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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Scholarship 2018
Geography

2.00 p.m. Wednesday 21 November 2018

RESOURCE BOOKLET

Refer to this booklet to answer the questions for Scholarship Geography.

Check that this booklet has pages 2–24 in the correct order and that none of these pages is blank.

YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.

CONTENTS

INTRODUCTION: FRESH WATER IN A GEOGRAPHIC CONTEXT

Freshwater supplies drying up, climate change raising sea levels and altering borders, explosive population growth straining world resources, and global hyper-nationalism testing diplomatic relations—these are shaping up to be the major issues of this century. Fresh water demand is expected to go up 55% between 2000 and 2050. In the coming century, in terms of its value as a global resource, it has been described as "the next oil".

Fresh water supports almost every aspect of life. We use fresh water to drink, enjoy it for recreation, and use it to produce food, goods and services. "Ki uta ki tai" (from inland to the sea) captures the movement of water through the landscape and the many interactions it may have on its journey. "Ki uta ki tai" acknowledges the connections between the atmosphere, surface water, groundwater, land use, water quality, water quantity, and the coast. It also recognises the connections between people and communities, people and the land, and people and water.

Beauty, or the beast

Figure 1

Figure 2

Figure 3: Accessing freshwater supplies in a developing nation

Population demands

Population dynamics, especially growth and migration, contribute to freshwater issues. First, there is the physical scarcity of fresh water experienced in arid areas, and secondly, there is the shortage of potable (drinkable) water, typically caused by a lack of infrastructure in poor countries.

The remaining 60% of urban growth results from natural increase. Population growth, then, is a driving force behind the breakneck pace of urbanisation and compounds the challenges of providing safe water to city dwellers.

Figure 4: Global population growth since 1960

Figure 5: A building in Mexico City leaning due to land subsidence

Water shortages in Mexico City

Many of Mexico City's buildings are seriously leaning because of land subsidence. The water table is sinking at a rate of one metre per year. By the mid-20th century, high rates of population growth and accelerated industrialisation intensified the demand for fresh water.

