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Overview of existing Flood forecasting and warning infrastructures in Myanmar

Development and Implementation of the Myanmar stand-alone Flash Flood Guidance System (FFGS), Initial Planning Meeting

Khin Wah Wah Win
Staff Officer
DMH

26th - 28th February 2018

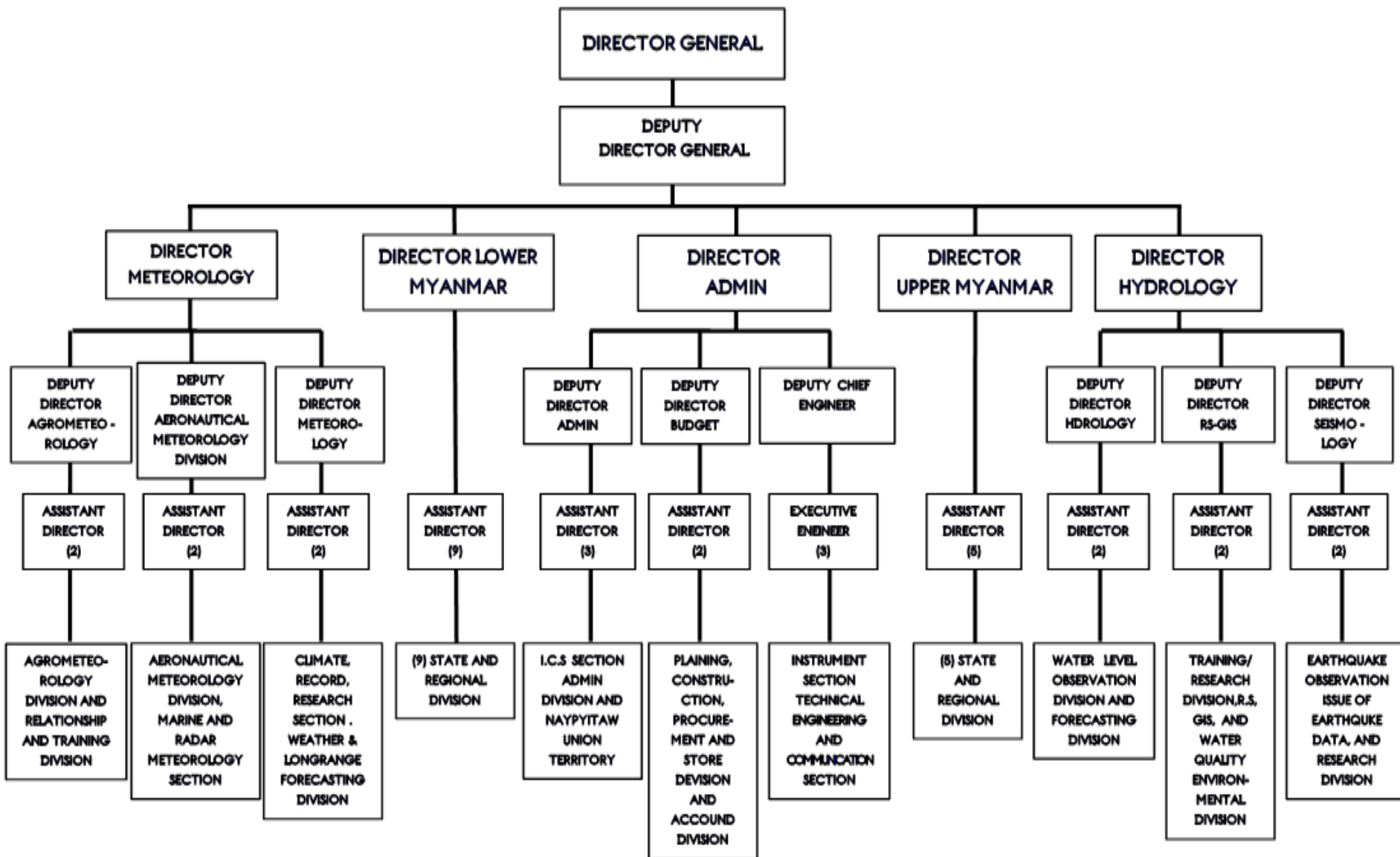
Nay Pyi Taw, Myanmar

Contents

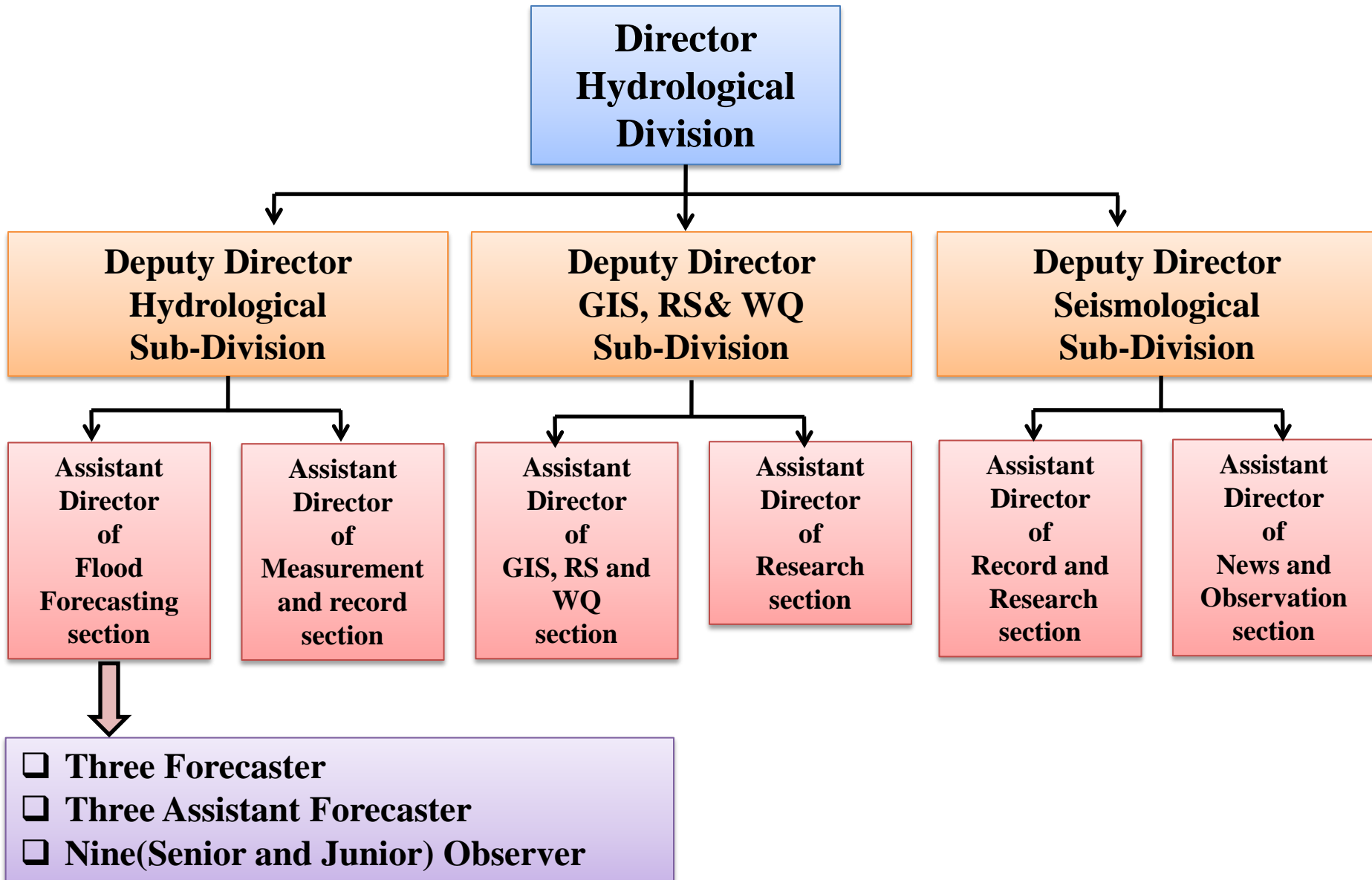
- Organizational Structure and human Resources
- Current hydrological networks system
- Flood & Flash Floods Events in Myanmar
- Early warning Information and Dissemination system in Myanmar
- National capacity for the provision of flash flood early warnings
- Conclusion

