

Learning Trail

@ Yishun Pond



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For more information, please visit us at www.abcwaterslearningtrails.sg
or email us at PUB_Learning_Trails@pub.gov.sg.

Discover Yishun Pond

Join us at Yishun Pond and learn about the Singapore Water Story. Discover how our small city-state, which used to face huge challenges such as droughts and pollution, has transformed into a global hydrohub and vibrant City of Gardens and Water.

Water sustainability is crucial to Singapore's success. Singapore has ensured a robust and sustainable water supply capable of catering to the country's continued growth through the Four National Taps. The four taps or sources of water are water from local catchments, imported water, NEWater and desalinated water.

Located in Yishun Town, Yishun Pond has undergone a makeover under the ABC Waters Programme, a long-term initiative that transforms our network of drains, canals and reservoirs into beautiful and vibrant waterscapes for recreation and community bonding. The rejuvenated pond features nature trails, panoramic lookout points, marshlands and floating wetlands for the community to get close to flora, fauna and the water.

Yishun Pond is an ideal spot for the community and students like you to engage in healthy recreational activities, discover the heritage of Yishun, and explore diverse habitats that thrive here. At the same time, Yishun Pond remains a vital part of our rainwater collection network.

We would like to thank our partners - Northbrooks Secondary School, Northland Secondary School, Woodgrove Secondary School, Yishun Secondary School, Khoo Teck Puat Hospital and the Ministry of Education for co-creating this trail with us. This trail would not be possible without their invaluable feedback.

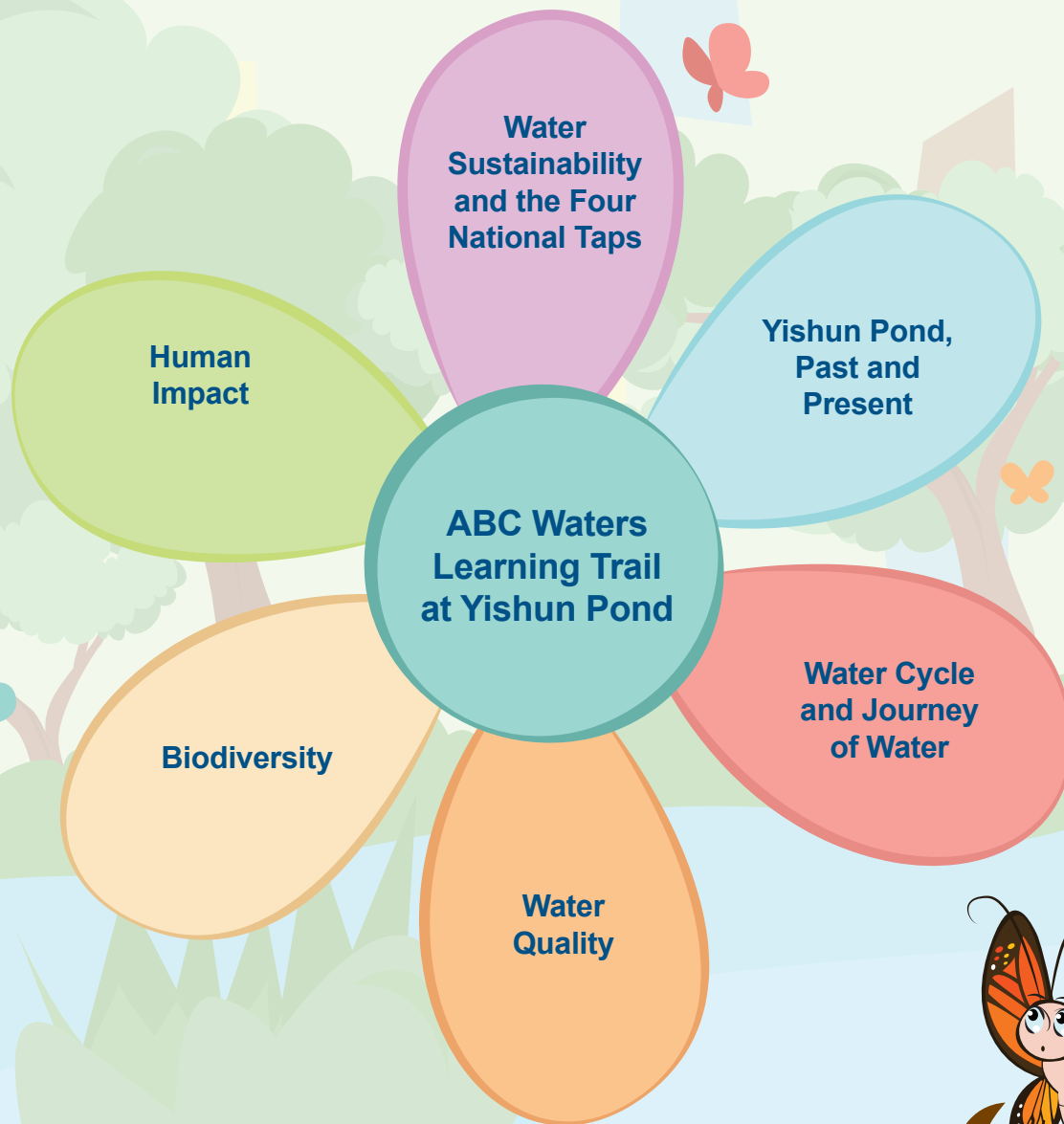
We hope to make Yishun Pond a meaningful place for outdoor learning. As you learn about our waters and the diversity of life it supports, we hope that you will cherish and take care of this precious resource.

