STAGE 3 SCIENCE

Drain or not to drain?

FOCUS AREA- Digital Technologies

Outcomes explored

A student:

- Plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T

Skills Focus

- Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships
- Employ appropriate technologies to represent data
- Compare data with predictions
- Present data as evidence in developing explanations

Content:

- Using and Interpreting Data

Content focus

Students:

- Develop knowledge and understanding of project management
- Learn abstraction and the relationship between models and real-world systems they represent

Australian Syllabus Links:

- ACTDIK015
- ACSIS090
- ACSIS107
- ACSIS218
- 0ACSIS221

STAGE 3 MATHS

Drain or not to drain?

FOCUS AREA - Whole Numbers 2

Outcomes explored

A student:

- Gives a valid reason for supporting one possible solution over another MA3-3WM

Content focus

Students:

- Interpret integers in everyday contexts, eg temperature

Australian Syllabus Links:

- ACMNA124

Drain or not to drain

FOCUS AREA - Data 1

Outcomes explored

A student:

- Gives a valid reason for supporting one possible solution over another MA3-3WM
- uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables MA3-18SP

Content focus

Students:

- Pose questions and collect categorical or numerical data by observation or survey
- Constructs displays, including column graphs, dot plots and tables, appropriate for data type with and without the use of digital technologies
- Describe and interpret different data sets in context

Australian Syllabus Links:

- ACMSP118
- ACMSP119
- ACMSP120

DRAIN OR NOT TO DRAIN?

After heavy rain you may have noticed large standing pools of water on the grass that seem to take forever to absorb into the ground. Or perhaps you have been surprised to feel dry ground despite recent rain. What might be the common thread in these two situations? Soil!

The Central Coast has a variety of soil texture, each with their own water infiltration rates and water holding capacity.

Soils with high water infiltration rates help the environment by reducing how much water runs over the land surface, causing erosion and transporting things like rubbish and chemicals into our waterways. Water that infiltrates into the soil can travel underground into our waterways, entering through the banks and streambed after natural filtration. Rain that infiltrates into the land also helps to replenish underground water sources called aquifers.

Soils with a high-water holding capacity can help the environment by holding onto the water for longer periods of time. Just like a sponge, the soil holds the moisture and allows plants ample time to access the water for photosynthesis.

In this activity students will identify different soil textures found at their classmates' homes on the Central Coast. Students will determine soil textures by measuring the composition using a mason jar experiment and then measuring the water holding capabilities of soil. There are 12 main textures of soils that can be present in the Central Coast and students will learn the why soil is a very important component of the water supply system.

Understanding the characteristics of different soil textures on the Central Coast will provide a better understanding of why areas may be flood prone, how rain can make its way to creeks, streams and aquifers and why certain soils are better for growing plants.

DRAIN OR NOT TO DRAIN EXPERIMENTS

This activity involves three experiments to give students a better understanding of the different textures of soil found in the local area.

The experiments require soil samples which can be collected from different sites around the school, or students can bring samples from around their house. We need two full cups from each sample site. Remember to write the location on each sample.

Mason Jar Soil (Experiment One)

Equipment needed:

- One cup of soil from the homes of the three volunteer students
- One 500ml mason jar per soil sample
- Ruler
- Colander
- One tablespoon of powdered dishwashing detergent
- Baking paper

