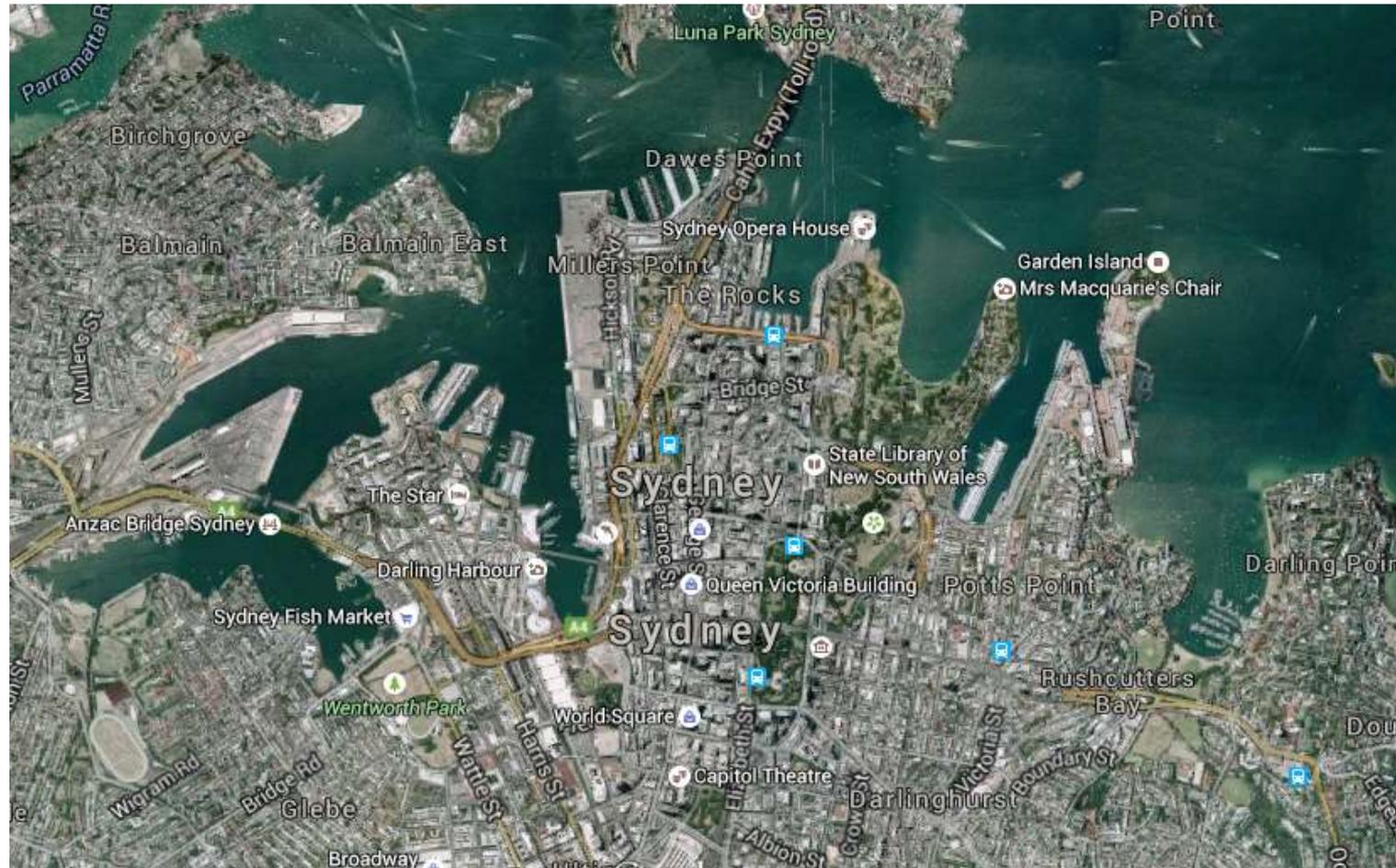


# Barangaroo Makes Use of Sea Water Cooling to Conserve Water

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# Barangaroo, Sydney



# Introduction



Barangaroo South – the southern 7.5 hectares of the site – is being built to house commercial, residential, retail and dining developments, along with a new landmark hotel.

