



Water Industry Night 2019

What can we learn from the past?
Ancient WSUD that works today!



Department of **Biodiversity, Conservation and Attractions**
Department of **Planning, Lands and Heritage**
Department of **Water and Environmental Regulation**





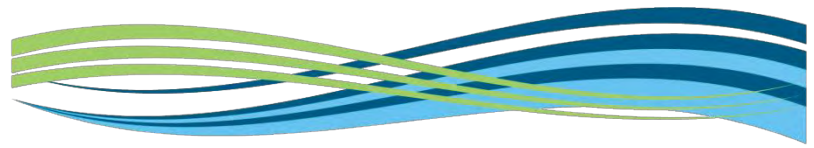
Water Industry Night 2019

Venue Sponsor



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Lands and Heritage**

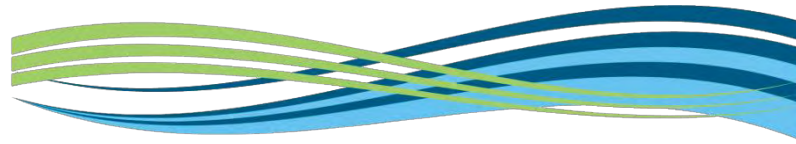
140 William St, Perth



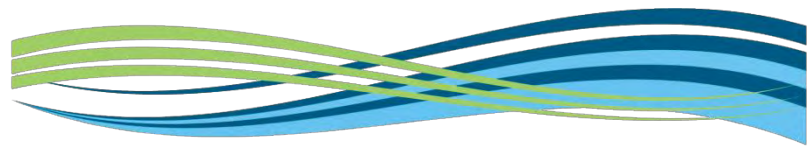
New Water Ways

**Water Industry
Night 2019**

Refreshments Sponsor



New Water Ways



New Water Ways

Water Industry Night 2019

Brendan Moore

Wadjuk Traditional Owner

Rebecca Epworth

Director, Coterra Environment

Wayne Edgeloe

Urban Development Leader, Calibre Group



Department of **Biodiversity, Conservation and Attractions**

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COTERRA
ENVIRONMENT

Water Management in Past Civilisations

New Water Ways

29 May 2019

Presentation by
Rebecca Epworth, Director

Coterra Environment

Introduction



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- Drainage in Buenos Aires circa 1780 AD and the subsequent Yellow Fever and Cholera outbreak.
- The Fajal irrigation system in Oman circa 500 AD to provide fair and equitable water.
- Water supply in Tunisia – foggara and wadis in the Sahara.
- Inkan farming and various water management practices in Peru and how they used engineering ingenuity circa 1400s AD and ~500 BC.

El Zanon – Buenos Aires



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El Zanon – Buenos Aires



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El Zanon – Buenos Aires



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El Zanon – Buenos Aires



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Falaj Irrigation - Oman

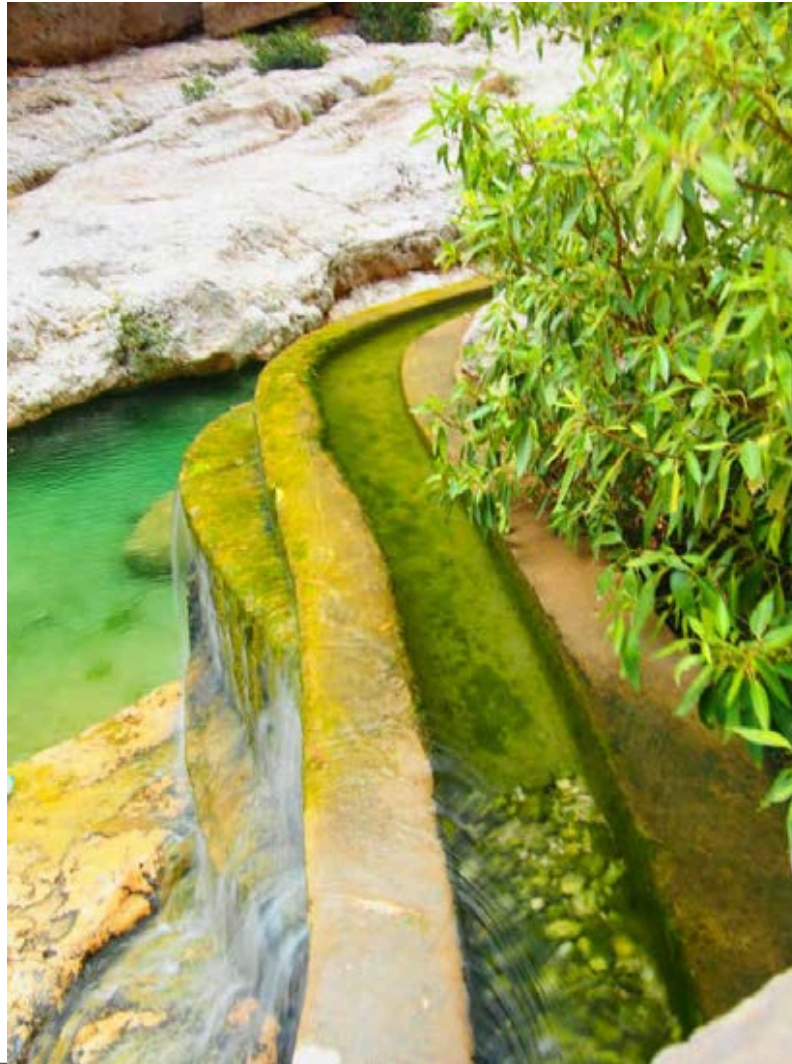
- 80% of Oman is desert and relies on a way of effectively dividing the water among all the inhabitants, fairly.
- Fajal means “split into parts”.



Falaj Irrigation - Oman



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Foggara - Tunisia



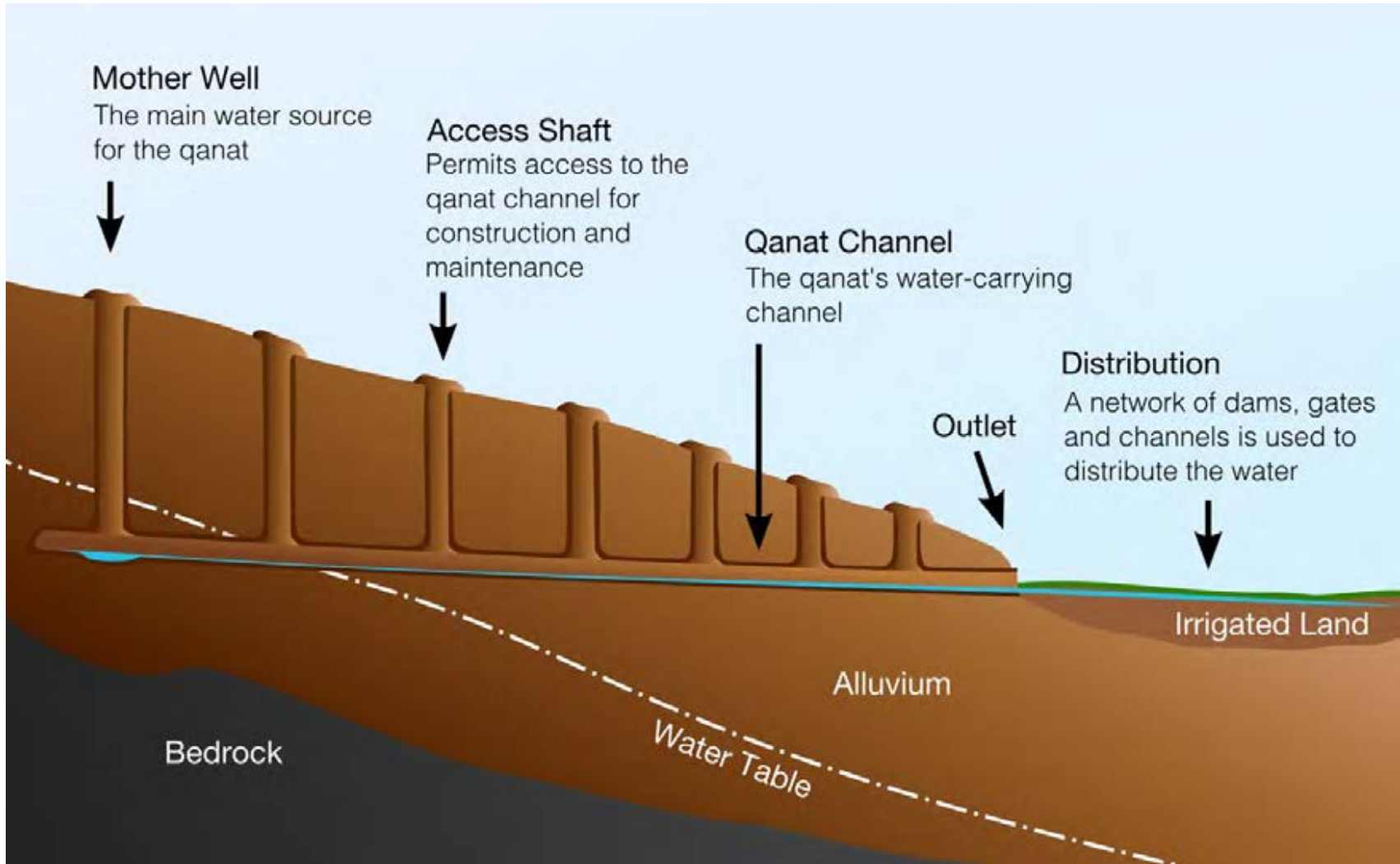
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Qanat Water Supply



