

Report on Activities of Working Group on Hydrology (WGH) of TC in 2016

(Item 8 of Tentative Program for TC 49th Session)

(Submitted by WGH)

ACTION REQUIRED:

This Committee is invited to:

- a) Review the activities of TC WGH conducted in 2016
- b) Approve the recommendations and AOPs of WGH for 2017 and beyond

APPENDIXES:

- I. DRAFT TEXT FOR INCLUSION AT SESSION REPORT
- II. Report on activities of Working Group on Hydrology (WGH) of TC in 2016

APPENDIX I

DRAFT TEXT FOR INCLUSION AT SESSION REPORT

8.2 Hydrological Component

1. The Committee reviewed the activities of the Members related to the implementation of the TC Strategic Plan and its annual operating plan (AOP) for the hydrological component during the past year. Details can be found in the **Appendix ??**.
2. The Session noted that, the Members conducted a series of activities in 2016 on hydrological component and achieved remarkable progresses on capacity building of flood forecasting and warning; the serious water-related disaster events, including river flood, urban flood, flash flood and debris flow, and drought happened in some Members such as China, Laos, Japan, Malaysia, Philippines, Vietnam, etc. The hydrological departments in the Members provided valuable service of flood forecasting and warning to the decision-making departments of the Governments.
3. The Session noted with pleasure that, the 5th WGH working meeting was successfully held from 5 to 8 September 2016 in Seoul, the Republic of Korea with theme of “Extreme Flood Forecasting System and Practical Guidelines for the TC Region”. Mr. Sung Eun Kim, the officer of Disaster Risk Reduction Section of UN-ESCAP, presented the “Building Resilience in Asia-Pacific: ESCAP Initiatives and Activities on Disaster Risk Reduction”. The information and Requests/Recommendations from ESCAP Member States in his presentation definitely would play very important role for WGH to propose new cooperation project under the framework of ESCAP disaster risk reduction. The Session expressed its appreciation to the Ministry of Land, Infrastructure and Transport (MOLIT) of the Republic of Korea (ROK), through Han River Flood Control Office (HRFCO) with cooperation of Korea Institute of Civil Engineering and Building Technology (KICT), for kindly hosting the meeting.
4. The Committee was informed on the implementation status in 2016 and future activities of on-going projects (AOPs):
 - a) SSOP-II: Implementation of Achievement of Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-hazard Early Warning System
 - b) Extreme Flood Forecasting System (EFFS)
 - c) Estimation for Socio-economic Impact of Sediment-related Disaster
 - d) Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members
 - e) Extension of Xin’anjiang Model Application in Selected River Basins in TC Members
 - f) Guidelines for extreme flood risk management in TC Region
5. The Session noted that, the contribution from WGH to the project on SSOP-II: Implementation of Achievement of Project of SSOP for Coastal Multi-hazard

Early Warning System. The Session also noted the WGH is willing to cooperate with and integrated its activities into the proposed SSOP-II, however, considering the final version of this initiative does not have any activity directly related to the Group, WGH agreed to remove the project from its AOP2017 list.

6. The Session was informed that, the operation system for EFFS project, which is led by the Republic of Korea, has been established as Level-1 (stage method), Level-2 (Rainfall-Runoff model), Level-3 (Flood Forecasting using radar data) with PC-version, and Level-4 (Establishment of Emergency Action Plan) module will be completed in 2017. The Session also was informed the report of field survey on EFFS in pilot Members, namely Lao PDR, Philippines and Thailand, is under drafting and hopefully be published in 2017 with combination of the Guideline for Extreme Flood Risk Management
7. The Session noted that, the project on Estimation for Socio-economic Impact of Sediment-related Disaster, which was proposed by Japan in 2013 and should be completed and closed in 2016, could not be moved forward because enough data regarding sediment-related disaster had not been collected from the Members in the past years; and WGH agreed the proposal to terminate this AOP from Japan-side at 11th Integrated Workshop which was held in Cebu, Philippine in October 2016.
8. The Session noted with pleasure that, the project on OSUFFIM, which was led by China, made remarkable progresses and achievement in 2016, including:
 - The field Surveys for OSUFFIM pilot study in TC Members were conducted in Hat Yai, Thailand from 16 to 19 May 2016; in Dongguan, China from 25 to 28 August 2016; in Davao and Cebu, Philippines from 24-28 October 2016; and in Vientiane, Lao PDR from 29 November to 4 December 2016, respectively. Prof. Yangbo CHEN, and the staff from RID, Thailand; PAGASA, Philippines and DMH, Lao PDR joined the events, respectively.
 - The OSUFFIM has been put into operation in flood control office of Dongguan city government.
 - Liuxihe Model, which is a physically based distributed hydrological model mainly for catchment flood processes simulation and prediction, has been set up for Utaphao Watershed which the Hat Yai locates in. The processing of super high resolution satellite images for modelling urban flood in Hat Yai city has been completed and the preliminary result has been achieved.
 - The English version of the System is on the stage of updating and the Guidelines of OSUFFIM is under drafting.
9. The Session also was informed that, the project on OSUFFIM made ambitious implementation plan for 2017, including:
 - The pilot study in Hat Yai of Thailand will be continued, and inundation data for the past flood events. And the operation system of OSUFFIM for Hat Yai is proposed to be installed in RID office for operation in trial in first quarter of 2017.
 - The field survey for pilot study in Malaysia with invitation from DID Malaysia is proposed to be conducted in first quarter of 2017 with present of Prof. Yangbo CHEN. DID Malaysia is willing to have a short technical seminar or training course during the field survey.

- A training course on operation of OSUFFIM for selected piloting Members was proposed in March-April 2017 with funding support from SYS University of China.
 - A working meeting or seminar on Thai OSUFFIM application is proposed to hold in Guangzhou in third quarter of 2017.
 - The team will accomplish the Guideline drafting and publishing, and distribute at the 12th IWS to be held in Jeju, the Republic of Korea, from 30 October to 3 November 2017.
 - A 3-day conclusion workshop and training course on OSUFFIM application are proposed to be held in SYS University, Guangzhou, China at the end of 2017. China-side also expressed that the self-funded participants from all TC and PTC Members are welcome. If funding is available from extra resources (such as ESCAP, WMO), the participants from PTC Members are welcome to join the proposed workshop/training course as one activity of enhancing the cooperation of two regional bodies.
10. The Session noted that, considering this project was proposed to be closed in 2017, SYS University was requested from Members to conduct phase-II for OSUFFIM so that to extend the achievement of OSUFFIM to more TC Members. The Session also noted with appreciation that Prof. CHEN Yangbo from SYS University, as chief scientist of OSUFFIM, is willing to contribute his knowledge and share his expertise on urban flood forecasting and inundation mapping to the Members.
 11. The Session noted that, the request to SYS University of China from Members to consider conducting phase-II for OSUFFIM to extent the application in selected pilot cities from more Members starting from 2018 after the current OSUFFIM project to be closed at 50th Annual Session of TC.
 12. The Session was informed that, the project on Extension of Xin'anjiang Model Application in Selected River Basins in TC Members, which is led by Bureau of Hydrology (BOH) of China, will be closed at TC 49th Session to be held in Japan in February. The final report drafted by BOH of China in cooperation with DID Malaysia was published as TC publication (TC/TD-No. 0012) of 2016. The Session also noted that BOH, China is willing to provide the technical support to the interesting Members after this project.
 13. The Session noted the progresses achieved on the project of Guidelines for Extreme Flood Risk Management in 2016 with support of HRFCO in cooperation with KICT of Korea and Members. The Session was informed that WGH set up a working team at 5th TC WGH meeting for reviewing and drafting Guidelines which is expected to be published in 2017.
 14. The Session noted the result of evaluating the effectiveness of on-going activities in WGH with the target to develop Members' capacity following the decision of the Committee made at 48th Session. The evaluating result indicated that, generally, most of the activities in WGH have very good effectiveness with the target to develop Members' capacity, and also have very important roles on enhancement of the close collaboration among Members.
 15. The Session noted that, WGH established the project-bank for next years under TC Strategic Plan and the strategic framework of ESCAP and WMO on