Have fun on the learning trail!

PUB, the national water agency



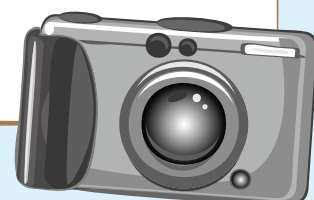
Treasures on the Trail



Look out for the following scenes or features around Yishun Pond. Snap photos of them as you experience this trail!

On a Photo Hunt

- An image of a farmer and his buffalo that reminds us of our water footprint.
- A special structure depicting the metamorphosis of a butterfly. Take a group shot here!
- Capture the fun of the good old days of friends playing hop scotch.
- An environmental feature to save energy – the solar panel.
- A feathered animal.



Our Water Story

By investing in water technology and adopting an integrated approach to water management over the last 50 years, Singapore has developed a diversified and sustainable water supply system known as the Four National Taps.

Local Catchment Water

Rainwater is collected through a comprehensive network of drains, canals, rivers and stormwater collection ponds and reservoirs before it is treated for our drinking water supply. Used water is collected through a separate system.



Imported Water

Singapore imports water from Johor, Malaysia. The 1962 water agreement will expire in 2061.



Our Four National Taps

NEWater

NEWater is high-grade reclaimed water. Used water is treated, then further purified using advanced membrane technologies, making the water ultra-clean and safe to drink.



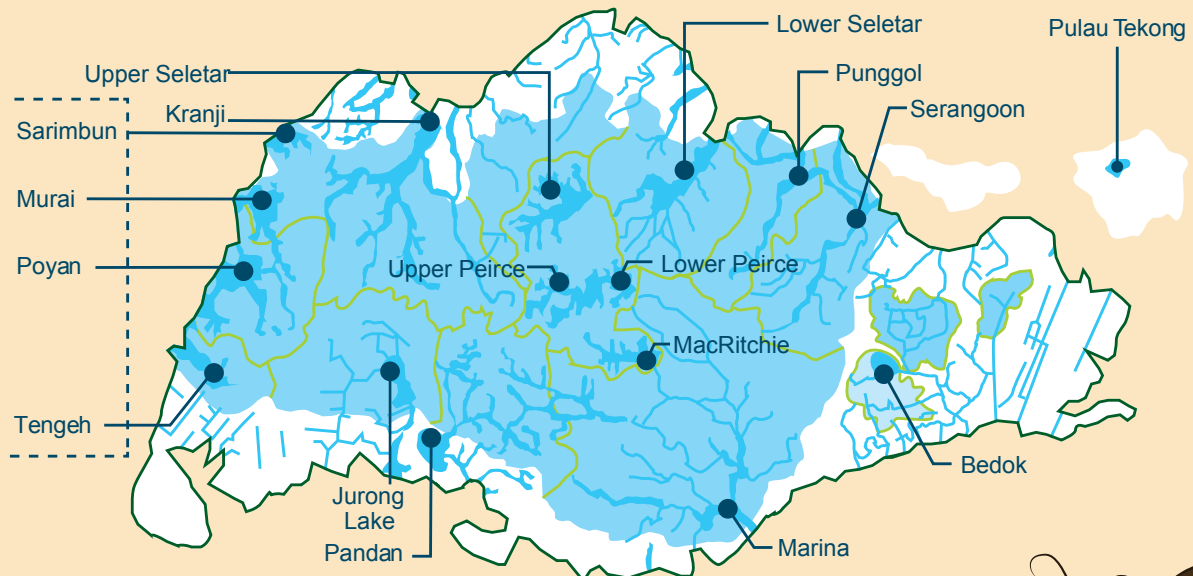
Desalinated Water

Singapore has one of Asia's largest seawater reverse osmosis desalination plants, producing 30 million gallons of water a day. Singapore's second desalination, Tuaspring has officially opened in September 2013, can produce 70 million gallons of water a day.



Reservoirs in Singapore

There are currently 17 reservoirs, 32 major rivers and more than 7,000 km of canals and drains in Singapore. **Mark an "X" where you think Yishun Pond is located on the map of Singapore.**



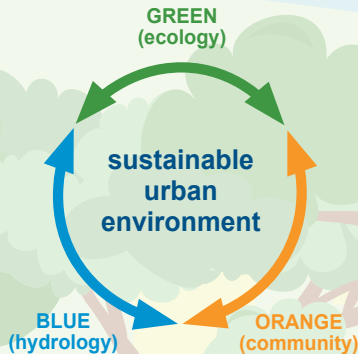
Singapore is our home.

At the heart of Singapore's water sustainability is how we use and care for our water. With a rising population and increased industrial activities, Singapore's current water demand of about 400 million gallons a day is expected to double in 50 years.



ABC Waters Programme

The ABC Waters Programme aims to integrate **Singapore's parks (green)**, **reservoirs and waterways (blue)** and the **community (orange)**. Look at the map of Yishun Pond below. Study what surrounds Yishun Pond, and identify where the features (a – i) are located.



