

Flood Resilience in Singapore

HOW IS CLIMATE CHANGE INCREASING FLOOD RISK IN SINGAPORE?

Climate change is causing more extreme weather events, resulting in unpredictable rainfall and rising sea levels. This increases flood risks.

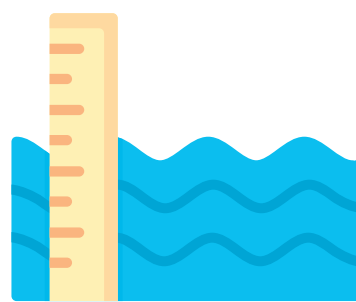


Singapore's Third National Climate Change Study (V3) projects **higher temperatures, more extreme wet and dry periods, and sea level rise around Singapore of up to 1.15 metres by 2100 and 2 metres by 2150.**

WHAT MAKES SINGAPORE VULNERABLE?



Having a tropical climate with frequent and abundant rainfall



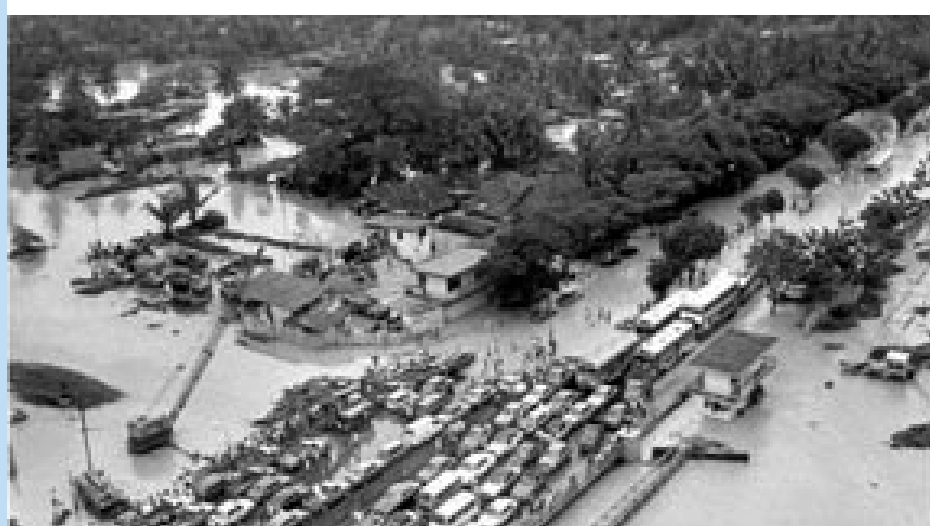
About 30% of the island is less than 5m above mean sea level, making these areas more susceptible to flooding



Limited land area poses challenges in expanding drainage capacity to cater to every extreme scenario



Newton Circus, December 1969



Braddell Road, December 1978

SINGAPORE'S HISTORY WITH FLOODS

Singapore used to experience frequent and widespread flooding in the 1950s to 1980s. Since then, we have made significant strides in flood management.

Flood prone areas in Singapore have reduced from 3,200 hectares (ha) in the 1970s to less than 30 ha in 2023. This is due to decades of continued efforts and significant investments to expand Singapore's drainage network and infrastructure to mitigate flood risks.

How is PUB strengthening Singapore's flood resilience?

With two-thirds of Singapore as water catchment, rainwater that falls in these areas is collected through an extensive network of drains, canals, rivers, stormwater collection ponds and reservoirs before it is treated for drinking water supply.

To enhance flood protection, PUB adopts the '**Source-Pathway-Receptor**' approach to achieve greater flood protection and introduce flexibility and adaptability to Singapore's entire drainage system.

This approach addresses not just the drains and canals through which stormwater travels (i.e. "**Pathway**"), but also in areas generating stormwater runoff (i.e. "**Source**") and areas where floods may occur (i.e. "**Receptor**").

DID YOU KNOW?

Singapore has about **8,000km** of drains, rivers and canals, which collect and convey rainwater into our reservoirs.