# District Cooling Heat Transfer

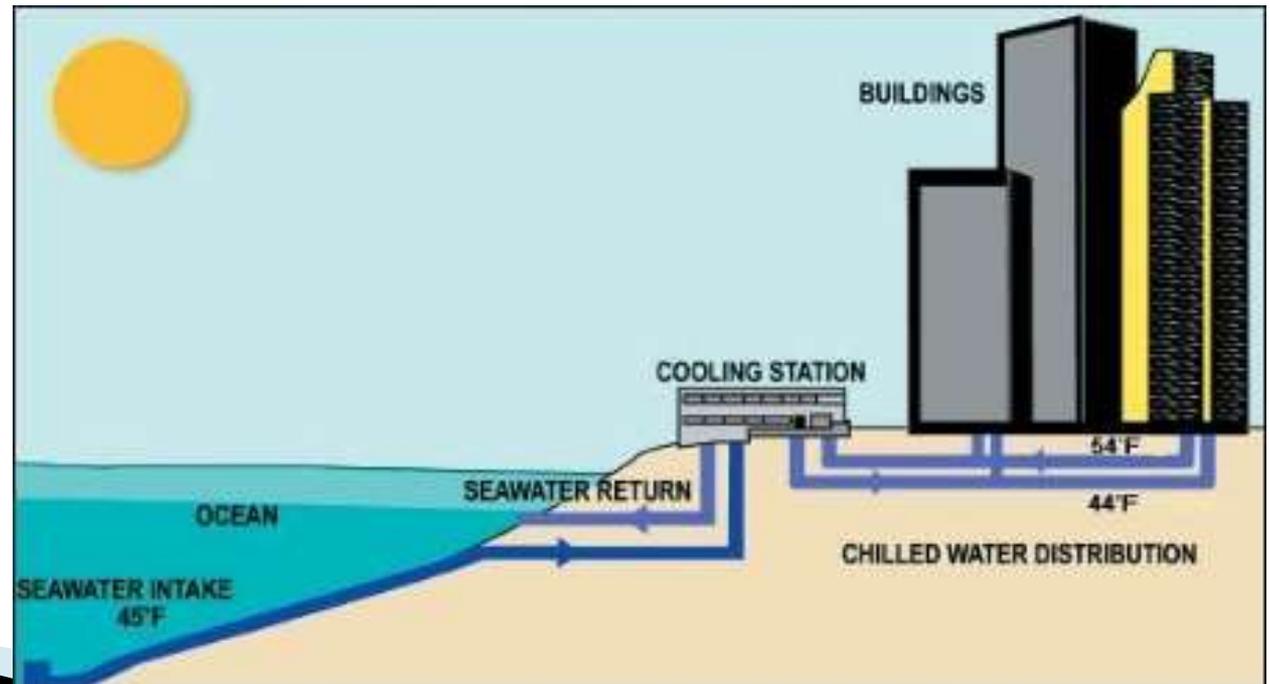
## Heat Sink:

- Atmosphere – using cooling towers
- Ocean / Lake
- River
- Underground

District Cooling Plant

Heat

Heat Source  
(Buildings of different usages)