Khoo Teck Puat Hospital

Khoo Teck Puat Hospital offers a comprehensive range of medical services and specialist care to the community in the north. The hospital overlooks Yishun Pond.



Lakeside Promenade

Patients and visitors can relax within lush and tranquil surroundings.



Timber Deck Over Inlet

An additional open area for outdoor programmes such as performances and family activities. Ramps ensure accessibility for physically-challenged patients as they relax and recuperate while taking in the calm and natural beauty of Yishun Pond.



The Spiral @ Yishun

Abstracted from the metamorphosis of a butterfly in its lifecycle, this 14.5 metre tall lookout tower features cocoon-shaped designs with a butterfly-winged shelter. It offers a panoramic view of the pond. An 84 metre overhead bridge offers seamless connectivity between Yishun Pond and the Yishun Park.



h

Marshlands and Floating Wetlands

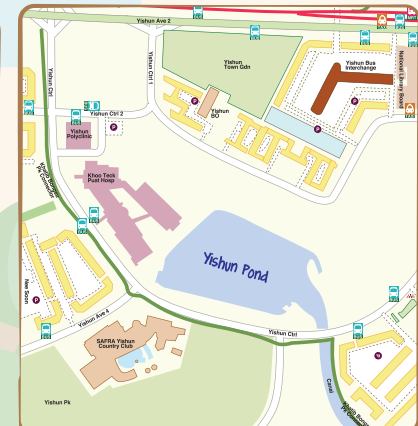
The marshlands around the shore soften the edges of the pond while the plants on the marshlands and floating wetlands uptake nutrients in the water improving the pond's water quality. They also provide natural habitats for fishes and birds.



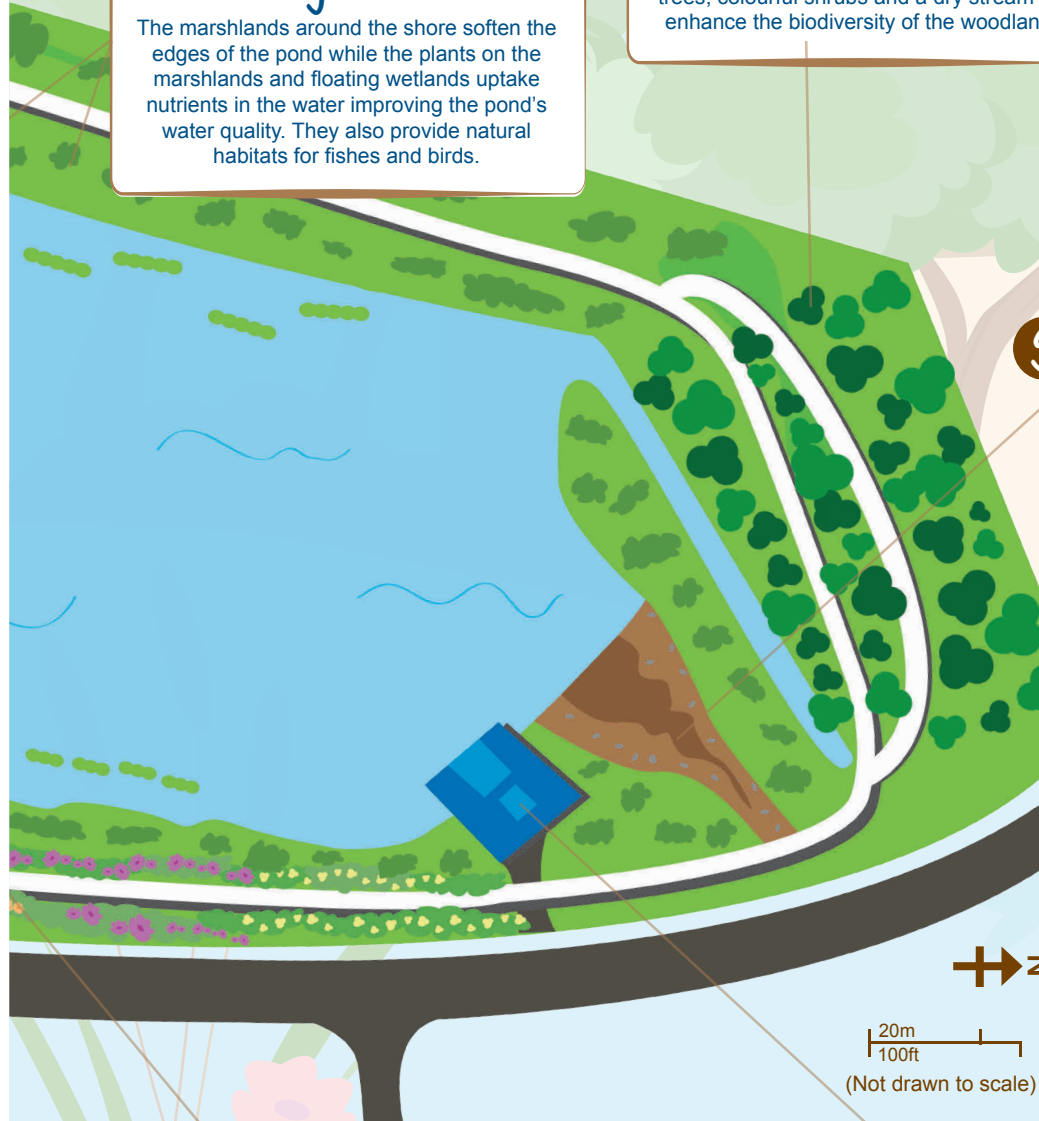
i

Woodlands

Indigenous species of shade and canopy trees, colourful shrubs and a dry stream bed enhance the biodiversity of the woodlands.