Organizational structure and human resources

ORGANIZATION CHART

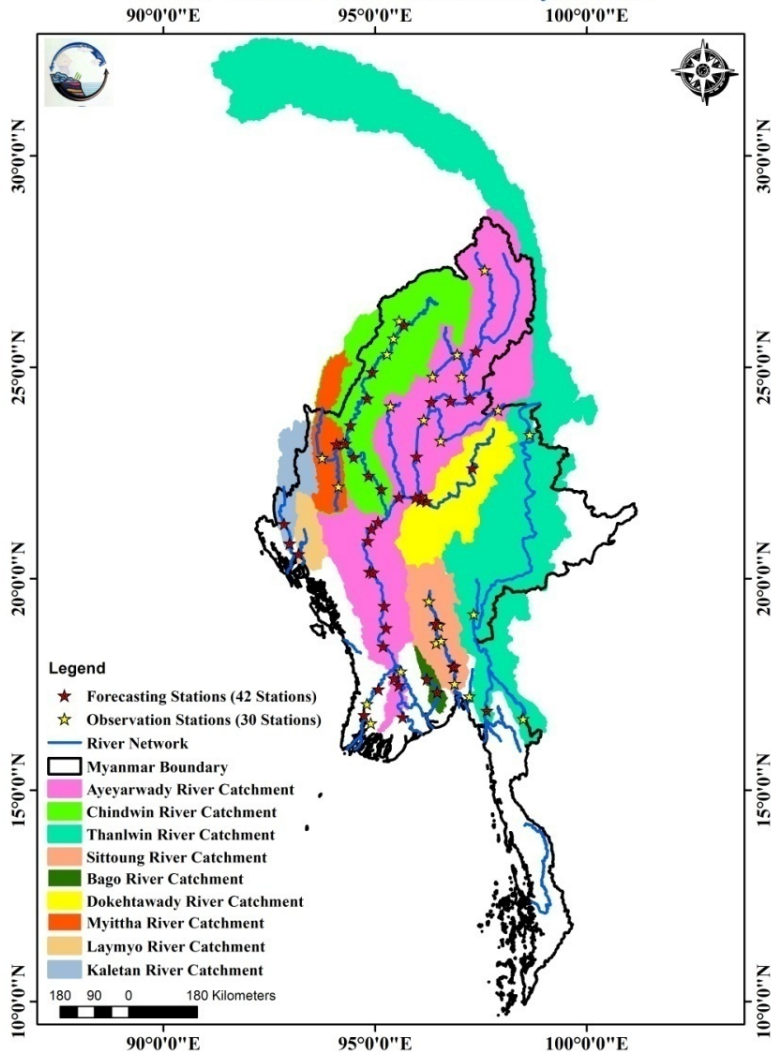


Organization Flow Chart of Hydrological Division



River Basins and Hydrological Forecasting stations in Myanmar

River Catchment Area in Myanmar

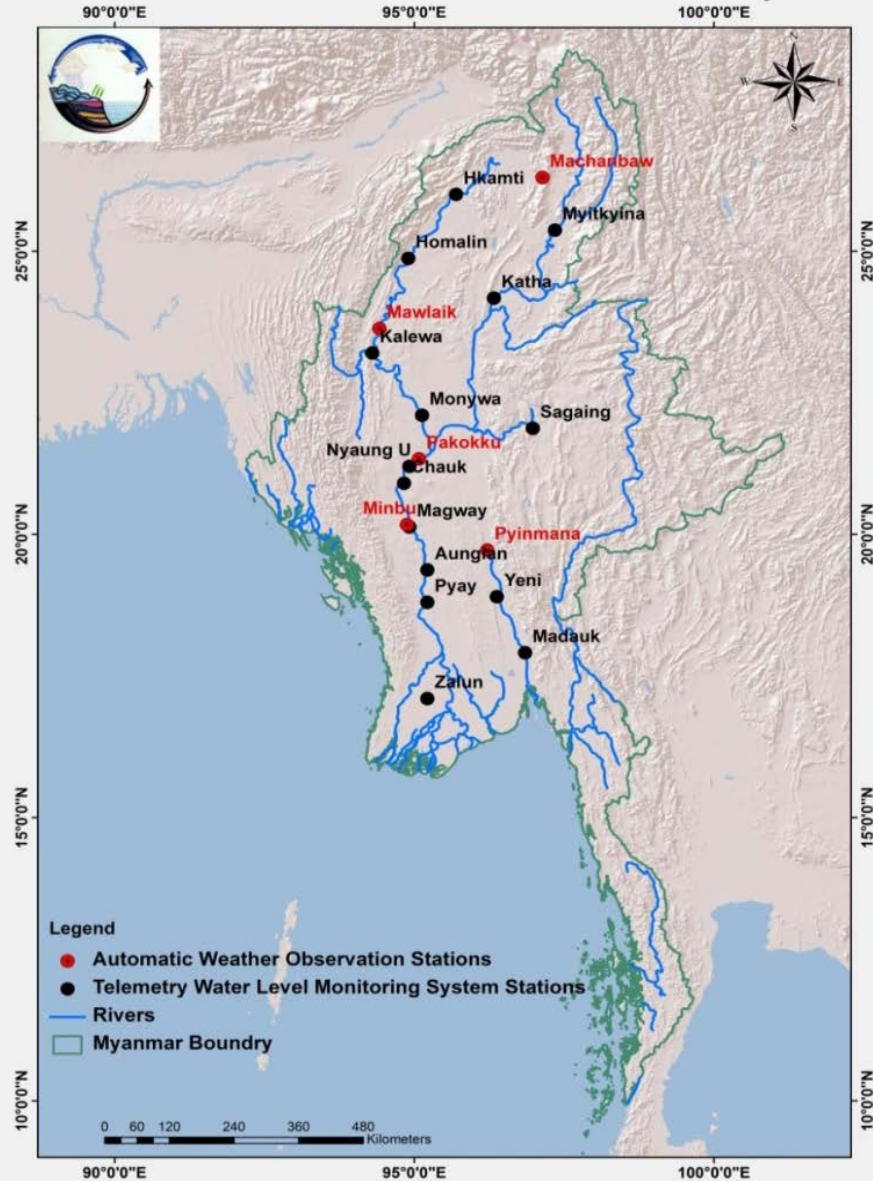


No.	River Basins	Forecast station
1.	Ayeyarwady	18
2.	Chindwin	8
3.	Sittoung	2
4.	Bago	2
5.	Dokehtawady	3
6.	Thanlwin	1
7.	Shwegyin	1
8.	Ngawun	2
9.	Myithar	1
10.	Toe	1
11.	Kalaten	2
12.	Laymyo	1
	Total	42