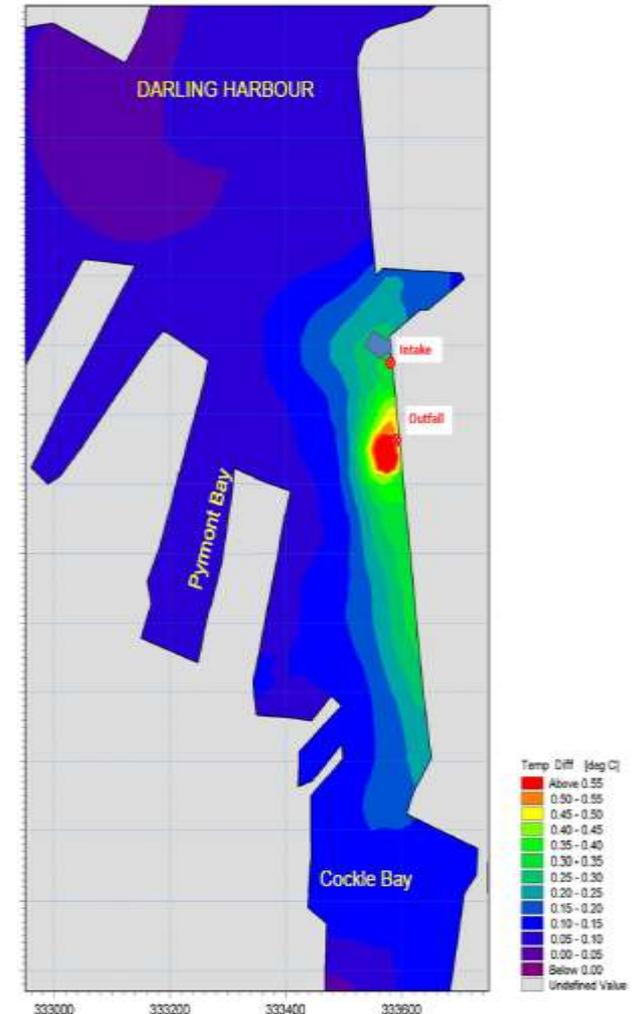
# Harbour water

- ▶ Seawater would be drawn from the northern end and discharged into the Harbour via an outfall located at the southern end of the Barangaroo South development.
  - ▶ This type of cooling system is currently in operation at a number of other locations within Sydney Harbour, including Sydney Opera House and Star City Casino
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# Seawater cooling: Challenges

## ▶ Environmental:

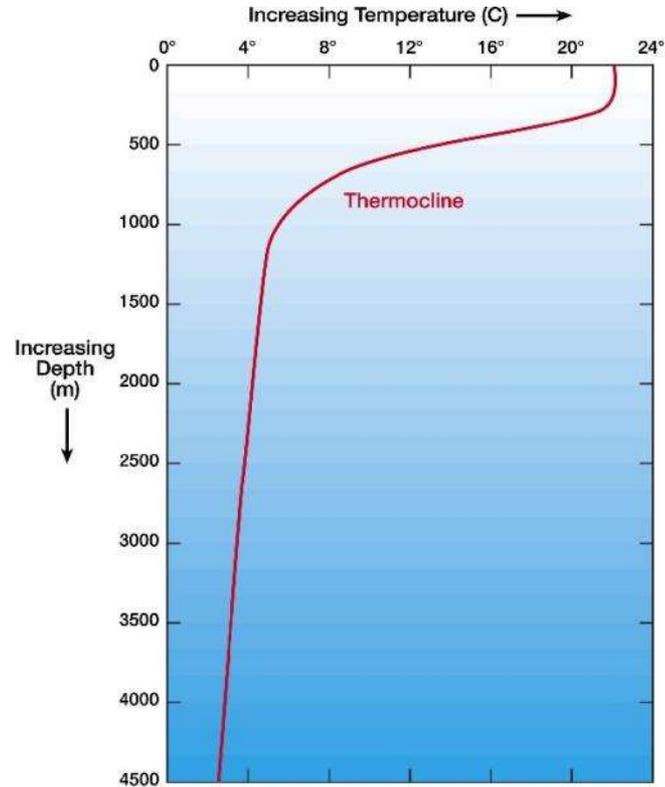
- Use of chemicals to treat sea water should be rapidly dispersed and diluted immediately upon discharge → biodegradable → no effect on marine life
- Temperature increase. A numerical simulation study was conducted and only 0.2°C was the average increase of temperature. (Use diffusers to slowly disperse discharge)



