

FUTURE PROOFING IN THE BUILT ENVIRONMENT

WHERE DOES WATER FIT IN

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What is future proofing?

Future proofing is a broad term that can encompass not only buildings and infrastructure but also communities, cities, countries or the whole planet.

It has adopted different meanings within these different contexts, ranging from resilience to climate change to demographic change and resource security.

It is sometimes confused with sustainability issues, life-cycle costing and even well being.

Whilst these may be relevant areas of consideration, here they are part of a more specific assessment process.

In relation to buildings, future proofing is an assessment process aimed at maximising whole-life value in the face of unpredictable, ongoing change.

Historic precedent

Future proofing is not a new phenomena.

The anthropologist Gregory Bateson is credited with telling the following story about planning for the future.

New College, Oxford, founded in 1379 has a large dining hall like other Oxford colleges. This is constructed using large oak beams.

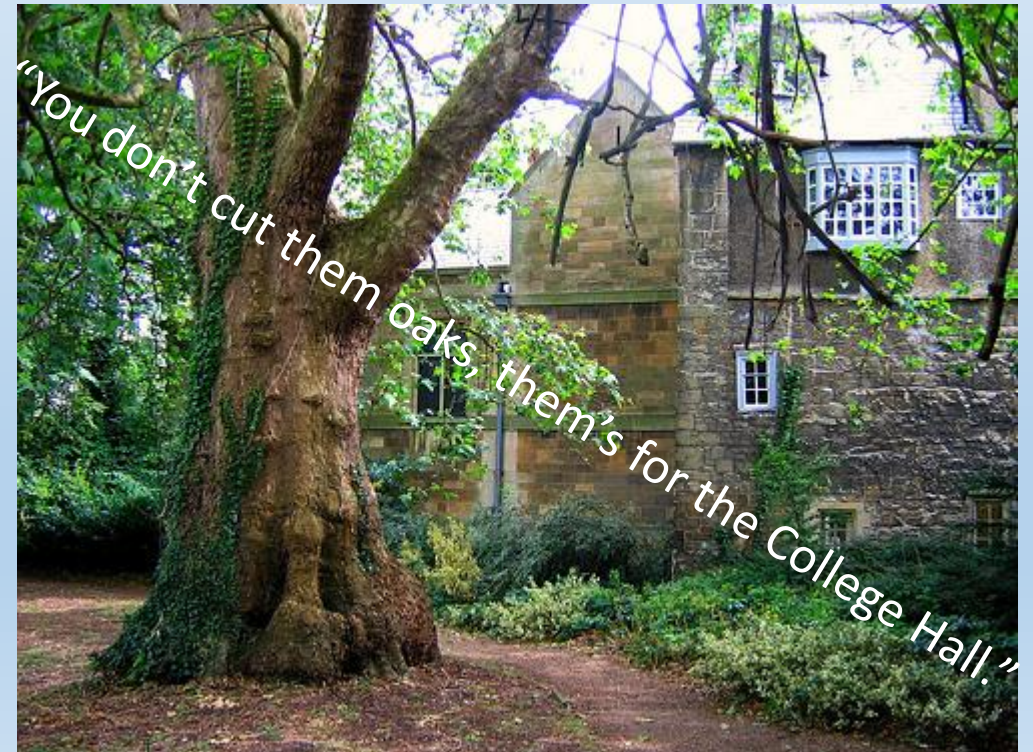
In 1859 it became clear that the beams needed to be replaced – a difficult and expensive undertaking given the size of the timbers required.

On Oak Beams & Contingency Plans

This is a story about planning, foresight, myths, reality, and the oak beams of College Hall at New College, Oxford.



It turns out that a stand had been planted and set aside when the great hall was built and while everyone at the college had forgotten about them, the forestry people had been under strict orders passed down for 500 years.



It was discovered however that replacement oaks had been planted in the college estates,
and these were cut for use in the hall.