Map of Yishun Pond



j

Spillway Channel

The spillway allows excess water from the pond to flow to the sea, so water level in the pond can be maintained. It has been aesthetically softened with gravel and boulders, turning it into a natural looking waterway that integrates with the overall landscape.



20m
100ft
(Not drawn to scale)



e

Flower Trail

The Flower Trail features indigenous flowering species.



f

Pumping station

The water in the pond is pumped to Lower Seletar Reservoir via a pumping station, before it is treated and sent to our homes.

Yishun Pond, Past and Present

PRESENT

2011

The ABC Waters Programme at Yishun Pond, a joint collaboration between NParks, HDB, Alexandra Health and PUB, was officially completed.



2007

The family of the late banker, Khoo Teck Puat, donated S\$125 million towards the hospital's building fund. This donation, together with the government's fund, helped to cover increased cost incurred due to the shortage of materials and labour. The hospital was named Khoo Teck Puat Hospital in his honour.

2006

The ABC Waters Programme was launched with the aim of turning Singapore into a City of Gardens and Waters.

1986

Yishun Pond was constructed in 1986 to collect rainwater from Yishun New Town.

2001

Construction of a new hospital, Khoo Teck Puat Hospital located near Yishun Pond began.

1976

Development of the area, that once made up the Nee Soon estate, began with the start of Yishun New Town Project. 'Yishun' was derived from the Chinese romanisation of Nee Soon.

1977

Construction work for Yishun New Town began after the resettlement of the villages.

1910

Nee Soon estate grew from the gambier plantations that were established along the Seletar River. These plantations attracted employment-seeking Chinese immigrants who settled down in the area while working for "Pineapple King", Lim Nee Soon.

1920

Nee Soon Village was named after Lim Nee Soon for his contributions to the rubber industry. He set up the Thong Aik Rubber Factory which was renamed as Nee Soon & Sons in the 1920s. It was later purchased by Lee Kong Chian in 1928.

1850

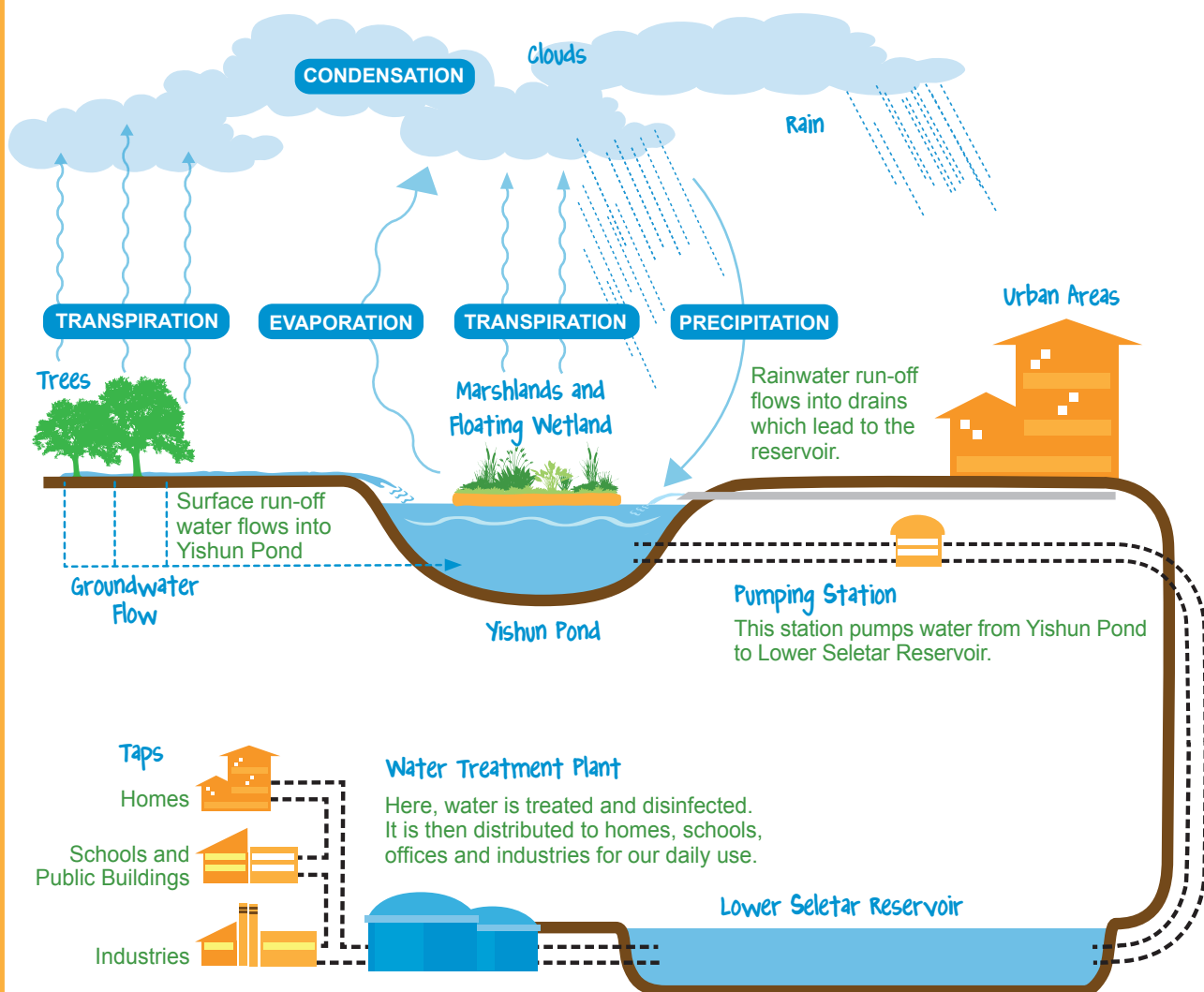
The origins of Nee Soon Village can be traced back to 1850 when land in Seletar was purchased for gambier plantations.

