

LIB INT ... REFERENCE CENTRE  
FOR ... WATER SUPPLY AND  
SA ...

The purpose of this book is to give more information about water upon which all life in Namibia depends.

Two symbols have been used, they refer to:

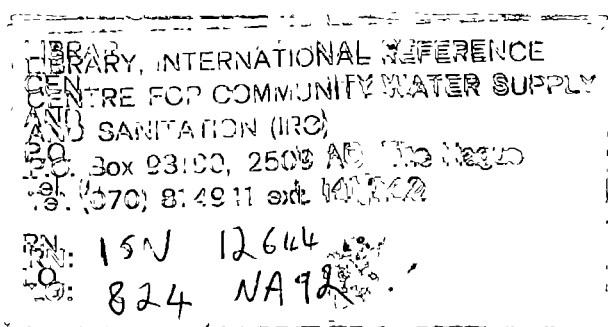


Important information



Things to do

Sponsored by: **NORAD** (Norwegian Agency for Development Co-operation)  
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With thanks to Shirley Bethune and Adrian Cashman of Department of Water Affairs for input, drawings and maps.

Thanks also to John Ward for comments.

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The Wildlife Society of Namibia and the Namibia Nature Foundation endorse this book to encourage an awareness of water and appreciation of its limitations and value in a country as arid as Namibia.

# About water

**Think about water - what would you do without water in your daily life?**

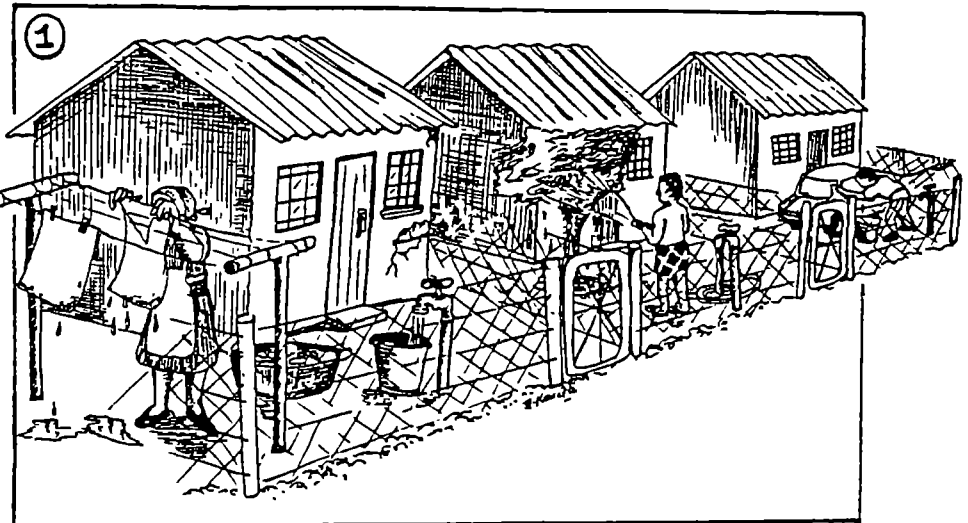
Write down five ways in which your family uses water. Try to work out how many litres of water are used for each activity per day.

Now look at these pictures:

*Which one looks most like the place where you live?*

Imagine that there is a water crisis where you live; perhaps the well or the dam has dried up, perhaps the water pipes are empty.

Make a rough sketch of how your home area would look under these conditions.



*How would the people cope with this lack of water?*

*How would you feel about it?*

*What would you or the people in your community do about it?*

*Which of the following statements are true?*

- People can live without water.
- We will survive as long as we have drinking water.
- Water is essential for our existence and for the survival of our environment.



Together with your classmates, work on a big picture called: **"Water is life"**.

Each person should draw or bring along a picture that shows how water is used. Try to show different ways that water is used by people, animals, plants, etc.

Paste the pictures on to a large piece of paper in a way that shows the importance of water, and stick it up in your classroom.

# People need water

*Do few or many people live in deserts where water is scarce?  
Would most people live near or far away from plentiful water?*

If we look back in history, we see that civilizations first developed along large rivers, for example: Nile River in Egypt,  
Ganges River in India,  
Rhine River in Germany.

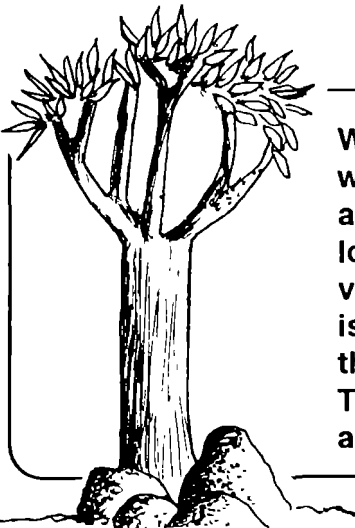
*Can you think of examples of river settlements in Namibia?*



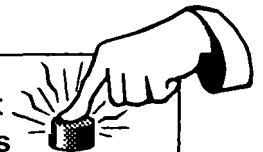
*This picture shows a settlement on a river bank.*

Describe some advantages of living near a permanently flowing (perennial) river.

