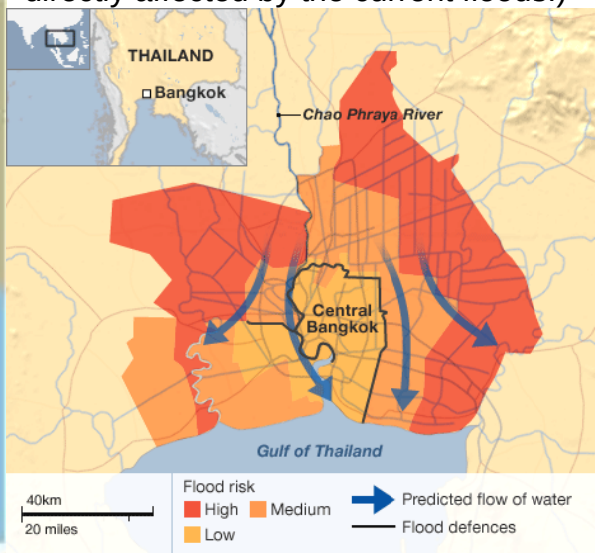
Fall 2011 Thai Flood Maps & Photos: Part 4

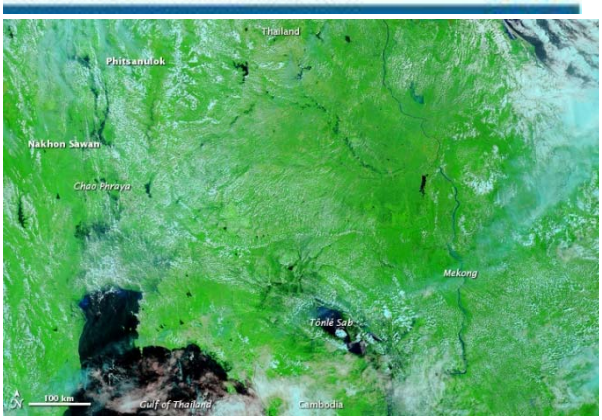
Map Overview of the Fall 2011 Thai Floods

E-mails from our readers indicate some concerns due to being unfamiliar with the various Thai place names mentioned in media reports. News broadcasters unfamiliar with Thai struggle with pronunciations adding to the confusion. So, here are some maps, diagrams, and charts to help orient you to the current flooding in Thailand. Of course, much of the media attention is in the Bangkok area and nearby industrial zones. Given the extent of the flooding, transportation is difficult for media folks to get around.

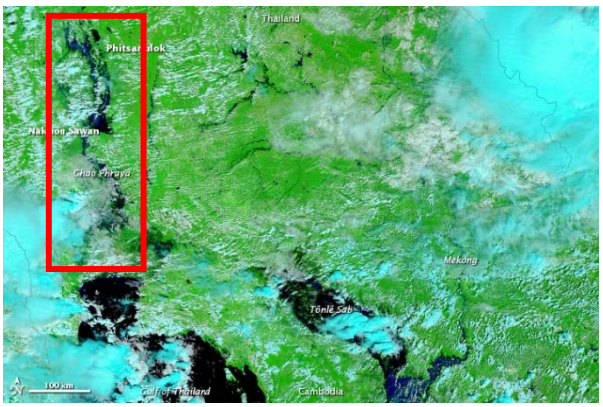
The Central part of Thailand is circled with a dashed red line. The smaller red circle is where most of the media coverage is focused. (The green dot is where the RTC-TH is located. We are safe and ***not*** directly affected by the current floods.)



The current flood threat to Bangkok as of 16-20 Oct.



