Analysis of urban flood prevention emergency plan in Pinghu City

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Abstract. With the acceleration of urbanization in China, urban flood disasters have gradually become a prominent type of urban disease, seriously affected the normal production and life of urban residents, and brought great challenges to urban flood control and disaster reduction work. Based on the current situation of urban flood control in Pinghu City and the latest Guidelines for the Compilation of Urban Flood Control Emergency Preparedness Plan, this paper analyses the scope of application, key defense objects and key points of urban flood control in Pinghu City, and puts forward the organizational system and responsibilities of urban flood control, preventive and early warning measures, emergency response actions, public defense guidelines, personnel transfer and placement, etc. Specific non-engineering measures for urban flood control are put forward for Pinghu City.

1. Introduction

In recent years, due to the impact of global climate change, the extreme weather of heavy rains has increased, and many provinces and cities in the country have experienced heavy rains. With the acceleration of urbanization, the direct economic losses and indirect losses caused by urban storms and floods are becoming more and more huge [1]. On the one hand, the prediction of local heavy rain with short history and high intensity is difficult, which brings great challenges to urban flood control. On the other hand, large-scale urban construction has greatly reduced the seepage of the ground and vegetation. Most of the rainfall forms surface runoff, and the rainwater confluence is fast, which greatly exceeds the urban drainage capacity and is prone to internal disasters [2]. About half of the cities in the country do not meet the national flood control standards set by the state. There is no uniform normative indicator for urban drainage. The drainage capacity of cities above the provincial capital is generally only equivalent to one year, and the drainage capacity of other cities is lower. Many cities have not yet completed or approved the urban flood prevention emergency plan, or have not updated and revised the existing plan for many years, and it cannot keep up with the speed of urban development, and the precautionary measures are poorly targeted and operability.

The frequent occurrence of waterlogging disasters has a tremendous impact on our social management, urban operation and people's production and life. In addition, the construction of drainage and waterlogging facilities in some cities is lagging behind and the emergency management capacity is insufficient. Severe rainstorms and waterlogging disasters have occurred in many places. Therefore, the preparation of urban flood prevention emergency plans is imminent.
2. Characteristics of flood disasters in Pinghu City

Pinghu City has a flat terrain and dense river networks. In history, drought, waterlogging, typhoon and other natural disasters occurred frequently, especially floods. Since the founding of New China, there have been 14 large and small floods from 1949 to 2000, with an average of 3.5 years, including 7 Meiyu-type floods and 7 typhoon-rain-type floods. From the disaster situation, the torrential rain caused by the typhoon is large, the flood level is high, and the flooded area is wide. The highest historical water level that occurred in the past is mostly caused by typhoon and rain. The highest water level of the Meiyu flood is slightly lower, but the high water level lasts for a long time, the drainage is not smooth, and the waterlogging is serious. Since the beginning of this century, the number of flood disasters has increased significantly, almost once a year. In addition to the natural factor of increasing rainfall, the change of regional water resources is also an important factor in the increase of flood frequency. According to incomplete statistics, the economic losses caused by the "99.6.30" flood disaster in pinghu reached 256 million yuan. Thus, the flood has seriously restricted the development of the national economy.

In 2000, Pinghu City Water Conservancy Bureau compiled the “Pinghu City Urban Flood Control Plan” and completed the “Pinghu City Urban Flood Control Project Feasibility Study Report”. In 2001, the “Preliminary Design of Urban Flood Control Project in Pinghu City” was compiled. In 2005, the design adjustment was completed. In 2006, the urban flood control project in Pinghu City was officially launched. The urban flood control project of Pinghu City was officially put into operation in July 2009. Since it was put into operation, the water level in the encirclement has been controlled at 1.15m-1.30m, and it has withstood the influence of typhoon morakot, plum blossom, haikui and fitow, as well as the heavy rainfall of August 25, 2011. Under the normal operation of the urban flood control project, there is no large-scale waterlogging in the large encirclement of the urban flood control project in Pinghu City. The operation of the urban flood control project changed the history of flooding in the central area of Pinghu before it encountered a higher water level (more than 1.5m).

3. Flood defense system

The urban flood control project of pinghu city adopts the plan of "the newly-built area elevates the ground to discharge itself, and the central area builds a large enclosure machine platoon", with a total area of 56.87km².