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Wadis - Tunisia



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Wadis – Flood Water Harvesting



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Inkan Farming - Peru



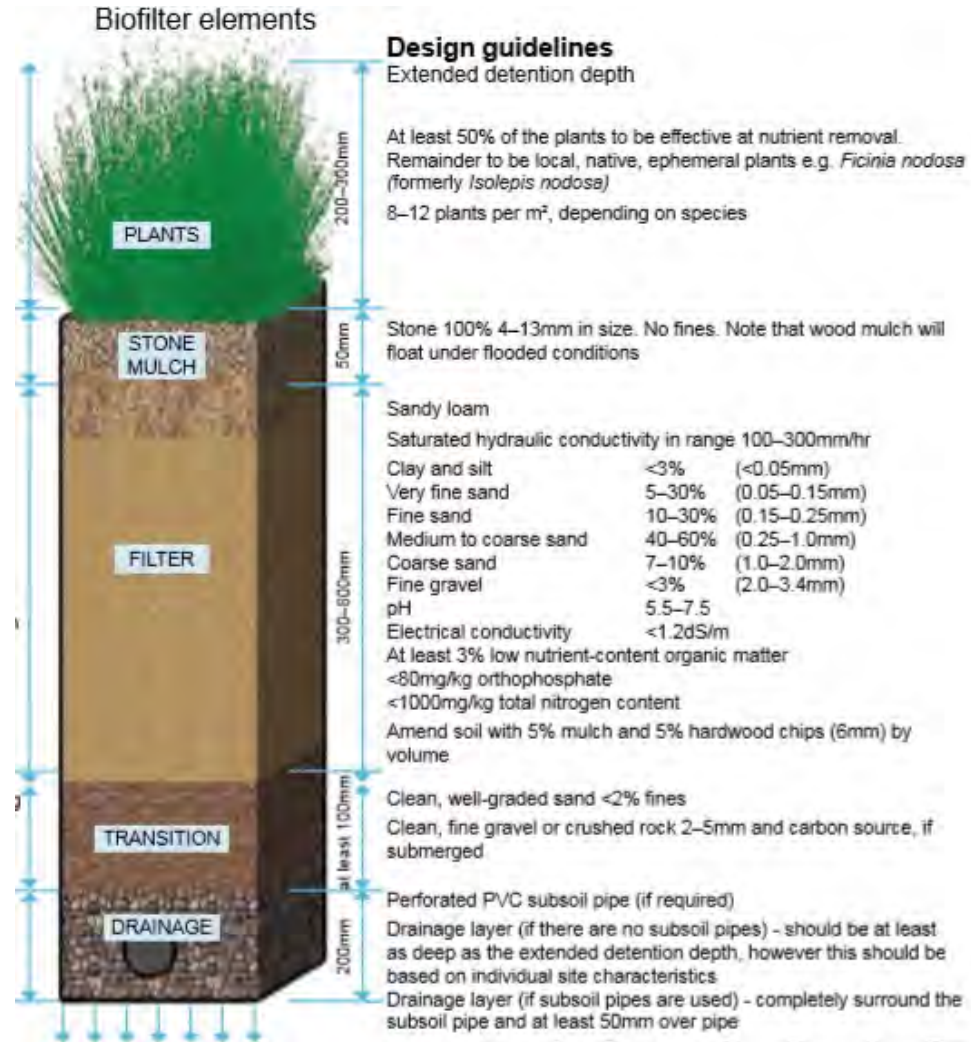
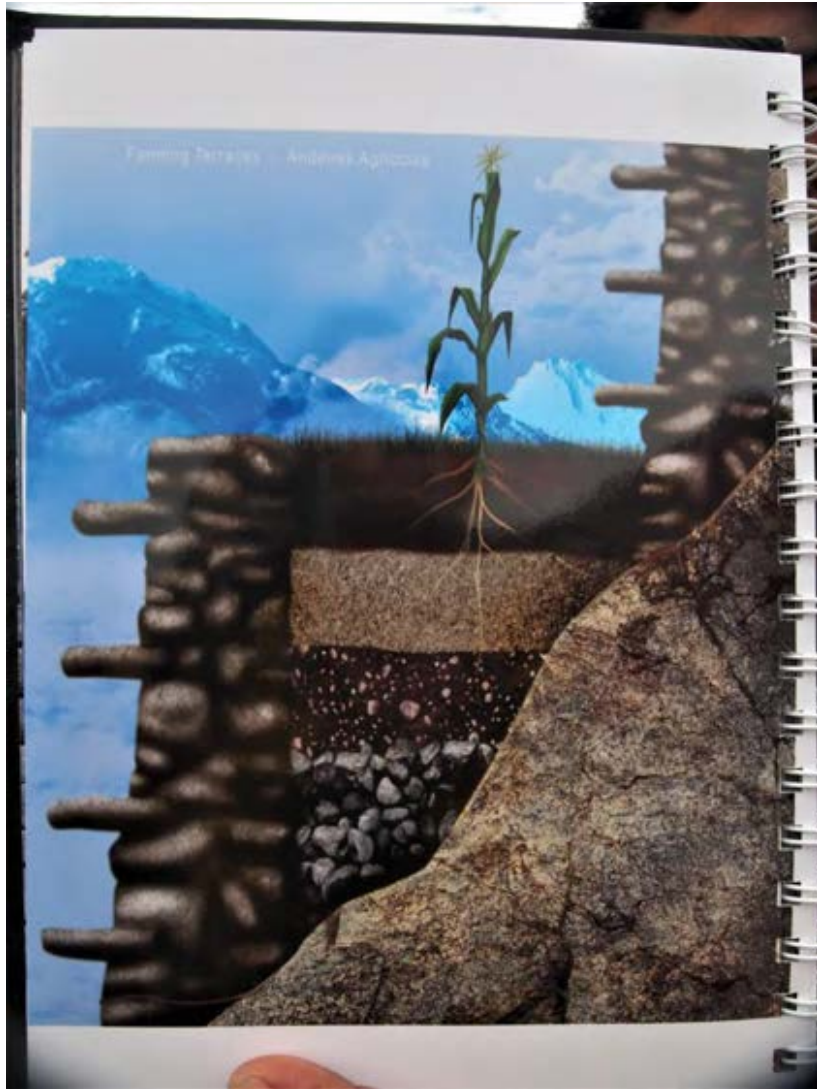
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Inkan Farming - Peru



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Inkan Farming - Peru



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Inkan Farming - Peru



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Water Management - Peru



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Nazca Aqueducts - Peru



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Qatar – Present Day





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Thank you

New WAter Ways-Water Industry Night

Brendan Moore: Sustainable water management from a
Traditional Owner perspective

Significance of waterways

- Natural land ownership boundaries.
- Not part of the estate but owned by Waugul, respected and revered.
- Source of sustenance –
- food, water and spiritual.
- Registered Aboriginal site.



Rights, roles and responsibilities

- For TO's managing waterways isn't just a matter of law (Heritage Act and Native Title) but NOONGAR lore.
- Derbal Yirragin is sacred registered Aboriginal site
- For Derbal Yirragin, TO's are Whadjuk People

The native title claim group comprises all those persons who are:

1. biological or adopted descendants of the union between the following couples:

* Boolabung and Weetang

* Alice Taylor (Berijan) and Tommy Nettle; or

2. biological or adopted descendants of any of the following persons:

* Wanetan

* Doornong

* Fanny Moderan, the mother of Cecilia Wilkes

* Tulbak; and

* John "Jack" Mungar Bennell.

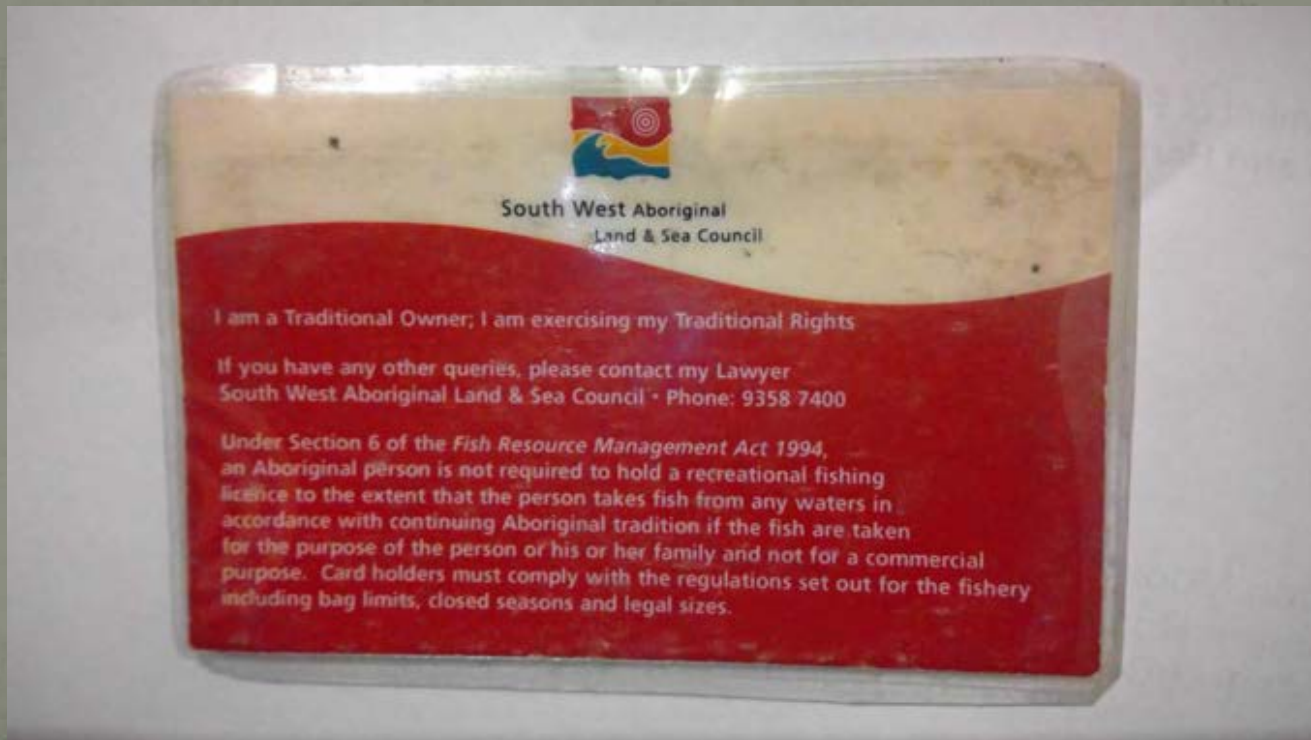
3. Paragraphs 1 and 2 above include the biological descendants of persons adopted in any intervening generation.