Terra MODIS image 8 Oct 2010



Terra MODIS image 11 Oct 2011

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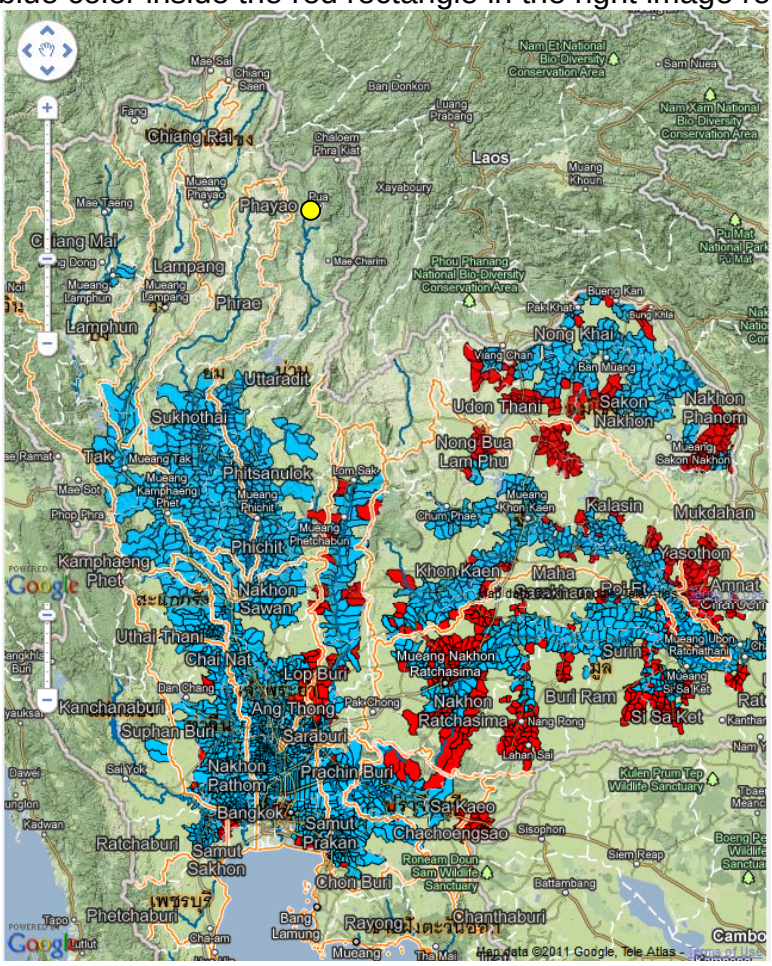
The differences in the MODIS images from the NASA Terra satellite of 8 Oct 2010 and 11 Oct 2011 reveals the magnitude of the floods is visible from space. The dark blue color inside the red rectangle in the right image represents water.



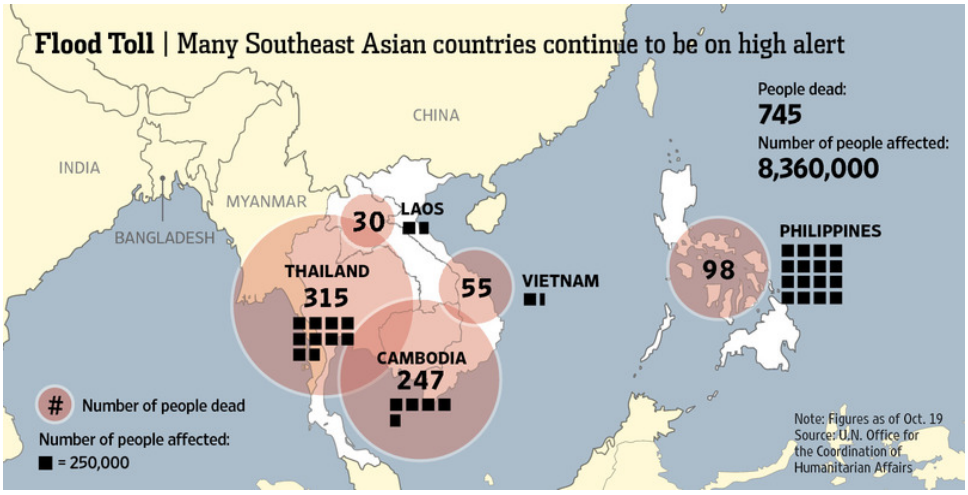
The map on the left shows the extent of the flooding in Thailand on 17 Oct 2011. The blue areas are flooded. The red areas are anticipated to be in danger of flooding.

The orange lines are river drainage basins. The blue lines are major rivers. The yellow dot indicates the approximate location of the RTC-TH.

The terrain slopes to the south so the rivers converge on the Chao Phraya that flows through Bangkok and on to the Gulf of Thailand.