water-related disaster reduction, which mainly focuses on enhancing the knowledge and capacity building on the management of water-related disaster risks for a resilient future in Typhoon Committee region, including:

- Innovative flood forecasting for non-data river basin;
- Flash flood (landslide, mud-flow) prediction and warning using QPE/QPF;
- Extension the application of urban flood forecasting and inundation mapping;
- Rainfall-runoff inundation mapping for river basins;
- Radar and satellite data utilization in flood forecasting and warning;
- Long-term forecasting for water resource management and drought monitoring and warning under climate change;
- Data-sharing in transboundary rivers;
- Dam operation for flood risk management under climate change;

16. The Session noted that WGH requested and encouraged Members to propose and profile new cooperation projects on hydrological component. The Session was informed currently some initiatives have been under consideration, including:

- ICHARM of Japan proposed a new project on Flash Flood Risk Information for Local Resilience to be officially launched at TC 49th Annual Session as WGH AOP 1 for the period from 2017 to 2019 with objective to develop a guidance tool for enhancing local resilience to flash flood disaster risks and disseminate it among the WGH member countries.
- HRFCO of the Republic of Korea proposed two initiatives: (1) Application of Hydrological Data Quality Control System in TC Members, and (2) Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique as two new WGH AOPs for the period from 2018 to 2022. Korea side will give shape to a work plan for these activities in 2017 through further discussion at 6th WGH working meeting, and will be officially launched at TC 50th Annual Session in 2018.
- BOH of China proposed a new project on Impact Assessment of Climate Change on Water Resources Availability in TC Members as WGH new AOP for the period from 2018 to 2020 with the objective to predict quantitatively the water resources availability, particularly drought trend in TC members in the context of climate change.

17. The Committee noted that Dr. OKAZUMI, Toshio, Director of Ministry of Land, Infrastructure, Transportation and Tourism, MLITT being on behalf of Japan Focal point of WGH announced that MLITT will enhance its support to Typhoon Committee collaboration with ICHARM International Flood Initiative project, which Prof. Koike introduced at the Technical Presentation and other related projects of JICA and ADB

CONCLUSIONS OF WGH

18. On the basis of the outcomes 5th WGH working meeting and the discussion of the WGH Parallel Session at 11th IWS, the following conclusions were reached:
- The working meeting of WGH is very important to review hydrological activities, deep technical discussion and implementation status of WGH AOPs, and also is very necessary to prepare IWS and annual session. The funding support and contribution from the Republic of Korea played the vital role in organizing the annual working meeting. WGH encourages the more and wider resources to support the activities to keep its sustainability.
 - The proposal of the Project on SSOP-II: Implementation of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, under the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries, has been shortlisted and forwarded to the final step in the hardworking and efforts of TCS. This initiative has both a regional and national-level components with the major objective to training Members on how to prepare SSOP by using the Manual so that to promote the capacity building on multi-coastal disaster early warning. To ensure the effectiveness of implementation and measure the outcomes indicators at the evaluate stage, the Committee with the RSMC Tokyo and New Delhi could focus on project implementation at regional level, and the national level component can be implemented with the support from RIMES. Such collaboration may facilitate successful outcomes at both levels. The close cooperation from beneficiary countries and target countries is very important to a successful project.
 - It is recognized that, to promote the capacity of forecasting, early warning and risk management for urban flood is an urgent need among TC Members, especially the real-time operational system on urban flood forecasting and inundation mapping. As the subsequent activity of TC first Cross-cutting project of Urban Flood Risk Management (UFRM), the on-going project of WGH on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) is a tangible measure on this aspect and it will play very meaningful and important role for TC Members to promote the capacity on the technique of urban flood forecasting and warning. To extend the achievement of pilot study in the region is necessity and meaningful to promote the capacity on urban flood risk forecasting and warning. It also could be considered as an activity under the cooperation mechanism of TC and PTC.
 - To develop the Extreme Flood Forecasting System and the Guidelines for Extreme Flood Risk Management will be definitely beneficial for the TC Members to strengthen their capacity on extreme flood risk reduction, especially under climate change. To enhance the achievement of development, the situation and needs on flood risk management in the Members should be considered and integrated into the System and Guidelines.
 - It is a consensus on that, to draw up a plan on considering and proposing a bank of new cooperation projects under the umbrella of TC Strategic Plan in a linkage with the initiatives and activities of ESCAP and WMO would be an urgent matter at present for WGH since all on-going AOPs of WGH will be closed in 2016 and 2017. In order to conduct the cooperation projects sustainably in TC Members, WGH discussed and determined the list of topics as the priority cooperation activities for long-term direction to develop the Member's Capacity on water-related disaster risk forecasting and warning.