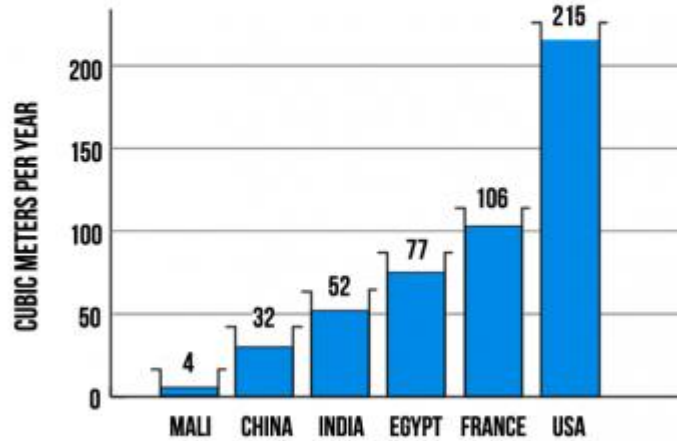
It has been suggested that these trees were expressly planted for the hall –

in effect, the hall had been **future proofed** against the possibility that the resources necessary to repair it would become (or remain) difficult to obtain.

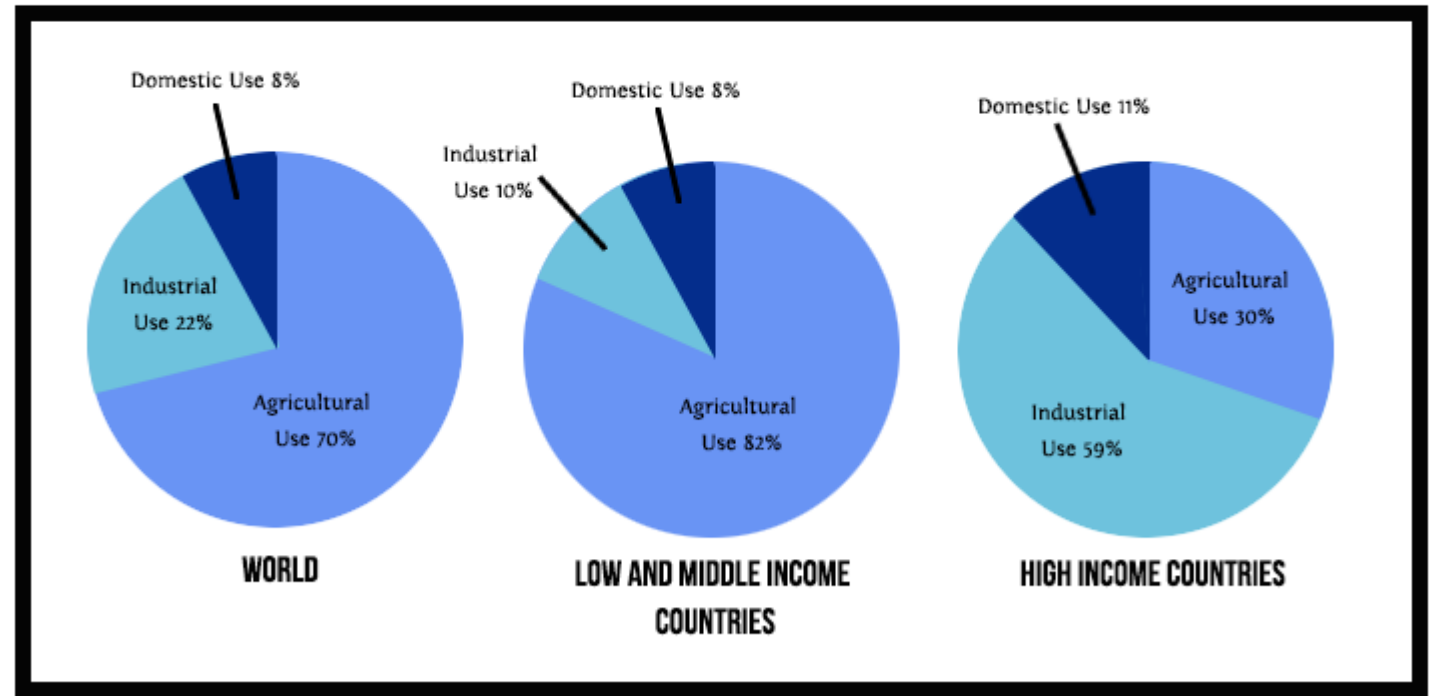
Uses of water



PER CAPITA WATER USAGE ACROSS THE GLOBE



GLOBAL USE OF WATER ACROSS INCOME GROUPS

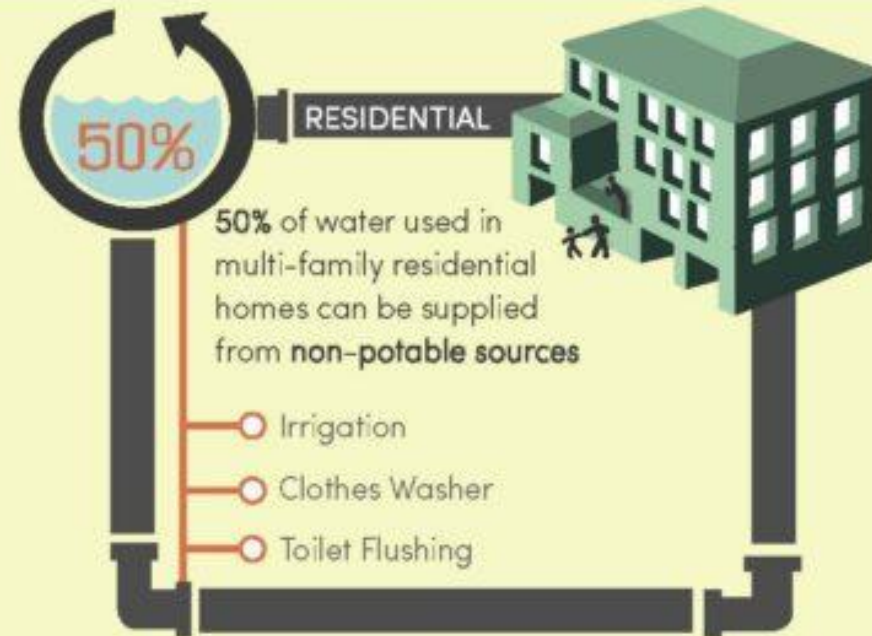
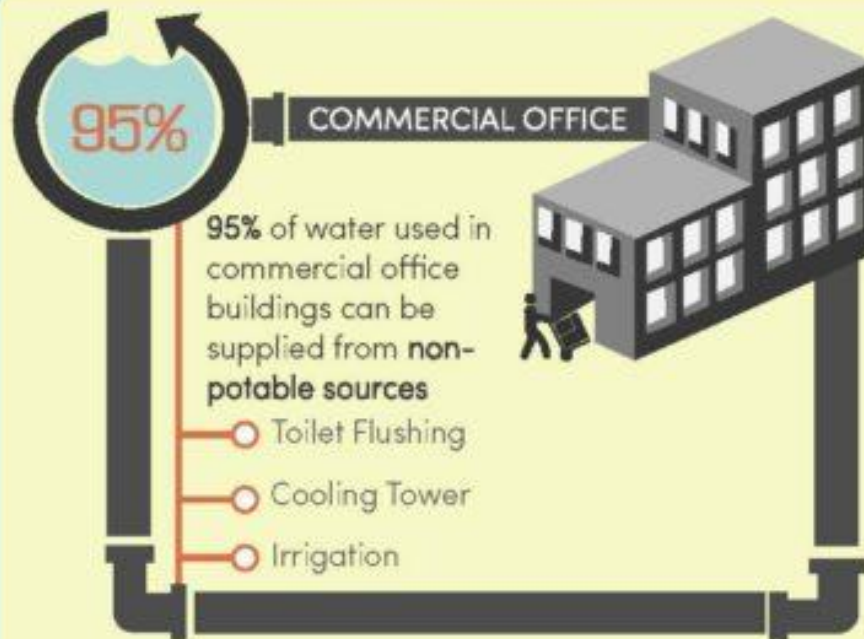


Scientists estimate that the annual total water volume used by industry will rise to an estimated 1,170 km³/year by the year 2025. The industrial component will also rise to 24% of the total freshwater usage by 2025.

Design Professional's Practice Guide for Integrating:

ONSITE WATER USE AND REUSE

Water is a finite resource. And yet almost all architects and engineers do not consider water reuse in the design, construction and operations of our buildings and neighborhoods.



Source: USEPA

It takes approximately 600L of water to produce 1000 bricks.