4. A person has been "adopted" by another person or persons for the purpose of paragraphs 1 to 3 above if they have been reared from childhood by ("grown up by") that person or persons.

- Source: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/NTDA%20Extracts/WC2011_009/SNTAExtract_WC2011_009.pdf.

Traditions and entitlement

- Ownership = Responsibility = Sustainability.
- Totems, turtle traditions and ritual.
- In addition to lore TO's must comply with regulations, bag limits, seasons and sizes.



Challenges - Environmental change

- Changes in hydrology, quality, frequency and volume.
- Dams, land clearing, salinity and run-off rural and urban landscapes.
- Foreshore erosion, unstable edges and boat speed.
- From Derbal to Wardan = Estuary to Marine.
- Habitat destruction and new species.
- Turtles, prawns, crayfish ?

Climate Change

- The Derbal Yirragin is now a tidal marine system.
- Riverside planning applications under Aboriginal Heritage Act for sea walls is not the answer.
- Engineering solutions will not solve Environmental problems.
- We need to ameliorate climate change faster, manage a retreat from the foreshore, build natural buffers and slow down the river. Dabakan Bilya

Rebuild natural waterways

- Create natural foreshore habitats.
- Remove the water and fertiliser hungry lawns.
- Slow down the run-off, velocity and eutrophication.
- Allow community groups to eco-manage the foreshore landscapes.
- Develop water management plans – the river is not a sump.



Ancient Engineering & Water

WAYNE EDGELOE – URBAN DEVELOPMENT LEADER



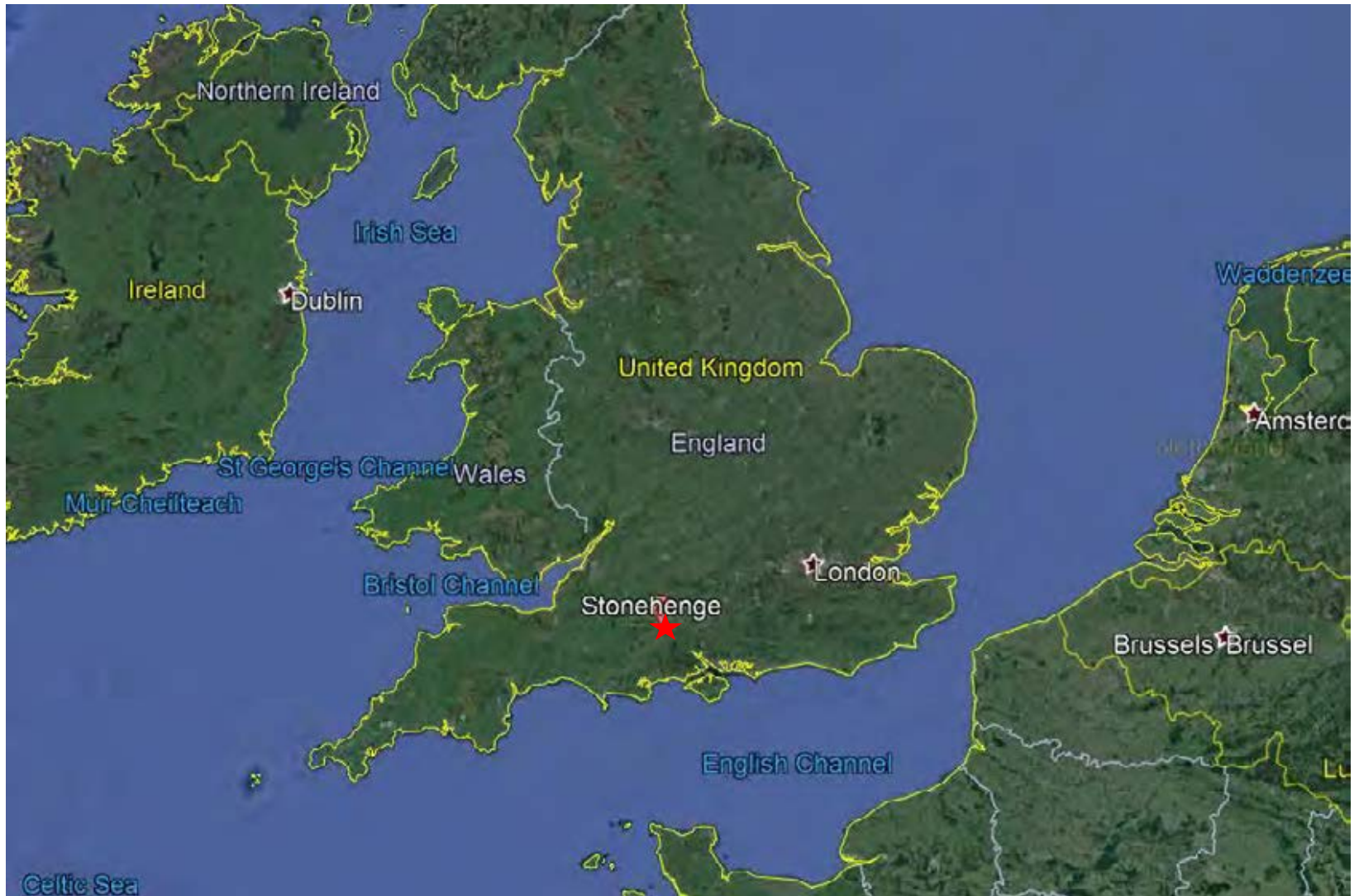


4 Ancient Civilisations





Stonehenge





Stonehenge





Stonehenge



3000 BC to 2000 BC, possible as early as 4000 BC



Stonehenge



Made of Bluestone (Basalt), 4.0 m high, 2.1 m wide and weighing around 25 tons each and transported from Southern Wales



Stonehenge



Tenons on top of the supporting sarsens



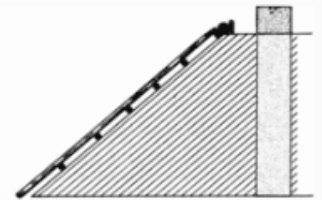
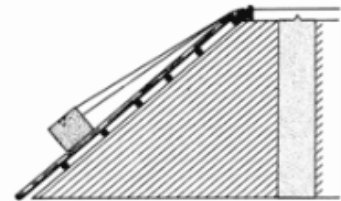
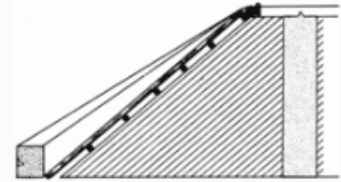
Stonehenge



Recess in Lintel



Stonehenge





Stonehenge



Public Access was closed in 1977, controlled access only now
Erosion and damage from Public