Places such as Windhoek and Ondangwa are not near permanent rivers.  
*Where did or do people living there get their water?*

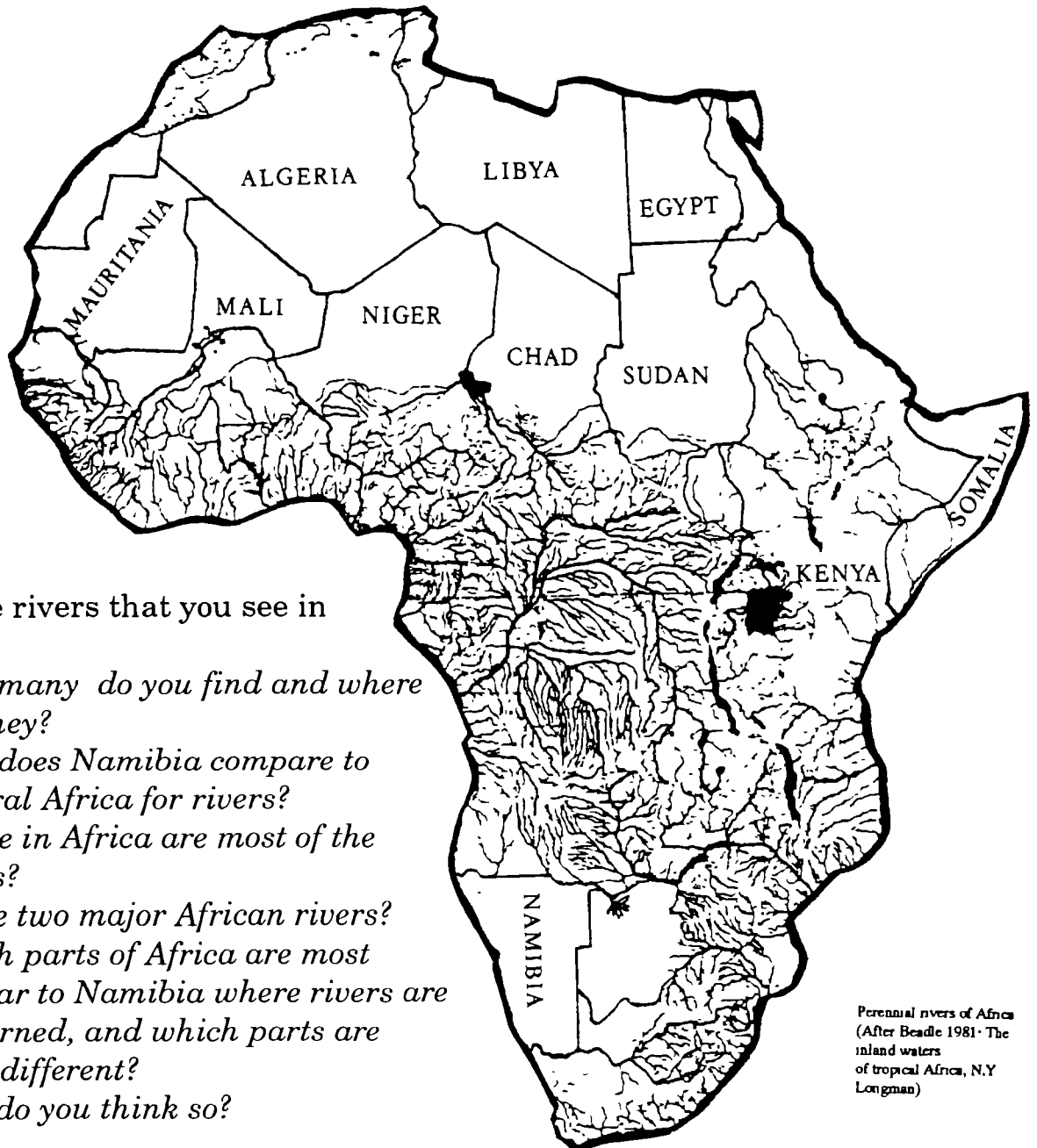


Water is one of the first things people must think about when they are planning to settle somewhere. Namibia is a particularly dry country, where water is limited due to low rainfall. We call this condition 'arid' where the land is very dry and lacking in water, or 'semi-arid' where there is slightly more water available. Under these conditions, the soil is not rich enough to support much plant life. Therefore, people cannot exist in large numbers in arid and semi-arid areas.



# The rivers of Africa

This map shows the rivers in Africa that flow permanently all year round. These are called perennial rivers.



Perennial rivers of Africa  
(After Beadle 1981: The inland waters of tropical Africa, N.Y. Longman)

Count the rivers that you see in Namibia.

- How many do you find and where are they?
- How does Namibia compare to Central Africa for rivers?
- Where in Africa are most of the rivers?
- Name two major African rivers?
- Which parts of Africa are most similar to Namibia where rivers are concerned, and which parts are most different?
- Why do you think so?

Could there be other rivers in Africa that are not shown on this map?

Perhaps you know of a river in Namibia that does not appear here. Name it.

