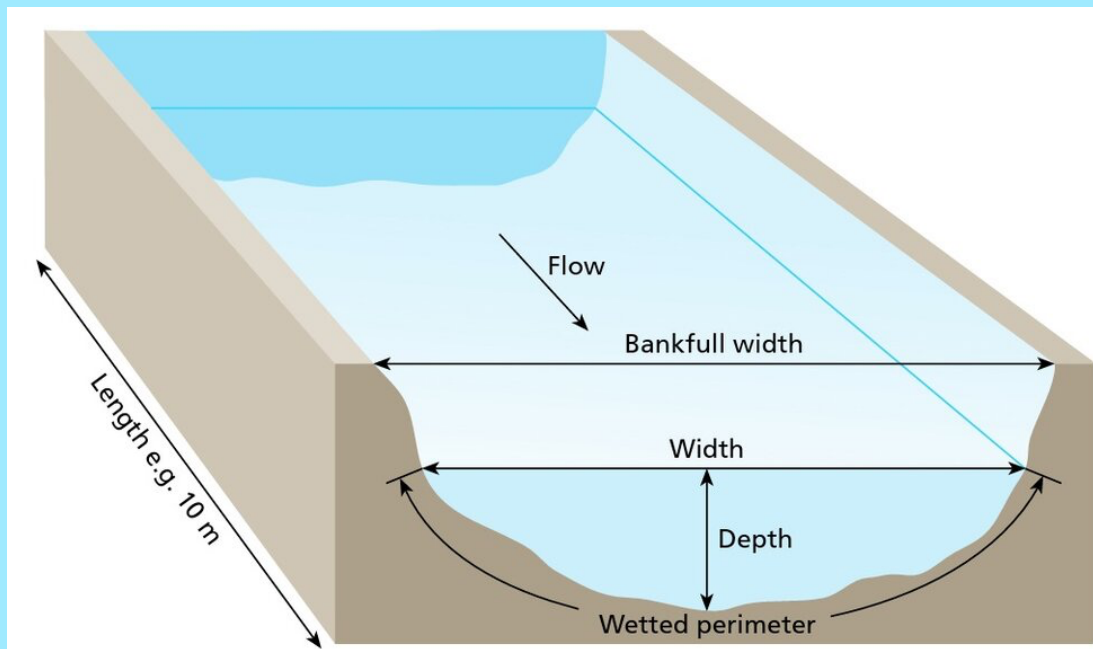


02

Cross-section

= Width \times Depth

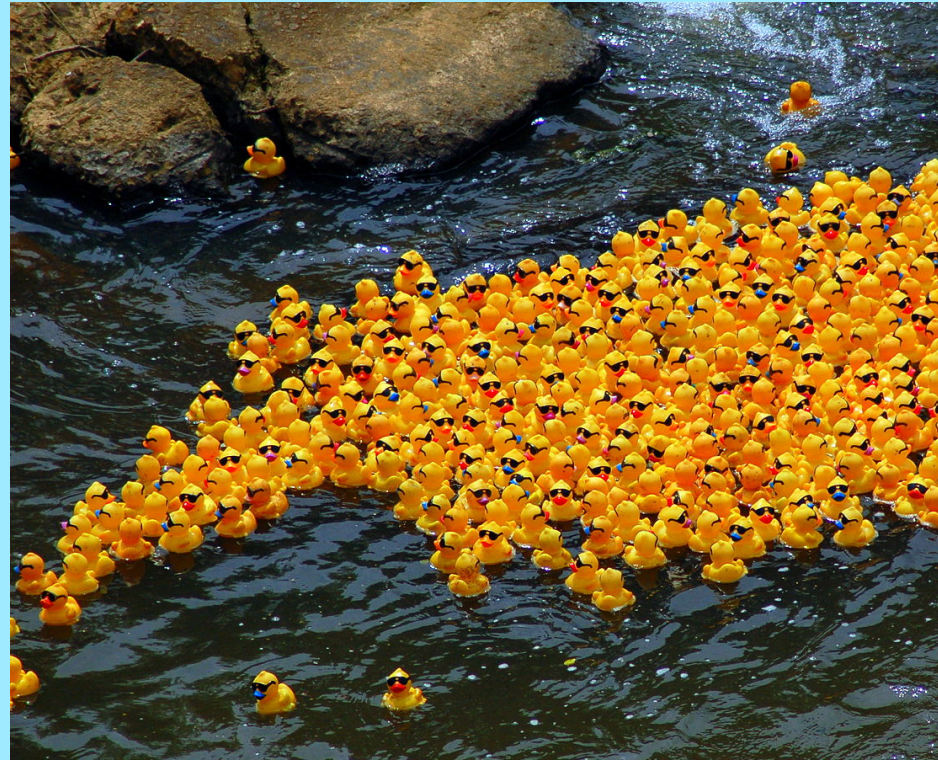
Record on your field sheet!



03

FLOAT!