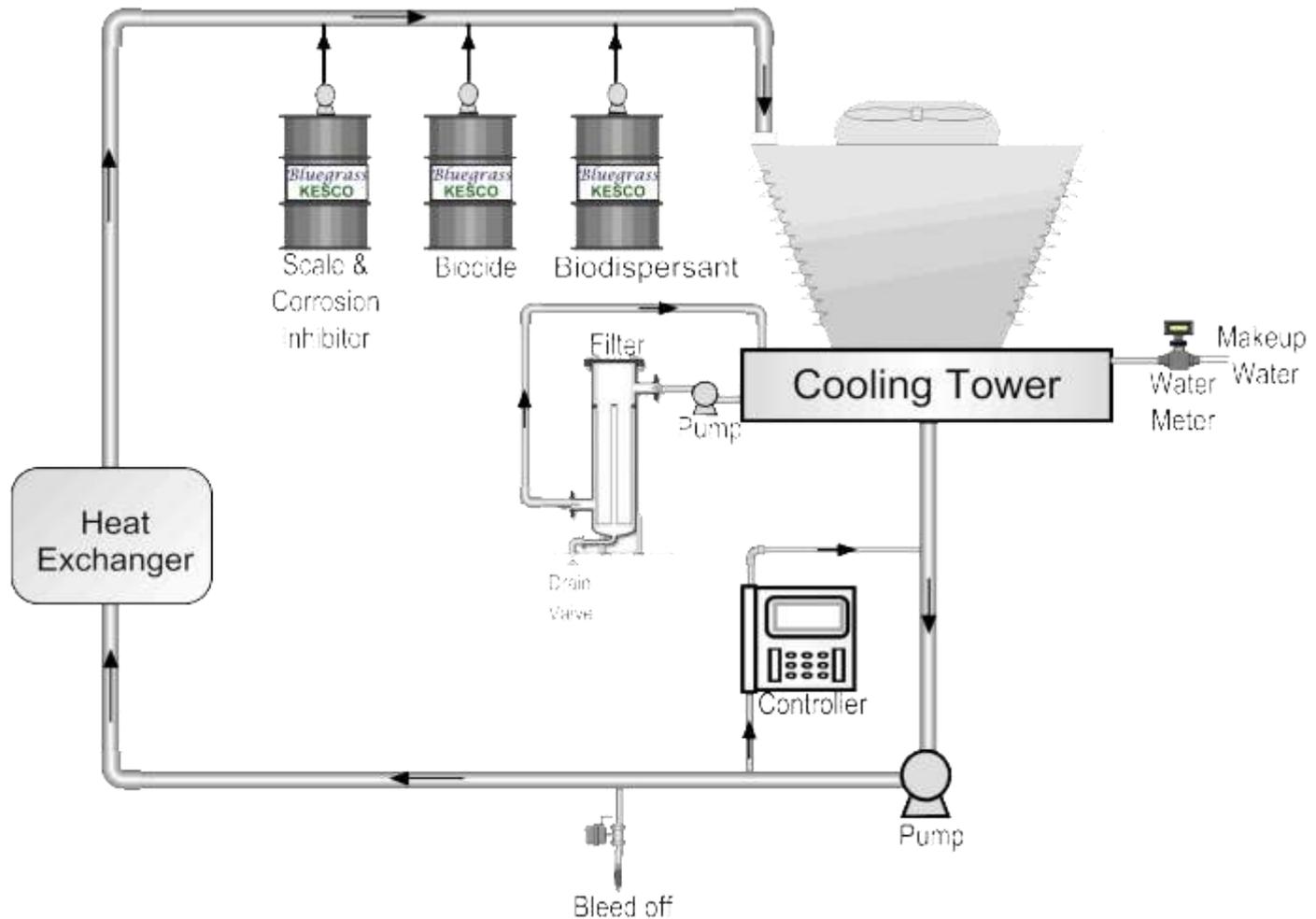
# Seawater Cooling: Challenges

- ▶ Seawater is corrosive: Use of material: FRP for piping, Titanium for heat exchangers and chiller tubes (no fouling), and stainless steel for valves.
- ▶ Seawater is bioactive:
  - Use minimal chemicals that have zero effect on marine life
  - Once through and dedicated equipment pumps so that water and bio-organisms are not allowed to grow inside piping/equipment.
  - Screens and filters at the intake to restrict entry of larger organisms

