Savuvi homes S1-S5
Wazenzi homes W1-W5
Hila homes H1-H5
Milma homes M1-M5
Community borders
Road
Rivers

Key
S Savuvi homes S1-S5
W Wazenzi homes W1-W5
H Hila homes H1-H5
M Milma homes M1-M5
Community borders
Road
Rivers

Mountain areas
Forest
School
Health centre
Port
Wind power station

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Watu Island Community Cards

Divide the class into small groups of 4-5 pupils. Give each group a map of Watu Island and one of the four community cards below. Each group will take on the role of living in that community.

After the pupils have had a chance to look at the map and read their community cards, have a class discussion about who and what is most at risk of flooding in their community.

Help pupils develop a list of flood risk factors on the island, such as closeness to river and sea, terrain, ages and abilities of people to respond to flooding.

Community name: The Savuvi
Location: live in the South West of the island
Homes: 5
Other buildings: primary school for 50 children
Average household size: 6 people
Main jobs in community: fishermen, skilled at boat building and carpentry

Community name: The Milma
Location: live in the central area of the island
Homes: 5
Other buildings: wind turbine and generator supplying electricity
Average household size: 6 people
Main jobs in community: farmers and skilled foresters

Community name: The Wazenzi
Location: live in the North West of the island
Homes: 5
Other buildings: secondary school for 30 pupils
Average household size: 8 people
Main jobs in community: builders of traditional homes and brick makers

Community name: The Hila
Location: live in North East area of the island
Homes: 5
Other buildings: health centre and hospital
Average household size: 7 people
Main jobs in community: land farmers and skilled craft people

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Learning from others

For your challenge you need to carry out some research to help develop your ideas.

We suggest using the internet to find out about flood-proof homes in different countries. You might want to use search terms such as flood-resistant homes and flood-proof houses.

Keep a record of any useful information and pictures that could help develop your ideas.

An example from Practical Action

Practical Action works with people whose lives are affected by flooding.

In north western Bangladesh, many families live in fear of the rainy season which is leading to increased flooding of many of the 320 rivers that criss-cross the country.

“Ten years ago, our neighbourhood was eroded by the river Jamuna. We lost our home, land, cattle-shed and cattle to floods.” Aklima Begum

Practical Action worked with the community along the Jamuna River to develop low cost flood-resistant housing.

Improved flood-resistant homes

The main features of the new homes designed and built to withstand river flooding are:

- Houses are built on a plinth of sandy soil, brick and concrete. This makes them strong and high enough to last through repeated floods.
- Jute panels make the walls resilient to floods, cost very little and are quick and easy to replace.
- Treated bamboo poles on concrete bases are strengthened with metal tie rods to hold the wall firm and safe.
- Fastenings bind the walls firmly to the houses ‘skeletons’ through a network of holes and notches. This means the houses can stay standing through the strongest of winds and rain.
- Corrugated iron sheets are used on the roofs to make the houses more rain resistant.

Other features

- Water-thirsty plants such as bamboo and banana are grown around the houses. They ‘drink up’ flood water and hold onto the soil, helping the ground around the homes to stay intact.

For more detailed information on flood resistant-homes in Bangladesh go to http://practicalaction.org/flood-resistant-housing-drr
Materials cards

Use the cards below to help you to make decisions about the choice of materials for your flood-proof home, your modelling materials and the costs involved.

**Polythene Roll**
For modelling you could use cling film

**Properties:** water resistant, does not provide structural strength, tears easily, malleable, non-recyclable, non-biodegradable

**Availability:** imported onto the island by boat - low transport costs due to its low weight

**Material cost:** £5 per roll (10m x 1m)

**Polyurethane Sheet**
For modelling you could use plastic bottles or polypropylene

**Properties:** water resistant, strong, recyclable, difficult to cut, liable to cracking, non-biodegradable

**Availability:** imported onto the island by boat - low transportation costs due to weight

**Cost:** £40 per roll (10m x 2m)

**Concrete**
For modelling you could use plasticine

**Properties:** water resistant, very strong, difficult to demolish, durable, malleable, non-recyclable, non-biodegradable