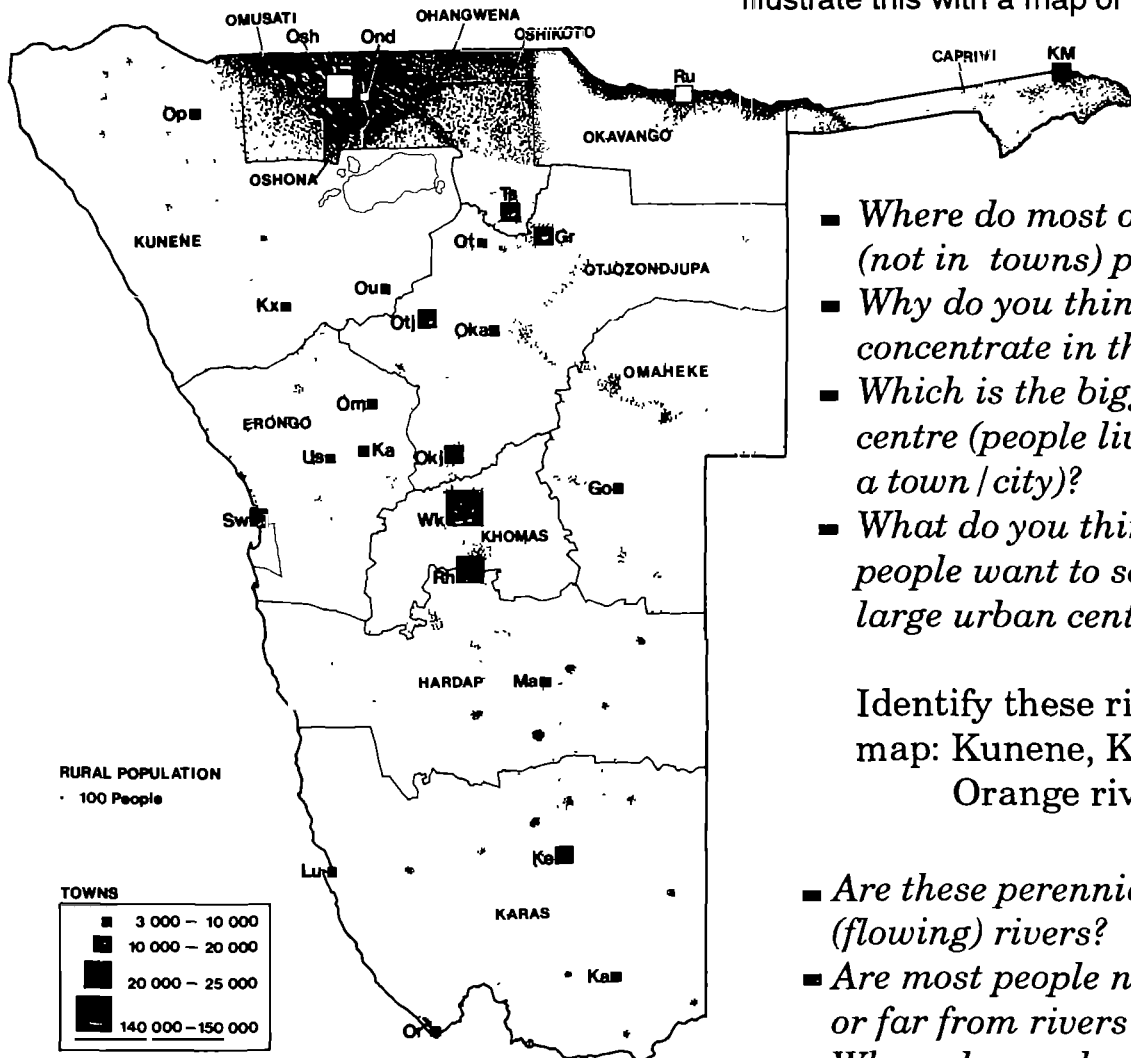
Why do you think it is not shown on the map?

Yes, many rivers in Namibia are not shown on a map of *perennial* rivers. These are called *ephemeral* rivers. This means that their river beds are dry for most of the year and only flow when there has been enough rain. However, they do have underground water most of the time. The amount and depth of this water varies according to the rainfall in the region.

# People and water in Namibia

Look at this map that shows where people live in Namibia.

Find the place on the map where you live and describe where your water comes from. Illustrate this with a map or sketch.



- *Where do most of the rural (not in towns) people live?*
- *Why do you think they concentrate in these areas?*
- *Which is the biggest urban centre (people living in a town / city)?*
- *What do you think makes people want to settle in a large urban centre?*

Identify these rivers on the map: Kunene, Kavango, Orange rivers.

- *Are these perennial (flowing) rivers?*
- *Are most people near or far from rivers?*
- *Where do people get their water from if they do not live near flowing rivers?*

Source: National Atlas of South West Africa, 1983

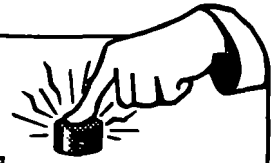
**Interview some older people in your community.** Find out:  
 why people first settled in the area,  
 where their water source was,  
 how it was used,  
 how it changed over the years,  
 why it changed - the main influences on water in the area,  
 whether there are problems with the water system and  
 how the problems could be solved.

Present your findings to the class.



# Rainfall in Namibia

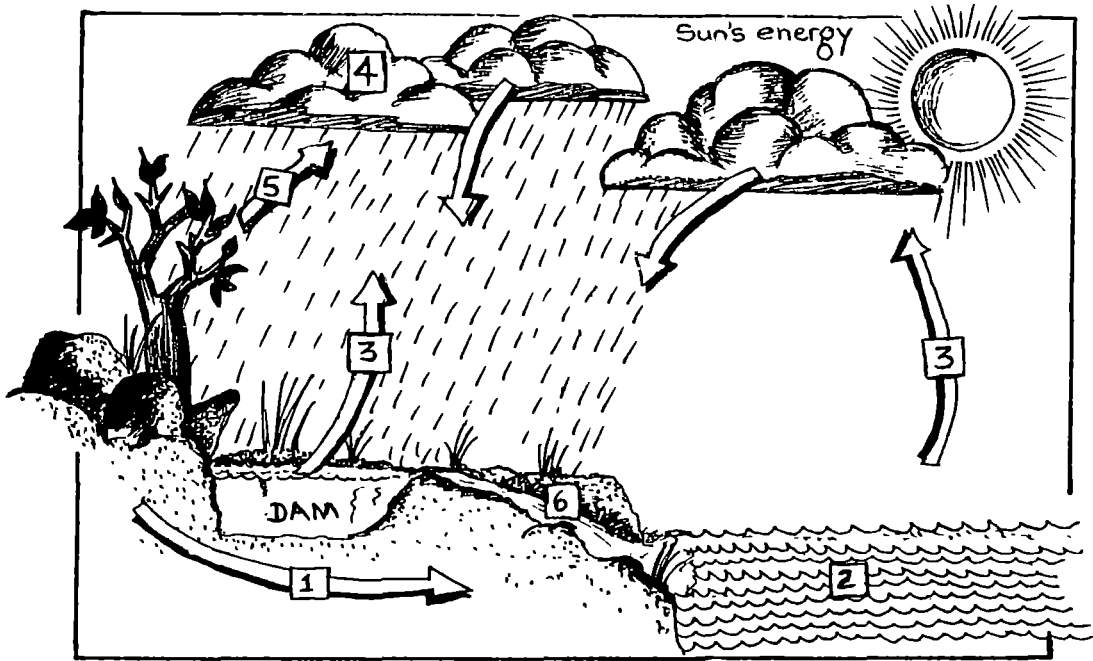
All water in our country originates from rainfall.  
 The perennial rivers need rain to keep them flowing.  
 Without rain the ephemeral rivers do not have surface flow at all,  
 nor do dams fill up.  
 Underground water, even if it collected long ago, needs to be refilled by rain.