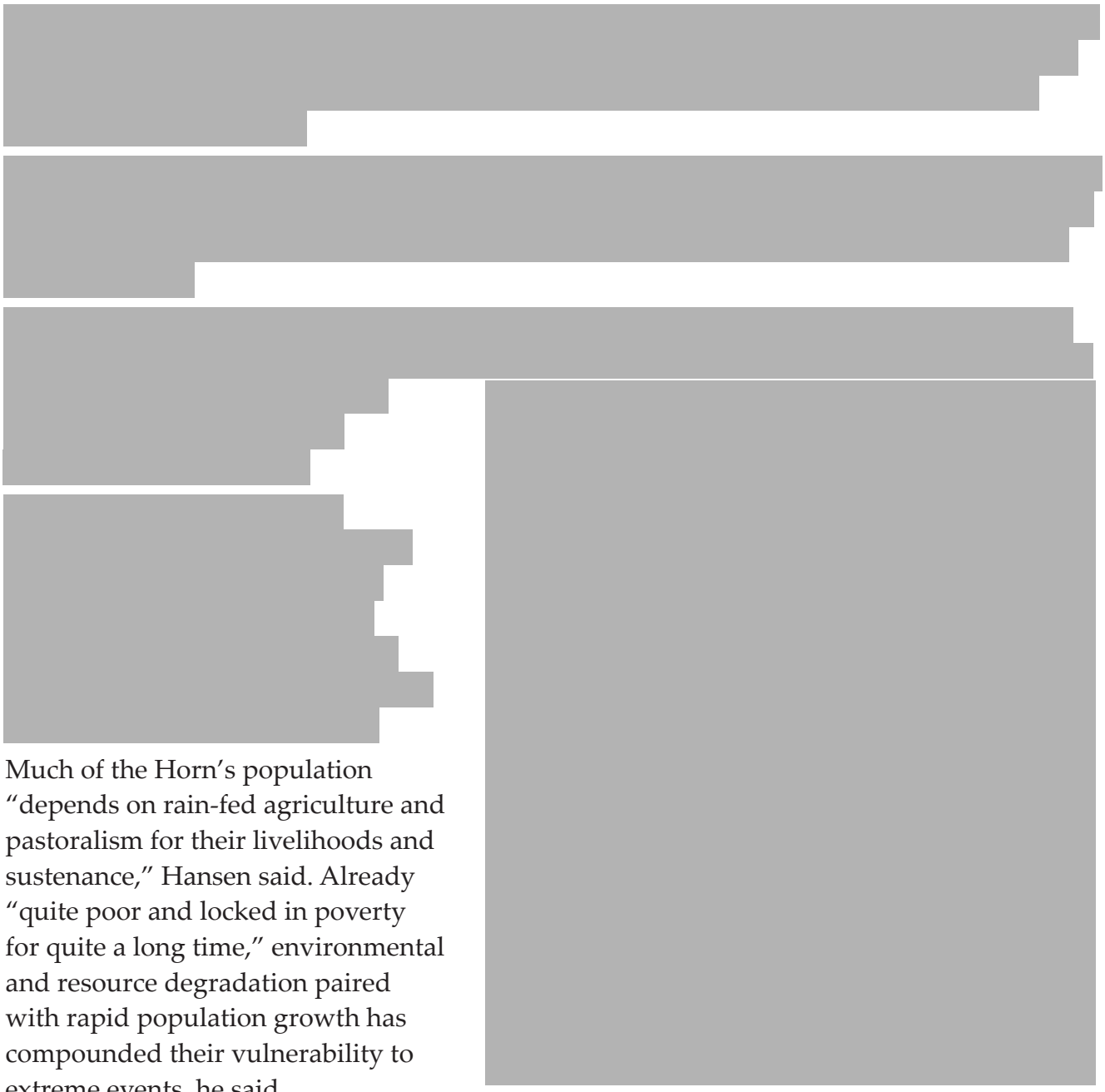
Pollution of the River Ganges

The Ganges, India's "river of life", is in imminent danger. One-tenth of the world's population relies heavily on the Ganges and its tributaries for freshwater supplies. Yet the river has become one of the most polluted on the planet, denying hundreds of millions access to clean water. Dead bodies, industrial effluent, and untreated urban sewage pollute the river.

Figure 6: Pollution in the Ganges

Climate change

As soon as 2025, two-thirds of the world's population may face freshwater shortages. Climate change will intensify the devastation. According to the United Nations Intergovernmental Panel on Climate Change, each degree Celsius rise in temperature could lead to a 20% reduction in renewable freshwater resources.



Much of the Horn's population "depends on rain-fed agriculture and pastoralism for their livelihoods and sustenance," Hansen said. Already "quite poor and locked in poverty for quite a long time," environmental and resource degradation paired with rapid population growth has compounded their vulnerability to extreme events, he said.

Figure 7

Figure 8: Limited freshwater supplies leads to the potential for future conflict that will impact children

Conflict

Conflict and political confrontation threaten to drown the call for co-operation in managing the world's limited freshwater supplies. Water has been called "the next oil" because of its importance to economic growth, and its use in everything from agriculture to industry, energy, and manufacturing.

In Syria, freshwater shortages caused by the worst drought in close to a millennium have been partly blamed for the country's generation-defining civil war.

Figure 9: Locations of ongoing conflicts worldwide (updated November 2017)

WATER QUALITY IN NEW ZEALAND

Figure 10: Rivers and lakes in the Auckland region

The rapid decline in water quality of Canterbury's Selwyn river from 1985 to 2017

Figure 11: Selwyn River in 2016 and 1985

Pre-European Māori shared natural freshwater resources; like land, fresh water was seen as a gift, to be used mindfully and protected for future generations. However, iwi have not been able to protect springs and streams, rivers or lakes, from the impacts of modern drainage schemes, dams, city water systems, pollution from farming, industry, transport and sewage, and more recently from the commercial water bottling industry. Many New Zealanders, Māori and Pākehā, are deeply concerned about the state of our fresh water resources.

A war over water

In 1983, Whangarei's Poroti Springs first ran dry. As a result watercress stopped growing, the eels disappeared, and the kōura (freshwater crayfish) died as their natural habitat disappeared. The local hapū, the kaitiaki of the sacred Northland springs, were impacted due to the near-extinction of its mauri, or life force, and the loss of their traditional food source.

Figure 12: Poroti's Pera Edwards at the dried-up stream in 1983

Many claims have been lodged with the Waitangi Tribunal for the return of traditional water rights, which have been overruled, and / or remediation of damage to traditional water sources.

Water take and consents

Figures obtained in 2017 found New Zealand companies pay an average annual fee of just $200 for each water consent.