RECOMMENDATIONS OF WGH

19. On the basis of the outcomes of 5th WGH working meeting and the discussion at the Parallel Session of 11th IWS and subsequent discussion, the WGH made the following recommendations:
- To appoint Mr. Yoshio Tokunaga from ICHARM of Japan as Chairperson, Dr. CHO Hyo Seob from HRFCO of the Republic of Korea and Dr. HOU Aizhong as Vice-Chairpersons of WGH, until the group selects a Chairperson and Vice-Chairpersons for the term of next two years to 51st Annual Session.
 - To request US\$24,000 from TCTF in total for supporting overall WGH activities for 2017 calendar year.
 - To request US\$6,000 special budget to support hosting OSUFFIM final workshop in SYS University, Guangzhou, China in the end of 2017.
 - To remove the SSOP-II from the list of WGH AOP2017 list.
 - To approve the proposal from ICHARM, Japan on Flash Flood Risk Information for Local Resilience by ICHARM of Japan as WGH AOP for the period from 2017 to 2019;
 - To request HRFCO, MOLIT of Republic of Korea to host WGH 6th working meeting with funding support in 2017.
 - To request SYS University, China to organize the final workshop on urban flood forecasting and inundation mapping with funding supporting. The workshop may be considered as one activity of enhancing the cooperation mechanism of two regional bodies of TC and PTC. The participants from PTC Members could be involved in the workshop if the funding is available from extra resources (such as ESCAP, WMO) ;
 - To request SYS University of China to consider the possibility of conducting phase-II for OSUFFIM to extent the application in more Members starting from 2018 after the current OSUFFIM project.
 - To request the Republic of Korea to draft the detail proposal for two initiatives, namely, the Application of Hydrological Data Quality Control System in TC Members, and the Application of Stochastic Flood Forecasting in TC Members as WGH new AOPs for the period from 2018 to 2022;
 - To request BOH of China to schedule the detail implementation plan for the initiative on Impact Assessment of Climate Change on Water Resources Availability in TC Members as WGH AOP for the period from 2018 to 2020;
 - To encourage Members proposing and leading the cooperation projects for hydrological component.
 - To request ESCAP and WMO to continue the support to implement further the on-going project of real-time Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM), which can be used in PTC and TC region.
 - To encourage the Beneficiary Countries and Target Countries to cooperate closely and forwardly with TCS on implementing SSOP-II should the funds become available.
 - To request ESCAP and WMO to provide guidance and assistance to TC proceeding with the project of SSOP-II should funds become available.
 - To continue focusing on improving the ability to forecast hydrological phenomena and provide measures for the effectiveness of the improvements.

APPENDIX II

Report on Activities of Working Group on Hydrology (WGH) of TC in 2016

In 2016, Working Group on Hydrology (WGH) of Typhoon Committee (TC) conducted a series of activities very positively referring to the decision of 48th Session which was held at the Ala Moana Hotel, Honolulu, Hawaii, from 22 to 25 February 2016. This report was drafted mainly on the base of the outcomes of 5th WGH working meeting which was held in Seoul, the Republic of Korea from 5 to 8 September 2016, and the discussion of the parallel session of TC 11th Integrated Workshop (IWS) which was held in Cebu, the Philippines from 24 to 28 October 2016.

The report highlighted the main progresses and achievements on hydrological component in Members in past year; briefly described the activities of WGH conducted in 2016, and summarized the status of implementation of WGH AOPs 2016. Based on the communication among Members and the discussion at TC 11th IWS, WGH proposed the implementation plan of AOPs for 2017 and beyond; and consequently requested the TCTF allocation for supporting WGH activities in the year of 2017.

THE MAJOR PROGRESSES ON HYDROLOGICAL COMPONENT OF MEMBERS IN 2016

- 1) The Members of the Committee in 2015 conducted a series of activities on hydrological component and achieved remarkable progresses in term of hydrological monitoring, data collection, data processing and flood forecasting.
- 2) In 2016, the serious flood disaster events, including river flood, urban flood, flash flood and debris flow happened in some Members such as China, Lao PDR, Japan, Malaysia, Philippines, Vietnam, etc. The hydrological departments in the Members provided valuable service of flood forecasting and warning to the decision-making departments of the Governments.

REVIEW OF THE FIFTH WGH WORKING MEETING

- 3) The 5th WGH working meeting was held in Seoul, the Republic of Korea from 5 to 8 September 2016. The meeting was hosted by the Han River Flood Control Office (HRFCO), Ministry of Land, Infrastructure and Transport (MOLIT) of the Republic of Korea (ROK) in cooperation with Korea Institute of Civil Engineering and Building Technology (KICT) with the generous offer of financial support, and co-chaired by WGH chairperson Mr. Tokunaga YOSHIO and the vice chairperson Dr. Hyo-Seob CHO.
- 4) The meeting was attended by about 20 participants from China, Japan, Laos, Malaysia, Philippines, the Republic of Korea, Thailand, USA and Vietnam. Mr. Sung-Eun KIM, the officer of UNESCAP and Dr. Jinping LIU, the hydrologist of TCS took part in the meeting.
- 5) The theme of the meeting was proposed as “Extreme Flood Forecasting System and Practical Guidelines for the TC Region” with the following purposes:
 - to review the implementation progresses of WGH Annual Operating Plan (AOP) in 2016;

- to present the Extreme Flood Forecasting System and to demonstrate it
 - to present a framework of Guidelines for Practical Response to Extreme Flood;
 - to review on a framework of Guidelines by the pilot target countries;
 - to discuss deepening the cooperation among WGH;
 - to discuss the preparation and hydrological contribution to prepare the 11th Integrated Workshop to be held in Philippines On 24-28 October 2016 and 49th Annual Session to be held in Japan on 20-23 February 2017.
- 6) The Session was informed that, Mr. Sung Eun Kim, the officer of Disaster Risk Reduction Section of UN-ESCAP, presented the “Building Resilience in Asia-Pacific: ESCAP Initiatives & Activities on DRR”. The participants recognized that, the information and Requests/Recommendations from ESCAP member States in his presentation definitely would play very important role for WGH to propose new cooperation project under the framework of ESCAP disaster risk reduction.
- ESCAP, together with WMO, has been supporting the member States in the Northern Pacific Ocean to jointly address risk from cyclones and other coastal hazards.
 - ESCAP is managing a multi-donor trust fund for tsunami, disaster and climate preparedness, supporting capacity building projects in Asia and the Pacific. Facilitated sub-regional cooperation platform for coastal multi-hazard early warning systems -- Synergized Standard Operating Procedures for Coastal Multi-Hazards Early Warning System (SSOP).
 - ESCAP has fostered sharing of knowledge, expertise and experiences of TC and PTC. In addition to the support for SSOP, a joint project of TC and PTC, ESCAP hosted the 3rd joint session of TC and PTC in February 2015. Moreover, it has supported joint training of TC and PTC.
 - Space applications (Earth Observation), climate and numerical models enhance substantially drought monitoring and early warning capacity. The objective of the regional drought mechanism is to integrate these knowledge products and services into the operational drought monitoring and management systems.
 - ESCAP’s Effort on Regional Cooperation for Floods focus on innovations in flood forecasting and establish inter-governmental platform of stakeholders.
 - ESCAP supports capacity building of member States in addressing disaster risk.
- 7) The WGH expressed their heartfelt appreciation to MOLIT, through HRFCO with cooperation of KICT, for kindly hosting the meeting and for all the excellent hospitality and logistic arrangement.

PROGRESSES OF WGH AOPS IN 2016 AND IMPLEMENTATION PLAN FOR 2017 AND BEYOND

- 8) The WGH has 7 AOPs in 2016 which are listed in table 1. The leading Countries made their great efforts and mostly achieved the expected results and progresses. The implementation statuses of WGH AOPs in 2016 are shown in Annex 1 and the success indicators of WGH AOPs for 2017 are shown in Annex 2.