<http://forest.mtu.edu/pcforestry/resources/studentprojects/bricks/mincond.htm>

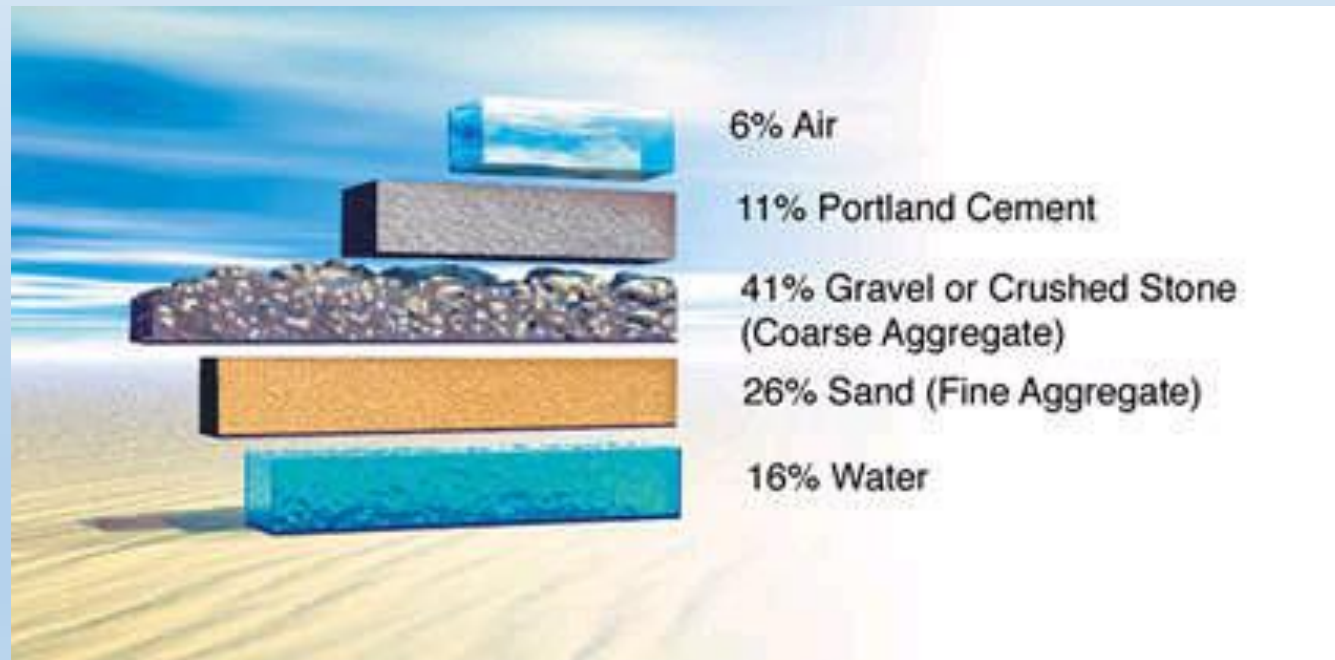