Write a poem or song about the rain.

Here is a diagram of the water cycle:

Match the correct labels to the numbers on the diagram: Sea



Evaporation

Condensation

River

Groundwater

Transpiration from plants

- What is a cycle?
- Why is this called a water cycle?
- Where does the water come from that makes rain?
- At which point does water become rain?
- Once the rain reaches the ground, what can happen to that water?



## What is evaporation?

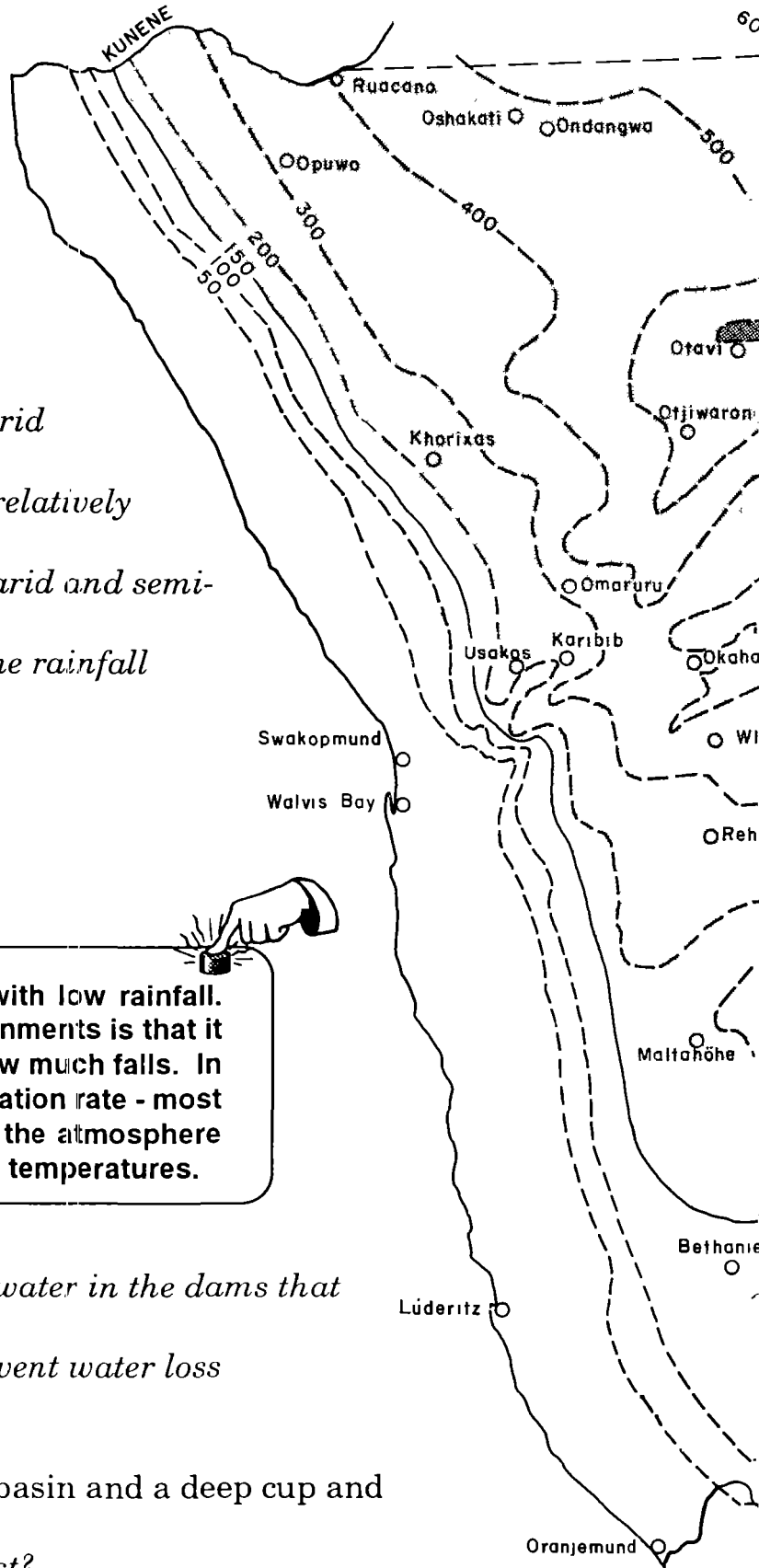
When you boil water for a long time, the water disappears. Where does it go? In a similar way to this, water from the sea or other surface water is also drawn up into the atmosphere by the sun's energy and becomes invisible water vapour (the liquid becomes gas).

## What is condensation?

Hold a cold plate above a pot or kettle of boiling water. You will see that you can make "rain" as the water vapour meets the cold surface. The same thing happens when water vapour rises from surface water, then cools and becomes clouds. Cold air cannot hold as much water as warm air and so some of the water falls back to earth as rain.

Study this map and answer the questions.

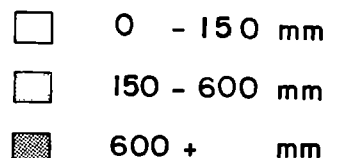
- *Can you see which area has the lowest rainfall?*
- *Which area has the highest rainfall?*
- *Is the highest rainfall area bigger or smaller than the lowest rainfall area?*
- *Which area would you call arid?*
- *Which area would you call semi-arid and why?*
- *What percentage of Namibia has relatively high rainfall?*
- *What percentage of Namibia has arid and semi-arid conditions?*
- *What would you conclude about the rainfall situation in Namibia?*