Stonehenge





Stonehenge



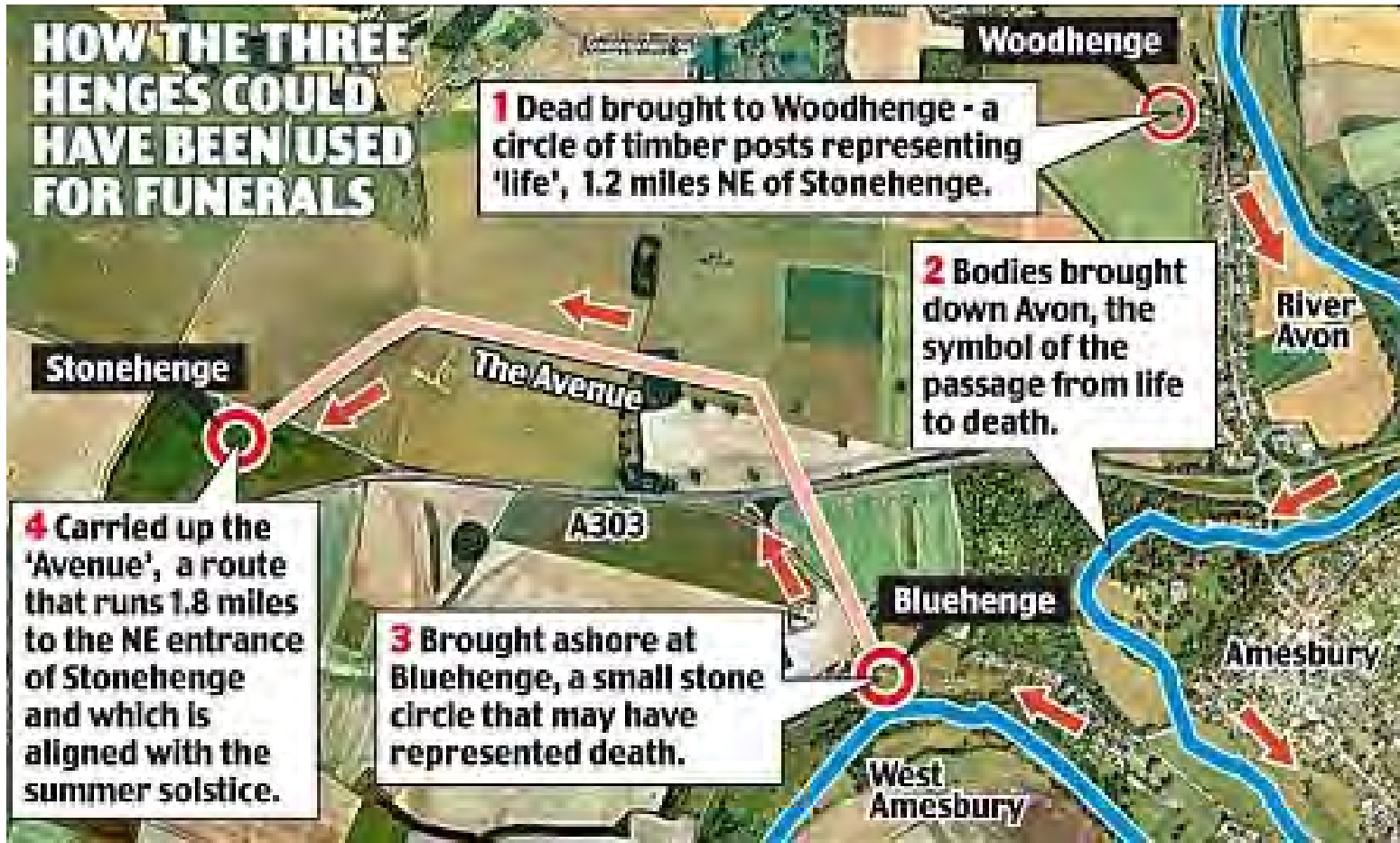


Stonehenge- Druids





Stonehenge- Druids



Early connection of water to Stonehenge by Druids. The journey from wood to stone via water was considered a symbolic journey from life to death.



Stonehenge- Druids



Druids believe in the existence of “Primal Spirits” or “Essences” that are a vital part of any being

- Water
- Wind
- Earth
- Fire

Essences are “souls” that form the world

Through the use of their magic they are able to come into contact with the essences of any being and even gain power about it.

Water played a very special part in ceremonies of Druids at Stonehenge





Stonehenge



СТОПЕНЕПГЕ

NATURALLY STILL SPRING WATER

OUR SPRING WATER

Stonehenge rests on the beautiful and vast Salisbury Plain. Beneath the enigmatic stone circle lies an aquifer with the most pristine water. Our bottles are filled with the pure and velvety smooth spring water which over many, many years has trickled through the thick layer of chalk that acts as a natural filter.