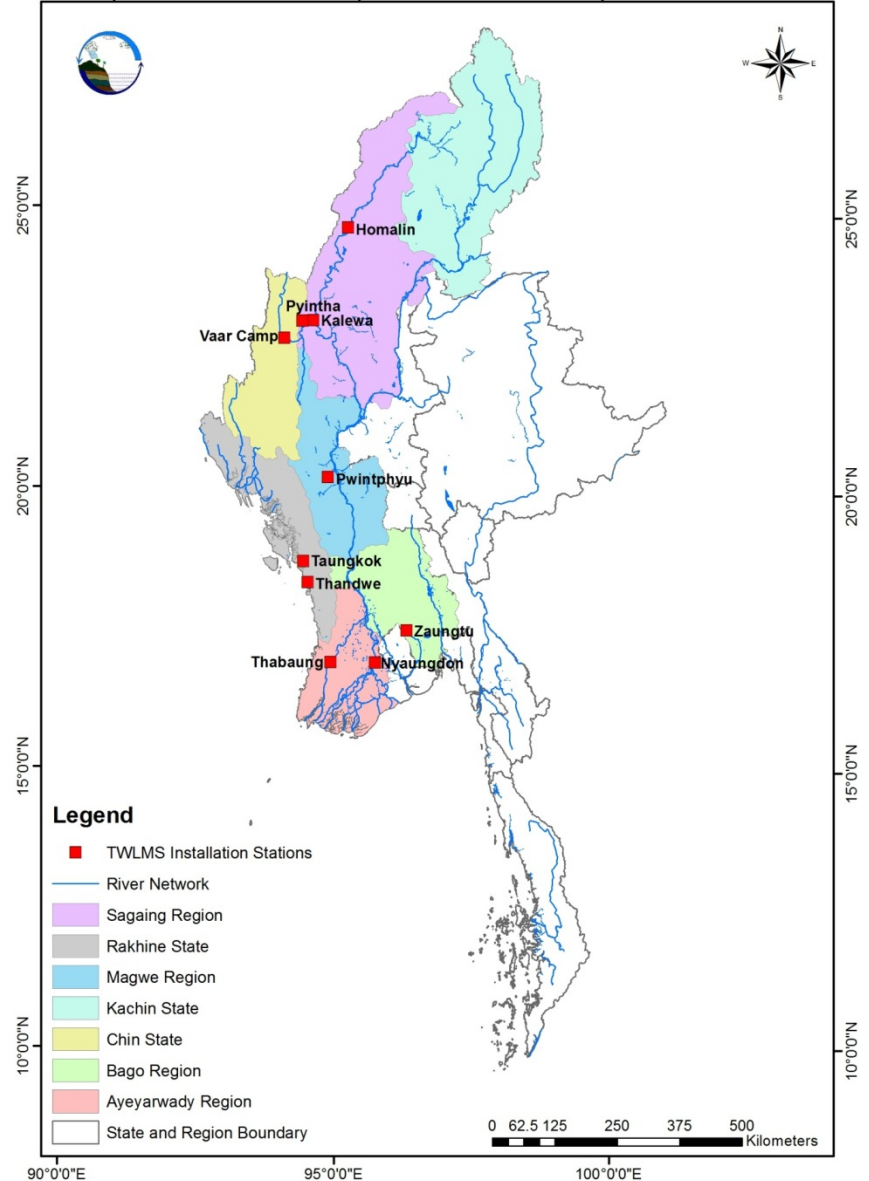
Hydrological Services January 1964

Already installed and Ongoing activities of TWLMS stations

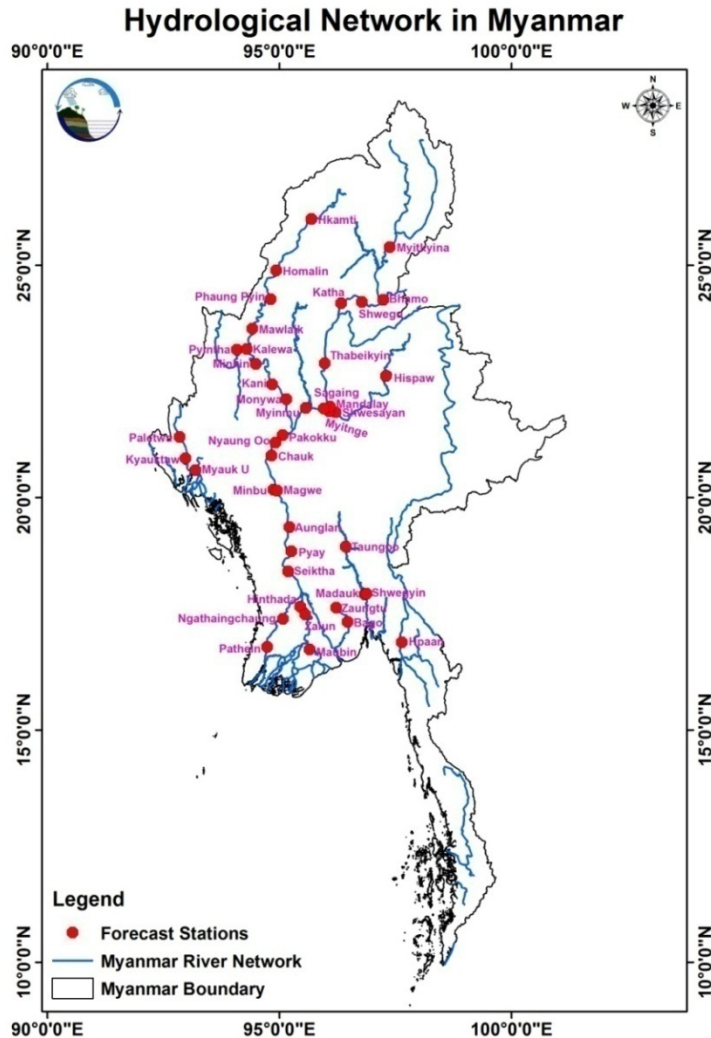
Present activities of TWLMS stations



Ongoing activities of TWLMS stations



Hydrological data observation and flood monitoring network system in Myanmar



- Department of Meteorology and Hydrology [DMH] plays an active role in disaster risk reduction of Myanmar, particularly in Early Warning Dissemination.
- DMH has (72) Hydrological observation stations.
- DMH issue Daily, (10) days, monthly and seasonal water level forecasts for major (12) rivers and also issues the flood warning and flood bulletin for these (42) stations during monsoon period.
- And also the minimum alert water level issue for (7) stations in central Myanmar area on Ayeyarwady and Chindwin rivers in low flow period.