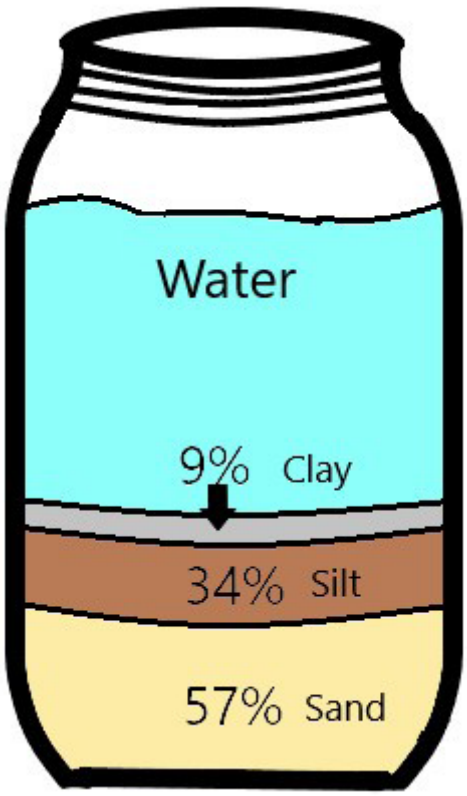
Mason Jar Experiment

- Pour soil sample through colander to remove any leaves or large debris. Catch the soil under the colander using baking paper and pour into mason jar
- Fill the rest of the mason jar with water almost to the top. Leave a 2cm gap of air under the lid
- Add one tablespoon of powdered dishwashing detergent to the water. This helps to separate the soil layers that will form in the jar
- Put the lid on the jar and shake vigorously for two minutes
- Leave the jars on a level surface for at least one full day
- The soil will settle into different layers; sand, silt and clay. Mark a line on the jar between each layer
- Use a ruler to measure each layer and record on the data sheet provided
- Repeat this process for each soil sample

Procedure

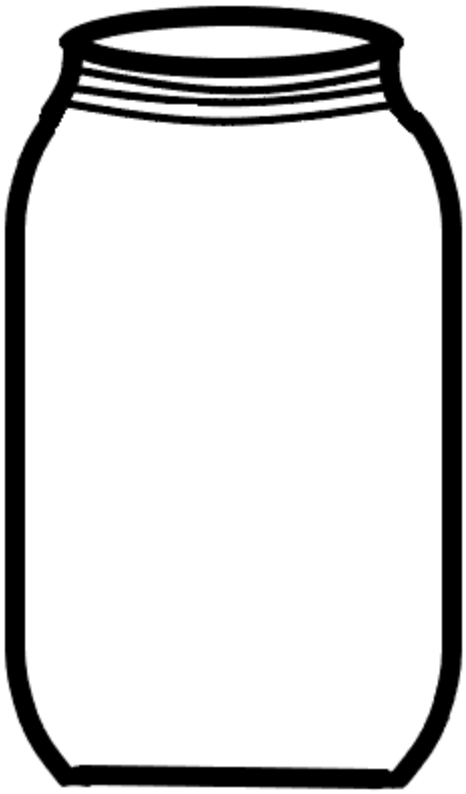
- Use the results from your Mason Jar Soil Layers experiment to fill in the Soil Texture Triangle Data table
- On the bottom side of the triangle, mark the number that correlates to the percentage of sand in your mason jar
- On the left side of the triangle, mark the number that correlates to the percentage of clay in your mason jar
- On the right side of the triangle, mark the number that correlates to the percentage of silt in your mason jar
- Use a ruler to draw in the lines on the Soil Texture Pyramid where sand, silt and clay intersect. The lines should follow the angle of the numbers
- Find the point where the three lines cross over - this tells you the soil texture for that soil sample
- Repeat for each soil sample

MASON JAR DATA SHEET



Soil Layers Data Example

	sand	silt	clay	Total
Layer thickness (mm)	33mm	20mm	5mm	58mm
%of total sediment	57%	34%	9%	100%



Student Soil Layers Data

	sand	silt	clay	Total
Layer thickness (mm)	___mm	___mm	___mm	___mm
%of total sediment	___%	___%	___%	___%

Table 1. Student Mason Jar Data

Draw in the layers as observed in your mason jar.