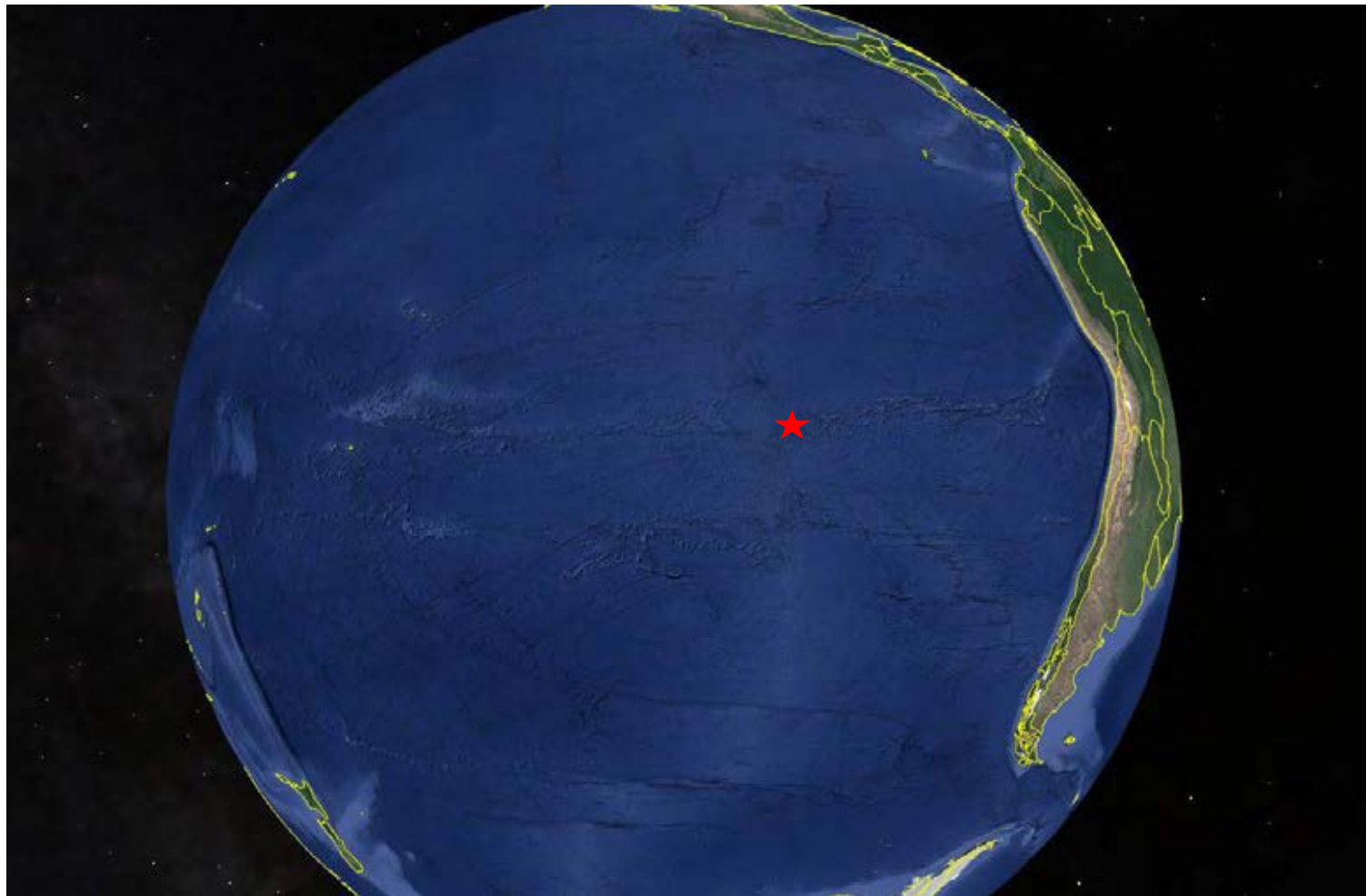


Stonehenge





Easter Island- Rapa Nui

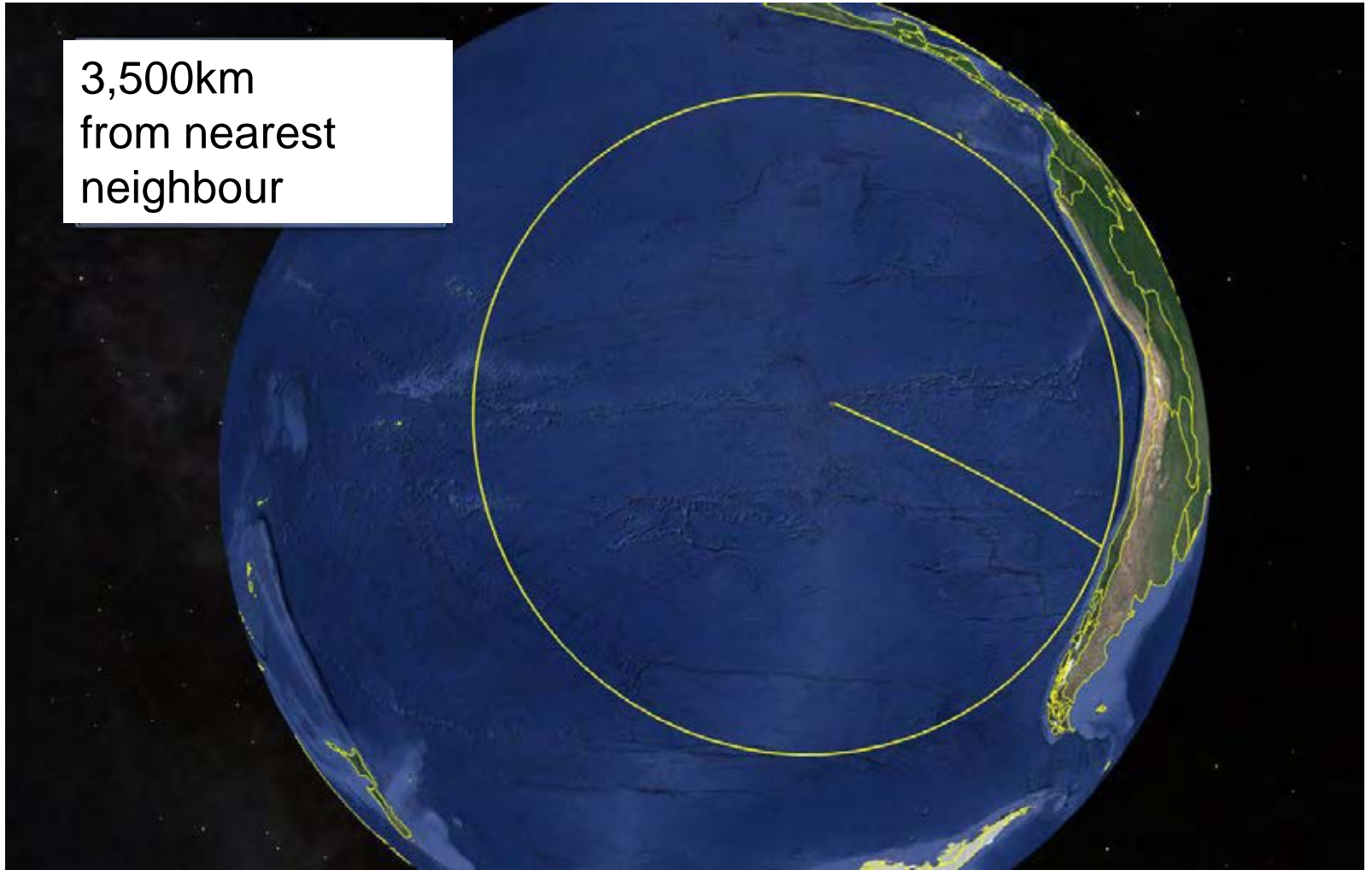




Easter Island- Rapa Nui

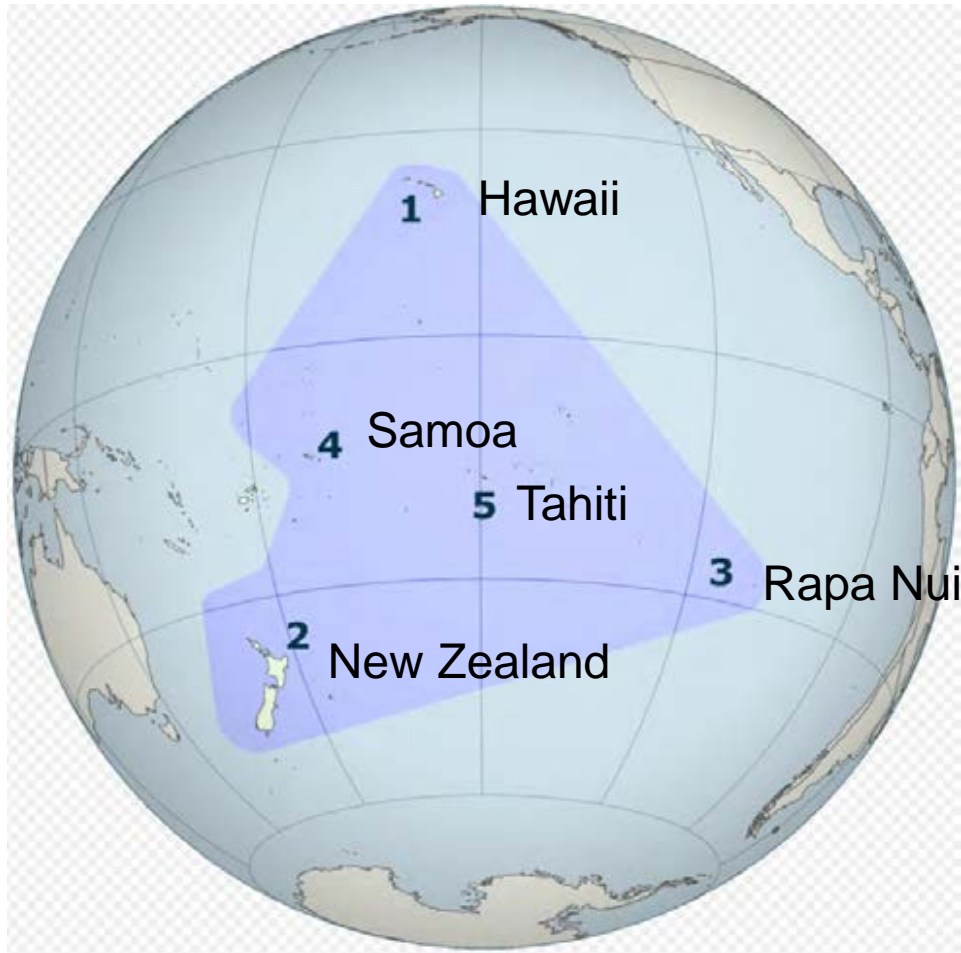


3,500km
from nearest
neighbour





Easter Island- Rapa Nui



Polynesian Triangle



Easter Island- Rapa Nui



Polynesians arrived approx. 1200 AD



Easter Island- Rapa Nui



Original Raft from Kon-Tiki expedition in 1947 by Thor Heyerdahl (Oslo Museum)

Heyerdahl believed that people from South America could have settled Polynesia in pre-Columbian times (<1492)



Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui



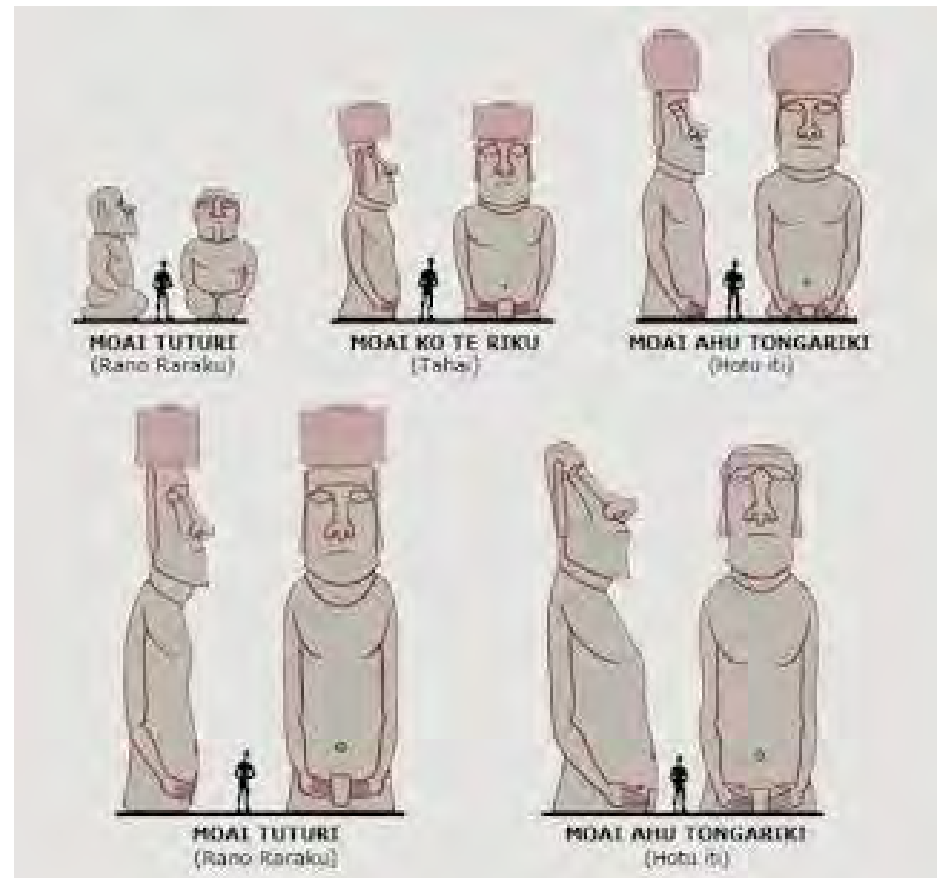
European arrival in 1722, the island's population was approx. 2,000–3,000, island denuded of vegetation.

European diseases, Peruvian slave trading expeditions in the 1860s, and emigration to other islands further depleted the population, reducing it to a low of 111 native inhabitants in 1877.

Now recovering with population 7,750 people on the island, of whom 3,512 (45%) consider themselves Rapa Nui



Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui



Approx. 1000 Moai on island many in poor condition



Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui





Easter Island- Rapa Nui



Legend of walking Moai



Easter Island- Rapa Nui





Easter Island- Rapa Nui



Legend of Rapa Nui diving below ocean at edge of land to drink water

Science News

from research organizations

Easter Island inhabitants collected freshwater from the ocean's edge in order to survive

Process of 'coastal groundwater discharge' made water safe to drink for ancient people of Rapa Nui

Date: October 9, 2018

Source: Binghamton University

Summary: Ancient inhabitants of Rapa Nui (Easter Island) maintained a society of thousands by utilizing coastal groundwater discharge as their main source of 'freshwater,' according to new research from a team of archaeologists.