DMH's Water Level Observation System



Latest Conditions

- Relay State: Deactivated (Open)
- Water Level: 5.529 meter
- Rain: 0.0 mm
- Wind Direction: WSW 243 °
- Wind Speed: 1.5 m/s
- Gust Speed: 5.0 m/s
- Temperature: 25.48 °C
- RH: 100.00 %
- Dew Point: 25.51 °C
- Battery: 4.96 V 100%

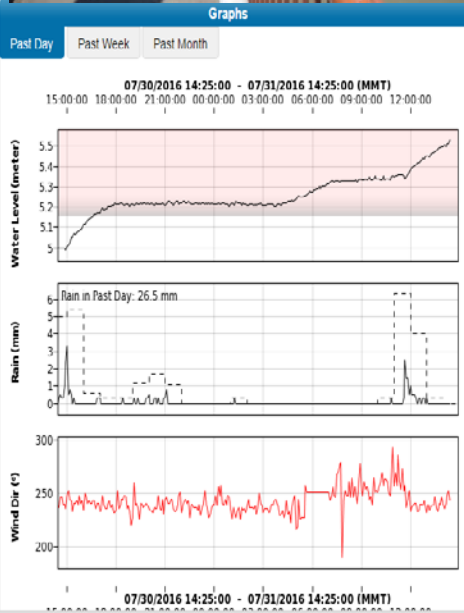
Activity Log

Next connection expected 31 minutes from now

- Today at 14:30 MMT
- Today at 13:30 MMT
- Today at 12:30 MMT
- Today at 11:30 MMT
- Today at 10:30 MMT

Data

- Data Files
- Custom Data



Types of Hydrology Forecast in Myanmar

Types of Forecast	Time of Issuance	Forecast Validity
General Long Range Water Level Forecast	April 28	Monsoon season
Seasonal Water Level Forecast	28 th of April, June, August, Oct	Early, Mid, Late Monsoon, Winter Monsoon
Monthly Water Level Forecast	28 th of every month	1 month
10 Days Water Level Forecast	8 th , 18 th , 28 th of every month	10 days
Daily Water Level Forecast	Daily	1 Day

Types of Warning

- Flood Warning
- Minimum Alert Water Level

Types of Bulletin

- Flood Bulletin
- Significant Water Level Bulletin
- Low Flow Bulletin

Daily Water Level Forecasts for (42) Stations at (12) Major Rivers

Department of Meteorology and Hydrology
Daily Water Level Forecast

9-2-2018

Rivers	Stations	Minimum Alert Water Level (cm)	Water Level at (12:30)hr (cm)	Water level Changes during last (24) hr (cm)	Water Level Forecast at next (24) hrs (cm)	Remarks
Ayeyarwady	Myitkyina		177	0	179	
	Bhamo		352	-4	347	
	Shwegu		193	-6	188	
	Katha		235	+13	231	
	Thabeikyin		296	+3	298	
	Mandalay	360	371	+2	373	
	Sagaing	170	257	+5	259	
	Myinmu		175	+5	178	
	Pakokku		1179	-1	1181	
	Nyaung Oo	1020	1160	-1	1161	
	Chauk	275	455	-2	454	
	Minbu	410	504	-1	503	
	Magway	410	488	-2	487	
	Aunglan		1312	-2	1311	
	Pyay		1779	-3	1777	
	Seiktha		200	-1	199	
	Hinthada		500	-1	499	
	Zalun		302	-2	301	
Dakhtawady	Hsipaw		121	0	120	
	Shwesaryan		154	+17	151	
	Myitnge		237	+18	235	

Rivers	Stations	Minimum Alert Water Level (cm)	Water Level at (12:30)hr (cm)	Water level Changes during last (24) hr (cm)	Water Level Forecast at next (24) hrs (cm)	Remarks
Chindwin	Hkamti		198	-1	197	
	Hornalin		2157	-1	2156	
	Phaung Pyin		361	-1	360	
	Mawlaik		173	-1	172	
	Kalewa		235	-1	234	
	Mingin		314	-1	313	
	Kani		210	-1	209	
	Monywa	100	183	-1	182	
Myittha	Pyinthar		293	-1	292	
Sittoung	Toungoo		210	-13	208	
	Madauk		638	-2	636	
Shwepyithar	Shwepyin		424	-8	422	
Bago	Zaungtu		127	-2	126	
	Bago		199	+6	201	
Tharshin	Hpaan		218	-34	213	
Ngazun	Ngathaing - Chaug		448	-12	446	
	Patheingyi		120	+35	125	
Toe	Maubin		384	-29	382	
Kaladan	Paletwa		315	+1	314	
	Kyauktaw		258	+9	259	
Lay Mye	Myauk U		372	-4	370	

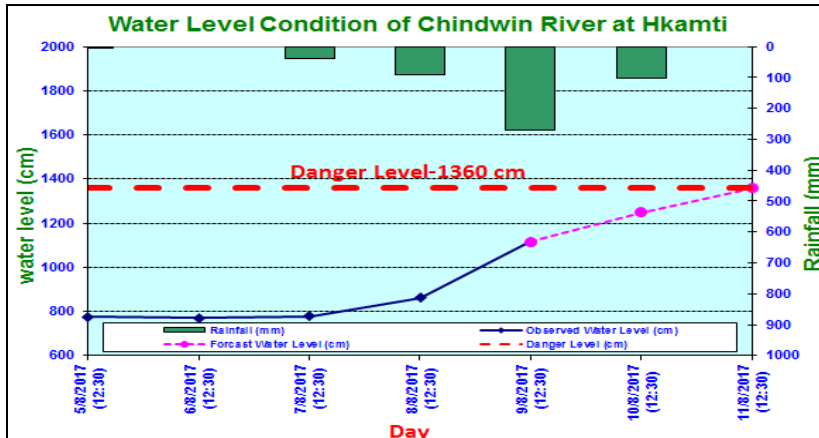
Flood Warning

(Issued at 16:00 hr M.S.T on 9-8-2017)

According to the (15:30) hrs M.S.T observation today, the water level of Chindwin River at Hkamti is observed as about (6)feet below its danger level. It may reach its danger level during the next (2) days.

It is especially advised to the people who settle near the river bank and low lying areas in Hkamti Township, to take precaution measure.

← Flood Early Warning Information
↓



Flood Bulletin

(Issued at: 14:00 hr M.S.T on 12-8-2017)

Flood condition of Chindwin River

According to the (13:30)hr M.S.T observation today, the water level of Chindwin River at Hkamti has exceeded about (1½) feet above its danger level, it may continue to rise about (1) foot during the next (1) day and may remain above its danger level.

Advisory

It is especially advised to the people who settle near the river bank and low lying areas in Hkamti Township, to take precaution measure.

Flood forecasting methods in DMH

- **Daily water level forecast**

- River Stage Correlation Method
- Multiple Linear Regression Method
- Integrated Flood Analysis System-IFAS (for research only)
- HBV model based on excel (for future)
- HEC-HMS Model for Ayeyarwady, Chindwin and Sittoung River

- **Seasonal water level forecast**

- Based on flood characteristic occurred in Analogue years
- Based on seasonal weather forecast
- Based on comparison of current flow with the individual hydrograph for the last (10) years
- Based on the average flow of the last (10) years
- Based on Flood frequency analysis
- Based on ENSO forecast