Source

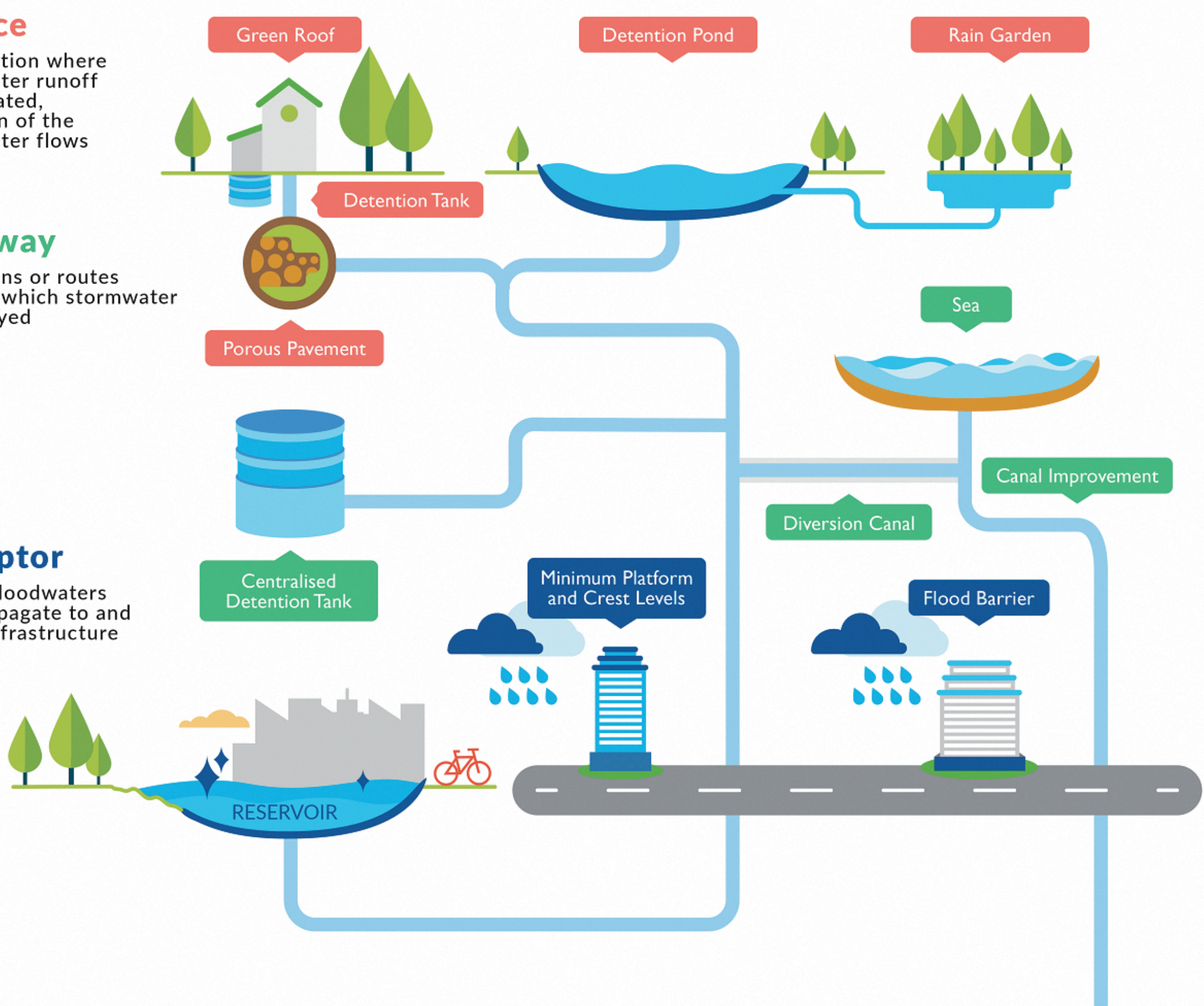
The location where stormwater runoff is generated, i.e. origin of the stormwater flows

Pathway

The means or routes through which stormwater is conveyed

Receptor

Where floodwaters may propagate to and affect infrastructure



"SOURCE" SOLUTIONS

Since January 2014, all new and re-developments of 0.2 hectares or more are **required to implement "source" solutions to slow down stormwater runoff** entering the public drainage system.

These could include detention tanks or rain gardens and bioretention swales.



Stamford Detention Tank

The **Stamford Detention Tank** under the Singapore Botanic Gardens can hold up to 38,000m³ of stormwater—equivalent to 15 Olympic-sized swimming pools.

It temporarily stores excess stormwater from drains in Holland Road during heavy rain, and releases it back when water levels subside. Together with the Stamford Diversion Canal, this enhances flood protection for Orchard Road.



Alkaff Lake

Situated within Bidadari Park, Alkaff Lake acts as a **stormwater retention pond** during heavy rain, slowing down runoff to downstream drains which cannot be widened further.