Water is safe to drink if it contains less than about 9,000mg/L of salt
We can't safely drink water saltier than our own bodily fluids, and blood plasma is 9,000mg/L.
Sea water is 35000 mg/L





Easter Island- Rapa Nui



Smithsonian.com

SmartNews Keeping you current

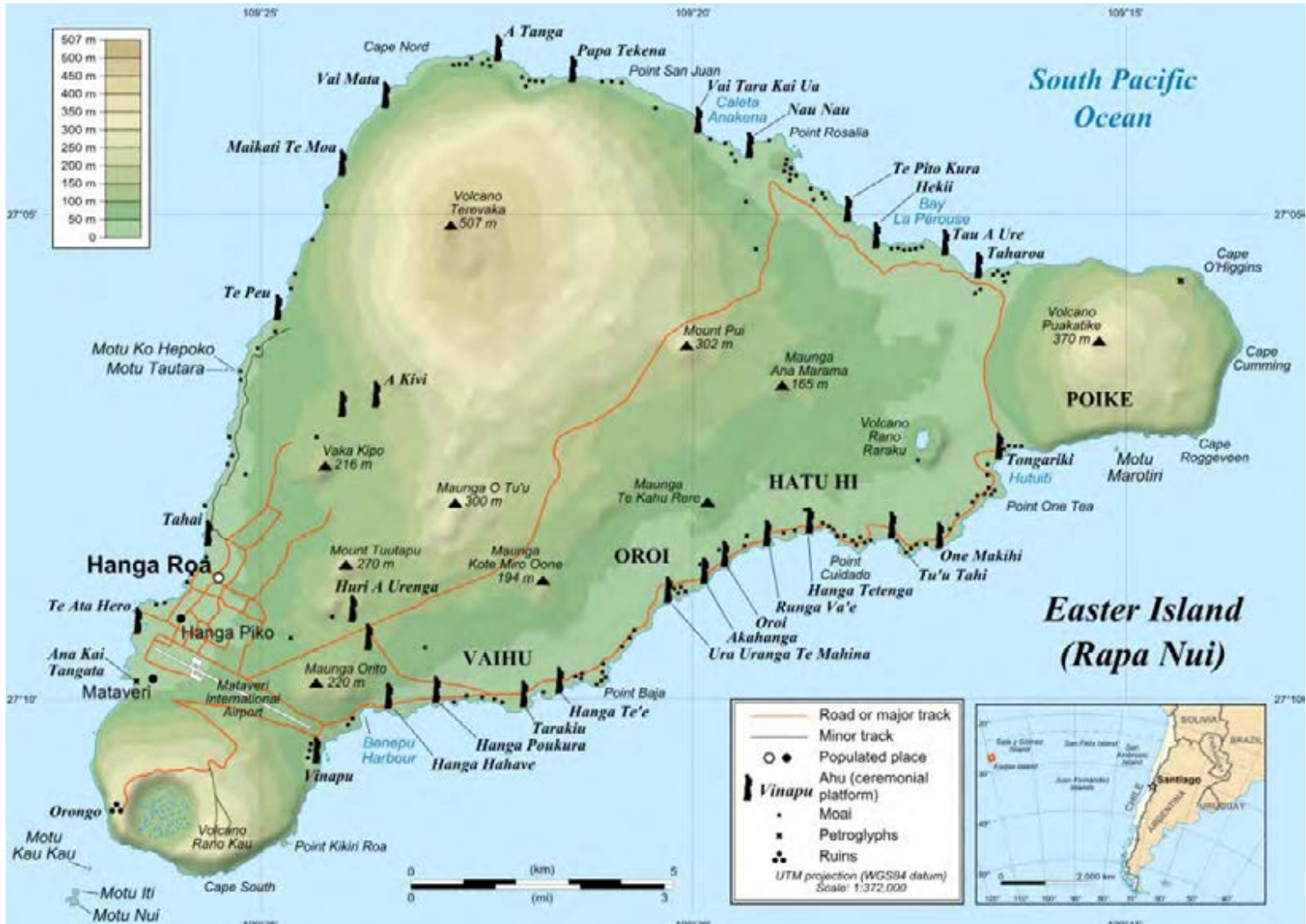
Easter Island Statues May Have Marked Sources of Fresh Water

A spatial analysis of the island's moai and ahu seem to line up with ancient wells and coastal freshwater seeps





