



## **JAPAN: TOKAI HEAVY RAIN (SEPTEMBER 2000)**

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**Abstract.** Information is provided about the general approach and experience on flood management and mitigation in Japan, and in the Tokai region in particular. Of interest are the modifications of the flood and water management policies within the country, which have shifted gradually from an initial flood control and the minimization of flood loss, to an integrated approach to basin water resources management. This has resulted in the establishment of a comprehensive river administration system for flood control, water use and environmental conservation, in addition to the preparation of detailed emergency management plans to deal with the flooding of urbanized areas

### **1. Location**

The Syonai river system (consisting of the Syonai and Shin river basins) is located about the center of Japan, in the Aichi Prefecture of the Tokai region. It comprises the area of Nagoya City – the 5<sup>th</sup> largest city in the country, with a population of about 3 million. Therefore, the two rivers forming the Syonai system flow through the densely populated urban area into the Pacific Ocean, thus being typical city-type rivers in Japan. The area is affected in the summer and autumn by numerous thunderstorms; these can generate floods, which in cases cause damages and human losses.

### **2. Nature of floods**

Due to the country's mountainous topography, many rivers in Japan are of the torrential type, having steep riverbed gradients. Hence, they are dangerous at the time of a flood because of the fast arrival of the flood wave. Furthermore, the embankments are generally built above the protected lowland. Thus, when the floods overtop the embankments the inundation of the protected lowlands has the potential to cause serious damage to the urban area where assets concentrate. On the other hand, the rapid urbanization in the floodplains has been inevitable, because of continuous population growth and less percentage of available area (as much as 80% of Japanese territory are mountains), and that most of productive/available lands are floodplains. In the Tokai region, this is also the case with the Syonai and Shin Rivers.

During the period 1957 to 2000 about ten important floods occurred in the Syonai River system; one of the major events was generated by the "Tokai heavy rain" (September 2000), as a result of the combined effects of an autumn rain front and a typhoon, and which affected the whole region. At many monitored points in the two rivers, water exceeded the established design levels and signs of possible collapse of banks were observed in many places (e.g. leakage of water from the bank, overtopping, partial collapse of the bank). A bank failure occurred which, together with the already widespread inundation within the protected area, increased the effect and depth of the flooding, which lasted for three days. The reported damage amounted to a death toll of 10 people; recommendations for taking refuge were made for about 580,000 people; the number of damaged houses in which flooding reached above floor level was 23,896; and 39,544 houses where flooding was below floor level. Flood-fighting community teams worked hard to prevent further damages.

### **3. Flood management and mitigation measures**

In Japan there are structural and non-structural measures for flood protection. The structural ones include embankments, excavation of riverbeds, dams and retarding basins, diversion channels, etc. The non-structural measures are of two types; the first are geared to decrease the run-off by means of storage of water in the basin (infiltration of rainwater, storage in each house). The



second is related to disaster prevention through local prevention plans (including information on disaster prevention), local ordinances (construction regulations, etc.) and the distribution of hazard maps.

Until recently, flood protection was mainly accomplished by structural measures. However, especially for rivers in city areas, restrictions against smooth implementation of river works – such as skyrocketing land prices, need of displacement of a number of buildings and houses - made structural measures more and more difficult to implement in a short period. On the other hand, concentration of properties into the city area was rapidly accelerated. In fact, the damage to assets during floods is seeing an increasing trend. Thus, while both types of measures are important, the relevance of non-structural ones has become greater for urban flood damage in recent years.

As regards the Shonai River system, flood control projects in the region can look back at a long history. The first full-scale projects were carried out in 1610 with excavation works in some rivers and the construction of levees; the implementation of such works continued up to present times. In April 1969 the master plan for the implementation of works was prepared and revised after a flood in 1972; accordingly, a number of protection structures were constructed or implemented. After the Tokai floods in 2000, the “*Special Emergency Project as the Countermeasures against Terrible Disasters in the Shonai River and the Shin River*” has seen implementation since that year. As part of the structural measures, the project includes the building of levees (raising and embankment in the lower part), improvements in the bank protection, the excavation of river channels, the rebuilding and reinforcement of bridges, the raising of fixed dams, improvements in the retarding basin, and increase of drainage pumps capacity. With regard to non-structural measures it comprises improvements related to the disaster prevention information system and to the flood fighting bases.

#### **4. Flood and water management instruments**

Flood forecasts and warnings have constituted an important flood management tool in Japan. With regard to the collection and transmission of information and data for the daily management of rivers, the national and prefecture river authorities are operating thousands of raingauges and water level stations throughout the country. These data were then provided to local people with flood forecasts or suggestions for evacuation, etc. In 1985, the *Foundation of River Basin Integrated Communications (FRICS)* was established under the auspices of the Ministry of Construction, with financing from central government and the prefectures and also subscriptions from interested companies. The FRICS, composed of a headquarter and eight regional centres, gathers data on rainfall from 23 precipitation radar bases, as well as from above-mentioned traditional observing facilities; this is processed in a user-friendly manner and passed on to users according to their needs. FRICS has developed about 500 frames for use by its information service, which is also available to the public through a web site, cell-phones and mobile Internet.