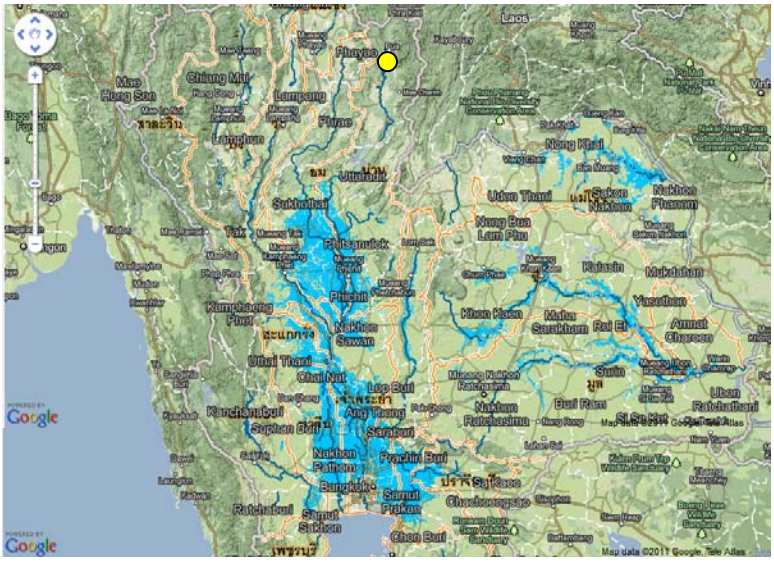
As of mid-October it was estimated that 50% of the flood water had yet to reach the Bangkok area. It is thought it might take 1 to 1 ½ months for the flood waters to drain from the north. This extends the danger period for Bangkok to the end of November. During that time there will be 3 spring tides (peak high tides) with the new and full moons. This will tend to slow the flow of the Chao Phraya. Potentially this could cause the river to overflow its banks and flood Bangkok.

Thailand is not alone. This year has been the year of flooding for much of SE Asia. The normally wet and rainy SW monsoon season got additional rain from 5 typhoons that tracked over SE Asia from the Philippines. Even though not at full typhoon strength (they often weaken to Tropical Depressions or even low pressure cells), the combined warm moist air from the Gulf of Tonkin and the Andaman Sea gave a big boost to the rainfall totals. [**Note:** When these typhoon remnants hit, the monsoonal trough had already migrated south. So the RTC-TH sites in Nan Province did not get much rainfall at all.] However, as the runoff in the rivers from the north began to fill and overfill the dams, officials began releasing



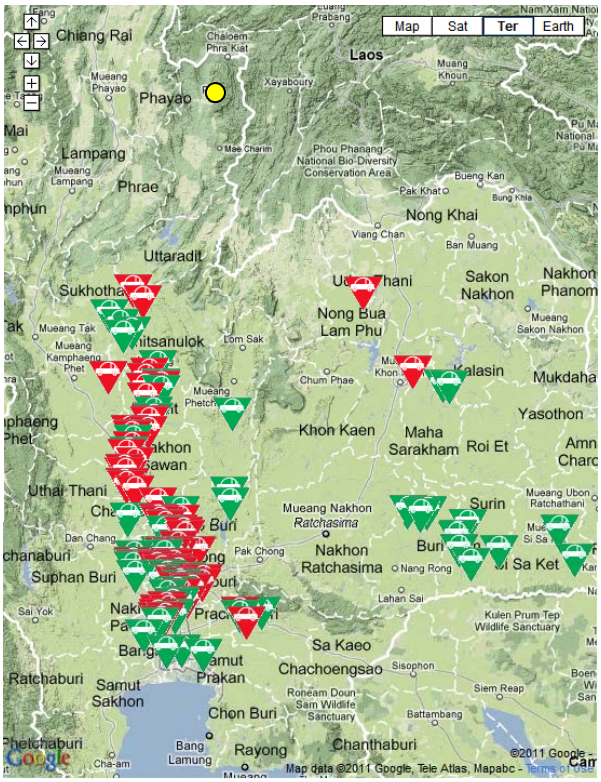
water to protect the dams. This caused areas downstream to begin to flood. The flood water continued and merged into the Chao Phraya River.

Major flooding took place from



Sukhothai southward to Ayutthaya and on to Nakhon Pathum and the northern suburbs of Bangkok (light blue area in the map to the left).

The drainage is south toward the Gulf of Thailand. All the flood water will be moving down the Chao Phraya through the Bangkok. As of 19 Oct, the volume of water released from the dams has decreased and eased the flood threat a bit.



This diagram shows the flood status of some of the major highways in Thailand. A red triangle indicates the road is flooded and impassable. Green triangles mean a highway is partially flooded. This could mean water is shallow enough to make it passable for traffic or that water has forced some lanes to be closed.