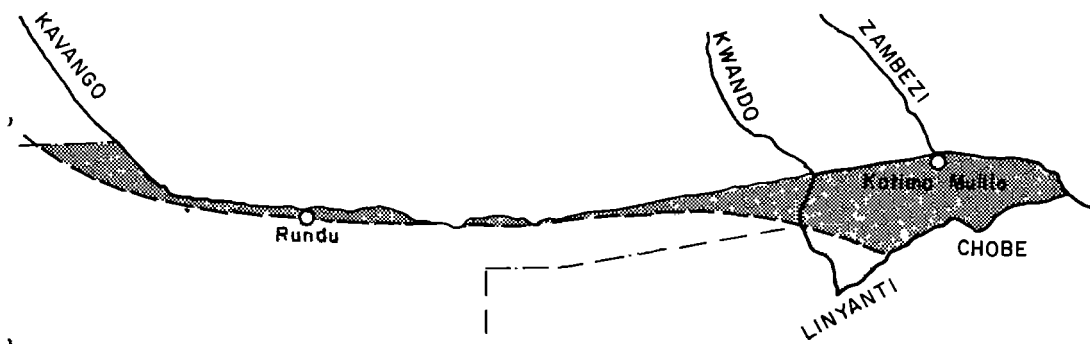
You can see that Namibia is a dry land with low rainfall. Another problem with rainfall in dry environments is that it varies in where it falls, when it falls and how much falls. In addition to this, there is a very high evaporation rate - most of the rain that falls evaporates back into the atmosphere soon after it has fallen because of the high temperatures.

- *What do you think happens to the water in the dams that are built to store water?*
- *What shape should dams be to prevent water loss through evaporation?*

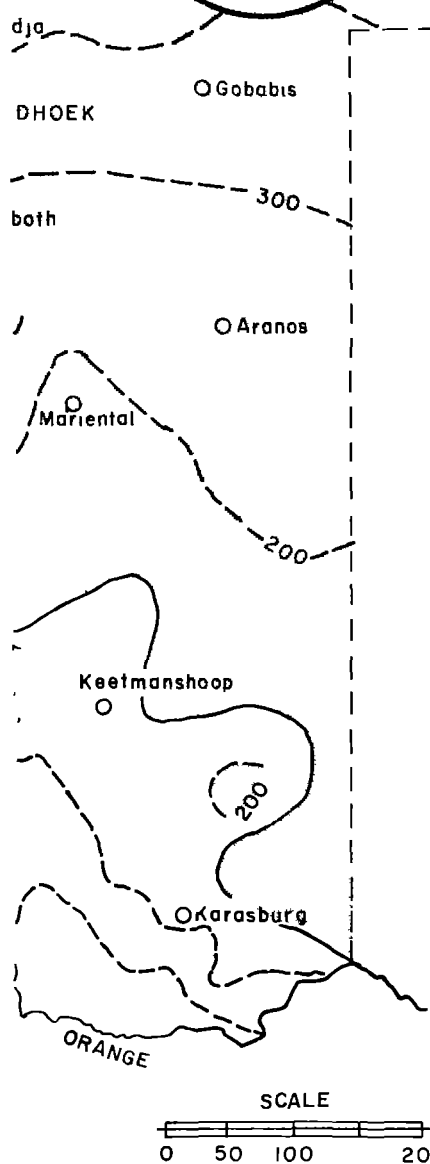
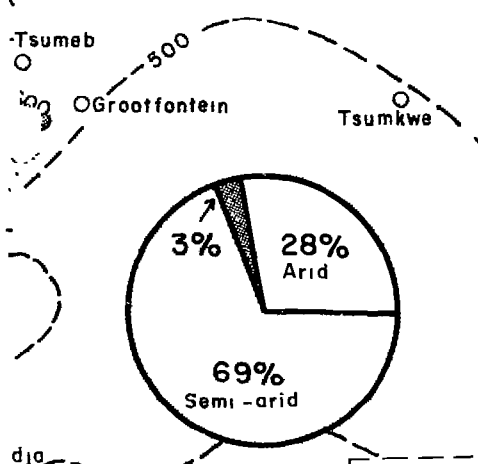
To help you find the answer, take a flat basin and a deep cup and put the same amount of water in each. Put them in the sun. *Which is empty first?*








Mean annual rainfall tells us what the average rainfall is for a year. Rain is measured in a specially marked container called a rain-gauge and added up for each month. Then the figures for each month are added to give the amount for the year. Figures for as many years as available are added together and divided by the number of years to give the mean (average) figure.



Find your own home area on the map and work out what the mean annual rainfall is there.

- Which rainfall area do you fit into?
- What farming activities take place in your area and why?

Describe the farming activities you would expect to find in the other areas.



- Together with your classmates, keep records of rainfall at your school. Make a rain-gauge with a transparent container and a ruler. Put it outside so that it can catch any falling rain. Record the amount of rain on a chart. After three months calculate the mean monthly rainfall.
- Draw a picture of your home area before it rains, then another picture of how it looks after rain. What changes do you notice?

*When did it last rain where you live?  
 What did you do?  
 What did you notice about the effect of the rain on the people, the animals, the land?*

# What about drought?

In Namibia, little rainfall is a normal condition.

*Should we be surprised when there are dry periods or droughts?*

*Or should we plan ahead so that we are prepared for droughts?*

Discuss these questions in class.