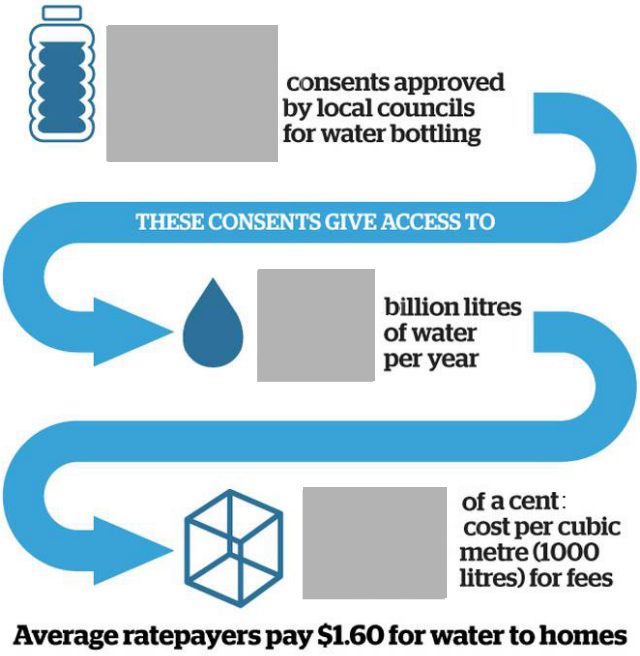


Figure 13

Figure 14: Cattle polluting the fresh water of Lake Taylor in North Canterbury

Pollution of freshwater resources in New Zealand

Nitrogen and phosphorus are the nutrients of most concern for the health of New Zealand freshwater supplies. They cause pollution in rivers, lakes, and aquifers as a result of run-off of fertilisers, animal faeces and urine.

Havelock North campylobacter outbreak

In August 2016, 250 students were sent home from Havelock North schools one Friday afternoon. By the end of the following week over 1100 people were seen by doctors and then over 5000 were sick across the suburb by the end of the following week.

The Hawke's Bay Regional Council believes that the most likely explanation for New Zealand's largest water-borne contamination is that sheep faeces, flushed from nearby grazing land into streams and surface water, got into drinking water through a weakness in the Brookvale Road bores of the Tukituki aquifer.

UNSUSTAINABLE WATER USE

Many big food-producing countries such as the US, China, India, Pakistan, Australia, and Spain have reached, or are close to reaching, their renewable freshwater resource limits. Unsustainable water use harms the environment by changing the water table and / or depleting groundwater supplies. Excessive irrigation is increasing soil salinity and washing pollutants and sediment into rivers, causing damage to freshwater ecosystems.

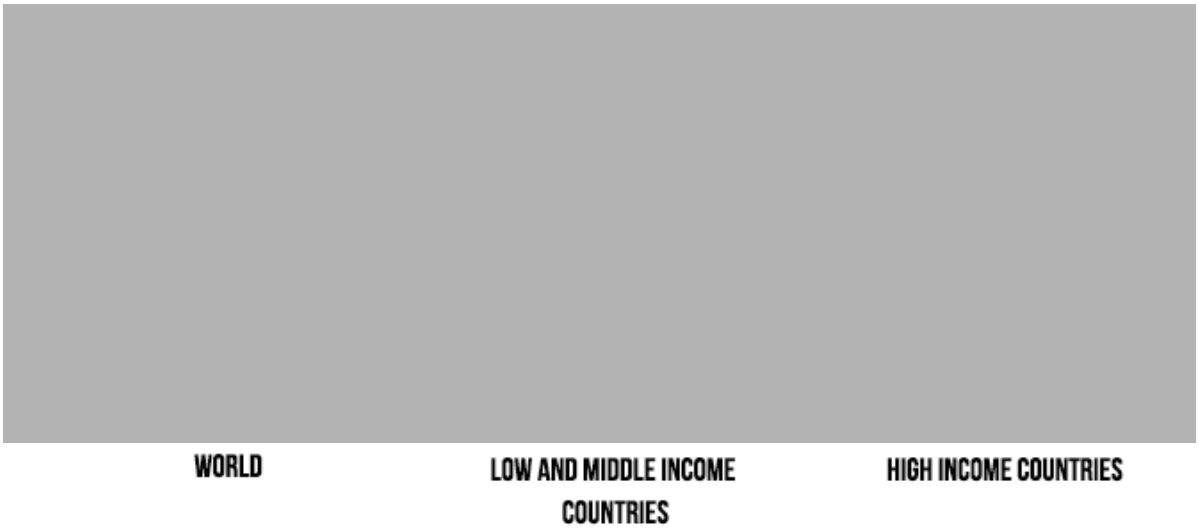


Figure 15: Global use of fresh water

The amount of water needed for domestic use is insignificant compared to the amount used by agriculture. Including domestic use and the amount of water contained in foodstuffs and their manufacture, one person uses 3400 litres of water a day. According to data, the amount of water used in agriculture needs to be doubled in order to eradicate malnutrition by 2025.