Label the layers of Sand, Silt and Clay

DETERMINING SOIL TEXTURE

Soil Texture Triangle Data Example

Sand	57%
Silt	34%
Clay	9%
Soil texture	Sandy Loam

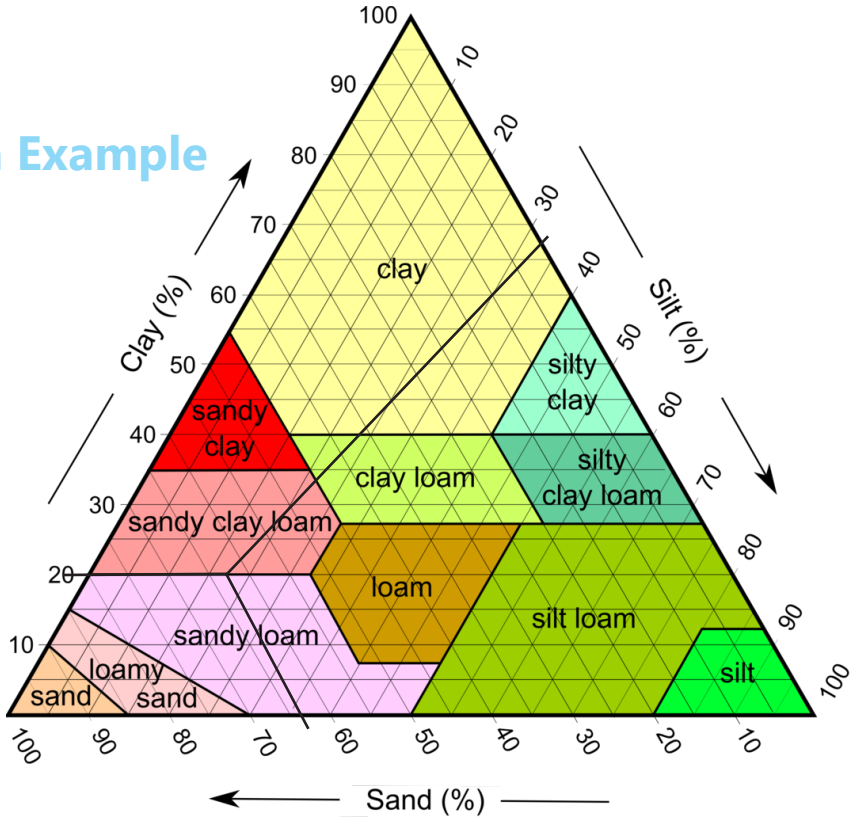


Figure 1. Example Soil Texture Triangle

Student Soil Texture Triangle Data

Sand	___%
Silt	___%
Clay	___%
Soil texture	

Table 2. Student Soil Type

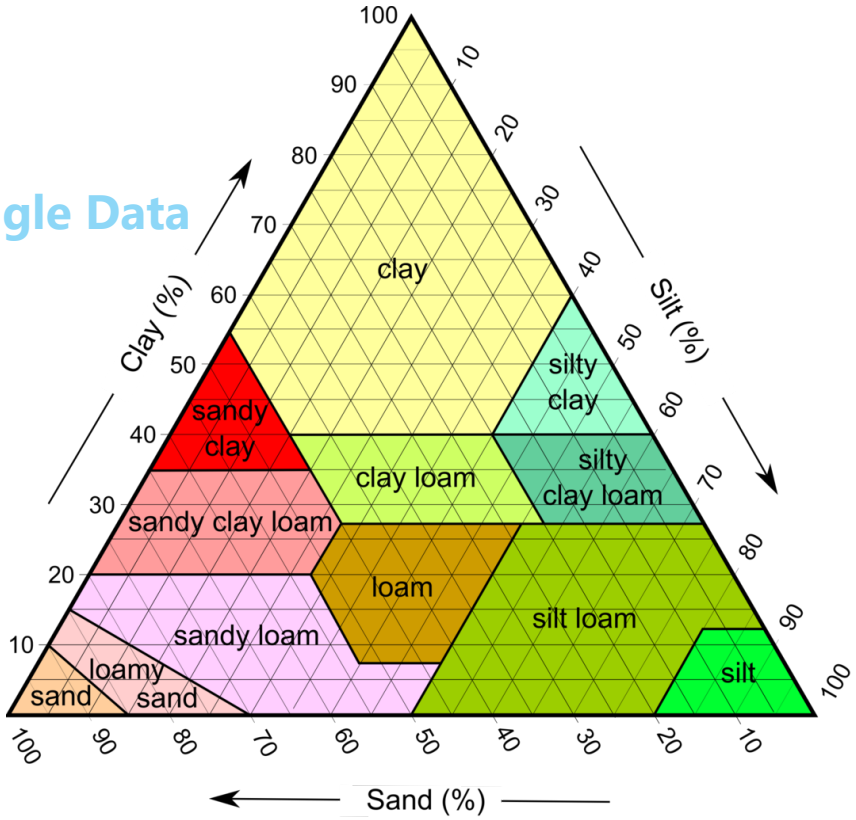
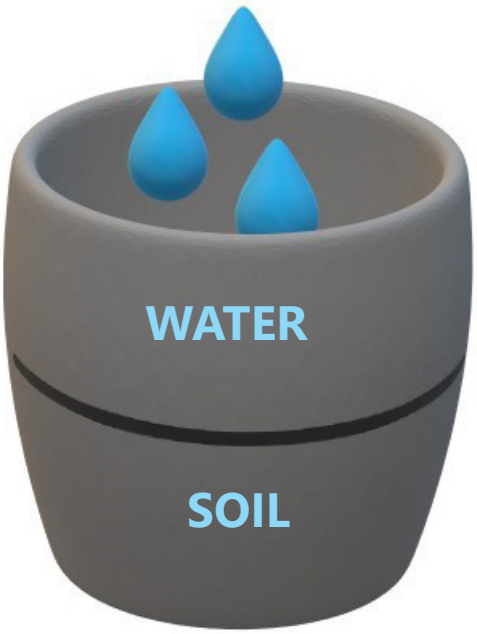