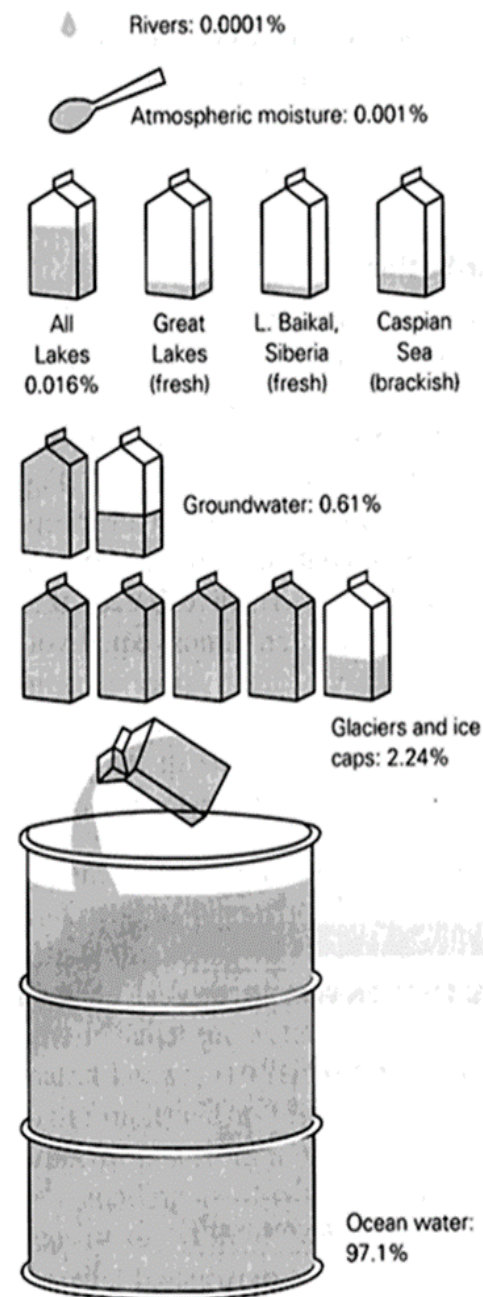
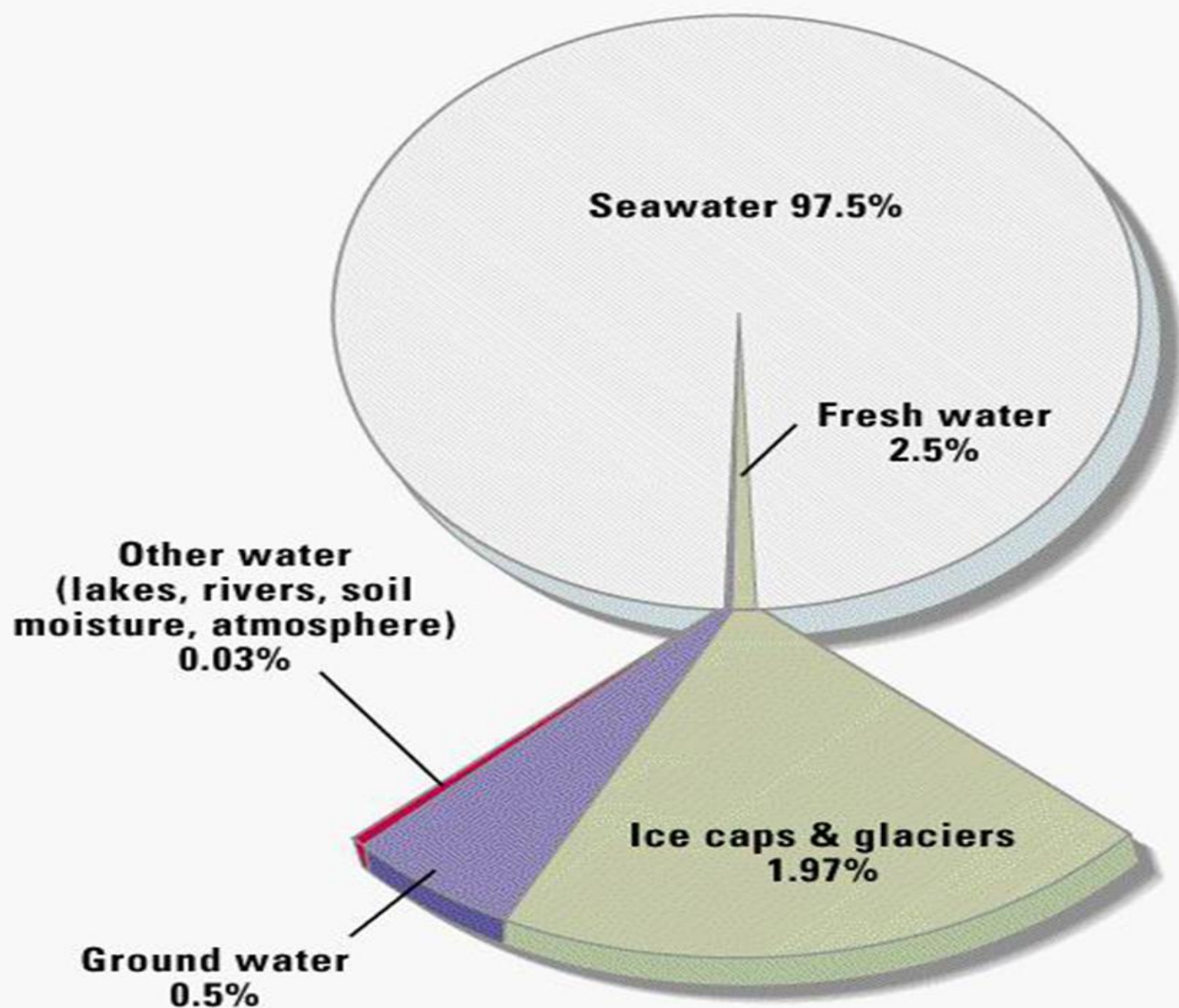