Table 1. The summary of WGH AOPs in 2016 and beyond

	<i>Projects</i>	<i>Driver</i>	<i>Duration</i>
AOP1	SSOP-II: Implementation of Achievement of Project of SSOP for Coastal Multi-hazard Early Warning System	TCS	2016-2017
AOP2	Extreme flood forecasting system	Korea	2012~2017
AOP3	Estimation for Socio-economic Impact of Sediment-related Disaster	Japan	2013~2016
AOP4	Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members	China	2014~2017
AOP5	Extension of Xin'anjiang Model Application in Selected River Basins in TC Members	China	2013~2016
AOP6	Guidelines for extreme flood risk management in TC region	Korea	2013-2017

AOP1: SSOP-II: Implementation of Achievement of Project of SSOP for Coastal Multi-hazard Early Warning System

- 9) The hydrologist of TCS Dr. Jinping LIU briefed the progresses after TC 48th Session and the current status of SSOP-II. The message from Panel of ESCAP Trust Fund on the proposed of SSOP-II which was re-submitted after WGDRR 11th workshop was forwarded to the participants.
- 10) The meeting noted that, the version of the proposal, which was submitted at TC 10th IWS, has been changed a lot according to the comments from ESCAP and RCMS-Tokyo with current activities proposed as:
 - Activity 1:** Conducting the training courses/workshops on mechanism of establishing and preparing SSOP for coastal multi-hazards EWS for DRR experts and warning experts from NTWCs, NDMOs, and Government sectoral agencies of 10 beneficiary countries at national level (3 days in RTC, Nanjing).
 - Activity 2:** Conducting consulting workshops (2 days) at national-level for selected 3 nations from TC and PTC regions (based on Activity 1) on supporting updating and improving the existing SOPs by using the knowledge of Manual of SSOPs in combine with Monsoon Forums of RIMES in April-May and October-November 2017 (or in October-November 2017 and April-May 2018, depends on the schedule of RIMES workshops) under the umbrella of UN ESCAP (2 x 3 national consulting workshops in selected countries, in total 6 workshops).
 - Activity 3:** Conducting RSMC attachment training in RSMCs Tokyo and New Delhi for Tropical Cyclones forecasters of selected 4 nations from TC and PTC regions (14 days in Tokyo x the number of selected nations in PTC region in Tokyo, 14 days in New Delhi x the number of selected countries in TC region).
- 11) The meeting was glad to be informed that the initiative has been short-listed among over one hundred others, and also noted that there are still many work to do on the final

version for final decision. The meeting expressed its appreciation to TCS for the efforts on drafting and proposing the initiative.

- 12) WGH recognized the initiative should be a very good cooperation project and expressed its willingness to cooperate with SSOP-II. Considering the final version of the initiative does not have activity directly related to WGH, however, the meeting agreed to remove the project from WGH AOP2017 list.

AOP2: Extreme Flood Forecasting System (EFFS)

- 13) The project of Extreme Flood Forecasting System (EFFS) made the progresses in 2016 including:

- The extreme flood forecast system has been established as Level-1(stage method), Level-2(Rainfall-Runoff model), Level-3(Flood Forecasting using radar data) with PC-version, and Level-4(Establishment of Emergency Action Plan) module will be completed in 2017.
- The field survey report has been reviewed with the pilot country Members, namely Lao PDR, Philippines and Thailand, and it will be combined to the guideline for extreme flood risk management.
- The TC WGH webpage has been operated for sharing information among WGH members.

- 14) The Plan of AOP2 for 2017 was scheduled as below:

- The operational system of EFFS will be finalized until August.
- The system will be distributed and installed targeting the three pilot country members, and system configuration will be conducted from September to December.
- The TC WGH webpage operation will be continued.
- The User Manual of EFFS will be finalized and published. And the Project on EFFS will be closed at TC 50th Session.

AOP3: Project on Estimation for Socio-economic Impact of Sediment-related Disaster

- 15) The project on Estimation for Socio-economic Impact of Sediment-related Disaster led by Japan was launched in 2013 and proposed to be completed in 2016. Because enough data regarding sediment-related disasters had not been collected from the Members, this project could not reach the proposed and expected goal.

AOP4: Development Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for Selected TC Members

- 16) The project of OSUFFIM, led by China, conducted a series of activities and reached remarkable progresses in 2016 on pilot study in both China and Thailand, including:

- The field Surveys were conducted in Hat Yai, Thailand on 16 to 19 May 2016 and in Dongguan, China on 25 to 28 August 2016, respectively. Prof. Yangbo CHEN and the Thai OSUFFIM team took part in two events.
- Liuxihe Model ---- a physically based distributed hydrological model mainly for catchment flood processes simulation and prediction ---- has been set up for Utaphao Watershed which the Hat Yai locates in. The processing of super high resolution satellite images for modeling urban flood in Hat Yai city has been completed and the preliminary result has been achieved. The meeting also noted

the next step of the pilot study in Hat Yai will focus on the processing the space data, including elevation, width and slope of every road (street); vegetation and roughness; cross-section shape and size of drainage system, including canal and underground pipelines; and inundation data for the past flood events.

- The OSUFFIM has been put into operation in flood control office of Dongguan government.
- The English version of System is on the stage of updating and the Guidelines of OSUFFIM is under drafting.
- The field survey mission of pilot cities in Davao and Cebu, Philippines was conducted from 24-28 October 2016, and in Vientiane from 29 November to 4 December 2016 were very successful and efficient. Prof. Yangbo CHEN and the staff from PAGASA and DMH joined two events, respectively.

17) The plan of OSUFFIM for next steps and 2017, including:

- The operation system of OSUFFIM for Hat Yai is proposed to be installed in RID office for operation in trial in first quarter of 2017.
- The field survey for pilot study in Malaysia was suggested by DID Malaysia to be conducted in February 2017 with present of Prof. Yangbo CHEN. DID Malaysia is willing to have short session technical training during the field survey and suppose to have English Version of the OSUFFIM model.
- A training course on operation of OSUFFIM for Piloting Members was proposed in March-April 2017.
- Up to 6th WGH working meeting in September/October 2017, the OSUFFIM team will update the system and improve the modelling result based on the real-time operation in Hat Yai and Dongguan, and will consider selecting new pilot cities for pilot studies in cooperation with TC Members.
- A working meeting or seminar on Thai OSUFFIM is proposed to hold in Guangzhou before TC 12th IWS.
- The team will accomplish the Guideline drafting and publishing, and distribute at the 12th IWS which will be held in October 2017 in the Republic of Korea.
- A 3-day conclusion workshop and training course on OSUFFIM application are proposed to be held in SYS University, Guangzhou, China at the end of 2017, in order to exchange the experiences and to extend the achievement of OSUFFIM application. China-side expressed its willingness to consider providing partially funding support for the participants from under-developed TC Members. China-side also expressed that the self-funded participants from all TC and PTC Members are welcome. If funding is available from extra resources (such as ESCAP, WMO), the participants from PTC Members are welcome to join the proposed workshop/training course as one activity of enhancing the cooperation of two regional bodies.
- The participants recognized the importance and necessity of development of a prototype real time OSUFFIM for TC Members to promote the capacity of early

warning of urban flood and emergency response, particularly urban flood forecasting and inundation mapping. Considering the good progresses of current OSUFFIM project, the OSUFFIM team was requested by Members to consider conducting phase-II for OSUFFIM to extent the application in selected pilot cities from more Members starting from 2018 after the proposed OSUFFIM project to be closed at 50th Annual Session.