PAST

The Water Cycle and Journey of Water from Yishun Pond

The water cycle or hydrological cycle is how the Earth's water recycles itself. The cycle includes precipitation, condensation and transpiration. The Earth's water changes continuously from liquid water to vapour and then back again. This cycle happens because of the Sun's heat and gravity.

The water cycle is important because it ensures the availability of water for all living things. Global climate change caused by human activities has led to abnormal weather patterns - intense rainfalls, longer dry spells and floods, which are impacting Singapore and other countries.



The Flower Trail

The Flower Trail is planted with many species of flowering plants, which support local species of butterflies, birds and other pollinators. Some plants, like the Lantana, produce nectar which is food for butterflies, sunbirds and bees, while others are host plants for specific butterfly species.

Observe the main plants along the Flower Trail and the animals that visit or live here. Tick those you have spotted.



Lantana



Black-eyed Susan



Heliconia



Canna



Duranta



Spider Lily

Did you know ?

Butterflies have specific plants which they will lay their eggs on for their caterpillars to feed on the leaves? These plants are called host plants. Planting local plant species will encourage the conservation of local animals that depend on them.



Animal Life at Yishun Pond

Yishun Pond is a freshwater habitat and supports a relatively rich biological community both in and around the water. Many birds and animals call this area home. **As you walk around, observe for animal (fauna) life and tick the ones you can spot.**



☐ Changeable Lizard
(not Chameleon)



☐ Spider



☐ Malayan Water
Monitor Lizard



☐ Grasshopper



☐ Terrapin



☐ Apple Snail



☐ Dragonfly



☐ Frog



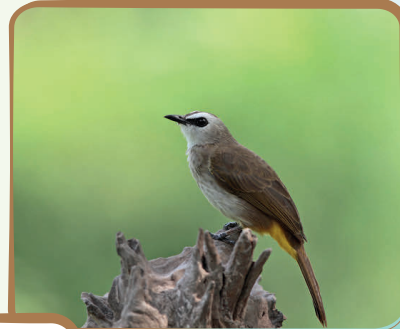
☐ Eggs of Apple Snail



Black-naped Oriole



Collared Kingfisher



Yellow-vented Bulbul



Brahminy Kite



Brown-throated Sunbird



Pacific Swallow



Striated Heron



Common Tailorbird



Purple Heron



White-bellied Sea Eagle



Common Sandpiper



Little Egret

Other animals observed:

Water Quality Testing

Good water quality is essential for living things to thrive. The most common standards used to assess water quality relate to the health of ecosystems. **Collect some water at one location of Yishun Pond and test for the following parameters. Record your readings and observations in the space below.**



DEBRIS AND SMELL

SIGNIFICANCE

Observe and smell the water. This can give you basic information about water quality. On its own, water does not have any smell. The smell of the collected water can give you a rough indication of pollution sources.

OBSERVATION

What can you see:

In the water:

On the water surface:

What can you smell:

ANALYSIS



COLOUR

SIGNIFICANCE

The colour of the water can give some clues as to what may be in the water. There may be dissolved pollutants or bacteria. Coloured water, however, does not necessarily mean the water is polluted.

OBSERVATION

- ☐ Turbid or murky brown – soil particles in water, resuspension from the bottom or banks of the reservoir.
- ☐ Brown or dark brown – brown pigments from leaves called tannins are dissolved in the water.
- ☐ Green – algae suspended in water – indicates an algal bloom, usually caused by high nutrients in the water, fertilisers or organic matter.
- ☐ Turbid or murky grey or black.
- ☐ Others

ANALYSIS



TURBIDITY

SIGNIFICANCE

Turbidity is the level of “murkiness” of the water. It refers to the amount of particles such as soil, sediments, algae or organic matter that are suspended in the water.

Turbidity affects the amount of light that can penetrate through the water, which determines the amount of light reaching the different depths of the reservoir. This in turn has an effect on aquatic plant life.

OBSERVATION

Which is the faintest number you can see on the turbidity disc?

1 2 3 4 5

ANALYSIS



TEMPERATURE

SIGNIFICANCE

The temperature of the water will vary with the weather and time of sampling. The temperature of water in the reservoir could range between 20 - 30°C which affects the amount of dissolved oxygen. The temperature is higher nearer the surface of the water and lowest near the bottom of a water body.