TABLE 3-1**DISTRIBUTION OF FRESH AND SALINE, LIQUID AND FROZEN WATER IN THE WORLD**

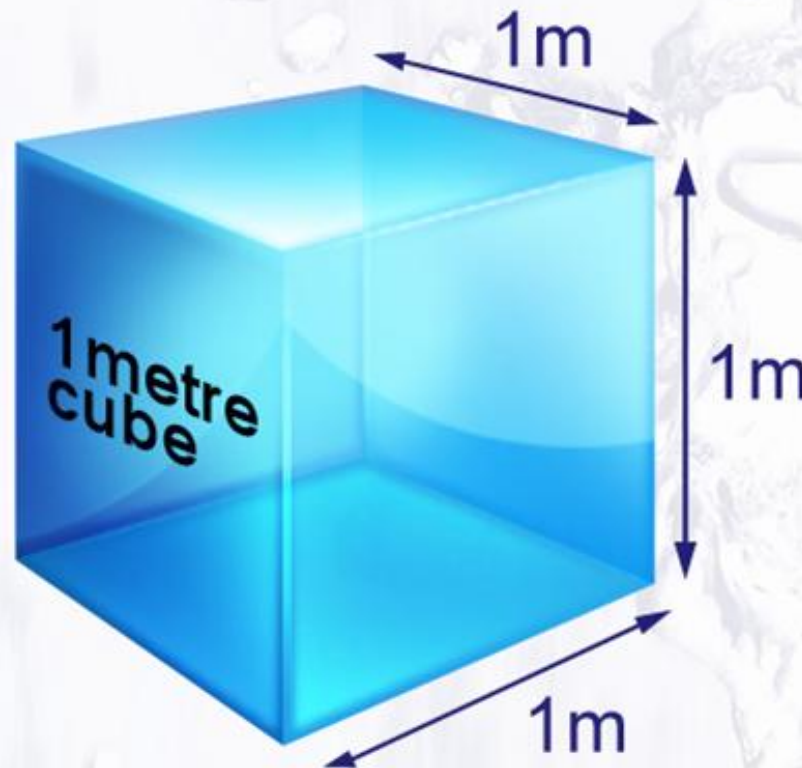
Most surface fresh water is trapped in the Antarctic ice cap, and ground water is the other major freshwater reserve. Lakes contain relatively small amounts, and the volume of saline lake water (< 3 ppt salinity) roughly equals that of freshwater lakes. The largest uncertainty is in the estimation of groundwater volume.

Site	Volume (km ³)
Oceans	1,322,000,000
Polar ice caps and all glaciers	29,200,000
Exchangeable ground water	24,000,000
Freshwater lakes	125,000
Saline lakes and inland seas	104,000
Soil and subsoil water	65,000
Atmospheric vapor	14,000
Rivers and Streams	1,200
Annual inputs	
Surface runoff to ocean	37,000
Ground water to sea	1,600
Precipitation	
Rainfall on ocean	412,000,000
Rainfall on land and lakes	108,000,000





**1 cubic metre of water
is equivalent to:**



13 Baths

or



14 Loads of washing

or



28 Showers

or



111 Toilet flushes

or



1000 litres

or



1759 pints

On 1st April 2015 charges were split between Household and Non Household customers.

The volume charge (per cubic metre) for a Household supply is as follows and applies to metered customers only:

- Water = £1.9484 per 1m³ (£0.0019484 per litre)
- Sewerage including Surface Water Drainage = £3.3954 per 1m³
- Sewerage excluding Surface Water Drainage = £2.9956 per 1m³

For example, a typical family* of 4,
on a meter who have both Water and Sewerage
including Surface Water Drainage
would use on average 140 cubic metres (140,000 litres) of
water a year.