Procedures of Flood Early Warning System

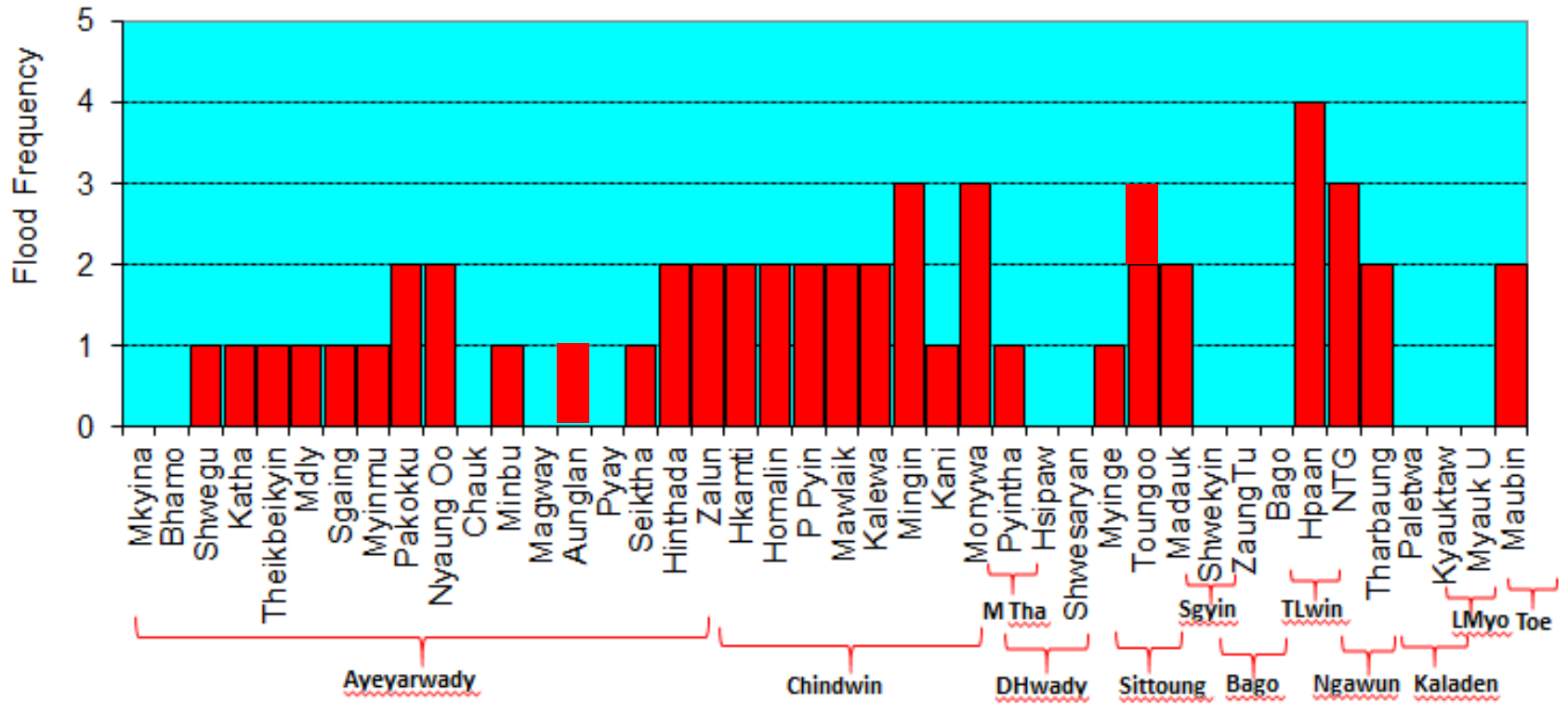
- Collect the hydro-met information from reporting stations (SSB, Phone, Telemetry etc.)
- Check and Analysis the hydro-met data
- Dam and weir water level information at upstream areas
- Weather forecast from weather forecasting section and global weather websites
- Estimate the water level forecast by using different techniques
- Issue the forecast, warning, bulletin and news.
- Disseminate the forecast, warning, bulletin and news to related organizations/ department
- Survey, collect the flood inundation depth and generate the flood hazard map

Flood types in Myanmar

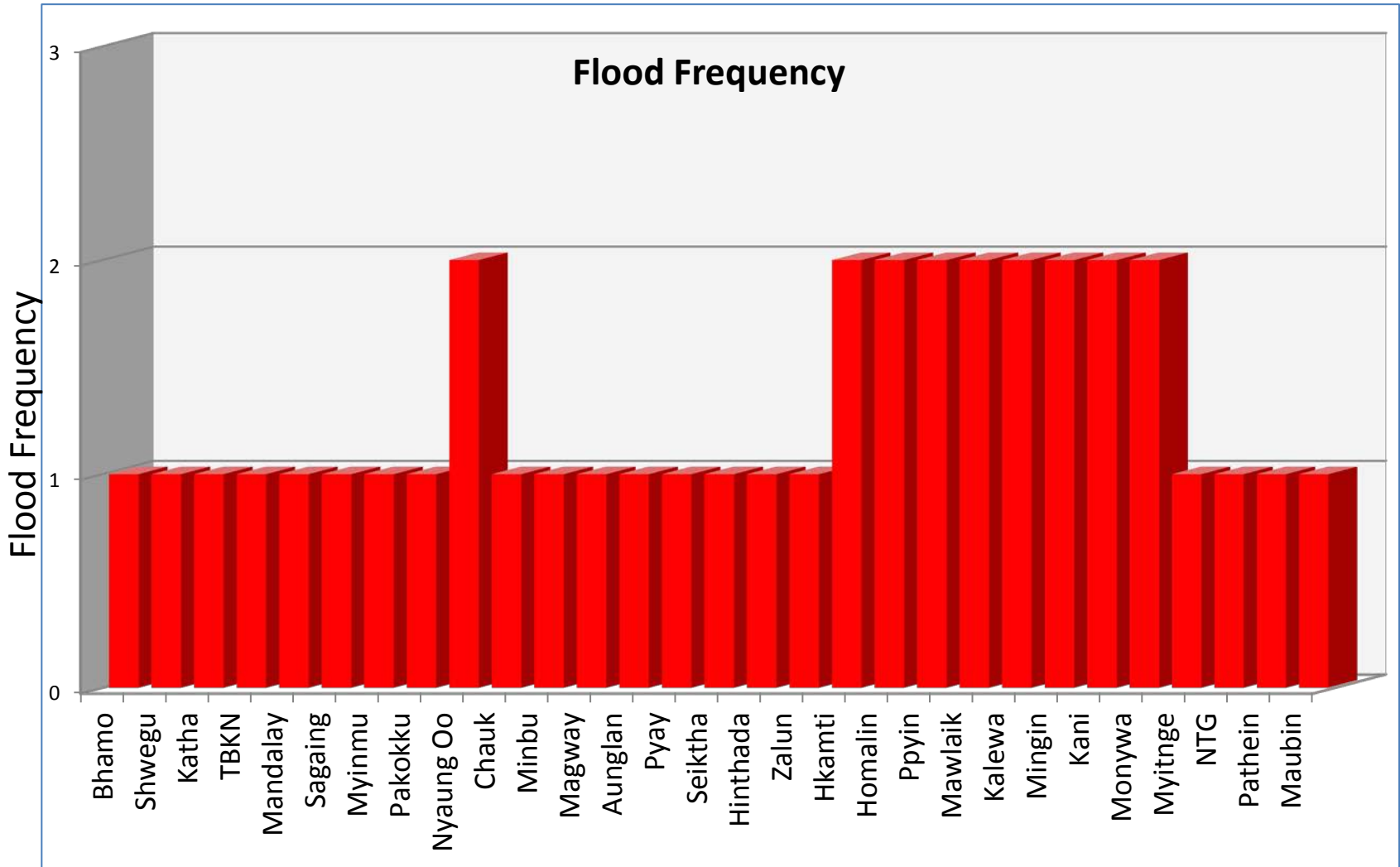
- **Widespread floods** mostly occur in the large and medium rivers. The severe river floods occurred in **1974, 1997 and 2004, 2015, 2016, 2017**
- **Flash floods** usually occur at the small rivers and tributaries of large rivers and also streams in the mountainous regions. The severe flash flood events are Manchanug Flash Flood at ShweSettaw Pagoda in **1987**, Shwegyin Flash Flood in **1997**, Wundwin Flash Flood in **2001**, Kyangin Flash Flood in **2006**, Rakhine Coast Flash Flood in **2010** and ShweChaung flash flood in **2011**

- The flood mostly occurs during July, August and September.
- The floods in Myanmar mainly occur due to the continuous heavy rainfall during monsoon period and also heavy rainfall due to the storms crossing Myanmar.