*If you were a farmer in our dry land, during a period of fairly good rains, how would you feel about these ideas? Which would you adopt and why?*

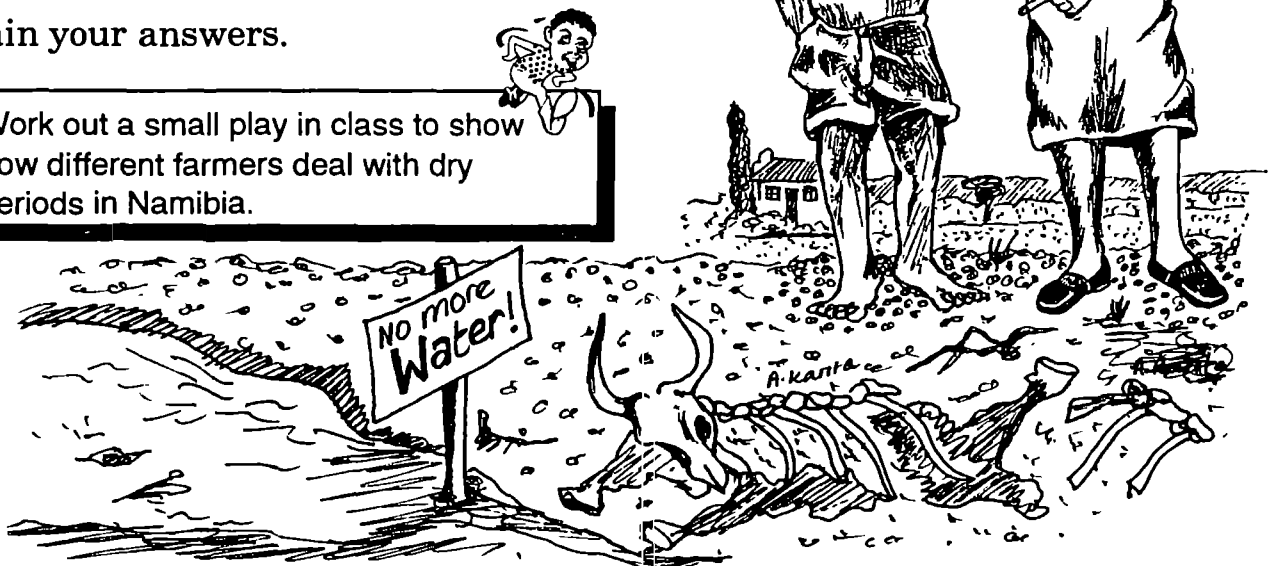
- If you had a dam with a hole in it, would you fix it to store water for drier times?
- Would you store extra stock feed rather than sell it?
- Would you buy lots more cattle or goats to graze on the extra grass?
- Would you plant extra crops to be irrigated from your borehole?
- Would you introduce wild animals which are better adapted to dryness?
- Would you move stock away from overgrazed areas so that plants and grasses can grow again?
- Would you put rocks across eroded cattle paths to prevent further erosion?

Now imagine that, as a farmer, you are faced with one of the long dry periods that are common in Namibia. Do you:

- drill extra boreholes for water although there is not enough food for the animals?
- work out how many of your animals can live without finishing the water and food, and sell the rest?
- use the water from the dam and borehole very carefully so that it lasts you through the drought?
- allow the animals to eat all the food and only sell them when there is nothing left?
- take your animals to the nearby pipeline and break it open to give them water?

Explain your answers.

Work out a small play in class to show how different farmers deal with dry periods in Namibia.



Have a look at this extract from a newspaper report and answer the questions.

## Water runs out

Windhoek is facing a serious water crisis due to a combination of low dam levels and excessive use by residents.

The situation is fast becoming desperate. At the current rate of consumption, Von Bach Dam will be empty by the end of next January and water restrictions are to be announced soon.

.....

Since calls for a voluntary 10 per cent water reduction have been ignored, the time is fast approaching when compulsory restrictions and various other measures will be enforced.

.....

If State dams are not recharged in the coming rainy season, the situation will get desperate.

.....the situation is much worse than during the early 1980's drought because Windhoek's population has doubled. New dam projects, such as the Omatako, have ensured that higher levels of domestic demand can be met, but "we must still rely on rainfall as the source of all our water".

.....

In the meantime, all consumers have been called upon to **save water and prevent wastage**.....

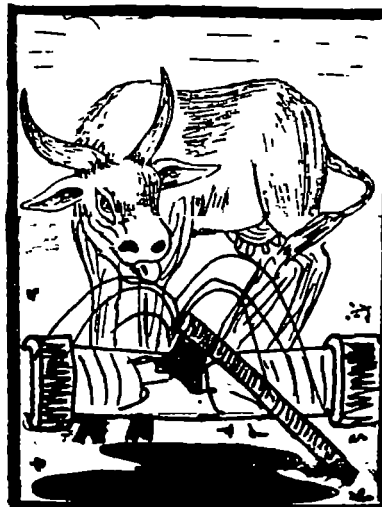
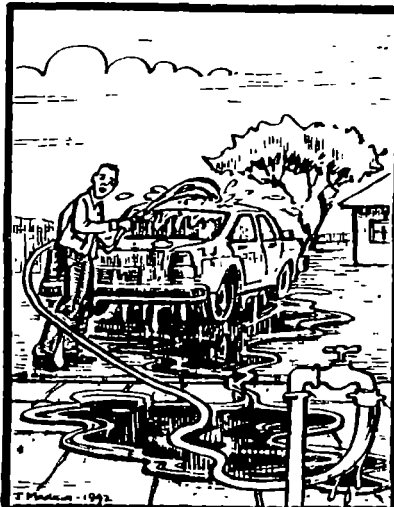
Modified from *The Namibian*.

- *Why is there not enough water for Windhoek? Is it because there has not been enough rain to fill the dams?*
- *What are compulsory water restrictions and why are they necessary in this case?*
- *What will happen to the dams if the drought continues into the next rainy season?*
- *What is the purpose of the Omatako Dam?*
- *Give two reasons why even extra dams are unable to supply sufficient water to the city.*



### "save water and prevent wastage"

Imagine you are a newspaper reporter in Windhoek. You have just written the above report and you want to get your message, that there is a water crisis, across to people who are not saving water. Fill in captions to these sketches to get your point across.