This would equate to an annual charge of £829.19 as
detailed below:

Water = £1.9484 x 140m3	£272.78
Sewerage including Surface Water Drainage = £3.3954 x 140m3 x 95%**	£451.59
Fixed charge - Water	£53.40
Fixed charge - Sewerage	£51.42
Total	£829.19

What the average household pays

	2003-04	2013-14	% increase
Anglian Water	£274	£434	58%
Dwr Cymru Welsh Water	£279	£434	56%
Northumbrian ¹	£207	£359	73%
Severn Trent	£213	£335	57%
South West	£335	£549/£499 ²	64%/49%
Southern	£252	£449	78%
Thames	£203	£354	74%
United Utilities	£242	£406	68%
Wessex	£263	£478	82%
Yorkshire	£231	£368	59%
Average	£236	£388	64%
RPI inflation (2003-12)			36.1%³

Source: Ofwat. Bill for water and sewerage. Notes: ¹ excludes Essex & Suffolk Water; ² South West Water customers will benefit from £50 government rebate from April 2013 - without this, average bill would be £549; ³ RPI inflation January 2003-December 2012 (source: ONS)

Innovate UK

Technology Strategy Board

Design for Future Climate: Adapting Buildings £5m funding 2010-14



Innovate UK
Technology Strategy Board

**The business case
for adapting buildings
to climate change:
Niche or mainstream?**

Executive Summary

by Matt Thompson, Ian Cooper
& Bill Gething

The full version of this report can be downloaded from
:

[www.gov.uk/government/publications/the-business-
case-for-adapting-buildings-to-climate-change](http://www.gov.uk/government/publications/the-business-case-for-adapting-buildings-to-climate-change)

Framework for the adaption strategies

Design for future climate

Opportunities for adaptation in the built environment



Bill Gething's 2010 Report

www.innovateuk.org/ourstrategy/innovationplatforms/lowimpactbuilding/design-for-future-climate-report-.ashx

Designing for comfort

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Water reuse as a key foundation of our sustainable future

Although both Israel and Australia have addressed the issue of water reuse in different ways, they show us that where there is a will, there is most definitely a way.

When we come to understand that all water—regardless of whether it comes from a lake, your tap or your toilet—is a resource, the limits of what we can do to ensure our water future expands astronomically.

But these systems do require more consistent and active management and care.

Water foot-printing

notes

Table 1 – Water Content of Raw Materials

Raw Material	Supplier	Moisture Content on Delivery (%)	Consumption (tonnes)	Water Content (m ³)
Keuper Marl	Wienerberger Waresley Works	10	2,619	262
Sandown Etruria Marl	Wienerberger Sandown Quarry	10.5	60,642	6,368
Coney Etruria Marl	I W Minerals	10.5	68,987	7,244
Washed Building Sand	Tarmac Meridan	12	11,265	1,352
Glossop Shale	Wienerberger Glossop Quarry	10	1,026	103
Fireclay Aldridge 4 way blend	I W Minerals	10	4,574	457
Fireclay Aldridge mix 10	I W Minerals	10	13,450	1,345
Fireclay Kingsbury	Wienerberger Kingsbury Works	10	4,574	457
			Total	17,588

Note – Moisture content percentages are estimated and will vary.

The total water input into Wienerberger is the sum of all direct and all indirect water. There is slightly more indirect water in the system, whilst direct water accounts for approximately 42% of water inputs as shown in Figure 2.