AOP5: Xin'anjiang Model Application in Selected River Basins in TC Members

- 18) The AOP5 on Xin'anjiang model application in selected river basins in TC Members is running for Sg Selangor river basin in the office of Department of Irrigation and Drainage (DID) Malaysia.
- 19) There are some problems on application the mathematic hydrological model identified as below:
 - Training. The training period within one week is not enough to make modelers understand the model fully including parameters calibration and real-time forecasting, find the problem that arises in that class and create a new application for new catchments. The training on modeling application should be enhanced under the umbrella of TC cooperation.
 - Data quality control. The problem has been found on hydrological data quality. The simulation results for historic flood are not so satisfied due to the deficiency of data qualify. The data
- 20) This project will be closed in 2016. BOH of China in cooperation with DID Malaysia will summarize the project and the final report will be distributed and distributed at 49th Annual Session to be held in Japan in February 2017.
- 21) The BOH is willing to provide the technical support to the interesting Members after this project.

AOP6: Guidelines for Extreme Flood Risk Management

- 22) The main progresses of this project in 2016 was drafting the Guidelines for Extreme Flood Risk Management in TC region which was presented and discussed at 5th WGH working meeting.
- 23) In order to have a better Guidelines, 5th TC WGH meeting decided to consist a working team for reviewing and drafting with core members as:
 - Dr. Chung-Soo KIM, KICT, RO Korea
 - Ms. Supinda Wattanakarn, RID, Thailand
 - Mr. Somphanh VTHAYA, DMH, Lao PDR
 - Mr. Badilla, Roy Amadore, PAGASA, Philippines
 - Ms. DANG Thanh Mai, NCHMF, NHMS, Vietnam
 - Prof. Yangbo CHEN, SYS University, China
- 24) Working team Members had a small meeting at the 11th IWS to be held in Cebu, Philippines from 24 to 28 October 2016. Future working plan has been decided to review and revise the Guidelines deeply and carefully before officially publish as TC publication in 2017, including:

- The guideline for revision will be distributed to working members until November.
- The working team Members are requested to review the guideline until February 2017
- The working team Members will discuss about the comments and suggestion during the 49th Session and rewrite the guideline until March 2017
- The 6th WGH working meeting will be hosted in conjunction with the user training courses.
- The Guideline for Extreme Flood Risk Management in TC region will be finalized and published, and will be distributed at 12th IWS.

EVALUATING THE EFFECTIVENESS OF ON-GOING ACTIVITIES IN WGH

- 25) Following the decision of the Committee made at 48th Session to request TCS to evaluate the effectiveness of the activities in the Committee, with the target to develop Members' capacity, WGH distributed a questionnaire to the project leaders of WGH AOPs, and 4 of 5 on-going projects completed the questionnaire. Based on the feedback of questionnaires, a form of evaluation was designed with the specific items listed under the general categories of implementation status, capacity of human resources development, capacity on system development, capacity on infrastructure development, and the comments from participating Members.
- 26) The level and point to evaluate the specific items were set as Outstanding (4), Very Good (3), Good (2), Adequate (1), In-adequate (0). The number of participating Members reflects the role and contribution of the project in the TC Members. If the number is or more than 4, it can be evaluated as outstanding, and so on. If the item is Not Applicable for the project, just put NA.
- 27) According to the average points by all relevant items, the level of effectiveness evaluation of WGH on-going projects were summarized in Table 4.
- 28) In general, most of the activities in WGH have very good effectiveness with the target to develop the Member's capacity, except the project which could not be able to be completed because of the internal problem from leading country.

Table 4 Effectiveness evaluation of the activities in WGH

Project names and points	Effectiveness with target to develop Members' Capacity				
	Outstanding	Very Good	Good	Adequate	In-adequate
AOP2: Extreme flood forecasting system (3.0)		x			
AOP3: Estimation for Socio-economic Impact of Sediment-related Disaster (0.42)				x	
AOP4: Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members (3.57)	x				

AOP5: Extension of Xin'anjiang Model Application in Selected River Basins in TC Members (3.0)		x			
AOP6: Guidelines for extreme flood risk management in TC region (3.25)		x			

- 29) In general, most of the activities in WGH have very good effectiveness with the target to develop the Member's capacity, except the project which could not be able to be completed because of the internal problem from leading country.

NEW PROPOSAL AOP IN WGH FOR 2017 AND BEYOND

- 30) The participants discussed the following topics recommended from 5th working meeting and reached consensus on that WGH should mainly focus on enhancing the knowledge and capacity building on the management of flood disaster risks for a resilient future in Typhoon Committee region.
- Innovative flood forecasting for non-data river basin;
 - Flash flood (landslide, mud-flow) prediction and warning using QPE/QPF;
 - Extension the application of urban flood forecasting and inundation mapping;
 - Rainfall-runoff inundation mapping for river basins;
 - Radar and satellite data utilization in flood forecasting and warning;
 - Long-term forecasting for water resource management and drought monitoring and warning under climate change;
 - Data-sharing in transboundary rivers;
 - Dam operation for flood risk management under climate change;
- 31) The participants realized that, it is an urgent matter at present for WGH to consider and propose a series of new cooperation initiatives since all AOPs of WGH will be closed in 2016 and 2017.
- 32) The participants took note with appreciation the information delivered at 5th working meeting by Mr. Patrick CHAN from National Weather Service Weather Forecast Office Guam, USA on Flash flood Guidance and QPE/QPF research and application in NOAA. The participants recognized the advantages on those aspects should be very helpful to promote the capacity building on flood-related disaster forecasting and warning, and requested USA to consider the possibility of leading one or two cooperation projects on this area for WGH.
- 33) The participants took noted with appreciation that, HRFCO of Korea is willing to propose or to take part in a project on rain radar and satellite data utilization in flood forecasting and warning; ICHRAM of Japan is considering to propose and lead a project on rainfall-runoff inundation mapping for river basins; RID of Thailand and DID Malaysia are considering to consider the possibility of proposing and leading the initiatives on drought monitoring and water resources management.
- 34) Members are encouraged to propose and profile new projects to establish a project-bank for WGH activities in next years, considering the new Strategic Plan of Typhoon Committee and the strategic formworks of ESCAP and WMO.
- 35) The new project on Flash Flood Risk Information for Local Resilience as WGH AOP 1 for the period from 2017 to 2019 was proposed ICHARM of Japan.