READING

The temperature of the water is:

°C

ANALYSIS



DISSOLVED OXYGEN

SIGNIFICANCE

This refers to the amount of oxygen dissolved in a given volume of water, at a given temperature and atmospheric pressure. It can be measured in milligrams per litre (mg/l) or parts per million (ppm). The minimum amount of dissolved oxygen needed to sustain fish life is about 4mg/l.

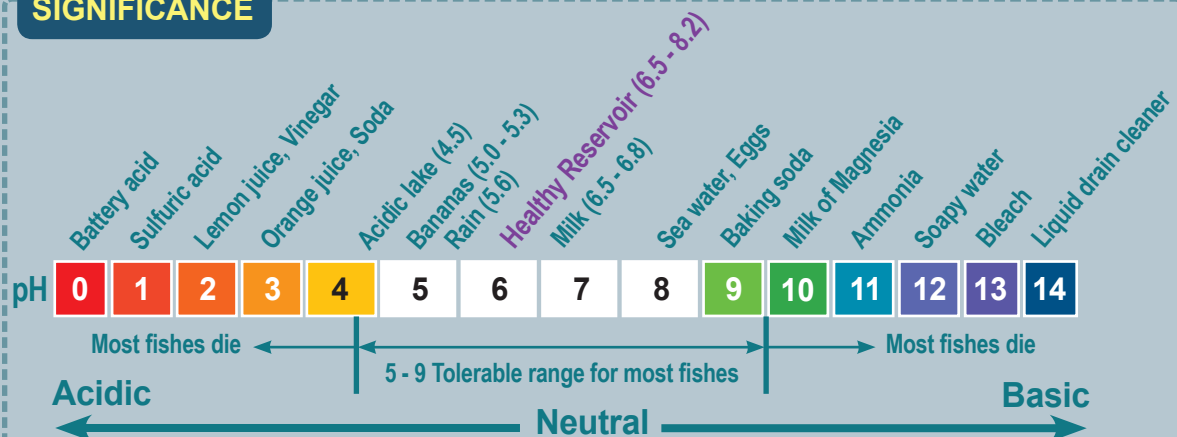
READING

ANALYSIS



pH

SIGNIFICANCE



READING

The pH of the water is:

ANALYSIS

Other Properties of Water:

There are other properties of water that you can test, such as electrical conductivity, hardness of water, amount of nitrates, phosphates and ammonia. Discuss the importance of these properties and how they can be measured.

CONCLUSION:

Overall quality of water

Can you drink the water from this reservoir? Why?

Where does the water in Yishun Pond come from? How do these parameters affect the water quality in the reservoir?

What is the conclusion for the water quality in Yishun Pond? What are the consequence of your results on our water supply and aquatic life in Yishun Pond?

If another reading is conducted at this pond, do you think there will be any differences between the water parameters? Why do you think the readings may be similar or different?

What are the limitations of this water quality testing activity?

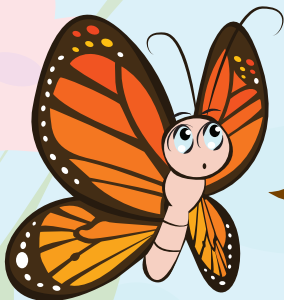


Water used for our water supply needs to be as clean as possible! Even though water undergoes treatment, the cleaner it is, the easier and cheaper to treat the water. Clean water in our ponds and reservoirs also create healthy habitats for aquatic life.

Human Impact

Yishun Pond is a recreational hotspot for people in the neighbourhood. What are some things that can spoil a visitor’s experience at this beautiful pond? Observe the human activities that take place around the pond. **As teams, identify the possible impact of these activities on Yishun Pond and suggest practical solutions to minimise them.**

Human Activity	Possible Impact on Yishun Pond	Suggested Solutions
Walking 		
Jogging 		
Cycling 		
_____ 		
_____ 		
_____ 		
_____ 		



Do you know...
 that it is everyone’s responsibility to care for and protect public facilities?
Speak out against vandalism!

Marshlands and Floating Wetlands in Yishun Pond

Marshlands are plants growing at shallow water along the edge of the pond and have a softening effect to the pond. Constructed floating wetlands, like the ones here, are engineered systems designed to allow emergent plants to grow on floating mats. The roots of these wetland plants provide a large surface area for a biofilm of beneficial microbes to attach to.