**Availability:** imported onto the island by boat - weight of material leads to high transport costs

**Material cost:** £10 per sack covering 15m²

**Steel**
For modelling you could use foil food trays or card wrapped in foil

**Properties:** water resistant, prone to rust, strong, recyclable, difficult to cut into sections, non-biodegradable

**Availability:** imported onto the island by boat – weight of material leads to increased transport costs

**Cost:** £50 per sheet (2m x 3m)
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**Bamboo**
For modelling you could use straws

**Properties:** water resistant, reasonable strength but will need binding together, biodegradable, recyclable

**Availability:** easily available on the island

**Cost:** £1 per 1m treated bamboo cane

**Dung/Soil/Ash**
For modelling you could use mud or clay

**Properties:** malleable, recyclable, biodegradable, repels termites, fibrous which stops soil cracking

**Availability:** readily available in many areas of the island

**Cost:** free

**Softwood**
For modelling you could use wood splints or lolly sticks

**Properties:** very absorbent, reasonable strength, susceptible to termites, biodegradable, recyclable

**Availability:** readily available on the island in all forest areas

**Cost:** £2 per 1m length

**Glass**
For modelling you could use perpex, plastic or clingfilm

**Properties:** recyclable, non-biodegradable, water resistant, highly fragile

**Availability:** imported onto the island by boat - weight of material leads to high transport costs compared to locally available material

**Cost:** £30 per sheet (2m x 1m)
**Hardwood**

For modelling you could use lolly sticks or balsa wood.

**Properties:** absorbent, strong, durable, resists termites, biodegradable, recyclable

**Availability:** this needs to be transported onto the island and then down the river. There is no readily available hardwood on the island.

**Cost:** £10 per 2m plank

---

**Corrugated iron**

For modelling you could use aluminium foil or corrugated plastic.

**Properties:** water resistant, prone to rust, strong, recyclable, difficult to cut into sections, non-biodegradable

**Availability:** imported onto the island by boat - weight of material leads to high transport costs compared to locally available material.

**Cost:** £40 per sheet (2m x 1m)

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**Bricks**

For modelling you could use plasticine or lego bricks.

**Properties:** strong, weather resistant, durable, recyclable, non-biodegradable

**Availability:** can be made on the island or imported via boat.

**Cost:** 50p per brick

---

**Reeds**

For modelling you could use grass or leaves.

**Properties:** need attaching to another structure, malleable, weather resistant

**Availability:** available throughout the island.

**Cost:** free

---

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## Summary of costs

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Polythene Roll</strong></td>
<td>Cost: £5 per roll (10m x 1m)</td>
<td></td>
</tr>
<tr>
<td><strong>Concrete</strong></td>
<td>Cost: £10 per sack covering 15m²</td>
<td></td>
</tr>
<tr>
<td><strong>Polyurethane sheet</strong></td>
<td>Cost: £40 per sheet (10m x 2m)</td>
<td></td>
</tr>
<tr>
<td><strong>Steel</strong></td>
<td>Cost: £50 per sheet (2m x 3m)</td>
<td></td>
</tr>
<tr>
<td><strong>Bamboo</strong></td>
<td>Cost: £1 per 1m cane</td>
<td></td>
</tr>
<tr>
<td><strong>Softwood</strong></td>
<td>Cost: £2 per 1m length</td>
<td></td>
</tr>
<tr>
<td><strong>Dung/Soil/Ash/Sand</strong></td>
<td>Cost: Free</td>
<td></td>
</tr>
<tr>
<td><strong>Glass</strong></td>
<td>Cost: £30 per sheet (2m x 1m)</td>
<td></td>
</tr>
<tr>
<td><strong>Hardwood</strong></td>
<td>Cost: £10 per 2m plank</td>
<td></td>
</tr>
<tr>
<td><strong>Corrugated iron</strong></td>
<td>Cost: £40 per sheet (2m x 1m)</td>
<td></td>
</tr>
<tr>
<td><strong>Bricks</strong></td>
<td>Cost: 50p per brick</td>
<td></td>
</tr>
<tr>
<td><strong>Grass/Reeds/Jute</strong></td>
<td>Cost: Free</td>
<td></td>
</tr>
<tr>
<td><strong>Nails</strong></td>
<td>Cost: 10p per nail</td>
<td></td>
</tr>
<tr>
<td><strong>Metal fastenings</strong></td>
<td>Cost: £5 per fastening</td>
<td></td>
</tr>
<tr>
<td><strong>Nuts and bolts</strong></td>
<td>Cost: £1 per nut and bolt</td>
<td></td>
</tr>
<tr>
<td><strong>Rope</strong></td>
<td>Cost: £5 per 10m</td>
<td></td>
</tr>
</tbody>
</table>
Costing your home

Instructions: Make a list of the materials you’ve included in your final design. Cost each material and then total the cost of your home.