# Water resources in Namibia

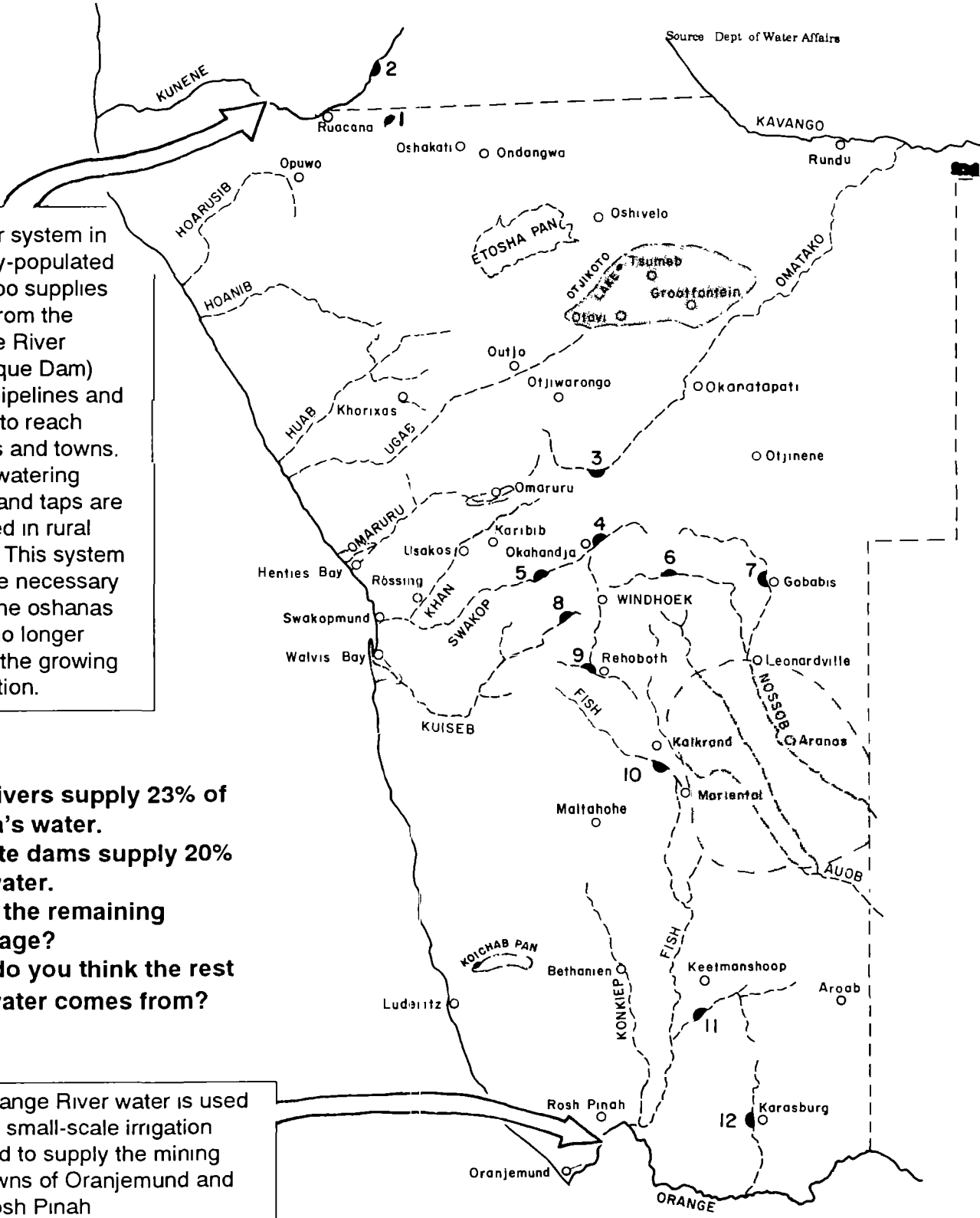
## Surface water

The oshana system occupies a vast flat plain between the Kunene and Kavango Rivers. In the rainy season this becomes a wide plain of water that drains into Etosha Pan and many smaller interlinking pans. These oshanas may provide the people with water for many months after good rains.

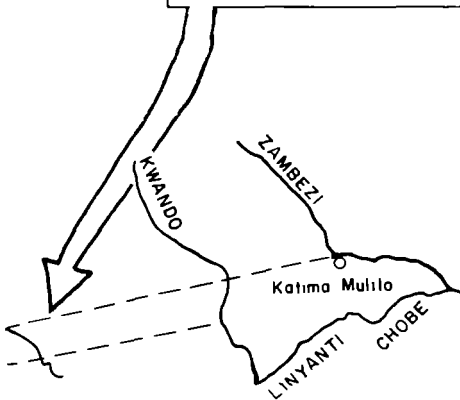
A water system in densely-populated Owambo supplies water from the Kunene River (Calueque Dam) using pipelines and canals to reach villages and towns. Cattle watering points and taps are provided in rural areas. This system became necessary when the oshanas could no longer supply the growing population.

**These rivers supply 23% of Namibia's water.**  
**The State dams supply 20% of the water.**  
**What is the remaining percentage?**  
**Where do you think the rest of the water comes from?**

Orange River water is used for small-scale irrigation and to supply the mining towns of Oranjemund and Rosh Pinah







The Kavango River water rises each year between February and March, and the water spills over onto the floodplains next to the river. Many plants grow there, supporting plentiful animal life. Fish also breed in the pools. When the water level drops again, pools are left in the floodplain and grasses grow. The people living near the river make use of the plants and animals for food and shelter. They also use the land for grazing their animals and planting their crops.



Most of our dams are built on ephemeral rivers so that water flowing in the rainy season is captured and stored for dry times. Look at the map and find which dams supply water to: Windhoek, Mariental, Oshakati / Ondangwa.