As of 20 Oct:

- 75 highways in 18 provinces are flooded and impassible.
- 192 rural roads in 29 provinces are impassible.
- All northbound rail service has been canceled.

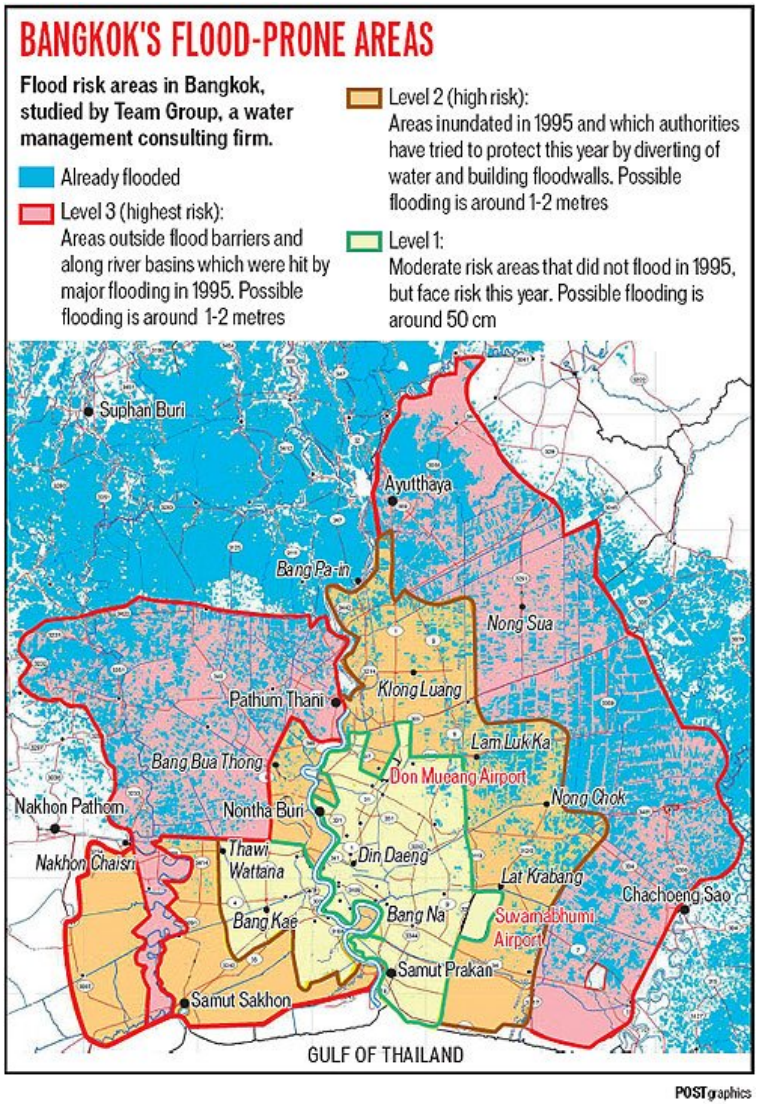
Flooded highways make it hard to evacuate people and to move relief materials and supplies to deal with the flooding. Additionally, in the central plain

highways and railways are built up higher than most of the floodplain. People flooded out of their homes head for the only high ground in the area: the main highways. They set up temporary shelter along the highway. At times they encroach on the highway forcing the closure of a lane. At the very least, it adds to traffic congestion and increases the hazard to the survivors.

The light blue areas in the map on the right are flooded. The main area of flooding north of Bangkok is the Chao Phraya flood plain. The solid red circle is Ayutthaya (site of a UN World Heritage) which is completely underwater.

This is the area with many industrial parks and factories closed as reported in the news.

Follow Hwy 32 / 1 south to the first airport symbol where



they set the FROC (the Flood Relief Operations Center). Suvarnabhumi airport is the airport symbol to the SE.

As the flood waters move south, all eyes shift to Bangkok with more industries and the financial / political centers of the country. The map on the left shows the flood status and potential for the area:

- **Blue:** Already flooded
- **Pink:** Highest risk of being flooded to a depth of 1-2 m.
- **Orange:** High risk of being flooded to a depth of 1-2 m.
- Area inside the **green line** has a moderate risk of flooding to a depth of 0.5 m.

The Chao Phraya River flows through Bangkok on its way to the Guld of Thailand. It seems inevitable that some of the city will be flooded. The questions that remain unanswered are:

- Where?
- How deep?
- How long?