Easter Island- Rapa Nui





Easter Island- Rapa Nui



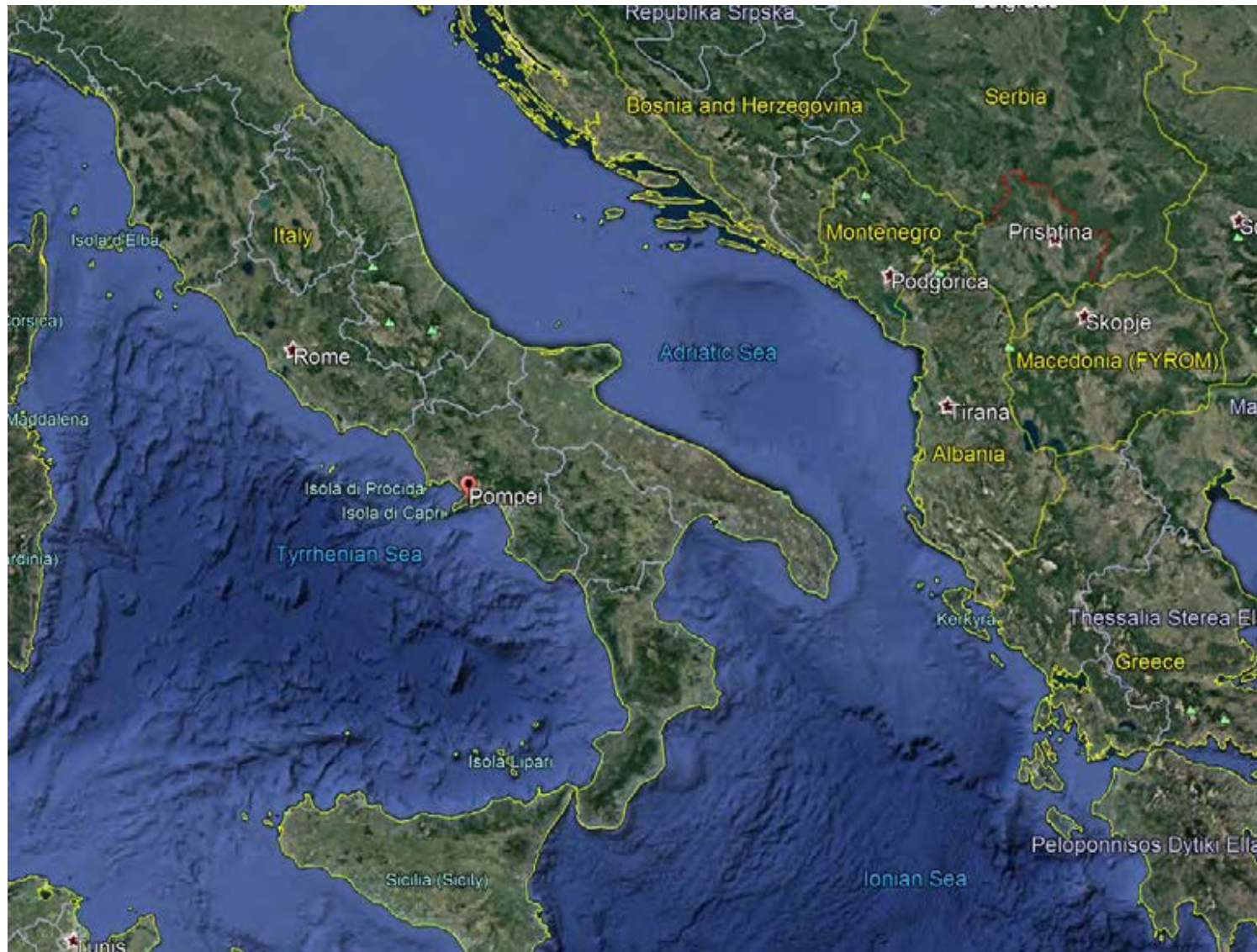


Easter Island- Rapa Nui





Pompeii



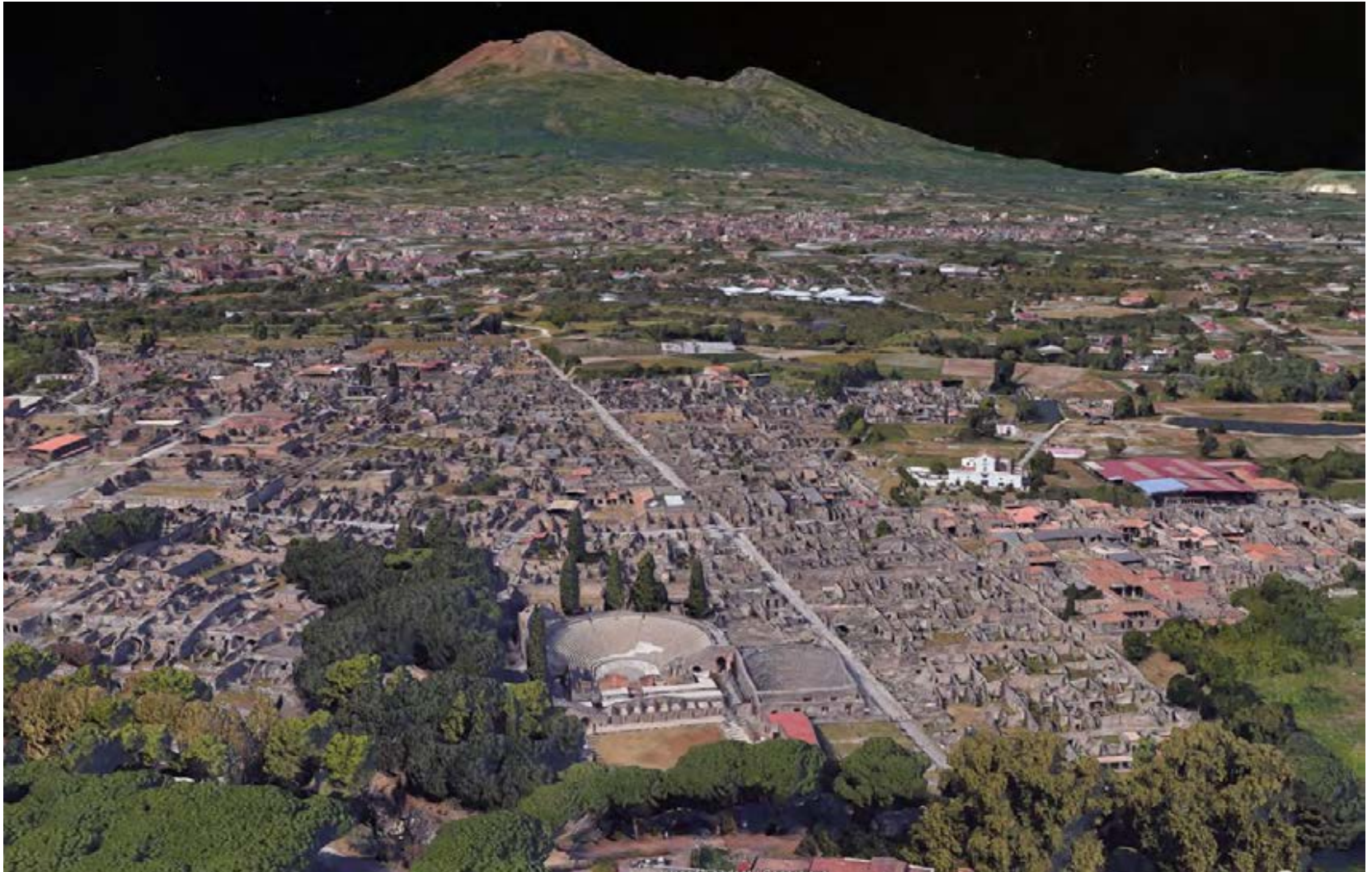


Pompeii





Pompeii





Pompeii



Buried by 6m of ash from eruption of Mt Vesuvius in AD 79, rediscovered 1748



Pompeii



Plaster casts made from voids in the compacted volcanic ash



Pompeii





Pompeii



Road systems catered for minor and major flows



Pompeii



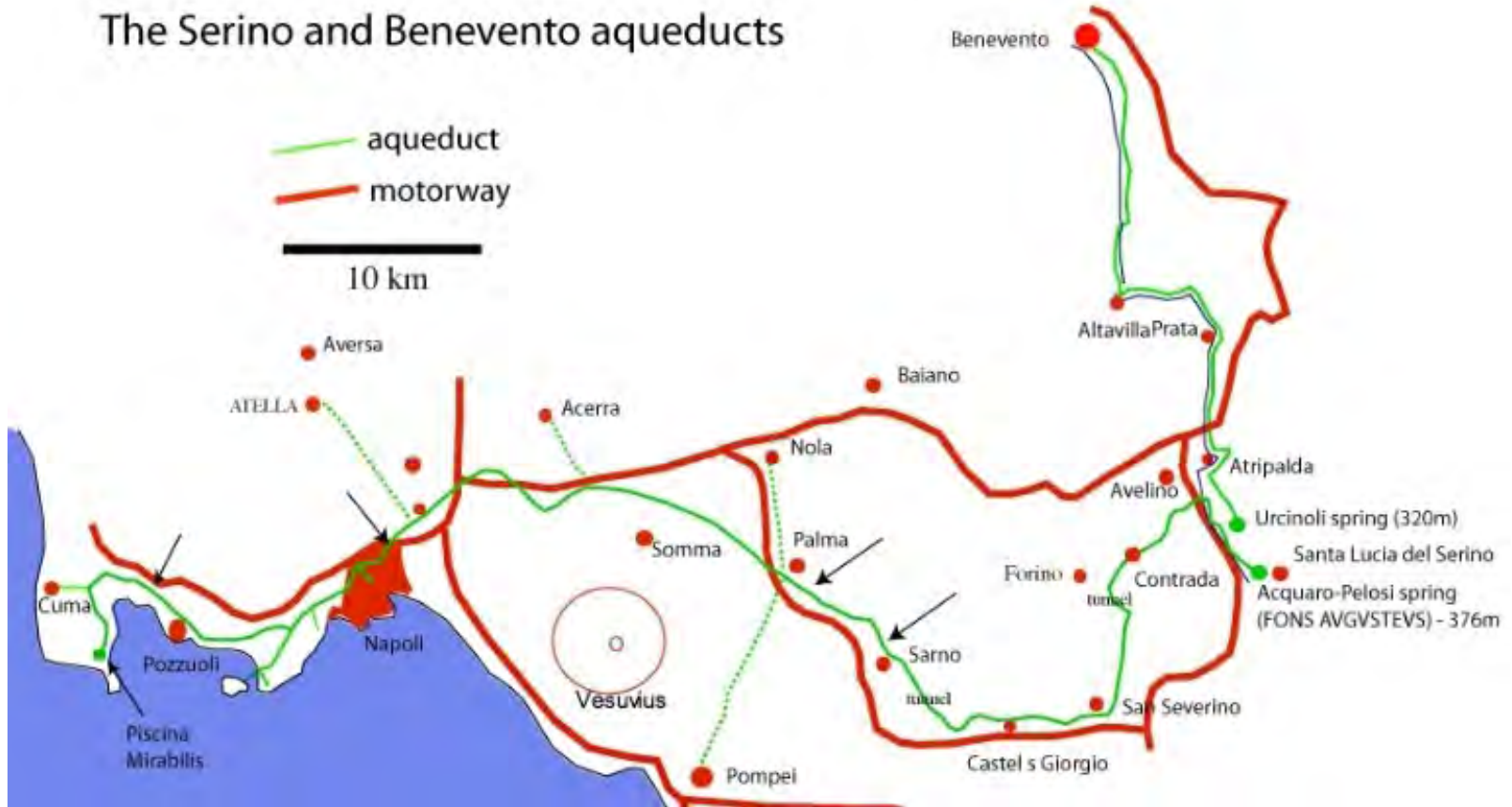
Chariot Tracks



Pompeii



The Serino and Benevento aqueducts



Aqueduct system supplying Roman Settlements –
Integrated Water Supply Scheme



Pompeii



Water fountains throughout city, public baths and underground storage for rainwater, supplemented from external supply by aqueducts



Pompeii



Voids in roof to allow water entry to internal ponds, most houses featured water fountains



Pompeii



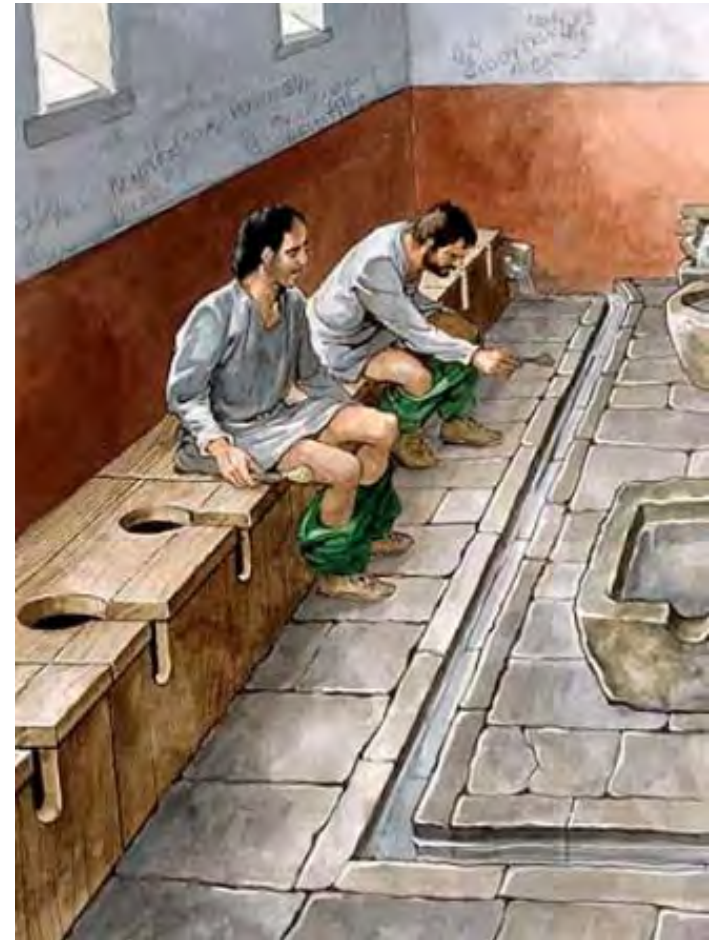
Lead water pipes



Charged for water based on size of tap



Pompeii



Lavatories were common in City, had wooden seats, flushed with bucket of water into cesspit near house or under street



Pompeii



Ancient Roman Bronze Water Valves



Svalbard





Svalbard





Svalbard

Why go to Svalbard????

- Northern most airport in the world
- Northern most teller machines in world
- Northern most restaurants in the world
- Great food and drink
- 24 hours of dark
- Human Population 2067
- Polar Bear Population 2650
- Very low taxation
- No Visas – for anyone





Svalbard





Svalbard



Midday in main street of Longyearbyen



Svalbard – Aurora Borealis



Northern Lights – but I missed them again as too cloudy



Svalbard – Aurora Borealis





Svalbard – Polar Bears



Not safe to walk in streets outside city without rifle- Polar Bears





Svalbard- do polar bears hibernate?





Svalbard



Original Seedbank in old Coal Mine in 1984 – utilises **Permafrost**



Svalbard- Global Seed Vault



Doomsday Seed Bank – Global Seed Vault opened 2008
Capacity 4.5m samples with 500 seeds per sample



Svalbard



The world's coldest bank
In the event of the unthinkable, the Svalbard Global Seed Vault can preserve our food crop history

Deep inside the mountain
It's 145.9m (478.7ft) from the entrance to the back of the vault.

Natural protection
The vault is set deep into the sandstone of the mountain of Platåberget.

Seed storage
The Svalbard Global Seed Vault can hold up to 4.5 million seed samples, for a maximum 2.25 billion individual seeds.