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity used</th>
<th>Cost per unit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Softwood</td>
<td>3m</td>
<td>£2</td>
<td>£6</td>
</tr>
</tbody>
</table>

Total cost of home
## Testing materials for absorbency - results table

<table>
<thead>
<tr>
<th>Material</th>
<th>Height that the water was absorbed to (cm)</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test 1</td>
<td>Test 2</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

Which material absorbed the least amount of water?  ________________________________
Testing materials for tensile strength - results table

<table>
<thead>
<tr>
<th>Material</th>
<th>Weight added to material (g)</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test 1</td>
<td>Test 2</td>
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</tbody>
</table>

Which material was the strongest? ________________________________
Beat the Flood

Material activities summary sheet

Complete this sheet to help you make decisions about the choice of materials for your flood-resistant home.

<table>
<thead>
<tr>
<th>Material</th>
<th>Does it absorb water/is it waterproof?</th>
<th>How strong is the material? Does it bend?</th>
<th>Cost</th>
<th>Availability</th>
<th>Any other comments</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

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**Structures activity sheet**

Look at the pictured examples of structures. Cut them out and add them to either the frame or shell structures boxes in the table below.

<table>
<thead>
<tr>
<th><strong>Frame structures</strong> are structures supported from a ‘skeleton’ frame. The materials need to be strong and often need reinforcing to make the frame stable.</th>
<th><strong>Shell structures</strong> are made or assembled to make one piece. The load is spread throughout the whole structure.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples of frame structures</strong></td>
<td><strong>Examples of shell structures</strong></td>
</tr>
</tbody>
</table>
| **Pros**  
- Easy to design and build  
- Parts can be replaced if damaged | **Pros**  
- Light  
- Minimal material required |
| **Cons**  
- Joining different parts together can create weaknesses  
- Braces are often needed to strengthen the building | **Cons**  
- A small fault in any part of the structure will weaken the whole structure  
- More difficult to make |
Frame and shell structures pictures

- Bicycle
- Cardboard box
- Chair
- Climbing frame
- Skeleton
- Bicycle helmet
- Drinks can
- Birds egg

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Structures template 1

We suggest that the templates are printed onto card and laminated for pupils to use in the testing structures activity.
Structures template 2

We suggest that the templates are printed onto card and laminated for pupils to use in the testing structures activity.
Design Specification

Before developing your ideas for your flood-resistant home, think about the features that you want your home to have, and give a reason why these are important.

Materials
What properties do you need the materials in your home to have?

Suitability for the community/family
What features do you want your home to have to make it suitable for the people who will live in it?

Size
What are the maximum and minimum dimensions of your design?

Construction method
What type of structure do you think best suits the conditions and materials available on the island?

Environmental issues
Will you consider the effect of your choice of materials on the environment?

Cost
What is the maximum cost you can spend on your design?
Design ideas

Develop a few ideas for your flood-resistant homes and sketch them below.

Annotate your design ideas with notes alongside your drawings to give additional information. You can include:
- details of hidden parts such as fixings, openings, interior elements
- information about materials and size
- how your design would be suitable for the community
- how the design meets the specification points

As a group: share your design ideas and compare them with your design specification. Consider which ideas, or which parts of your ideas, meet the specification points the best. Use your individual ideas to select the final design for your group.
Final design

Present a final design drawing of your group’s idea with annotations to explain its features.
Include photographs of your final model, before and after the flood test.

Before

After

Names: ____________________________
**Beat the Flood**

**How well did they do?**

Listen to each group’s presentation and give a mark out of 10 for each heading below (0 is the lowest and 10 the highest). Total the score.

<table>
<thead>
<tr>
<th>Group name</th>
<th>How well did the group understand the needs of their community?</th>
<th>How good was their choice of materials?</th>
<th>How good was their choice of structure?</th>
<th>How good is their overall design?</th>
<th>Did they work well as a team?</th>
<th>How did the model do in the flood test?</th>
<th>Overall score out of 60</th>
</tr>
</thead>
</table>