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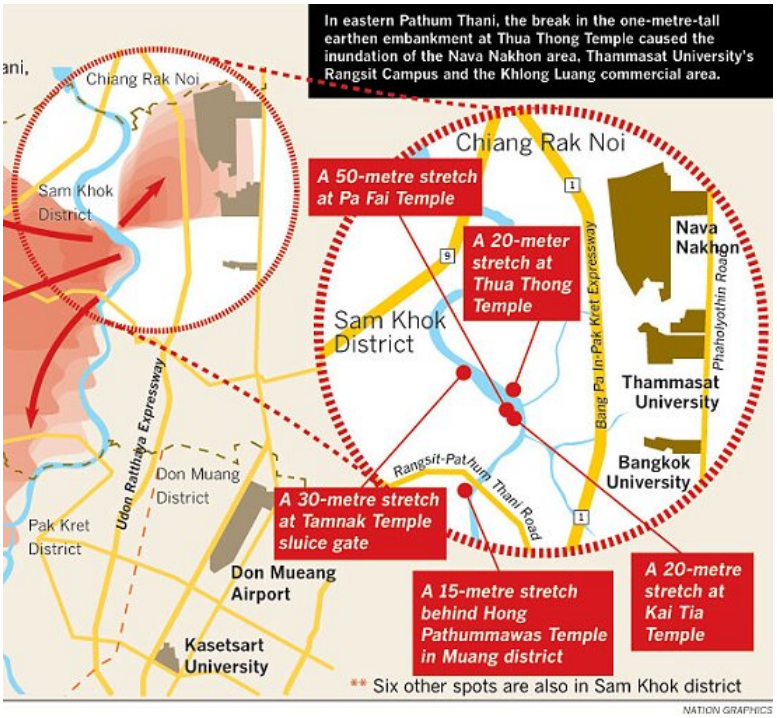
Pathum Thani Floods

(Left pink area in the previous map)

A breach in a1 meter high earthen barrier in the Sam Khok District of Pathum Thani let flood waters inundate the Nava Nakhon industrial park and the Rangsit campus of Thammasat University and other parts of Pathum Thani. This was not good news for Bangkok.

This area is NW of the FROC at the Don Meuang Airport (the former Bangkok International Airport) along the Chao Phraya River.



The defense of Bangkok is to move flood waters to the Gulf of Thailand as quickly as possible via the Chao Phraya River and diverting flood waters through various canal systems to the Bang Pakong River east of Bangkok. Some of the districts in Bangkok and surrounding the city would have to bear some flooding. There was talk about government compensation to people who allowed flood water to be diverted over their land.

Earthen barriers and sand bag walls would be built to reinforce certain critical areas. Some would be as high as 3 meters.

Symbols for the above map

- **Big Pink arrows**: Planned flow of flood waters
- **Red arrows:** Planned main canal to divert flood water
- **Black lines:** Permanent flood barrier
- **Pink dots:** Pump stations
- **Green dots:** flood gates
- **Brown line:** Road built high enough to be a flood barrier.