■ *Why do you think each of these centres is supplied by a dam?*

KEY	
	Perennial rivers
	Ephemeral rivers
	Major dams
	Major aquifers

#### MAJOR DAMS:

- |               |                 |             |
|---------------|-----------------|-------------|
| 1. Olushandja | 5. Swakoppoort  | 9. Oanob    |
| 2. Calueque   | 6. Otjivero     | 10. Hardap  |
| 3. Omatako    | 7. Daan Viljoen | 11. Naute   |
| 4. Von Bach   | 8. Friedenau    | 12. Dreihuk |

## Underground water

Most of Namibia's water (57%) comes from below the surface of the ground. This underground water is found in certain rocky layers that are able to store and hold water in large quantities. These water-bearing layers are called **aquifers**. There are many different types of aquifers in Namibia:

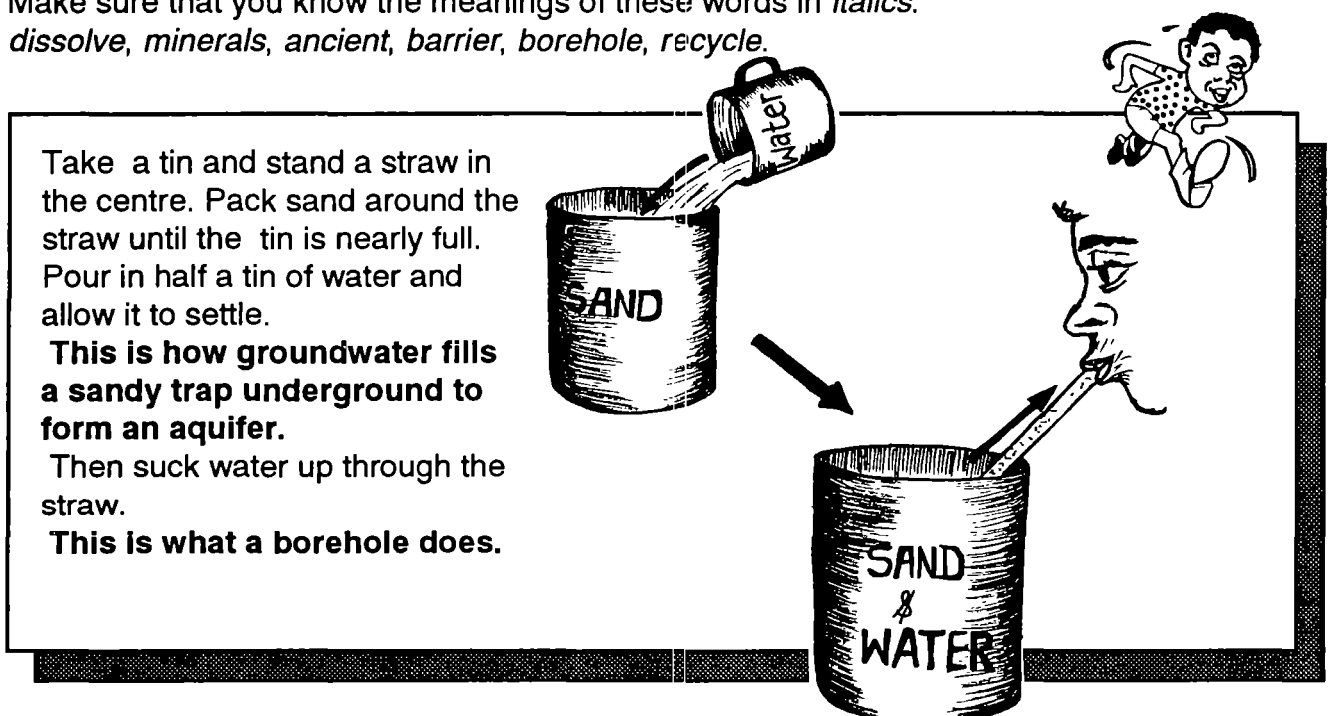
- Aquifers may be under river beds. These are called **alluvial** aquifers. Find three of these aquifers on your map. Water is pumped from the **Kuiseb** and Omaruru River aquifers to supply Henties Bay, Swakopmund, Rössing Mine and Walvis Bay with water.
- Aquifers may occur in sand where water was trapped by rocks way back in time when there was higher rainfall. This is called **fossil** water. Lüderitz uses fossil water from Koichab Pan.

c. Aquifers may be found where water has *dissolved* certain types of rock (**limestone** and dolomite) making big underground **caves**. The Karstveld area is a huge system of underground caves. Dragon's Breath is an underground cave with a large lake. Otjikoto Lake became a lake when the roof of its underground cave collapsed. The Eastern National Water Carrier draws water from the Karstveld aquifer into its system of canals and pipelines. This system was built to supply more water to Omaheke (Hereroland) as well as to the Windhoek area and to Karibib for mining.

d. There are **artesian** aquifers where the water is under pressure because it is trapped between rock layers that it cannot pass through (**impermeable** rocks). The water may be warm because it has been underground for a long time. Where there are cracks in the rocks the water bubbles to the surface. This happens at the Ai-Ais Springs. The Auob-Nossob river system and the Stampriet artesian aquifer are other examples. This water is usually not suitable for drinking because it is full of *minerals* and salts.

e. Small amounts of water collect underground in places where rock types change. These changes happened in *ancient* times when the earth's crust was disturbed by **molten** rocks forcing their way to the surface of the earth. **Faults** formed where the earth's surface cracked and moved out of position; **dykes** formed when hot molten rock squeezed through cracks in the earth's surface. Water seeps into the ground and collects up against *barriers* caused by changes in the rocks. Many boreholes in Namibia are drilled along dykes and faults to bring water to the surface. Windhoek first grew as a settlement because of the natural springs on the fault system there. *Boreholes* still supply some water to Windhoek, but because of its rapid growth, dams now supply most of the water. Only some water is *recycled* or re-used.

Make sure that you know the meanings of these words in *italics*:  
*dissolve, minerals, ancient, barrier, borehole, recycle.*



Copy this crossword on to a piece of paper. Fill in the words using the clues below. These words are in **bold** print in the section on **underground water**.

## Across

- 1 name of one river that supplies water to west coast towns
- 3 ..... water was trapped in ancient times
- 5 ..... rock has become liquid through heating
- 6 ..... aquifer is an underground water body under pressure
- 8 a hollow area underground
- 9 to do with a river
- 10 one rock type squeezed into cracks in other rock types

## Down

- 2 impossible to pass through
- 3 crack in earth's surface
- 4 a type of rock that dissolves in water
- 7 an underground body of water