Figure 2. Student Soil Texture Triangle

SOIL DRAINAGE

DRAIN HOLES



Equipment needed:

- One cup of the same soil used in the Mason Jar Soil experiment
- One clear plastic cup with five small holes punched into the bottom
- One clear plastic cup with NO holes
- One 100ml graduated cylinder
- One piece of mesh or filter paper to fit the bottom of the cup

Procedure:

- Label the cup (with holes) with the location and soil texture of the sample as determined from the soil texture triangle experiment.
- Place the mesh or filter paper into the bottom of the cup with holes. This will stop the soil from falling through the holes
- Pour the cup of soil into the cup with holes
- Fill the graduated cylinder with 100ml of water
- One student can hold the cup with holes above the empty cup with no holes. Another student can pour the 100ml of water onto the soil
- Wait for two minutes while water drips into the cup below
- Pour the collected water into the graduated cylinder to measure
- Record your results on the data sheet provided

SOIL DRAINAGE DATA SHEET

1. What is the AIM of your experiment? (What are you trying to find out?)

What soil texture did you use in the experiment – (Sandy Loam, Sandy Clay, Silt)?

Soil texture:

2. How much water did you add to the soil?

A = mL of water

3. How much water drained through?

B = mL of water

4. Calculate how much water remained in your soil.

A - B = mL of water

5. Now copy from the board the combined results of the experiment for the whole class.

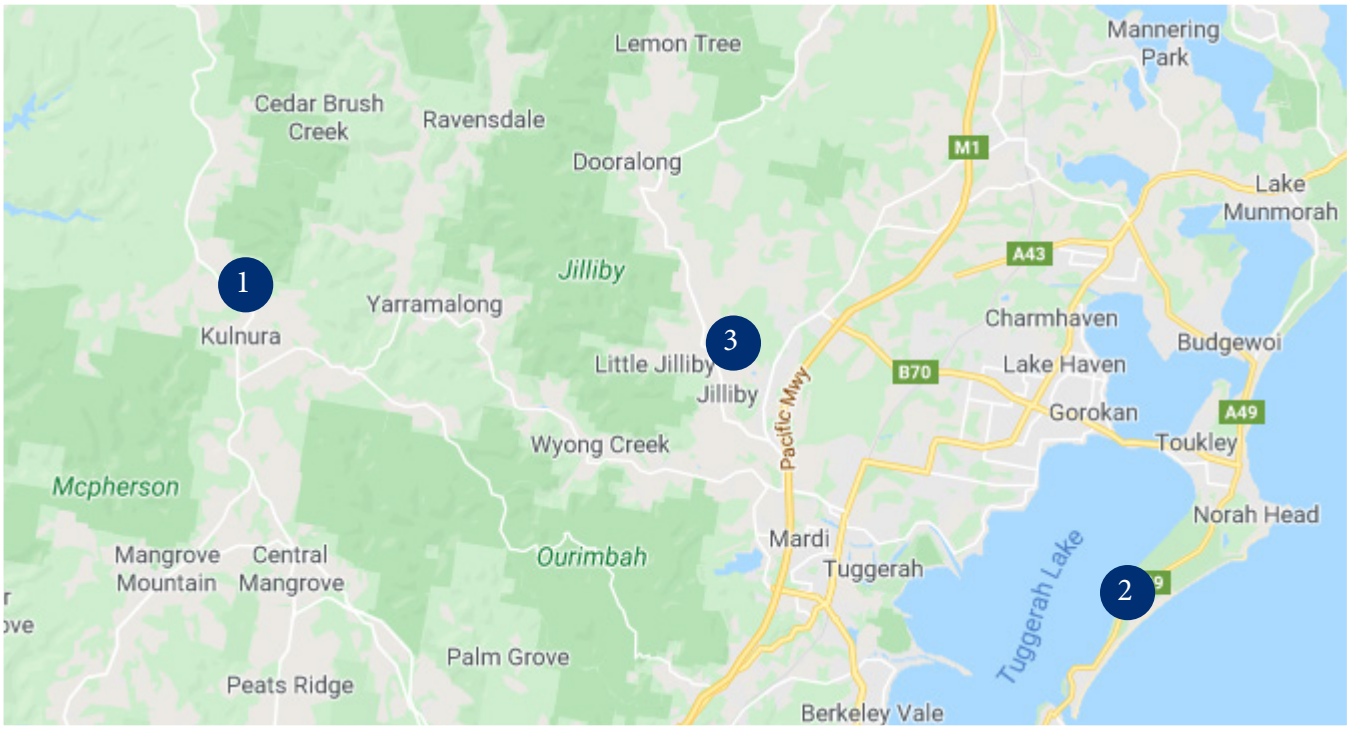
		Volume of water (mL)		
Soil texture	Soil location	Water added to the soil (A)	Water drained from soil (B)	Water held in the soil (A-B)
		100 mL		
		100 mL		
		100 mL		