- The main objective of this initiative is to develop a guidance tool for enhancing local resilience to flash flood disaster risks and disseminate it among the WGH member countries.
 - The basic principle is to integrate 1) risk forecasting methods on flash flood, 2) monitoring methods using SAR on flash flood damages and 3) communication methods on effective use of flash flood information into one tool.
 - Activities for the initiative will include: Data Collection; Simulator on Flood and Sediment Movement; Risk Information and Warning System for Evacuation; Communication System and Land Use.
 - The preliminary roadmap for this initiative was scheduled as below:
 - 2017 quarter 1 – Technical Presentation in 49th TC annual session to be held in Japan in February 2017
 - 2017 quarter 2-4 – Case Study in Japan, Introduction at 6th WGH working meeting and 12th TC IWS and needs assessment and discussion among Members.
 - 2018 quarter 1 – 1st Draft Guideline, Screening for the Sturdy area in TC Members (TBD)
 - 2018 quarter 2 - 2019 quarter 3 – Case Study in some TC Members
 - 2019 quarter 3 - 4 – Final Report
- 36) Application of Hydrological Data Quality Control System in TC Members and Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique were proposed by HRFCO of the Republic of Korea as two new WGH AOPs for the period from 2018 to 2022. Korea side will give shape to a work plan for these activities in 2017 through further discussion at 6th WGH working meeting, including the main objective, the basic principle, the main activities and the preliminary roadmap. And this initiative will be officially launched in 2018 at TC 50th annual session.
- 37) The project on Impact Assessment of Climate Change on Water Resource Availability in TC Members was proposed by BOH of China as a new WGH project from 2018 to 2020, and this initiative will be officially launched in 2018 at TC 50th annual session.
- The overall objective of the proposal is to quantitatively assessment of water resources availability, particularly drought trend in TC members in the context of climate change, to improve TC members' capacity by holding several training courses, and providing scientific supports for sustainable water resources utilization of pilot catchments.
 - the main activities of the proposal are as follows:
 - Test suitability of RCCC-WBM model to pilot catchments of TC members. Collect hydro-meteorological data and general information of typical catchment with the supports from TC members, analyze hydrological features of these catchments, test performance of RCCC-WBM model.
 - Organize training workshops on RCCC-WBM model. Prepare training materials of RCCC-WBM model; organize 3 workshops during a 3-year proposal period, once in each year, 20-30 trainees in each workshop. Workshops will be organized in different places or countries.
 - Application of RCCC-WBM for drought assessment of pilot catchment. The code of RCCC-WBM will be shared with trainees, and trainers will help them to apply

the model to pilot catchments for hydrological modeling and drought assessment.

- 38) The WGH AOPs in 2017 and beyond are summarized in table 2.

Table 2 the summary of WGH AOPs in 2017 and beyond

	Projects	Driver	Duration
AOP1	Flash Flood Risk Information for Local Resilience	Japan	2017~2019
AOP2	Extreme flood forecasting system	Korea	2012~2017
AOP3	Guidelines for extreme flood risk management in TC region	Korea	2013-2017
AOP4	Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members	China	2014~2017
AOP5	Application of Hydrological Data Quality Control System in TC Members	Korea	2018-2022
AOP6	Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique	Korea	2018-2022
AOP7	Impact Assessment of Climate Change on Water Resource Availability in TC Members	China	2018~2020

BUDGET PROPOSED FOR WGH ACTIVITIES IN 2017

- 39) WGH proposed **\$24,000USD TCTF** totally to support WGH annual activities in 2017 shown in Table 3.

Table 3 The summary of budget of TCTF to support WGH activities in 2017

Item	Item	TCTF(USD)
1	Support to attend Integrated Workshop (IWS) and other activities	10,000
2	Support publishing the two technical reports of AOP2 and AOP6	5,000
3	Support activities related to OSUFFIM	6,000
4	Support hosting AOP 6 seminar with hosting 6th WGH working meeting.	3,000
	Total	24,000

- 40) To support organizing the proposed 3-day workshop/training course in SYS University, Guangzhou, China at the end of 2017, WGH requests **\$6000USD special budget** from TCTF for supporting international transportation of participants from Members.

WGH CHAIRPERSON SELECTION FOR NEXT TWO YEARS

- 41) WGH had deep discussion and full communication on its Chairperson selection for next two years. The candidates of Chairperson are Mr. Yoshio Tokunaga from ICHARM of Japan and Dr. CHO Hyo Seob from HRFCO of the Republic of Korea. However, it does not yet get consensus on the person to take the position of Chairperson. WGH agreed to coordinate and select its new chairperson and vice chairperson at 6th WGH meeting based on further communication among hydrological components of Members for the term of next two years to 51st Annual Session.

CONCLUSION OF WGH PARALLEL SESSION

- 42) On the basis of the outcomes 5th WGH working meeting and the discussion of the WGH Parallel Session at 11th IWS, the following conclusions were reached:
- The working meeting of WGH is very important to review hydrological activities, deep technical discussion and implementation status of WGH AOPs, and also is very necessary to prepare IWS and annual session. The funding support and contribution from the Republic of Korea played the vital role in organizing the annual working meeting. WGH encourages the more and wider resources to support the activities to keep its sustainability.
 - The results of evaluating the effectiveness of the on-going Annual Operation Projects in WGH with the target to develop the Member's Capacity indicated that, the cooperation activities under the Strategic Plan of the Committee may play very positive role in promoting the capacity building on water-related disaster risk reduction through various approaches, such as workshop, training course, pilot study and study visiting. The leading Members of the AOPs need to consider more on how to involve the Members in the activities as far as possible so that to make the Members learn from the cooperation and exchange and develop their capacity building. The Members should be encouraged to participate further actively in the cooperation activities of the Committee.
 - The proposal of the Project on SSOP-II: Implementation of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, under the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries, has been shortlisted and forwarded to the final step in the hardworking and efforts of TCS. This initiative has both a regional and national-level components with the major objective to training Members on how to prepare SSOP by using the Manual so that to promote the capacity building on multi-coastal disaster early warning. To ensure the effectiveness of implementation and measure the outcomes indicators at the evaluate stage, the Committee with the RSMC Tokyo and New Delhi could focus on project implementation at regional level, and the national level component can be implemented with the support from RIMES. Such a collaboration may facilitate successful outcomes at both levels. The close cooperation from beneficiary countries and target countries is very important to a successful project.
 - It is recognized that, to promote the capacity of forecasting, early warning and risk management for urban flood is an urgent need among TC Members, especially the real-time operational system on urban flood forecasting and inundation mapping. As the subsequent activity of TC first Cross-cutting project of Urban Flood Risk Management (UFRM), the on-going project of WGH on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping

(OSUFFIM) is a tangible measure on this aspect and it will play very meaningful and important role for TC Members to promote the capacity on the technique of urban flood forecasting and warning. To extend the achievement of pilot study in the region is necessity and meaningful to promote the capacity on urban flood risk forecasting and warning. It also could be considered as a activity under the cooperation mechanism of TC and PTC.

- To develop the Extreme Flood Forecasting System and the Guidelines for Extreme Flood Risk Management will be definitely beneficial for the TC Members to strengthen their capacity on extreme flood risk reduction, especially under climate change. To enhance the achievement of development, the situation and needs on flood risk management in the Members should be considered and integrated into the System and Guidelines.
- It is a consensus on that, to draw up a plan on considering and proposing a bank of new cooperation projects under the umbrella of TC Strategic Plan in a linkage with the initiatives and activities of ESCAP and WMO would be an urgent matter at present for WGH since all on-going AOPs of WGH will be closed in 2016 and 2017. In order to conduct the cooperation projects sustainably in TC Members, WGH discussed and determined the list of topics as the priority cooperation activities for long-term direction to develop the Member's Capacity on water-related disaster risk forecasting and warning.