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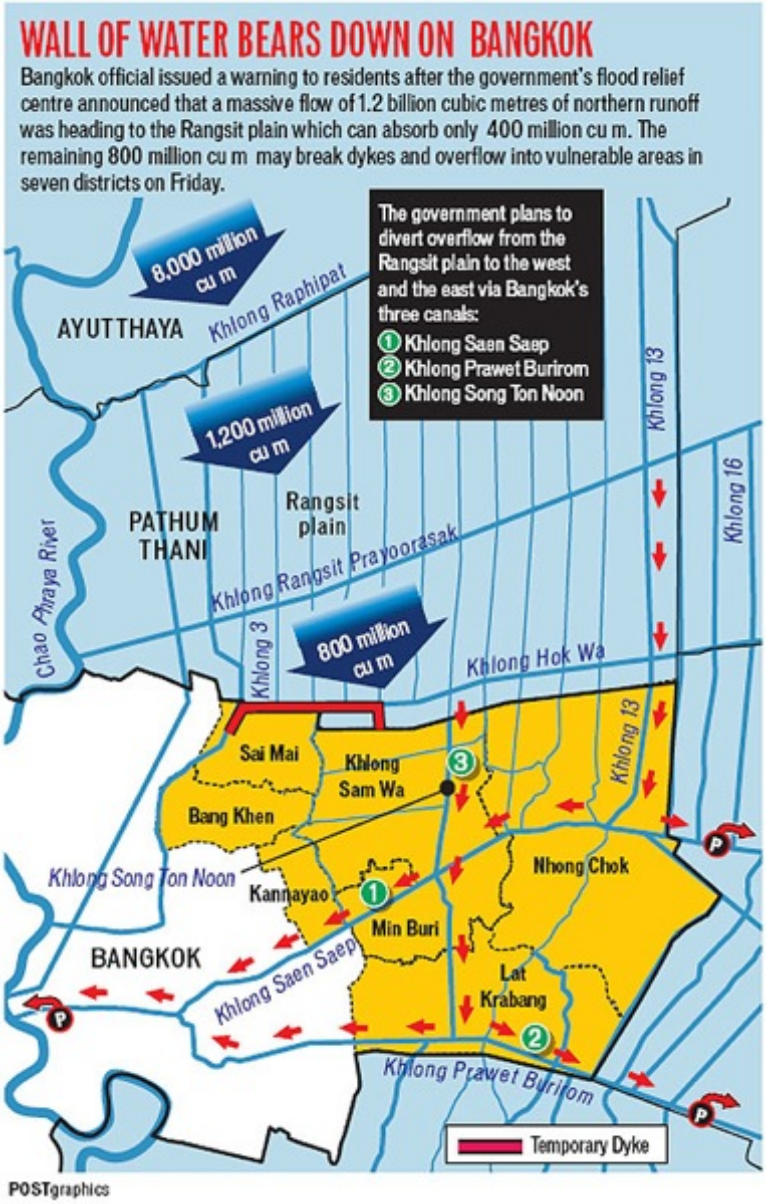
The diagram at the right shows the approaching flood waters from the north. It shows these water volumes:

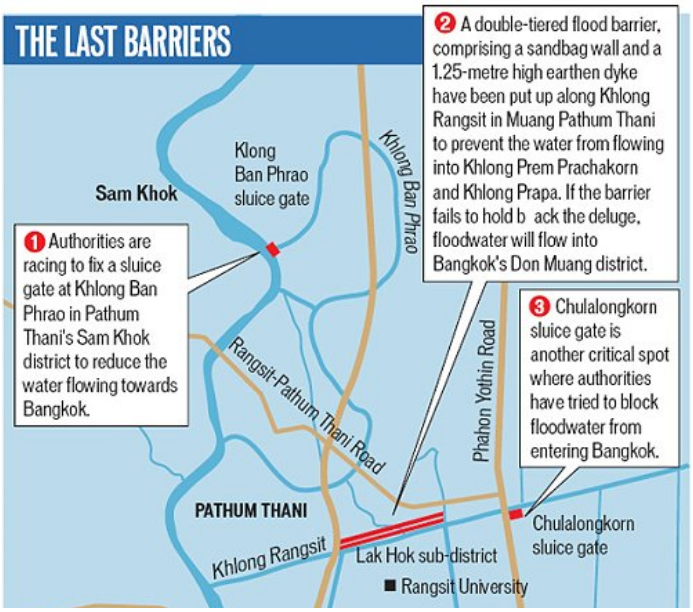
- **Ayutthaya:** 8,000 million cubic meters
- **Pathum Thani:** 1,200 million cubic meters
- **800 million cubic meters** posed a threat to 7 districts of Eastern Bangkok as of 15 Oct 2011.

The thick red line is one of the temporary dikes built in the past few days to strengthen the city's flood barriers. The red arrows show the intended flow path to divert flood waters via canals and pumps around the city center to minimize potential flooding.

Eastern Bangkok could be flooded if:

- A flood barrier is breached;
- More water arrives due to more rain or more water comes from the north
- The spring (peak) high tides in the Gulf of Thailand reduce the flow velocity of the Chao Phraya River.





To reduce the water flow toward Bangkok, the government is:

#1: Fix a sluice gate at Khlong Ban Phrao in Pathum Thani

#2: Build a 2-tiered flood barrier along a section of Khlong Rangsit consisting of a sand bag wall and a 1.25 m high earthen dike. (If this barrier fails, flood waters will get into parts of central Bangkok.)

#3: Block flood waters from getting to Bangkok at the Chulalongkorn sluice gate on Khlong Rangsit east of the city.