Table 3. Water drained vs held

SOIL DRAINAGE DATA SHEET

6. What is the conclusion for the class experiment?
(What did your class find out about the drainage of different soils in this experiment?)

7. Let's look at the soil composition from three locations across the Central Coast. Answer the questions based on the conclusion from your own class experiment.



Location 1 Kulnura Area

Soil depth	Clay %	Silt %	Sand %
0-100cm	+50%	5-20%	30-45%

Location 2 Wyrrabalong National Park

Soil depth	Clay %	Silt %	Sand %
0-100cm	0-5%	10-15%	+85%

Location 3 Jilliby area

Soil depth	Clay %	Silt %	Sand %
0-100cm	25-30%	10-25%	50-60%

Table 4. Location Soil Data

In which location would water drain the easiest?

In which location would water drain the least effectively?

Which location presents the best conditions for water drainage?

DRAIN OR NOT TO DRAIN?

Teacher Debrief Q&A Ideas

1. **What soil texture would be best for plant growth?**
   Loamy soils are best for plants as they can hold water which gives the plant roots time to absorb the water they need. Many plants find it hard to grow in sandy soils as the water passes through too quickly. Many soils also find it hard to grow in clay soils as the water cannot penetrate the surface of the clay. However, some plants have adapted to thrive in soils that are high in sand or clay.
2. **Why would it be important to understand how different soils interact with water?**
   If you have a garden or farm, or a planning to build a park or sporting field; the soil is a very important thing to consider. Having proper soil for drainage is important so parks and fields are not flooded when it rains and having the soil that can hold onto water is important when trying to grow fruits, vegetables or crops.
3. **How does the soil impact our water supply system on the Central Coast?**
   The soil can directly impact our water supply system in a few different ways. If water can infiltrate the soil, water then can make its way to underground aquifers or enter into creeks and rivers through banks and beds. This process also provides a natural filtration system. Soils that don't allow water to infiltrate can quickly move water over the surface of the land which can fill creeks, rivers, and dams but can also create flooding.
4. **If you wanted to create a pond or dam which soil would be best to use and why?**
   Clay soils would be the best to use when creating a pond or dam as the clay creates a barrier to contain the water. If your soil was loam or sand the water would drain out very quickly and the pond or dam would dry up.
5. **Did all the student soil samples turn out to be the same texture of soil or were they different? What were the main differences between the soils sampled and how does this correlate to the location they came from?**
   Most likely the soils may have slightly different percentages of sand, silt, and clay. Students may find that the soils were similar if they all came from the same region. Try using a map to compare the different soil sample sites. Try collecting samples from the beach, bush, oval or garden for comparison and to test different theories.