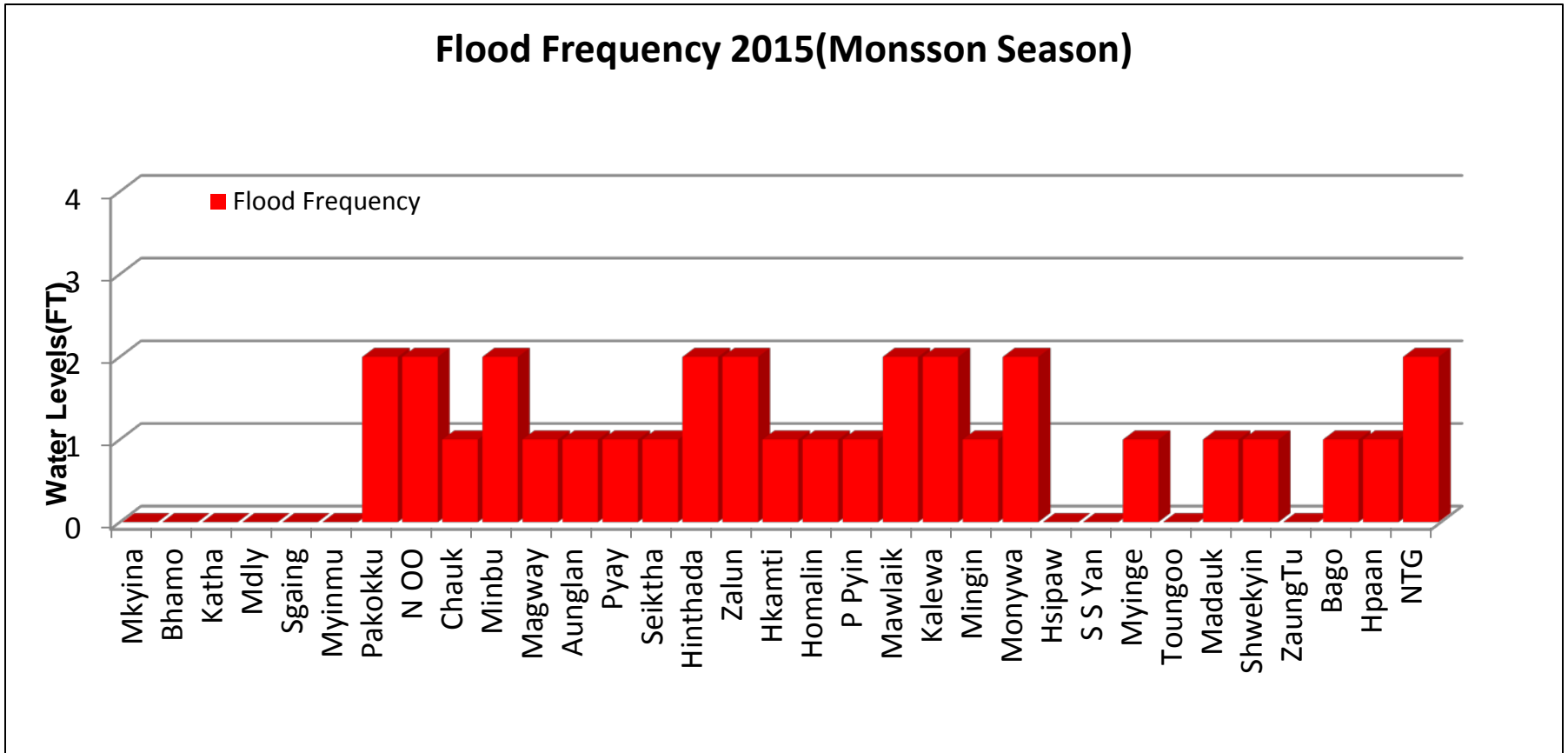
Flood Frequency During Monsoon Season of 2017



Flood Frequency During Monsoon Season of 2016



Flood Frequency During Monsoon Season of 2015



2015 Severe Flood in Myanmar

- Cause - Severe Flood and Landslide by unusually heavy rainfall and also cyclone Komen
- Period - 20 July 2015 to August
- Affected areas - 12 states and Regions except from Kayah and Thanintharyi
- President, in line with the section 11 of Natural Disaster Management Law, **declared Chin State, Sagaing Region, Magway Region and Rakhine State as the worst disaster- affected areas on July 31.**

Impacts of severe flood and landslide in Myanmar



Flash Floods Experience

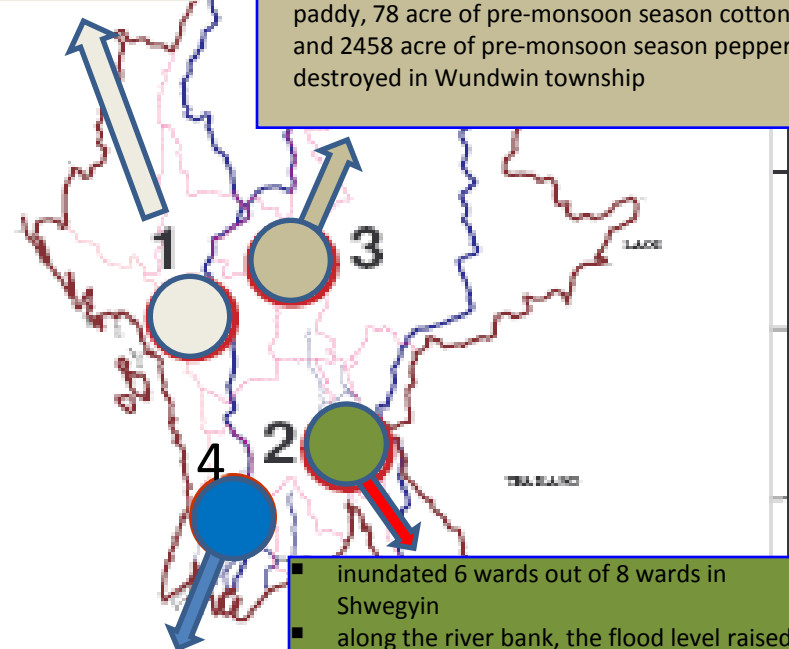
- ❑ 104 houses in Latpandan village and Minbu township were inundated and destroyed
- ❑ it also caused damages to cars, religious rest houses, big and small shops and properties of religious elders amounted to about 2503030.
- ❑ damaged Uyinywa bridge, Padaung bridge, Thitjpyauk Chaung bridge in Ngape towship, Padan Zekar Palta canal, Pan Hlain Min canal

- 3 quarters and 6 villages in Wundwin Township were affected by flood, including (2259) houses and (10) schools.
- (427) Houses and 1 school destroyed
- 42 people killed
- (226) people missed
- (45) Cattle, 1 horse and 128 pigs killed.
- 1188 acre of rainy season sesame, 554 acre of summer season sesame, 155 acre of summer paddy, 78 acre of pre-monsoon season cotton and 2458 acre of pre-monsoon season pepper destroyed in Wundwin township