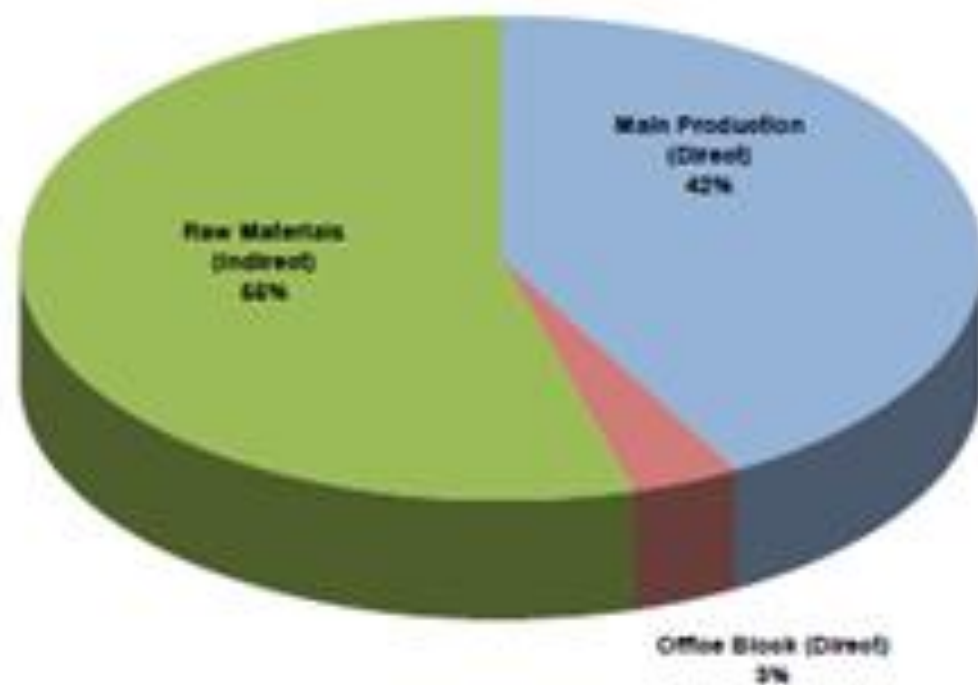


Figure 2 – Site Water Inputs (2010)

4 RESULTS

The overall site water balance for 2010 is summarised in Table 2 and represented schematically as a 'Sankey' diagram in Figure 5.

Table 2 – Quantity and Cost of Water Inputs and Outputs (2010)

		Total Water In (m ³)	Cost of Water In	Total Water Out (m ³)	Cost of Water Out
Indirect Water	Raw Materials	17,588	£0	0	£0
Direct Water	Prep Mixer	8,817	£ 7,637	0	£0
	Shredder and Mixer	4,569	£ 3,980	0	£0
	VAC Chamber	0	£0	2,127	£0
	Dryer	0	£0	28,097	£0
	Tunnel Kiln	0	£0	750	£0
	Office Use	1,100	£ 954	1,100	£ 1,616
Totals	Total Water Consumed	32,074	£ 12,571	32,074	£ 1,616 ¹
	Total Cost of Water ²				£ 27,010

1. Effluent is charged assuming 20% of all mains water supplied is treated as effluent. In 2010 the Sandown site were charged for 2,900 m³ of effluent, but only produce 1,100 m³.

2. Total water costs include extra charges of £12,623 for Water Standing Charge, Sewerage Standing Charge and Surface Water Charge, and exclude VAT.

The water footprint was calculated per tonne of bricks produced.

This was determined by looking at the amount of water consumed by Wienerberger in 2010.

The figures were calculated assuming the moisture content of the raw material going into the process accounted for 17,588 m³ as well as assuming the water content of the materials was 14% after the prep mixer, 15.4% after the VAC chamber and 0.4% after the dryers.

$$\sum (\text{water}_{\text{raw materials}} + \text{water}_{\text{main production}} + \text{water}_{\text{offices}}) = \sum (\text{water}_{\text{evaporation}} + \text{water}_{\text{effluent}})$$

$$\text{WF}_{\text{prod}} = \text{Total Water out/total production} = \text{Total Water in/total production}$$

$$\begin{aligned}\text{Potable WF}_{\text{prod}} &= 14,513,000 \text{ l} / 147,640 \text{ tonnes of saleable product} \\ &= \underline{98 \text{ l per tonne of product}}\end{aligned}$$

$$\begin{aligned}\text{Total WF}_{\text{prod}} &= 32,074,000 \text{ l} / 147,640 \text{ tonnes of saleable product} \\ &= \underline{217 \text{ l per tonne of product}}\end{aligned}$$

Alternatively:

$$\begin{aligned}\text{Total WF}_{\text{prod}} &= 32,074,000 \text{ l} / 63,637,931 \text{ bricks} \\ &= \underline{0.5 \text{ l per 2.32 kg brick}}\end{aligned}$$