# Sea water temperature vs depth



# Conventional Cooling Towers



# Conventional Cooling Towers

- ▶ Not exactly attractive

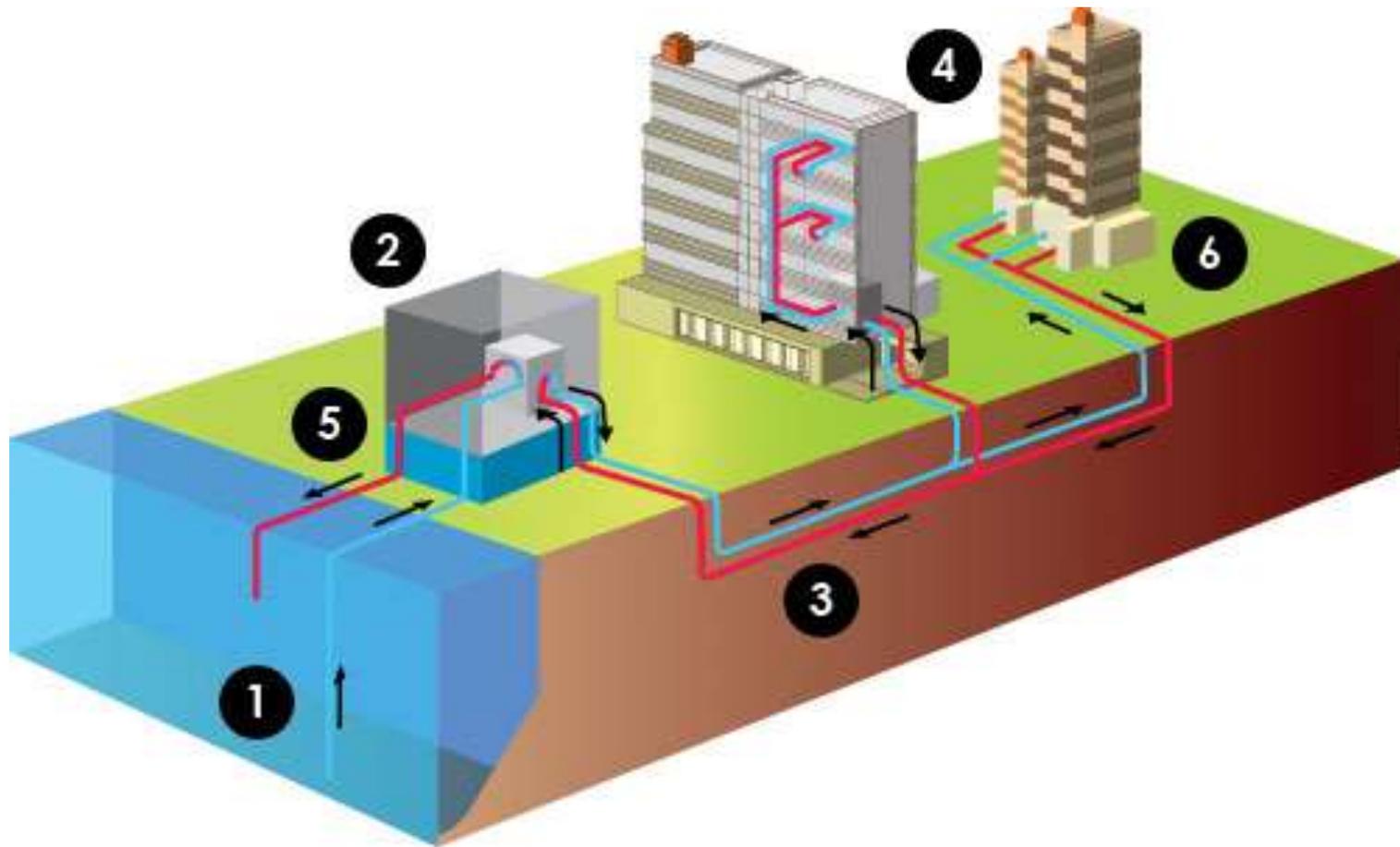


# Seawater cooling

- ▶ Invisible



# Direct vs Indirect Sea water cooling



# Seawater cooling: around the world (Not a new technology)



New York City



Hong Kong Harbor



Jeddah Airport



Nassau, Bahamas



Cancun, Mexico

- ▶ Toronto's deep lake water cooling (Enwave)
- ▶ Cornell University's Lake Source Cooling System