- Release your duck at the upstream mark of your length
- Time how long it takes for the duck to reach your downstream mark
- Repeat three times and average



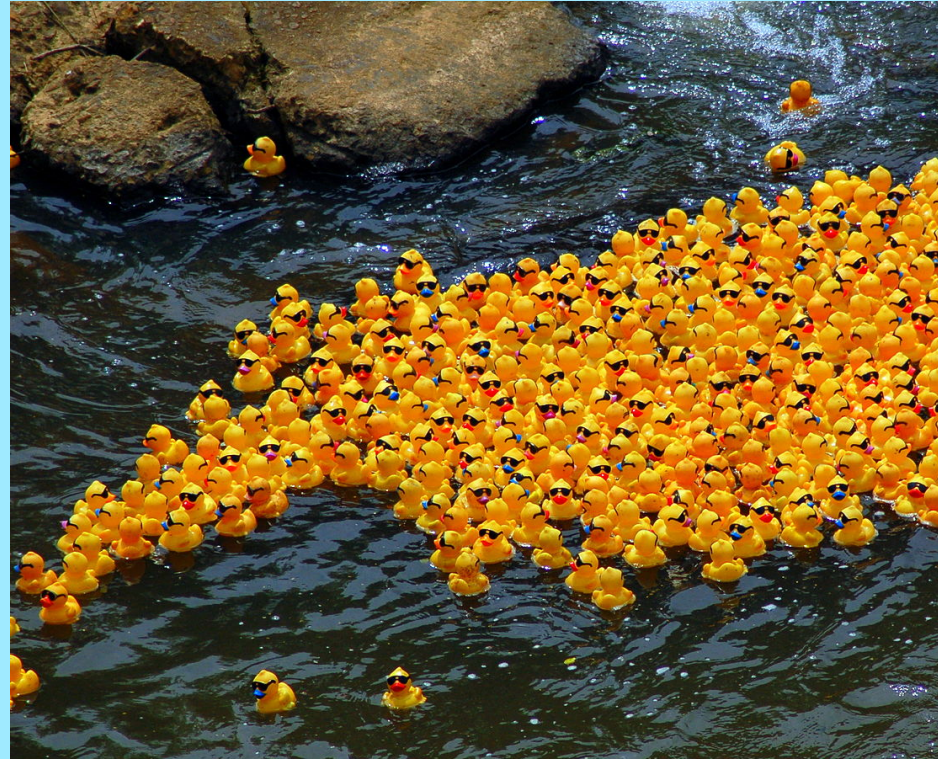
04

Flow velocity

The **Flow velocity** of the river will be the velocity at which your duck moves downstream....

$$\text{Surface flow rate} = v = \frac{\text{length (m)}}{\text{time (s)}}$$

$$\text{Mid - Depth flow rate} = 0.85v$$

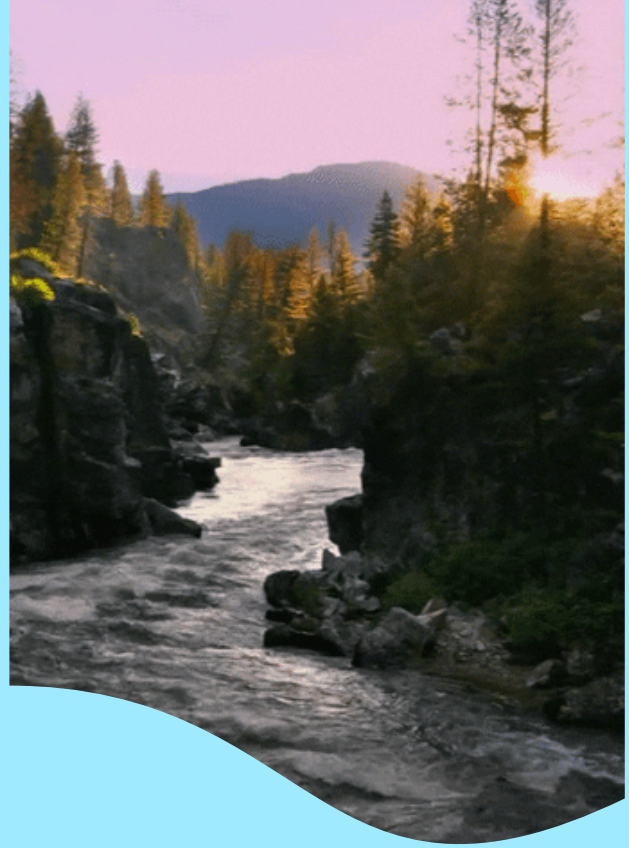


05

Calculate discharge

$$\begin{aligned} \text{Discharge} \\ &= \text{Flow Rate} \\ &\times \text{Cross Section} \end{aligned}$$