At present, the area of the urban flood control project of Pinghu City (including the Nanshi District) is 15.16km². The east is bounded by Huancheng East Road, south to Huai Orange Road, west to Pinghu Avenue and 07 Provincial Highway, and north to Fushun Road. The total length of the embankment line is 20.42km, all of which are roads with dikes, the elevation of the embankment is 2.92m, 18 bridges are built (excluding the South Gate Station), 7 pumping stations (in combination with the sluice), and 30 pumping stations are installed. The drainage flow rate is 78.8m³/s, and the engineering flood control standard is once in 50 years.

The application scope of the urban flood control emergency plan of Pinghu City is 56.87km² of the urban flood control planning of Pinghu City, with the focus on the surrounding area of the 15.16km² urban flood control project in the built-up area.

4. Key protection object

The key protection targets include urban low-lying flood-prone areas and residents of dangerous houses, urban flood control projects, underground space engineering facilities, hazardous chemicals production and storage points, and other important objects for urban flood control.

According to the survey, during the typhoon of “Fete” in 2013, there were 23 main water points in the urban planning of Pinghu City. The deepest water depth and the largest water accumulation area were the East Lake Avenue and the stadium at the entrance of the Construction Bureau. which are the most prone to flooding in pinghu city. There were three water points with large water accumulation area, namely the stadium, Jiaxing Automobile School and Dongsheng New Village. The accumulated water area exceeds 36,000 square meters.
At present, the urban low-lying and flood-prone areas mainly include the Nanhetou Provincial Cultural Relics Protection Area, the Stadium, the Civil Affairs Bureau, the Party School Block of the Municipal Party Committee, Dongsheng New Village, Donghu Avenue, Xiangzhong Road and Donghu Avenue North Intersection. The underground space mainly includes large-scale commercial and hotel underground parking lots such as RT-Mart, China Resources Supermarket, Xincheng Wuyue, Runfeng Plaza, underground parking garage and administrative center underground parking lot.

5. Organizational system construction

Established Pinghu City Flood Control Coordination Group. Under the unified command of the city's anti-finger, it is responsible for the urban flood control and rescue and relief work in Pinghu City after the launch of this plan. When necessary, the municipal party committee and the municipal government shall deploy urban flood prevention and rescue work, and the coordination team shall organize and implement it.

Pinghu City Flood Control Coordination Group has set up 8 emergency working groups, including comprehensive group, monitoring and early warning and dispatching group, emergency rescue and personnel transfer group, publicity and public opinion response group, material management and logistics support group, emergency medical rescue and health epidemic prevention team, stability group and power communication guarantee Group. The constituent units, responsible persons and main job responsibilities of each group has been clarified. The team members of each group are composed of 1 member in charge of each group and 2-4 experienced members.

6. Emergency Response

6.1 Early warning issuance and division of responsibilities

(1) The municipal defense index unified organization will release the public warning information of urban flood prevention to the public during the urban flood emergency period. No other department may publish it without authorization. The urban flood control coordination team is responsible for providing early warning information on urban flood control to the city defense index.

(2) The Municipal Meteorological Bureau is responsible for providing early warning information such as weather forecasts and typhoon forecasts.

(3) The Municipal Water Conservancy Bureau is responsible for providing early warning information such as rainfall and water level.

(4) The Municipal Construction Bureau is responsible for providing early warning information within the city.

(5) The Municipal Public Security Bureau is responsible for providing road warning information.

(6) Pinghu Telecom, Mobile, and Unicom, in accordance with the directives and requirements of the city's defense index, actively contact the higher-level units for resources, issue early warning information at the fastest speed in the shortest time, and fulfill the public public early warning duties and obligations.

(7) Pinghu Broadcasting and Television Station shall broadcast warning information and flood prevention and rescue knowledge by rolling subtitles and inserting video and audio as required.

6.2 Emergency response level

Pinghu City's urban flood emergency response is divided into two levels, from low to high, divided into: level II (significant), level I (particularly significant).

When the following one or more conditions are met, it is the urban flood prevention level II emergency response:

(1) The water level of Pinghu Station reached 2.36m.

(2) The water level of Pinghu Station has reached 2.10m and above, and the flood control and deformation of the flood control project in the city have caused great dangers.
(3) The area of waterlogging within the planning scope of urban flood control in Pinghu City (referring to the depth of water accumulation greater than 15 cm, and the time of water accumulation greater than 30 minutes, the same below) reaches 20%-35%.

When the following one or more conditions are met, it is the urban flood prevention level I emergency response:

1. The water level at Pinghu Station has reached 2.36m and the Municipal Meteorological Bureau has forecast that the rainfall in Pinghu City will reach a heavy rain (rainfall > 200mm) or process rainfall > 300mm in the next 24 hours.
2. The water level at Pinghu Station reaches 2.62m and above.
3. The city flood control project has a major danger such as the failure of the gate to close.
4. The area of waterlogging within the city flood control planning of Pinghu reaches more than 35%.