A threat to the global economy

Unsustainable water use is threatening agriculture, other business, and populations globally. The Water Stress Index calculates the water stress of over 168 countries by evaluating renewable supplies of water from precipitation, streams, and rivers against domestic, industrial, and agricultural use. The arid Middle East and North Africa region is the most at-risk region in the index, with Bahrain, Qatar, Kuwait, Libya, Djibouti, UAE, Yemen, Saudi Arabia, Oman, and Egypt categorised as the ten most water-stressed countries, listed in order of risk.

The effects of water stress on global food inflation are illustrated by recent price hikes for soya beans, which have been pushing all-time highs.

ISSUES OF INEQUALITY

Billions of people have gained access to water, but huge inequalities remain

Figure 16: People line up to collect fresh water at Yazarthingyan lake in Dala township, near Yangon, Myanmar

Since 1990, 2.6 billion people have gained access to potable water from an "improved" source (one that is designed to protect against contamination). But even by 2015, 663 million people—one in ten—still drank water from unprotected sources. Huge inequalities persist between and within countries; almost half of people drinking water from unprotected sources live in sub-Saharan Africa, eight in ten live in rural areas, and there are large gaps between the richest and the poorest. Still today, in 41 countries, a fifth of people drink water from a source that is not protected from contamination.

Figure 17: Developing nations are making progress—the map shows the percentage of each country's population that has gained access to an improved drinking water source since 1990

Collecting fresh water is still a major burden for groups and individuals, especially in sub-Saharan Africa. Fortunately, in most countries, the majority of people spend less than 30 minutes collecting fresh water, or have a piped supply within their home. But in some regions, especially sub-Saharan Africa, many spend more than 30 minutes—and some more than an hour—on each trip to collect fresh water. This burden still falls mainly on women and girls, who are responsible for this task in eight out of ten households that don't have a piped supply. Mongolia is the only country where men and boys have primary responsibility for collecting fresh water.

Figure 18: Where the burden falls in countries where at least one in ten households collects fresh water from outside the home

Cultural factors play an important part in the allocation of drinking water in many parts of the world. In South Asia, caste (social class in society) is often an important factor in determining access. In Andhra Pradesh, a province in India, for example, low-caste women cannot draw water from wells in high-caste villages. Similarly, ethnic divisions in much of Latin America restrict certain communities' access to potable water. In Bolivia, the average rate of access to piped water is 49% for indigenous speakers, compared to 80% for non-indigenous speakers.

GEOPOLITICS

Riparian rights (the right to take water) has shaped geopolitics for centuries. In many areas of the world, bodies of water run through several countries or brush up against many countries' borders. In the case of a river, upstream countries where the river originates enjoy inherent power and leverage over the downstream countries. And these may be in regions where relationships between countries are already fraught.