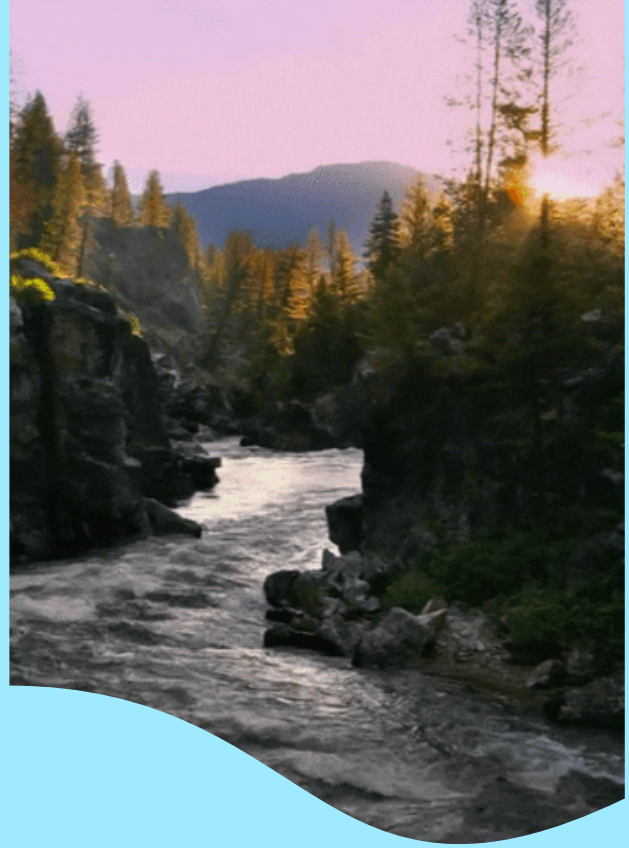
Don't forget to record!



So...

How *fast* is a river moving?

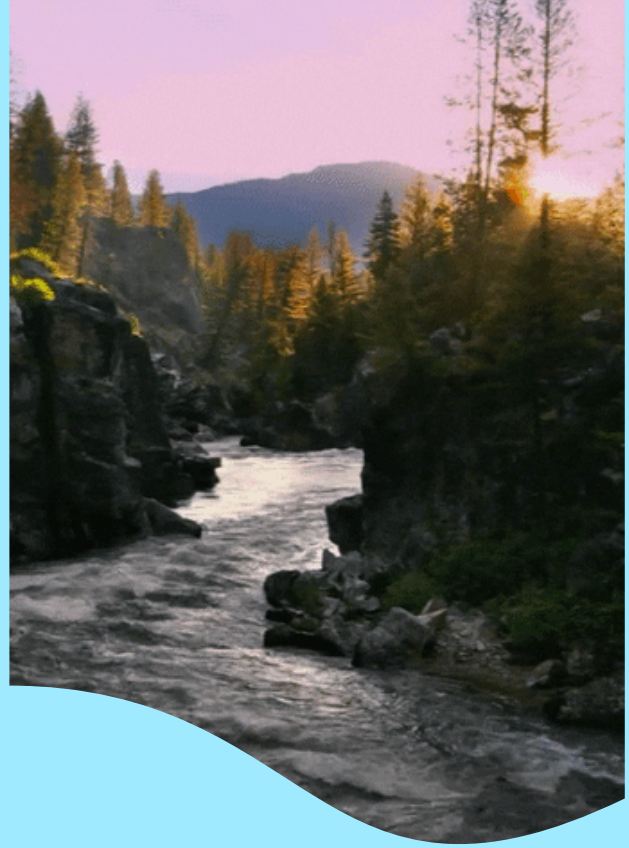
The same velocity at which something floats down the river!



So...

How *much water* flows through it?

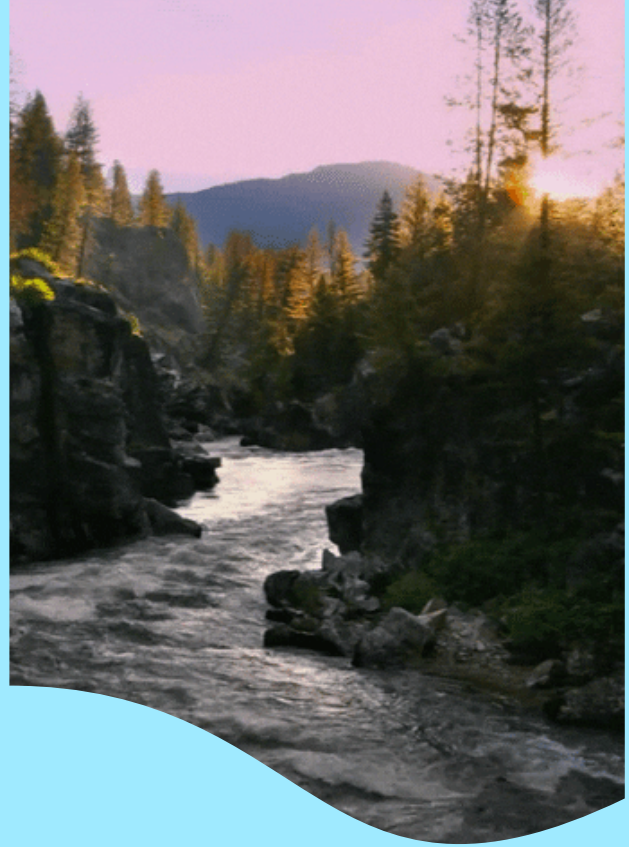
The discharge is the velocity of the river multiplied by the cross section!



So...

How can these be measured?

*With a few simple tools and
some creative math!*





Good work!

Do you have any questions?

Contact Juno, Science Education Coordinator
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