6.3 Emergency response

Urban Flood Control Level II Response Defense Focus: Inspection of urban defense projects, evacuation and transfer of people in dilapidated buildings, low-lying areas and underground spaces that are vulnerable to floods, low-lying and flood-prone areas in urban areas, and urban infrastructure security. The city flood control coordination team conducted a meeting to discuss the situation in the urban area that may be affected by heavy rain, further clarify the defense priorities and countermeasures, and deploy relevant work. Urban kindergartens, primary and secondary schools suspend outdoor teaching activities. The emergency department will issue a notice for the preparation of personnel transfer in a timely manner, open up the disaster avoidance site, and issue an order for the transfer of personnel. All departments shall prepare for emergency rescue according to their respective responsibilities, and each emergency working group shall do a good job of monitoring and early warning and dispatching, emergency rescue and personnel transfer, material security, public opinion response, and emergency medical treatment.

City Flood Control Level I Emergency Response Defense Focus: Organize emergency rescue of urban flood control projects and other important facilities, rescue the detained personnel, expand the scope of personnel transfer depending on the situation of danger, provide material allocation for resettlement personnel, and strengthen urban flood control and drainage work. The city flood control coordination group will preside over the meeting, and the members of the urban flood control coordination group will further prepare for emergency rescue or carry out relevant rescue and rescue work. Urban kindergartens, primary and secondary schools are closed. Each member unit carries out related work according to their respective duties.

6.4 Public defense guidelines

In order to avoid or mitigate the casualties and property losses caused by heavy rain, floods, typhoons, guilt and its secondary disasters and engineering risks, the public’s awareness and ability to prevent and mitigate disasters have been enhanced. In compiling the plan, specific points of public self-defense and mutual rescue and ways of consultation and rescue were put forward, and the defense guidelines after the emergency response of urban flood control was clearly defined. Including defense guidelines for TV stations and radio stations to broadcast to the public, and the defense guidelines and emergency response levels sent by mobile communication operators to mobile phone users are reduced (end).

6.5 Personnel transfer and placement

According to the characteristics of urban flood control in Pinghu City and the topographical conditions, the urban flood control in Pinghu City adopts a combination of independent transfer and centralized transfer and resettlement.

In the main urban area of Pinghu City, the permanent residents are mainly transferred and resettled. Residents with safe housing structure and comfortable living conditions should be mobilized to take
their own houses as places of resettlement or places with relatives and friends on the premise of adequate preparation of commonly used medicines and food, drinking water and radio. The main objects of centralized transfer and resettlement are:

1. Residents living in urban dilapidated houses and new residents of the city.
2. Residents living on the first floor of the urban area with transfer and resettlement needs.
3. Residents living in the underground space of the city.
4. Persons in urban areas who do not have a fixed residence or other need to transfer and resettle.

7. Conclusions
The urban flood prevention emergency plan is an implementation plan for preventing and disposing of urban floods, guilts, and typhoon storms. It is an efficient and orderly guarantee for urban flood relief and disaster relief work, and must be highly targeted, thorough, and operable [2]. During the preparation of the urban flood prevention emergency plan for Pinghu City, a large number of on-the-spot investigations were carried out to fully grasp the location of key protection objects such as low-lying and easy-to-defect areas, dangerous houses, hazardous chemicals and underground space.

According to the opinions of the member units of each anti-finger, the classification of emergency response levels, the responsibilities of each member unit and emergency response measures shall be clarified, and 8 emergency working groups shall be established during the urban flood emergency response period. The implementation of the emergency plan requires coordination and cooperation between all units and departments, and strives to fight [4]. On the basis of the preparation of guidelines, the public defense guidelines, personnel transfer and resettlement measures during the emergency response period were added, and clear urban flood prevention and non-engineering measures were proposed for Pinghu City.

References
[1] Wang X. Progress and countermeasures of urban flood control emergency management. People's Yangtze River News, 2014.
[2] Zhao W, Hu Y.L, Lu X. Characteristics of urban flood control in China and its countermeasures. China National Defense, drought resistance, 2013.
[3] Tu H.L, Feng L. Construction and operation of urban flood control project in Pinghu City. Journal of Zhejiang University of Water Resources and Hydropower. 2014.
[4] Wang W.J. Analysis of urban flood prevention emergency plan in Yangquan City, Shanxi Province. China National Defense and Drought Relief. 2018.