RECOMMENDATIONS OF WGH PARALLEL SESSION

43) On the basis of the outcomes 5th WGH workshop & meeting and the discussion of the Parallel Session of 11th IWS, the participants concurred to make the following recommendations to the TC 49th Session to be held in Yokohama City, Japan from 21 (Tuesday) to 24 (Friday) February 2017:

- To request Mr. Yoshio Tokunaga from ICHARM of Japan and Dr. CHO Hyo Seob from HRFCO of the Republic of Korea continue working as Chairperson and vice chairperson of WGH, respectively, until new chairperson and vice chairperson of the Group are selected at 6th WGH meeting for the term of next two years to 51st Annual Session.
- To appoint Dr. HOU Aizhong from BOH of China as Vice-chairpersons of WGH for the term of next two years to 51st Annual Session.
- To request US\$24,000 from TCTF in total for supporting overall WGH activities for 2017 calendar year.
- To request US\$6,000 special budget to support hosting OSUFFIM final workshop in SYS University, Guangzhou, China in the end of 2017;
- To remove the SSOP-II from the list of WGH AOP2017.
- To approve the proposal on Flash Flood Risk Information for Local Resilience from ICHARM of Japan as WGH AOP for the period from 2017 to 2019;
- To request HRFCO, MOLIT of the Republic of Korea to host WGH 6th working meeting with funding support in 2017.
- To request SYS University of China to organize the final workshop on urban flood forecasting and inundation mapping with finding supporting. The workshop may be considered as one activity of enhancing the cooperation mechanism of two regional bodies of TC and PTC. The participants from PTC Members could be involved in the workshop if the funding is available from extra resources (such as ESCAP, WMO) ;

- To request the SYS University of China to consider conducting phase-II for OSUUFIM starting from 2018 after the proposed OSUFFIM project to be closed at 50th Annual Session to extent the application in selected pilot cities from more Members.
- To request HRFCO, MOLIT of the republic of Korea to draft the detail proposal for two initiatives of Application of Hydrological Data Quality Control System in TC Members and Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique as WGH new AOPs for the period from 2018 to 2022;
- To request BOH of China to draft the detail implementation plan for the proposal on Impact Assessment of Climate Change on Water Resources Availability in TC Members as WGH new AOP for the period from 2018 to 2020;
- To encourage HRFCO to continue the WGH webpage running for effective sharing information among WGH member countries;
- To encourage Members to propose and lead the cooperation projects of hydrological component.
- To request ESCAP and WMO to continue the support to implement further the on-going project of real-time Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM), which can be used in PTC and TC region.
- To encourage the Beneficiary Countries and Target Countries to cooperate closely and forwardly with TCS on implementing SSOP-II should the funds become available.
- To request ESCAP and WMO to provide guidance and assistance to TC proceeding with the project of SSOP-II should funds become available.
- To request AWG to figure out a set of appropriate indicators and methodology for evaluating the effectiveness of activities in the Committee with the target to develop the Members' capacity, if the Committee is willing to continue the evaluating.
- To continue focusing on improving the ability to forecast hydrological phenomena and provide measures for the effectiveness of the improvements.

CONCLUSIONS OF WGH

- 44) On the basis of the outcomes 4th WGH working meeting and the discussion of the WGH Parallel Session at 10th IWS, the following conclusions were reached:
- The working meeting of WGH is very important to review hydrological activities and implementation status of WGH AOPs and to prepare IWS and annual session. The meeting should be continued.
 - The Project of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP), under the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries, is a very successful example to closely link the two regional bodies together. The outcomes and achievement of this project, which could benefit TC and PTC regions as well as other regions, should be transferred into application in practice of disaster risk reduction for promoting the capacity building in Members. As the continual project, SSOP-II, which was submitted by TCS and proposed to conduct a series of training courses and workshops on the "mechanics" of preparing and implementing SSOPs for coastal multi-hazards early warning system, will benefit the Committee in various aspects. As one part of supports for decision-making of disaster risk management, technical training on hydro-meteorological forecasting and warning is also very important to promote the capacity of coastal multi-hazards early warning.

- To promote the capacity of forecasting, early warning and risk management for urban flood is an urgent need among TC Members, especially urban flood forecasting and inundation mapping. As the subsequent activity of TC first Cross-cutting project of Urban Flood Risk Management (UFRM), the on-going project of WGH on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) is a tangible measure on this aspect and it will play very meaningful and important role for TC Members to promote the capacity on the technique of urban flood forecasting and warning. This activity may be established a linkage with SSOP-II proposed by TCS.
- To develop the Extreme Flood Forecasting System and the Guidelines for Extreme Flood Risk Management will be definitely benefit the TC Members to strengthen their capacity on extreme flood risk reduction, especially under climate change. To enhance the achievement of development, the situation and needs on flood risk management in the Members should be considered and integrated into the System and Guidelines.

Annex1. Implementation Status of WGH AOP 2016

Annex 2. Successor Indicators of WGH AOP 2017

Annex 1. Implementation Status- WGH AOP 2016

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Completed YES/NO
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a, SG 5a KRA 5 SG 5a SG 5b KRA 6 SG6b	1	SSOP-II: to promote the capacity on coastal community resilience to coastal multi-hazards through extending the achievement of SSOP-I in TC and PTC regions	To conduct a series of training courses and workshops on the "mechanics" of preparing and implementing synergized standard operating procedures for coastal multi-hazards early warning system in beneficiary countries	WGM WGDRR TRCG	Secretariat support and coordination	(a)First (b)Second (c)Third (d)Fourth	TCS, Members, ESCAP WMO PTC 16 beneficiary Members from TC and PTC	(b,c) Workshop on Innovative Technology for Urban Flood Risk EW (2days in BKK, Thailand) (c,d) Training Course on Real-time Operational Urban Flood Forecasting and inundation Mapping (3 days in SYS University, Guangzhou, China)	SSOP-II Budget (ESCAP Trust Fund)	Project funding; BOH, China; RID, Thailand; DID Malaysia	(b, c) NO (c, d) Not Yet
KRA1 KRA 4 SG 4a SG 4b KRA5 SG 5a KRA 6 SG 6b	2	Extreme flood forecasting system	To conduct the publication of field survey report To complete the extreme flood forecasting system with PC-version To operate the TC WGH homepage		See above	(a) First (b) Second (c) Third (d) Fourth	RID of Thailand, PAGASA of Philippines Laos	(a,b) To review the field survey report with the subject country members (a,b,c) To establish the extreme flood forecast system with PC-version (a,b,c, d) To operate the TC WGH homepage		MOLIT, TCTF	(a, b) Yes (a, b,c) On-going (a,b,c,d) Yes
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	3	Project on estimation for socio-economic impact of sediment-related disaster	Establish common collecting format and methods of investigation for disasters to estimate estimation for socio-economic impact of sediment-related disaster and to share common	WGDRR	See above	(a)First (b)Second (c)Third (d)Fourth		(b) To make a "Sediment-related Disaster Record Database" to share the records in TC Member. (c) To report and share the results of estimation of socio-economic impact		MLIT NILIM SABO	(b)no (c)no