The causes of flash floods

- Heavy rain
- Rainfall intensity and duration, topography, soil conditions, and land cover
- Over flow of dams and reservoirs
- Poor flowing rate of water in the stream

1. **Manchaung Flash Flood** in 1987
(at Shwe Settaw Pagoda)
2. **Shwegin Flash Flood** in 1997
3. **Wundwin Flash Flood** in 2001
4. **Kyangin Flash Flood** in 2006



- Loss of human life – 18
- Lost Person – 14
- Injured – 1
- Affected person – 1992
- Damaged building – 417
- Damaged Schools – 5
- Inundated paddy field – 5100 acre (Not damage)
- Damaged Bridge – 4
- Damaged Railroad – 1
- Total length of damaged rode – 75 feet
- Broken Gas Pipeline (at 2 places)

- inundated 6 wards out of 8 wards in Shwegyin
- along the river bank, the flood level raised about 2 meter above the ground and caused (215) houses washed away in Shwegyin
- In Shwegyin township, 8 wards and 26 villages, 1/4 of the areas suffered flood and 504 houses washed away.
- The affected population numbered up to (30870).
- The flood caused 3 lost of lives, death of 26 cattle
- damaged (6050) areas of paddy field.

Flash Flood in 2010

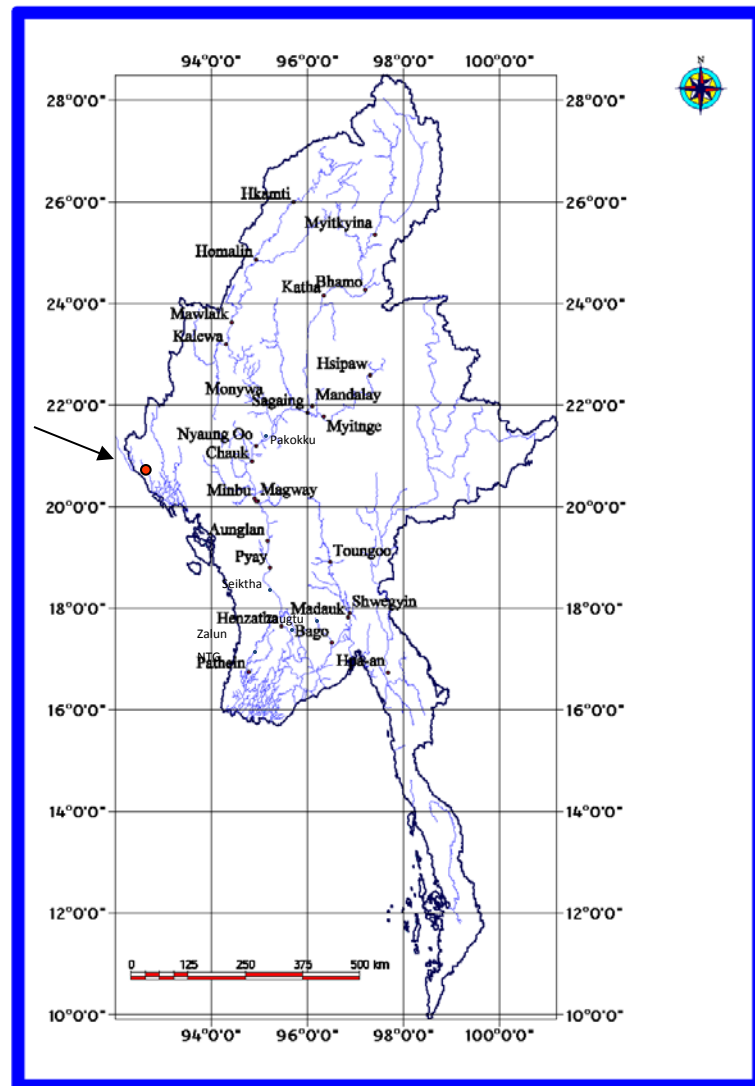
- Due to the strong to vigorous monsoon after advancing the SW monsoon to the whole country, the heavy rainfall occurred in the whole country especially in Rakhine coast.

Buthitaung

Duration	Rainfall (inches)
12-6-2010	3.10
13-6-2010	3.43
14-6-2010	4.30
15-6-2010	18.10
16-6-2010	2.30
17-6-2010	4.30

At Buthitaung Station

Damages caused by flood



Wards/ villages	Death toll			livestock losses				Damages of Houses	Losses of		Diesel (Barrels)
	Male	Female	Total	Buf- falo	Cat- tle	Pig	Goat		Rice	Paddy	
29	35	41	76	10	79	67	85	50	6111	1450	20

2011 Flash Flood

Myanmar• Flash Flood in Myanmar
Situation Report No. 1
24 October 2011



OCHA

United Nations Office
for the Coordination of
Humanitarian Affairs

Coordination Saves Lives

This report is produced by OCHA in collaboration with humanitarian partners. It was issued by OCHA Myanmar Country Office. It covers the period from 20-24 October 2011. The next report will be issued depending on availability of information.

I. HIGHLIGHTS/KEY PRIORITIES

- Flash floods affected the Magway, Mandalay and Sagaing Regions on 19 October. Authorities indicate that some 35,000 people were affected, and 78 either killed or missing.
- Damages to infrastructure hamper access.
- Local authorities immediately started the response, in collaboration with partners. However, needs for food, shelter, NFIs (clothes, blankets, utensils, etc), Oral Rehydration Salt (ORS), etc continue to be recorded.

Magway Region was the worst affected by the floods. There, some 26,000 people living in five Townships of Pakokku District (Myaing, Pauk, Pokokku, Salin and Seikphyu) lost their houses and belongings. The water flow in the local streams raised and washed away 2,123 houses and flooded an additional 8,000 affected, approximately 75% of the houses.

2011 Flash Flood

Thandwe (18.6.2011)

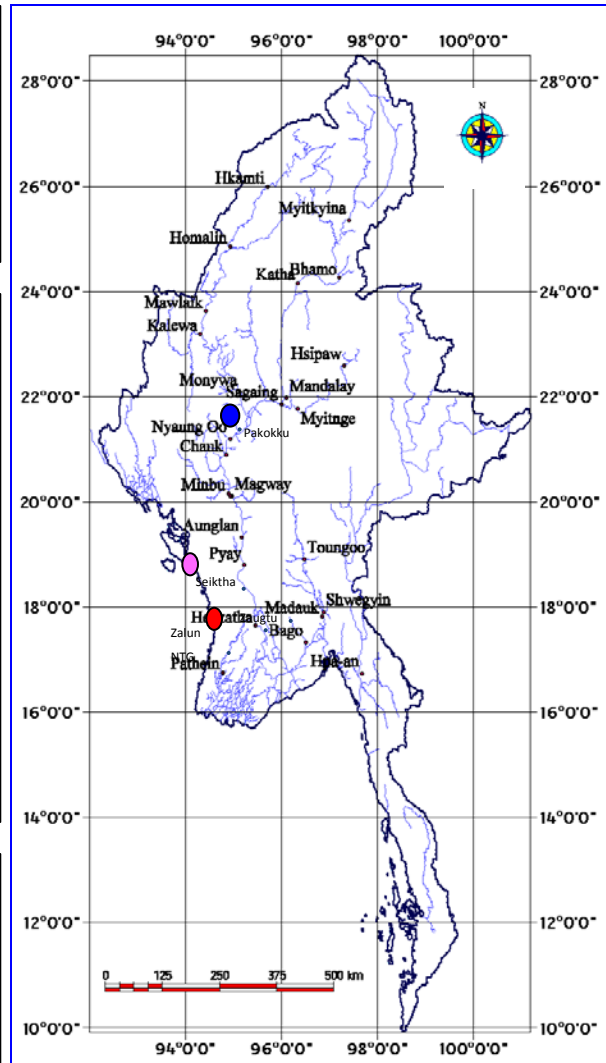
Rainfall 7.48 in (17.6.2011)
12.45 in (18.6.2011)
(Due to Depression at North Bay)