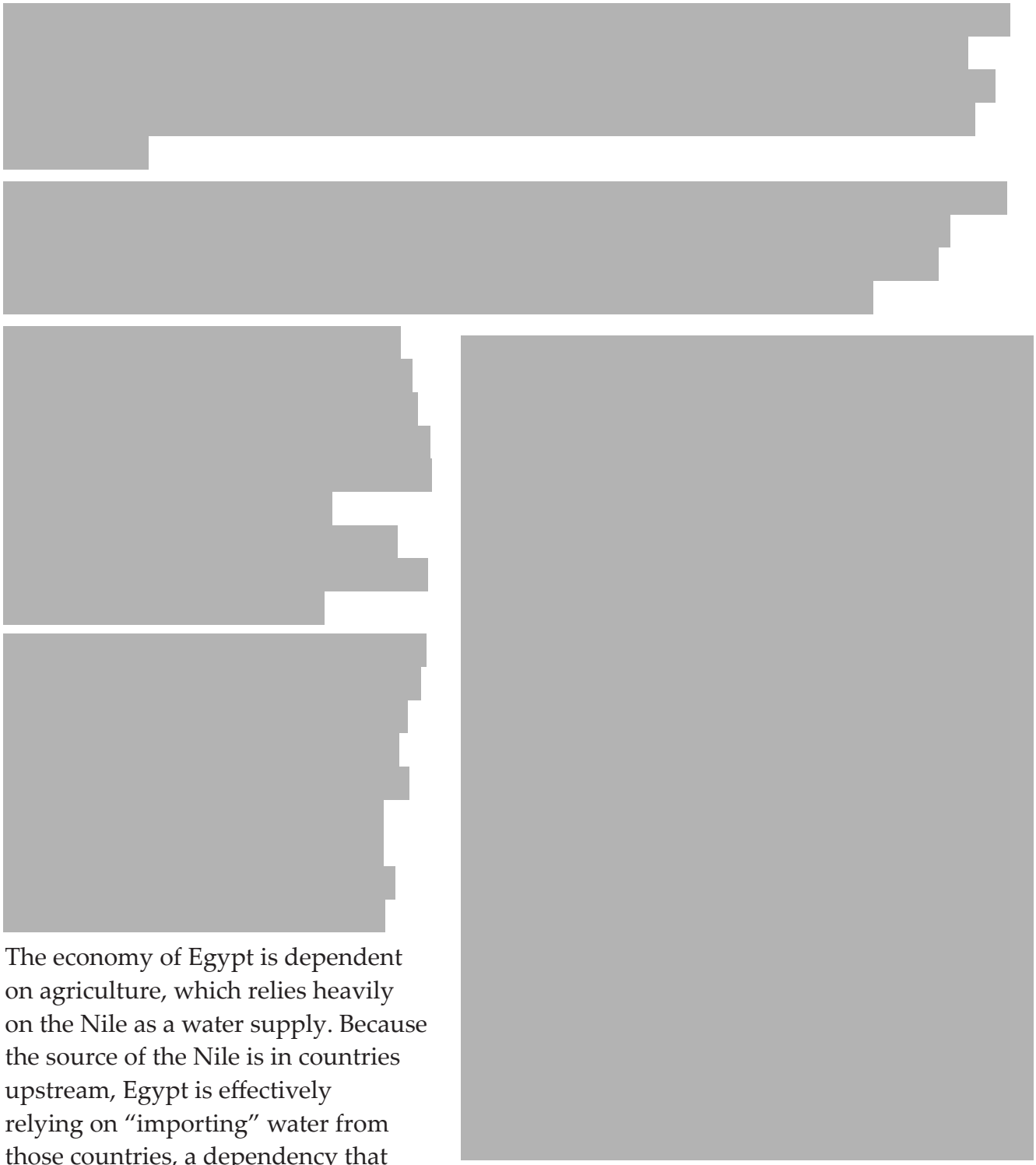


Figure 19

The economy of Egypt is dependent on agriculture, which relies heavily on the Nile as a water supply. Because the source of the Nile is in countries upstream, Egypt is effectively relying on "importing" water from those countries, a dependency that may lead to future water conflicts. Ethiopia's tributaries supply about 86% of the waters of the Nile. Egypt has historically threatened war on Ethiopia and Tanzania over the Nile River. Egypt has armed Somali separatist rebels in Ethiopia during

and since the Somalian invasion of Ethiopia in the 1970s. Over the years, the states involved have put agreements and treaties in place so that conflict can be controlled. In 2015, Egypt and Ethiopia put enough differences aside to begin construction of the Grand Ethiopian Renaissance Dam on the Blue Nile. When completed, this will be the largest dam in Africa.

Country	Population 1995 (millions)	Population 2025 (millions)	GDP per capita 2016 (US$)	Population below the poverty line (US$1/day) (PPP) (%)	Water availability per capita (m^3)
Egypt					
Ethiopia					
Kenya					
Rwanda					
Sudan					
Tanzania					
Uganda					

Figure 20: Key statistics on the countries of the River Nile

Figure 21: It takes 3781 litres of water to produce one pair of Levis 501s

Measuring water consumption in manufacturing and the supply chain is fundamental to introducing more sustainable practices. Water count and numeracy in litres is fast becoming a core sustainability skill for responsible and resilient businesses. In the United Kingdom, 66% of businesses see opportunities in water, from cost-savings to brand value and shareholder confidence.