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Completed YES/NO
			technical background in TC members.								
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	4	Development of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM)	On site OSUFFIM installation, training and maintenance in Chinese and Thailand pilot cities Field survey and modeling in Malaysia and Vietnam pilot cities OSUFFIM English version completion	BOH, BOH BOH and Sun Yat-Sen University of China; RID of Thailand DID, Malaysia	See above	(a)First (b)Second (c)Third (d)Fourth	BOH, China; Sun Yat-Sen University of China; RID of Thailand DID, Malaysia NHMS, Vietnam	(a-c)Implementation of OSUFFIM in Chinese and Thailand pilot cities (c-d)Model set up of OSUFFIM in Malaysia and Vietnam pilot cities (d) Submission of draft OSUFFIM manual English version	TCTF \$6000 for support the OSUFFIM installation, training and maintenance in Thailand pilot cities, Field survey and modeling in Malaysia pilot cities	BOH, China; SYS Univ. ; RID, Thailand; DID, Malaysia NHMS, Vietnam TCTF	a-c) On-going (c-d) On-going (d) On-going
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	5	Extend application of Xin'anjiang Model in Selected River Basins in TC Members	Application of Xin'anjiang Model included in the National Flood Forecasting System (NFFS) of China in selected river basins in TC Members	BOH and DID of Malaysia RID, Thailand NMHS, Vietnam	See above	(a)First (b)Second (c)Third (d)Fourth	BOH and Hohai University of China; DID of Malaysia RID, Thailand NMHS, Vietnam	(a-c) to perfect English version of Model and document (b-d) establish the real-time operational application of model (d) report to IWS and Session	TCTF \$3000 for support the activities related to Model application in selected Members	TCTF BOH, China DID, RID, NMHS	(a-c) Yes (b-d) Yes (d) On-going
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	6	Guidelines for extreme flood risk management in TC region	To hold the 5 th WGH meeting in the R.O.K To develop the practical guideline for extreme flood risk management in English		See above	(a) First (b) Second (c) Third (d) Fourth		(b,c) To prepare and host the WGH working meeting (b,c,d) To develop the guideline for extreme flood risk management for collecting the members opinion	\$5000TCTF for review the English version of guideline and seminar linked with 5 th WGH meeting	MOLIT, TCTF	(b,c) Yes (b,c,d) On-going

Annex 2. Successor Indicators of WGH AOP 2017

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	1	Flash Flood Risk Information for Local Resilience	to develop a guidance tool for enhancing local resilience to flash flood disaster risks and disseminate it among the WGH member countries.	WGDRR	Coordination	(a) First (b) Second (c) Third (d) Fourth	ICHARM	(a) Technical Presentation (b-d) Case Study in Japan and needs assessment		ICHARM, MLIT
KRA1 KRA 4 SG 4a SG 4b KRA5 SG 5a KRA 6 SG 6b	2	Extreme flood forecasting system	To complete the development of extreme flood forecasting system with PC-version and publish the technical report including the theoretical background and system manual. To operate the TC WGH homepage.		See above	(a) First (b) Second (c) Third (d) Fourth	RID of Thailand, PAGASA of Philippines DMH of Laos	(a,b,c) To complete the development of extreme flood forecast system with PC-version (c,d) To publish the technical report (a, b, c, d) To operate the TC WGH homepage	\$2500	MOLIT
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	3	Guidelines for extreme flood risk management in TC region	To hold the 6 th WGH meeting in the R.O.K To publish the guideline for extreme flood risk management including the field survey report.		See above	(a) First (b) Second (c) Third (d) Fourth	RID of Thailand, PAGASA of Philippines DMH of Laos	(b,c) To prepare and host the 6 th WGH working meeting (a, b, c) To publish the guideline for extreme flood risk management	\$2500 Plus \$3000	MOLIT,
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	4	OSUFFIM system development and trial operation	1. Development of OSUFFIM operational system 2. Trial operation of OSUFFIM operational system in pilot cities 3. compile the user guideline both in Chinese and English 4. have a workshop to distribute the outcomes of OSUFFIM 5. start 1-2 new pilot cities in TC members		See above	(a) First (b) Second (c) Third (d) Fourth	Dongguan Flood Management Office RID of Thailand, PAGASA of Philippines	(a,b,c) Complete the development of OSUFFIM operational system (a,b,c) Trial operation of OSUFFIM in Chinese and Thailand pilot cities (d) publish user guideline in English; (d) Final workshop in SYS Uni. (d) Field investigation to 1-2 new cities in TC Members	\$6,000 + Special \$6000 for supporting the final workshop	SYS Uni. RID, PAGASA. DID, NMHS, DMH TCTF

- SG1: To enhance cooperation among TC Members to reduce the number of deaths by typhoon-related disasters by half in the ten years of 2006 – 2015 (using the ten years of 1990 - 1999 as the base line).
- SG2: To reduce the socio-economic impacts of typhoon-related disasters per GDP per capita by 20 per cent in the ten years of 2006- 2015 (using the ten years of 1990 - 1999 as the base line).
- SG 3a: To identify and explore the beneficial use of resources such as rainfall brought by typhoon.
- SG 3b: To study and promote the increasing use of typhoon-related beneficial effects among the Members.
- SG 4a: To provide reliable typhoon-related disaster information for effective decision making in risk management in various sectors.
- SG 4b: To strengthen capacity of the Members in typhoon-related disaster risk management in various sectors.
- SG 4c: To enhance international and regional cooperation and assistance in the field of disaster risk reduction.
- SG 5a: To promote and enhance culture of community-based disaster risk management among the Members.
- SG 5b: To promote education, training and public awareness of typhoon-related disasters among the Members.
- SG 6a: To facilitate RSMC capability to respond to the needs of the Members in forecasting and capacity building.
- SG 6b: To improve capacity of Members to provide timely and accurate user-oriented and friendly tropical cyclone products and information.
- SG 6c: To enhance capacity of Members' typhoon-related observation, monitoring, forecasting and warning.
- SG 7a: To strengthen the capacity of Typhoon Committee to effectively discharge its responsibilities and functions described in this Strategic Plan and completed its stated mission in accordance with the Typhoon Committee's Statute.
- SG 7b: To mobilize available resources and engage collaborators for the implementation of the strategic goals.
- KRA 1: Reduced Loss of Life from Typhoon-related Disasters.
- KRA 2: Minimized Typhoon-related Social and Economic Impacts.
- KRA 3: Enhanced beneficial typhoon-related effects for the betterment of quality of life.
- KRA 4: Improved Typhoon-related Disaster Risk Management in Various Sectors.
- KRA 5: Strengthened Resilience of Communities to Typhoon-related Disaster.
- KRA 6: Improved capacity to generate and provide accurate, timely and understandable information on typhoon-related threats.
- KRA 7: Enhanced Typhoon Committee's Effectiveness, Efficiency and International Collaboration.