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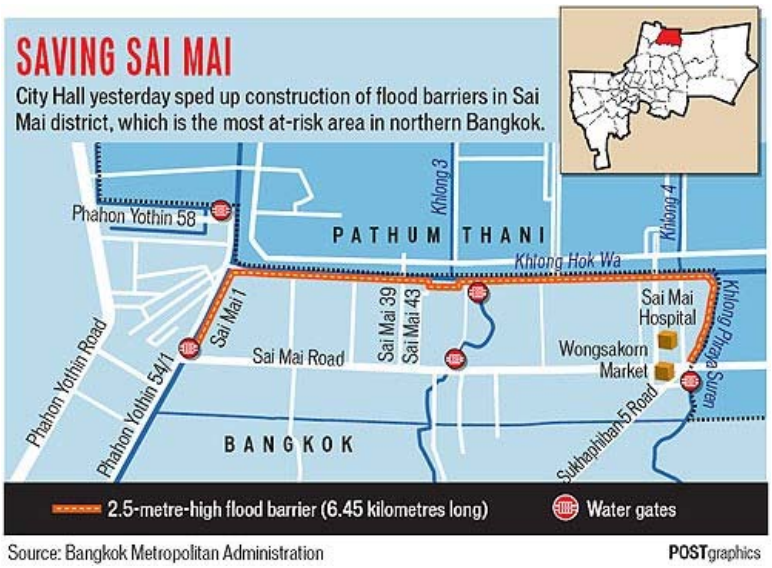
This critical barrier has been the focus of a major flood defense effort. This graphic is a close up view of the red line (Item #**2**) in the previous graphic.

This hastily constructed flood barrier is 2.5 m high and 6.45 km long. The red dots indicate flood gates.

This is a situation of hoping for the best, but preparing for the worst. Some shop owners in Bangkok are opting to sand bag their businesses despite assurances from authorities that the situation under control. "Better safe than sorry" is the motto being voiced by some merchants.



Trying to Move the Water Out Faster

Hundreds of boats along with Royal Thai Navy vessels used their propellers in an attempt to push water in the Chao Phraya River downstream to the Gulf of Thailand. There is no way to tell how effective this was. But it shows the government is making every effort to speed flood waters away from the city.

During the full and new moons of October and November, spring tides (peak high tides) will occur in the Gulf of Thailand. This will move sea water into to estuaries of the Chao Phraya and reduce the flow velocity of the river. This in turn could cause the Chao Phraya to overflow its banks in the Bangkok area. At the same time, more flood water is draining from the north. It is estimated about 50% of the northern flood waters have yet to reach the Bangkok area.

The first spring tide for October took place this past weekend. Others a due at the end of October, mid-November, and the end of November.

The Fear of More Water

The work to defend Bangkok and other industrial park areas from flooding goes on. Any increase in the flood water volume is a serious threat to all these defensive efforts. The major threats come from:

- **More Rain:** The summer SW monsoon season typically comes to an end in October. But "whacky" weather seems to be more common in the past few years. This year Thailand got the remnants of 5 consecutive typhoons coming from the Philippines.
- **Flood Barrier Failure:** Any breach of Bangkok's flood barriers is NOT welcomed. Flood barrier materials are in short supply and face increasing costs. Transporting them to Bangkok and in / around the city is hampered by flooded roads.

In the Ayutthaya area, disgruntled residents got frustrated after being flooded for a month. They tore down sand bag walls to release the flood waters from their community and let it flow to the south. Undercurrents of unrest are simmering in Thai society carrying over from the political divisions.

More rain over any of the river basins feeding into the Chao Phraya River system adds to the threat.

Nakhon Sawan (north of Bangkok) built its barriers 2 months prior to the flood. It only took one boat to accidentally hit an earthen dike to flood the entire city.

The threat of a failed flood barrier is very real and should not be discounted.

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- **Flood Gate Failure:** There are numerous flood gates on the many canals in the greater Bangkok area. Like much of the public infrastructure, these gates are old and exposed to the elements. Over the years they are in need of maintenance and repair. Some flood gates are already at capacity or have flood water flowing around them.