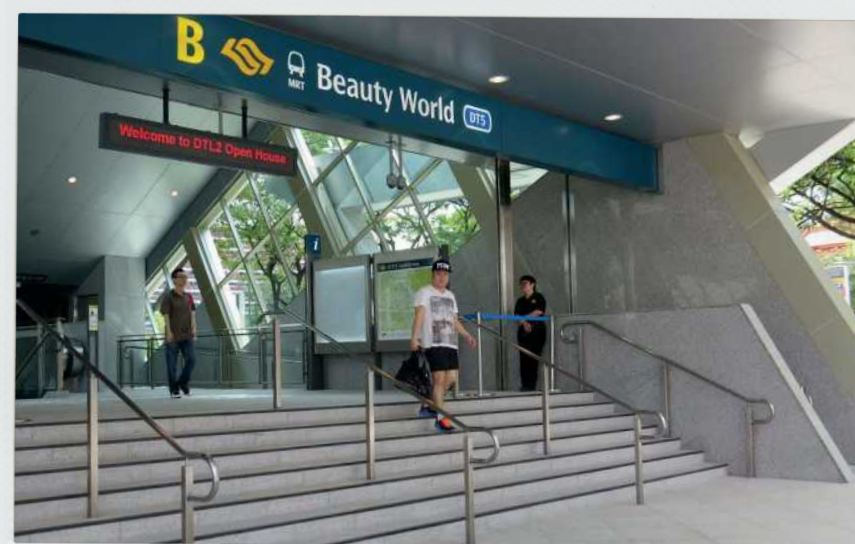
Not only does the lake reduce flood risks for the estate, it also turns into a recreational space for public to enjoy during dry weather.

"PATHWAY" SOLUTIONS

To enhance our "pathways" to cope with higher intensity storms, PUB raised the design standards in 2011 for drains to cater for more intense rainfall events.

"RECEPTOR" SOLUTIONS

"Receptor" solutions aim to provide additional flood protection for buildings and key infrastructure. Some of these measures include **setting minimum platform and crest levels and placing flood barriers** to prevent floodwaters from entering buildings.



Minimum crest level for entry to underground station

LEVERAGING TECHNOLOGY FOR IMPROVED FLOOD MONITORING AND RESPONSE

PUB has over 1,000 water level sensors and more than 500 CCTVs installed across the island, alerting us to fast-rising water levels in our drains and canals in real-time. This allows us to **issue early alerts to the public** and **deploy our Quick Response Teams** to the affected areas quickly to render assistance and keep public out of harm's way.



How is PUB supporting the community to be flood-ready?

While PUB continues to invest in flood protection measures, **it is not possible to cater for all extreme storm events and prevent floods entirely due to Singapore's land constraints.** The realities of climate change require us to build our flood resilience as a nation.

TIMELY ALERTS ON FLOOD RISKS

PUB informs public of flood risks by sending **advance alerts and updates** on heavy rain and flood prone areas through multiple channels [PUB Flood Alerts Telegram (<https://t.me/pubfloodalerts>), myENV app].

Motorists can also receive location-specific alerts to avoid flood-risk areas.

PUBLIC OUTREACH AND RESOURCE DISTRIBUTION

Every year, before the Northeast Monsoon season, PUB conducts door-to-door visits to **engage residents and shop owners about flood-proofing and safety measures during floods.**

To date, PUB has handed out around **16,000 flood protection devices** to households and shop owners in flood prone areas and hotspots, including inflatable flood bags, portable flood barriers and flood gates.



ENGAGING BUILDING OWNERS

Building developers, owners and town councils are responsible for maintaining drainage systems and flood protection measures on their premises.

PUB conducts **regular inspections and educates stakeholders** about these responsibilities.



FLOOD RESPONSE EXERCISE AND JOINT INSPECTION

Every year, PUB joins forces with train operators to ensure that our **MRT stations, which are critical infrastructure, are flood-ready.** 65 different stations are visited in turns.

These visits ensure flood protection measures are in place and functioning well.



What should you do during a flash flood?

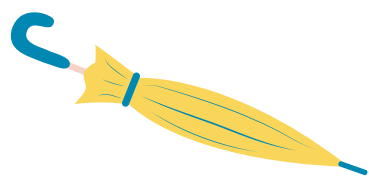
WHEN YOU'RE OUT:



- Avoid flooded areas and stay on higher ground.



- Do not walk through flood higher than your ankles.



- Use a stick or umbrella to check for open drains and firmness of the ground.

WHEN YOU'RE DRIVING OR RIDING:



- Avoid driving through a flooded area above road kerb height or when road markings are no longer visible.



- If the flooded area is absolutely unavoidable and assessed to be passable, drive slowly and steadily.



- Do not restart a stalled vehicle. Turn on hazard light, call for assistance and move to higher ground.



- Upon exiting a flood, gently tap on brakes to dry them. Test them before driving off.

IF YOUR HOME OR BUSINESS PREMISE IS IN A LOW-LYING AREA:



- Always ensure drains and drainage systems within your compound are well maintained and choke-free, and flood barriers are in good condition.



- Move essential items to higher ground.



- Install flood barriers when there is a risk of flood to protect your property from the rising water level.



- If you need to evacuate, turn off all main switches and disconnect electrical appliances.