Vault rooms
The three rooms inside the vault are around 10m (33ft) wide, 6m (20ft) high and 27m (89ft) long each.

High security
Two airlocks seal the vault and a security door that requires several keys to open keeps intruders out.

Control room
Here, the temperature of the vault is maintained and the facility is monitored.

Refrigeration units
Compressors cool the already frigid air down to a constant -18°C (-0.4°F).

Seed stacking
Dozens of shelves in each room hold hundreds of boxes, containing hundreds of packets, containing around 500 seeds each.

A work of art
Crowning the roof and entrance of the facility is an illuminated artwork made of mirrors, prisms and 200 fibre-optic cables.

HOW IT WORKS



Svalbard- Global Seed Vault



Doomsday Seed Bank built to survive

- Global catastrophe
- Tsunami
- Sea Level rise
- Melting of Ice Caps (built 130m above sea level)
- Total power failure (several weeks to get to temp of bedrock -3 degrees C and 200 years to get to 0 degrees C)





They didn't allow for climate change melting the Permafrost



When you build a vault for doomsday
but Don't build it to withstand doomsday.

The Doomsday Vault, designed to save important
seeds from global catastrophes, may soon fall
victim to a global catastrophe.



IFLSCIENCE.COM

The 'Doomsday Vault' Is In Serious Danger

The Norwegian Island of Spitsbergen, part of the Arctic Sva...



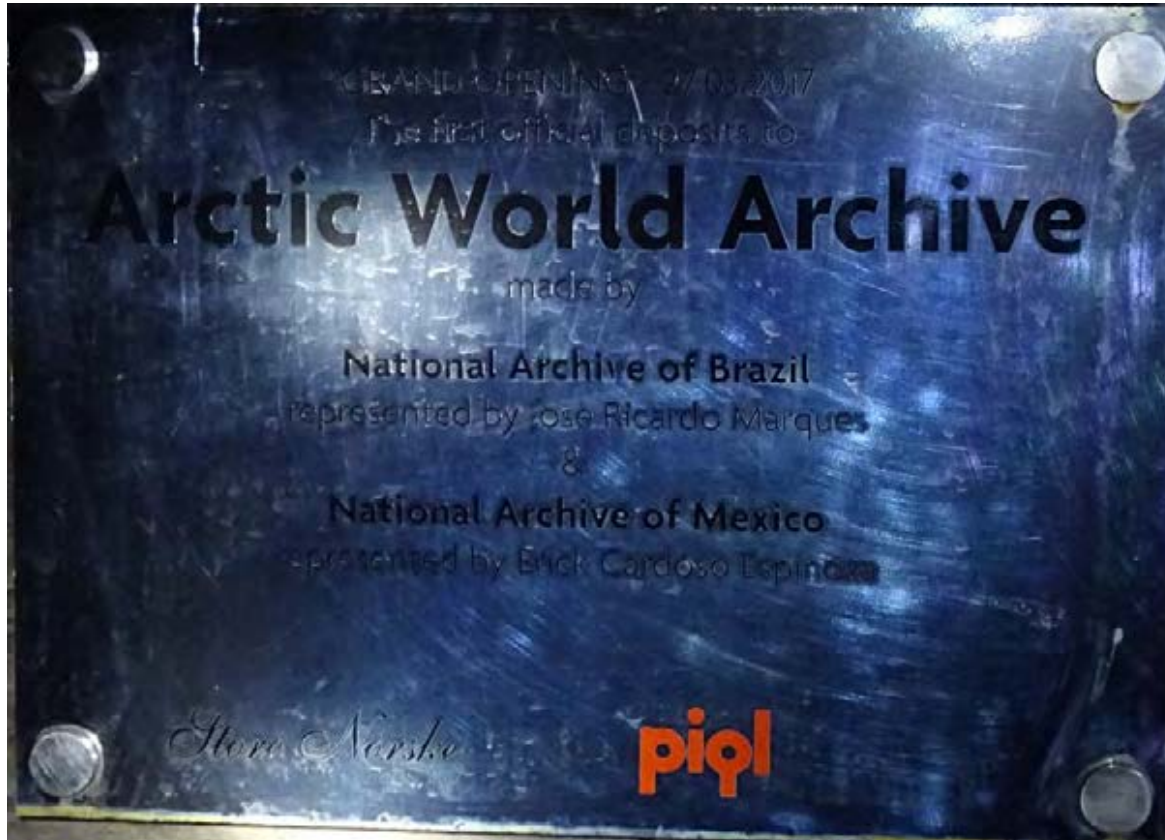
Svalbard



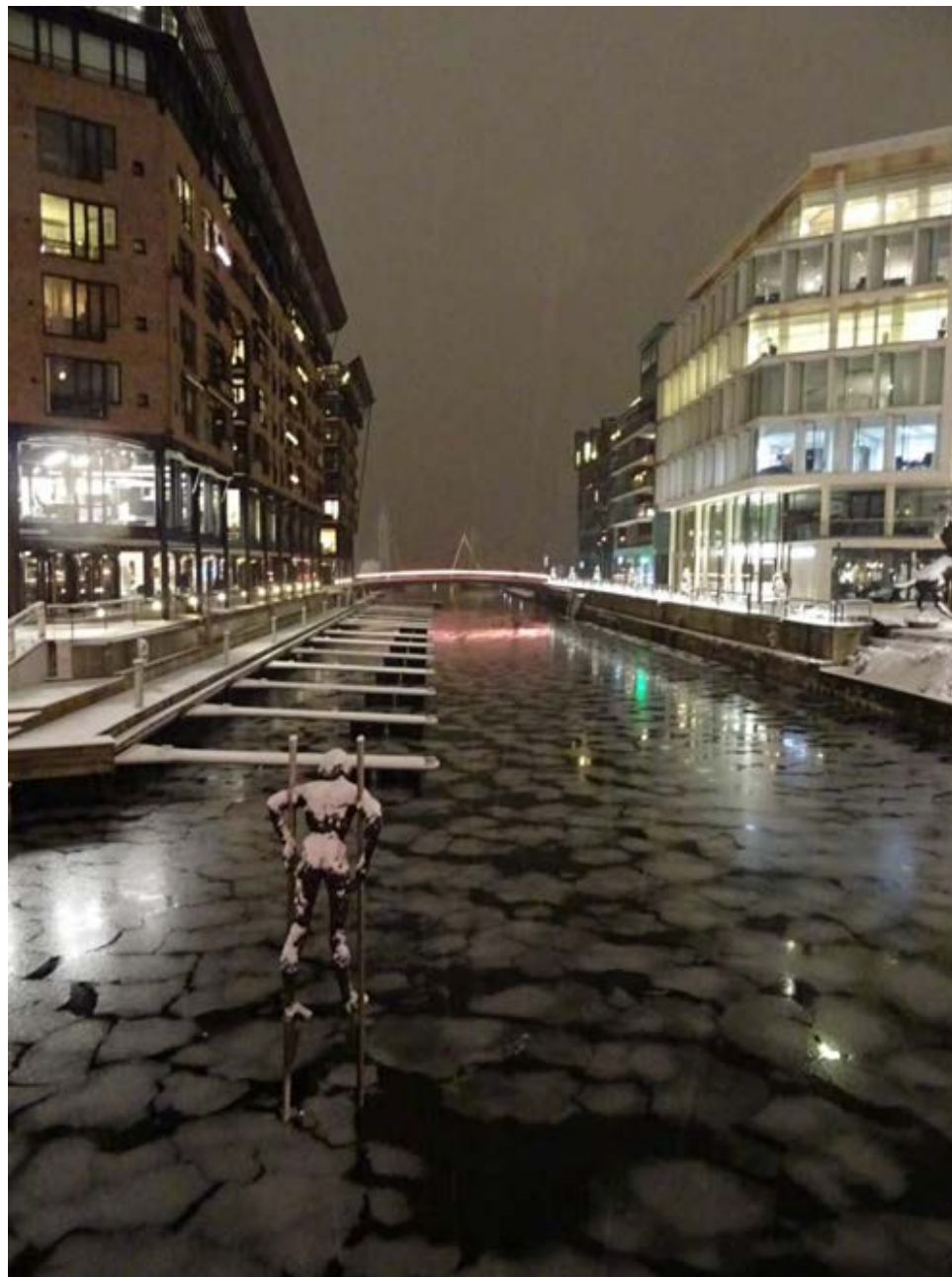
Doomsday Seed Bank – Global Seed Vault – works in progress as permafrost melting and flooding entry. Water seeped 15m into tunnel before freezing



Arctic World Archive



The archive is located inside an abandoned coal mine on Svalbard, and is nuclear safe. Data is stored offline on digital film that has a lifetime of 500 years



“Walking on thin ice”



Water Industry Night 2019

www.newwaterways.org.au

Building the WSUD capacity of Government and industry to improve the delivery of urban water management and water sensitive cities.



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Water Industry Night 2019

Next event – hope you can come along!

**Valuing the benefits of water
sensitive projects: an application to
Tarralla Creek Renaturalisation**

Rita Chandra

Yarra Valley Water

**Water Sensitive Cities Speaker Series Talk
Friday 28 June, 12 noon , the Atrium theatrette**



Department of **Biodiversity, Conservation and Attractions**
Department of **Planning, Lands and Heritage**
Department of **Water and Environmental Regulation**



Next event – hope you can come along!



**Bus tour – WSUD in the City featuring green roofs,
walls, biofilters and urban wetland management**

Tuesday 25 June, 9am - 12.30pm

Thank you to our supporters



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