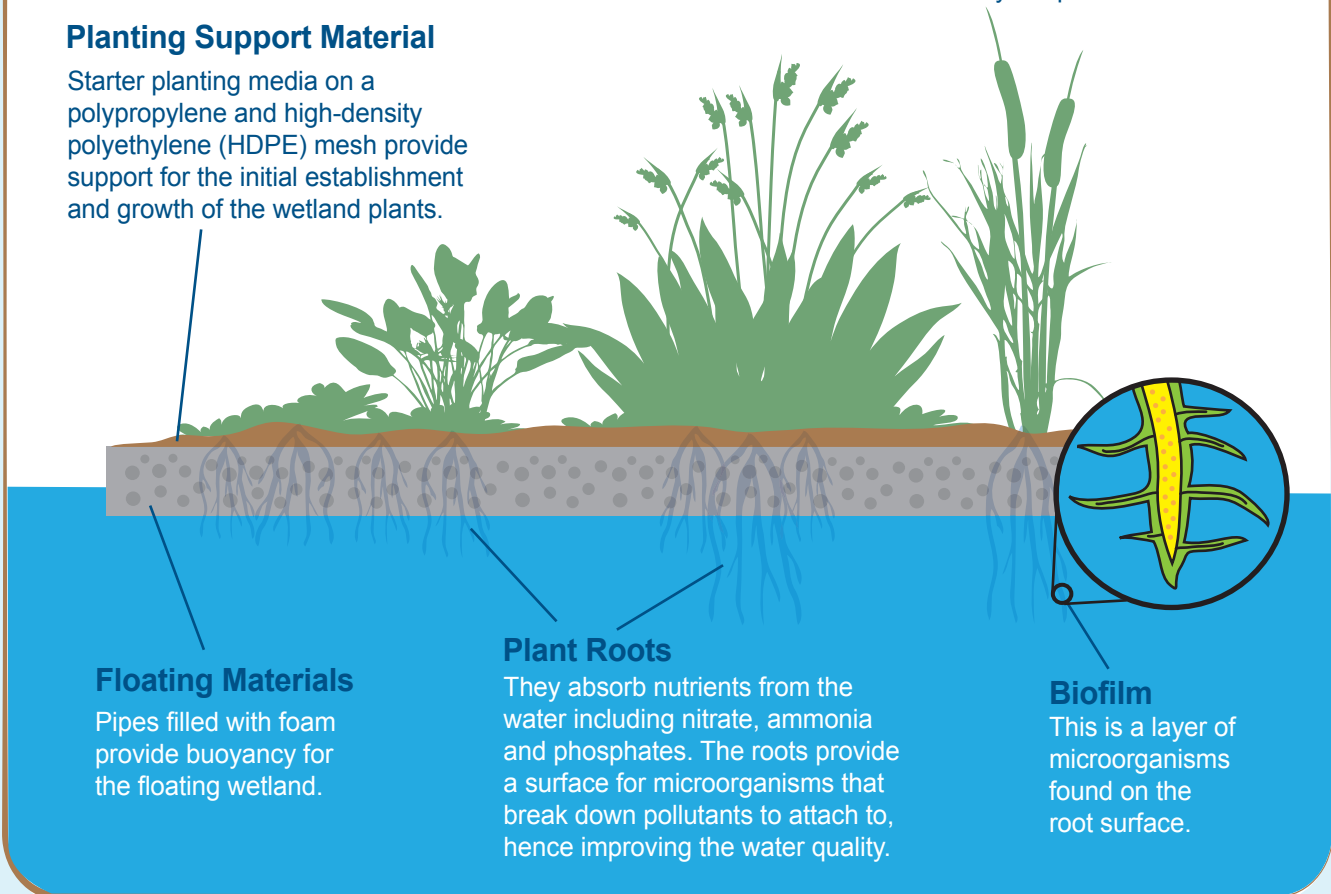
Cross-section of a Floating Wetland

Wetland Plants

They improve the water quality, provide shelter and food for animals and beautify the pond.

Planting Support Material

Starter planting media on a polypropylene and high-density polyethylene (HDPE) mesh provide support for the initial establishment and growth of the wetland plants.



How do the floating wetlands and marshlands benefit Yishun Pond?

Plant Life at the Floating Wetlands

Growing on this floating wetland are plants that were specifically chosen for their water cleansing properties. These plants uptake nutrients and pollutants through the roots. They remove nitrates, phosphates and other pollutants from the water, improving the quality of water in the pond.

Look closely at the floating wetland plants. Tick the ones you can identify.



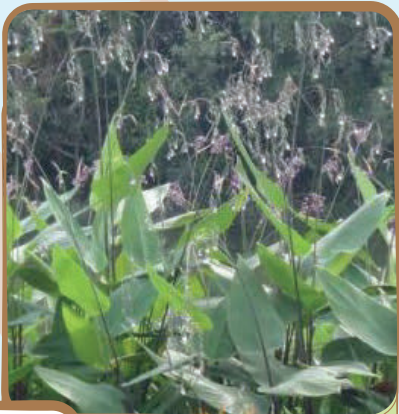
☐ Narrow-leaved cattail



☐ Dwarf Papyrus



☐ Water Canna



☐ Alligator Flag



☐ Umbrella Sedge



☐ Common Hanguana
or Bakong



☐ Pickerelweed



☐ Pin-stripe Plant



☐ Mangrove Fern

Your Reflections

Take a look at what you have learnt on this trail and share with us how you can play your part for water.

What is water sustainability and what does it mean to you?

How can you encourage visitors to care for Yishun Pond and other water bodies?

Did you know ?

To encourage prudent water use, the price of potable water in Singapore reflects the (marginal) cost of producing the next drop of water.

There are two components in the pricing:

Price of potable water = water tariff + water conservation tax

1. The water tariff aims to cover the full cost of production and supply of water.
2. The water conservation tax is imposed as a percentage of the total water consumption to reinforce the message that water is precious from the very first drop.