Gwa (19-20 July 2011)

Rainfall 3.68 in (19.7.2011)
13.07 in (20.7.2011)
Affect houses - 356
Affected Population- 1691
Landslide - 20 ft
(Thandwe-Gwa Highway)
- 20 ft
(Gwa- NTG Highway)

Bawlakhe (Nanpon Stream)

- Rainfall 1.54 in (3.10.2011)
- Sonme Street were inundated
- Some houses were inundated



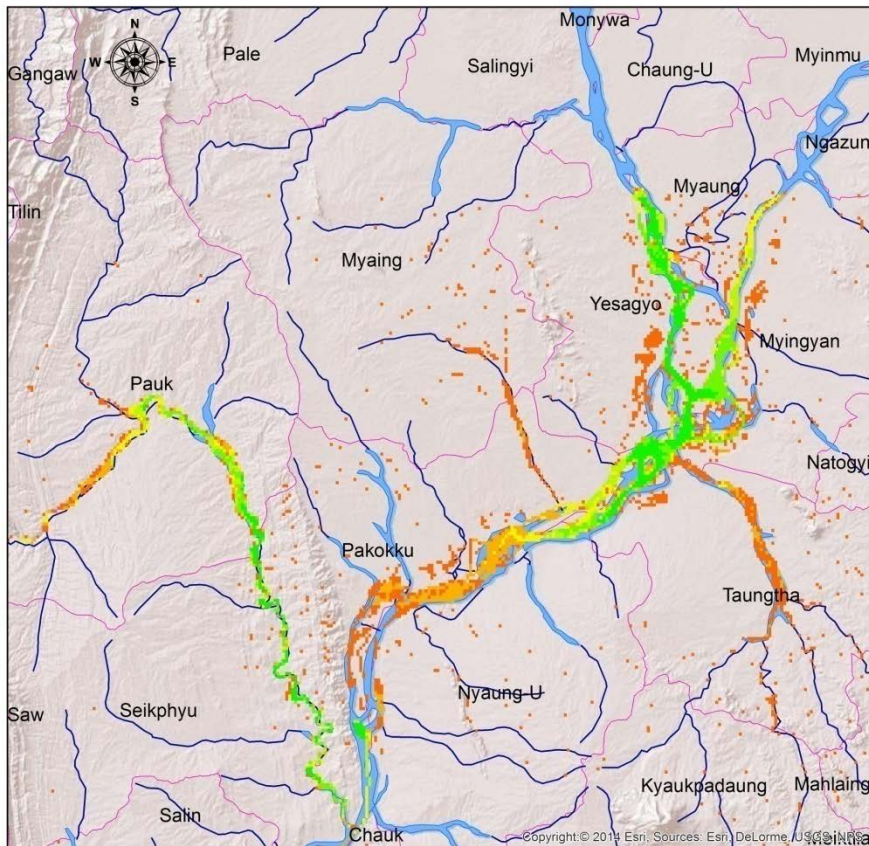
Pakokku District (19-20 Oct 2011)

- Rainfall (18-20 Oct 2011)

Pakokku	6.65 in
Gangaw	5.59 in
Nyaung Oo	9.34 in
Affect Villages/wards	102
Death toll	161
Livestock losses	3384
Damaged Houses	2535
Damaged Gov.Buildings	15
Damaged religious Building	33
Damaged Bridges	7
Affect houses	9523
Affected Population	29751
The loss in terms of cash	1544.59 (million kyats)

2011_flash flood event in Pakokku

2011_Flash flood in Pakokku District



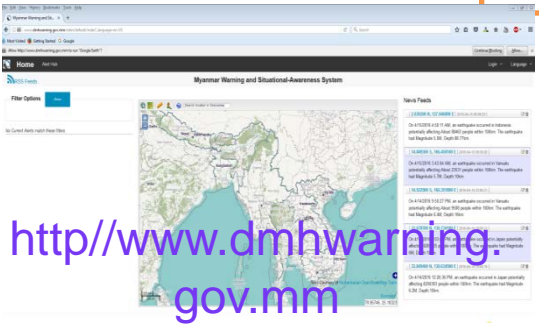
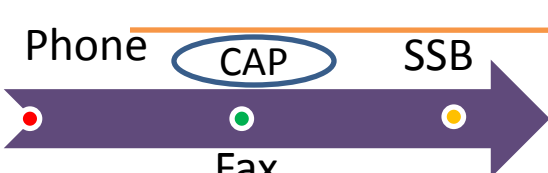
Early Warning Information and Dissemination System in Myanmar



DMH Website
<http://www.dmh.gov.mm>



<http://www.dmhwarning.gov.mm>

Fax

Severe Cyclonic Storm

According to the observations at (09:30) hrs MST today, the Severe Cyclonic Storm "Mora" over East Central and adjoining North Bay of Bengal has reached to North Bay of Bengal. It has started crossing Bangladesh Coasts between Chittagong and Cox'sbazar.

It will be maximum wind speed with (55)mph in Maungdaw and Sittwe district during the Severe Cyclonic Storm is crossing Bangladesh Coasts between Chittagong and Cox'sbazar.

Frequent squalls with rough seas will be experienced off and along Myanmar Coasts. Surface wind speed in squalls may reach (55-60) m.p.h.


During the Severe Cyclonic Storm is crossing to coasts of Bangladesh, probable maximum Storm Surge is about (3-5)feet at Maungdaw district and about (2-4)feet at Sittwe district, Northern Rakhine Coasts.

General caution

Under the influence of Severe Cyclonic Storm, widespread rain or thundershowers in Nay Pyi Taw, Sagaing, Mandalay, Magway, Bago, Yangon, Ayeyarwady and Taninthayi Regions, Kachin, Chin, Rakhine, Kayin and Mon States and fairly widespread rain or thundershowers in Shan and Kayah States with strong wind, regionally and isolated heavyfall.

Advisory

Under the influence of Severe Cyclonic Storm, strong wind, heavy rainfall, flash flood and landslide may occur during this time. Advisory for people living near high land areas, along Myanmar coasts, small river and streams is to take care of landslide and suddenly rise the rivers levels. Domestic flight, trawlers, vessels and ships off and along Myanmar Coasts are advised especially to avoid in condition of the Severe Cyclonic Storm.



DMH couldn't issue for flash flood forecast but just only advisory information.

National capacity for the provision of flash flood early warning

- According to the provision of flash flood early warning, will provide early awareness of impending local flash flood threats as national capacity .

CONCLUSION

DMH cooperation and collaboration with local and international organizations to upgrade the flood forecasting system to reduce the flood risk in Myanmar .

Website-<http://www.dmh.gov.mm>
<https://www.facebook.com/dmhmoezalanaypyitaw/>



Thank you!