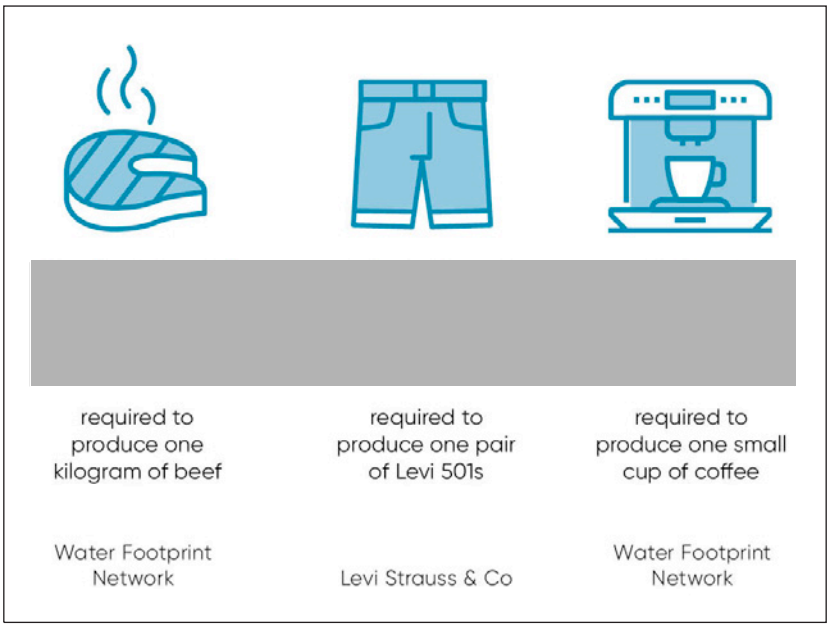


Figure 22: The water footprint of three common items

TECHNOLOGICAL SOLUTIONS

Smart technology can assist in the preservation, economical use, and efficient distribution of scarce water supplies.

Universal metering in the United Kingdom could reduce household water consumption by as much as 10–15%, but expanding the use of this simple technology requires significant investment by water companies that may then face public resistance.

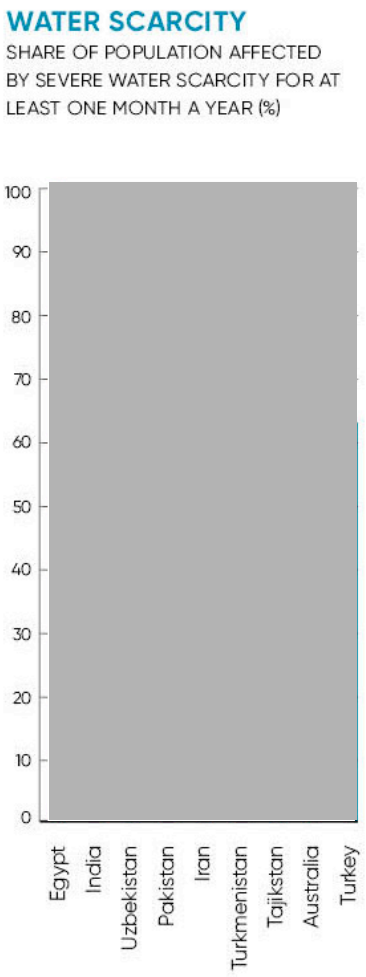


Figure 23

REUSE OF WASTE WATER

Figure 24: A wastewater treatment plant in the United Kingdom

As demand for clean fresh water increases, exacerbated by climate change, reusing waste water is becoming a cost-effective imperative to conserve scarce resources.

On the other hand, the wastewater treatment sector is starting to realise that wastewater sludge is a "bioresource", and thus more than just a waste to be disposed of. There are proposals to open the market for sludge, highlighting that the sludge market could produce benefits of up to £780 million and enough power for 500 000 homes. There are now 159 sewage plants in the United Kingdom producing energy or biogas equivalent to 203 megawatts of electric power.

DESALINATION

Figure 25: A desalination plant in Israel

After years of shortage and government campaigns urging conservation, Israel has used technology successfully to manage many of its freshwater problems. The country relies on desalination, which removes salt and impurities from sea water, to satisfy its water demands.

Desalination technology and expertise is now an Israeli export, with the nation's leading businesses in this sector advising and running projects as far afield as California in the United States and Tianjin in China.

SMALL-SCALE WATER STORAGE

A rainwater tank is a water tank used to collect and store rainwater run-off, typically from rooftops. This is known as 'rainwater harvesting'. For an average-sized New Zealand house with a 135 m² roof, this system can yield up to 1350 litres of fresh water from 1 cm of rain.

Figure 26

There are many low-cost designs that use locally available materials and village-level technologies for applications in developing countries where there are limited alternatives for potable drinking water.

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(continued overleaf)

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