Problem-based Learning



Problem:

Water consumption for the domestic sector in the last few decades has increased due to rapid industrial, economic and social developments in Singapore. Until 1995, the growth in domestic water consumption outpaced population growth. Today, an individual in Singapore uses an average of 151 litres of water per day. Singapore's target is to reduce this figure to 140 litres by 2030.

Instructions:

1. Get into your teams of no more than six members.
Take 10 minutes to discuss why reducing water consumption is important for Singapore. Next, develop a five-year plan that you can do to save water when you are at home and in school. Propose ideas of what industries can do to lower water consumption as well.
2. The guiding questions on page 19 may help you develop ideas for your five-year plan. Be creative and imaginative. Come up with more aspects to include in your plan.
3. There should at least be one team for each of these topic areas.
4. You are advised to spend no more than 45-minute to brainstorm ideas.
5. Each team will present their idea for 5-minute, followed by a two-minute 'Question and Answer' session with the other teams.
6. After all teams have presented their ideas, consider all of the factors recommended by other teams and put together a proposal.
7. Each team will then present their five-year plan for three minutes. This is a collective reflection time. Considering all aspects from Technology, Community, Policy and Environment, why is it important to reduce water consumption and how can we go about doing it?



Team 1 : Technology

- How can we leverage on technology and engineering solutions to create multiple new sources of water for Singapore?
- What are the limitations of technological solutions to water concerns such as high water consumption?
- At what cost (environmental, economical, and so on) are we willing to make such investments to create new sources of water?

Team 2 : Community

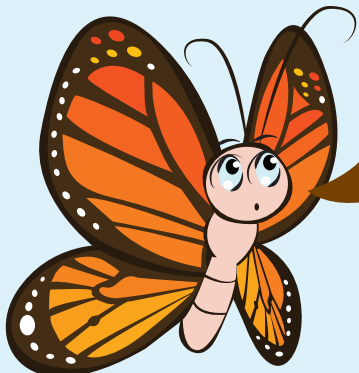
- What are some of the challenges to influence and inspire people towards water advocacy?
- How do we encourage water advocacy amongst students?
- Do you remember the seven basic water saving habits? Share some of these tips.
- How do we engage different stakeholder groups in our community to raise a high level of awareness amongst Singaporeans to practise water conservation habits in their daily lives?

Team 3 : Policy

- What are the challenges to water governance? The 'Save Water' campaigns in the 1970s was effective in reducing water consumption. Water supply was turned off for a stated number of hours on some days. Interrupting the water supply, however, caused inconveniences and potential health ramifications. Is this practice still feasible today? Are there any better ideas?
- What measures can you think of to engage industries to save water?
- Can you think of other measures to implement at a national level?

Team 4 : Environment

- Besides the economic and social reasons to water conservation, why do you think it is important for you and I to play our part to reduce our water footprint? How does it benefit the environment?
- What other measures can you think of? Do you think that incorporating water sensitive urban designs (ABC Waters design features) in our infrastructure would work? Why?



Did you know ?

The average distance women in developing countries walk to collect water is 6km. In Singapore, we should count ourselves lucky we have convenient access to safe drinking water.

NEWater Visitor Centre

Can we use each drop of water more than once? Yes! Singapore's answer to that question is NEWater. As one of the Four National Taps that ensures a diversified and sustainable water supply for Singapore, NEWater is treated used water that is further purified. Is water that is used before drinkable? How does reverse osmosis create 'new' water? Why do we need to recycle water this way?

Visit the NEWater Visitor Centre to find out more. You will be edu-tained by multimedia presentations and games, and witness the operation of advanced technologies in the production of NEWater.

For more information, visit
www.pub.gov.sg/water/newater.



Marina Barrage

Marina Reservoir is Singapore's first reservoir built in this millennium, bringing to fruition former Minister Mentor Lee Kuan Yew's 20-year vision to dam the Marina Channel to create a freshwater lake. The project materialised around the time PUB had made a paradigm shift in water management, calling on the public to look at water as a shared resource and to develop a joint ownership of our blue spaces. This new-age reservoir, formed by building Marina Barrage across the mouth of the Marina Channel, therefore fulfils more than its promised triple benefits of water supply, flood control and lifestyle activities.

By integrating its core functions together with features designed to attract the public, Marina Barrage helps to advance PUB's strategic objective to bring people closer to water. Its unique open concept is rare for public infrastructure and is a reflection of PUB's new approach in water management. There are no gates or fenced-up areas. The public can wander around the open grounds and learn about the Singapore Water Story.

For more information, visit www.pub.gov.sg/marina.





Acknowledgement

Northbrooks Secondary School

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Humanities Branch and Sciences Branch

PUB, Singapore's national water agency

PUB is the national water agency that manages Singapore's water supply, water catchment and used water network in an integrated way. PUB won the 2007 Stockholm Industry Water Award and was named Water Agency of the Year at the Global Water Awards 2006.

About PUB's tagline: Water for All: Conserve, Value, Enjoy

PUB has ensured a diversified and sustainable supply of water for Singapore with the Four National Taps (local catchment water, imported water, NEWater, desalinated water).

To provide water for all, PUB calls on all Singaporeans to play our part to conserve water, keep our water catchments and waterways clean and build a relationship with water so we can enjoy our water resources. We can then have enough water for all uses – for industry, for living, for life.

 **PUB** SINGAPORE'S
NATIONAL
WATER AGENCY

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