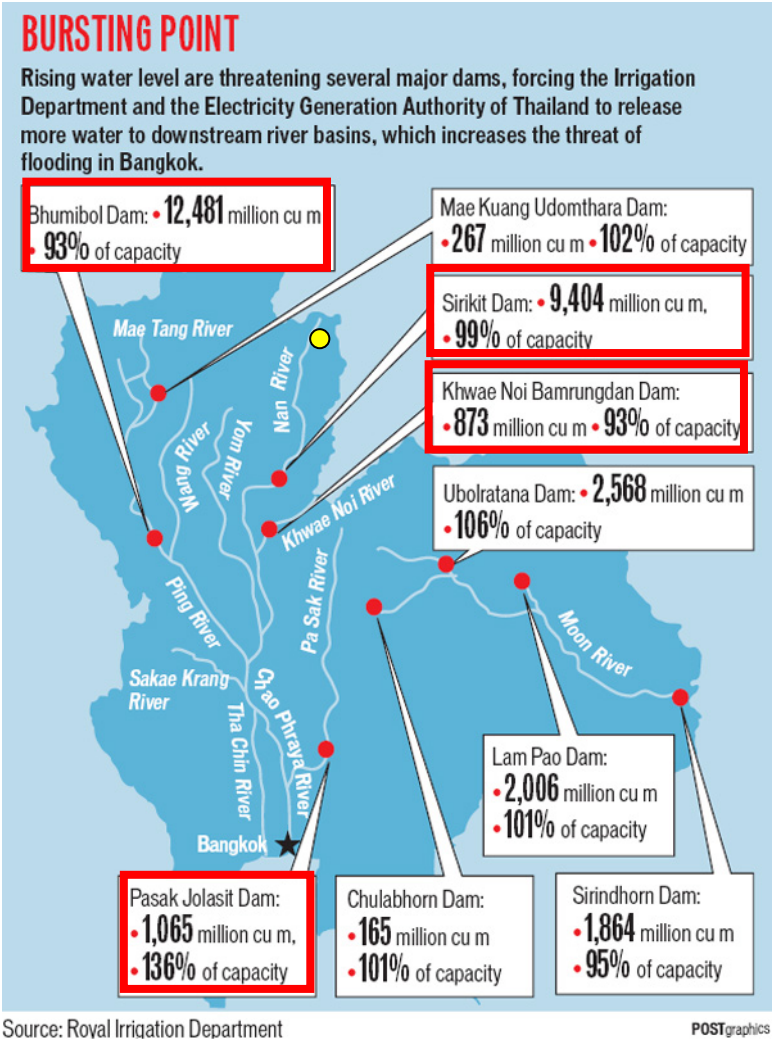
An overflowing flood gate on a flooded canal

- **Water Pump Failure:** There are numerous pumping stations of different sizes and capacities at various points in the canal system in the Bangkok area. A failure of any one pump adds stress to the rest of the system. Power supply and fuel are critical to keeping the pumps operating. Debris can clog them. Operators must be vigilante and be able to keep the pumps running for the duration of the crisis.

- **Dam Failure:** Not many folks are talking about this scenario, but it is always a possibility (no matter how remote). Keep in mind that the water released from the dams upstream of Bangkok was the primary reason water levels rose so quickly in to flood the provinces in the central plains. In the last week or so the volume of the releases has decreased significantly. But as of 20 Oct 2011 the reported

capacities of some key dams (in red boxes) upstream from Bangkok were:

- **Bhumipol Dam:** 99% capacity
- **Sirikit Dam:** 99% capacity
- **Kwae Noi Dam:** 100% capacity
- **Pasak Jolasit Dam:** 136% capacity



All dams have an acceptable flood capacity (AFC). This is the water discharge rate from the dam for the duration of the storm event that keeps the dam from failing. It was the unexpected consecutive and excessive rains from 5 remnant typhoons that pushed the authorities to begin release large amounts of water that caused the subsequent downstream flooding in central Thailand.

Obviously, any additional rainfall could increase the surface runoff flowing into these dams which are near, at, or over their designed capacities. This would force the release of additional water which will flow into already flooded areas.

"Over topping" is acknowledged to be the main killer of dams. Operators release water from dams to avoid water flowing over the top of the dam. High discharge volumes are usually regulated to avoid or minimize flooding. In this case, the amount of water released could not be well regulated due to the high influx of runoff from the storms. The Thai Meteorological Department reported its requests for upgraded weather radar and forecasting tools had been repeatedly denied over the years. As a result, they were incapable of generating rainfall intensity predictions as their properly equipped counter parts in other countries.

(To be continued)

The end is not yet in sight. It may take until the end of November until all the flood waters have flowed past Bangkok and out to sea.

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