In Nagoya City where the Tokai heavy rain occurred, a fixed-point observation system was introduced, calling for the cooperation of residents for the provision of information on water levels and on the situation of flood levels and damages; currently there are about 700 points.

If on the basis of forecasts (water level, rainfall, and others) there is danger of flood damage, information on evacuation is announced in two stages: a preliminary recommendation for residents to prepare for a possible evacuation; and subsequently a recommendation on the actual evacuation. The transmission of information include public relations vehicles, Internet, local public relations through the district headquarters for disaster rescue, television, radio, and others.

Recently, steps have been taken to carry out the maintenance and management of flood protection levees by means of information provided through optical fibre cables.

#### **5. Policy**



There are a number of laws for the development of water resources and for flood and land management. The *River Law* is the main legislative instrument determining flood and water management policies within the country; it has been modified several times to reflect changing needs in flood management over the decades. It was first enacted in 1896 establishing the law system on river management mainly for flood control purposes. In 1964, the use of water throughout the river system was added. As of 1997, river management was to be carried out by also adding the environment aspect; besides, revisions were made such as the introduction of a river improvement planning system that reflects the opinion of the local residents in the basin. For this, the “*Basic Policy for River Improvement*” and the “*River Improvement Plan*” are worked out. The first determines the distribution of the flow rates of basic and design high waters as the basic policy of river improvement over the entire river system. On the other hand, the objective of the River Improvement Plan is to cover the whole spectrum of improvements required in both river works and their maintenance; this is done in accordance with the Basic Policy for River Improvement, and taking into account the opinions of local governmental organizations and residents.

Legal regulations in the river administration are carried out based on the River Law. The use of rivers is clearly specified there-in. The use requires the permission of the river administrator in many cases. While basically permission is given with regard to the use of a river, there is no legal protection for the flood damage of the owner, and the person who wishes to possess it shall be responsible for such damage by him/herself.

The purpose of the *Water Resource Development Public Corporation* is to contribute to the growth of national economy and the improvement in people’s lives by means of implementing projects for the development or use of water resources based on the master plan for water resources development.

There is also a *Flood Fighting Law*, of which parts are being revised. The objectives of the revision are to seek the abatement of damage caused by flood disasters by measures such as new practices of flood forecast, the publication of assumed areas of inundation, and by ensuring smooth and quick evacuation in the assumed areas of inundation, and others. As a result of this, the preparation of hazard maps will be carried out by each municipality working as a unit, which will be used for evacuation activities at the time of a flood disaster.

In order to cope with flood damage in city areas like the one caused by the Tokai heavy rain in which damage potential is high, an emergency proposal was made in November 2000 concerning measures to control urban flood damage. As a result, the first “*Committee on Studies of Measures against Urban Flood Damage*” was held in July 2001 in order to promote these measures from planning to management and comprising rivers and sewerage.

Also as a result of the Tokay extreme rainfall and in preparation for similar events, the River Law states that the abovementioned “*Special Emergency Project as the Countermeasures against Terrible Disasters in Rivers*” should be undertaken in those areas where important damages occurred due to floods, high tides and others, to be implemented in five years on the whole. In addition to measures on structures, software measures such as the establishment of the disaster prevention information system and others shall be implemented, with the goal of achieving comprehensive flood control measures.

Finally, the purpose of the *Disaster Measures Basic Law* is to establish required systems through the national government, local governmental and other public organisations with respect to disaster prevention, in order to protect national land and the lives, bodies and property of the people from disasters.

A “*policy on comprehensive flood control measures*” was introduced in 1979, to be completed within a 10-year period. The main concept is to strengthen flood-retarding function in the basin in



many forms and incorporate these effects officially into flood management plans and strategies. An effort for a combination of measures between water and land management was started, thus linkage between water and land-use authorities was required.

## 6. Institutions responsible for flood management

In Japan, with respect to flood management rivers are classified into three categories: Class A, B and small rivers. Class A rivers are managed by the Ministry of Construction, Class B rivers by prefecture governors, and small rivers by the mayors of municipalities, each of them working as a river administrator. The distribution of human resources is established by the national or each local government, depending on the importance of the river in question. Regarding the budget, its distribution is made according to the importance of flood control works and the necessity of the use of water. A special budget will be allocated if serious damage has occurred, through the Special Project against Terrible Disasters in Rivers, etc.

Regarding the disaster prevention at the time of a flood, each local government takes the lead to carry out disaster prevention activities. These are carried out based on the flood-fighting plan of each local government. Fire brigades are organized in almost all the local governments in Japan. Their establishment is stipulated by the ordinances of municipalities, and they engage in disaster prevention activities.

The setup of disaster prevention meetings and the devising of regional disaster prevention plans are specified in the abovementioned “*Disaster Measures Basic Law*”, in which the responsibilities are clearly defined of the national government, prefecture governments and municipalities concerning disasters,

The *Cabinet Office* is in charge of the disaster prevention and measures against disasters. Here the *Central Disaster Prevention Meetings* are held to prepare the master plan of disaster prevention and earthquake disaster prevention plans and to promote their implementation, to prepare the plans concerning the emergency measures at the time of extraordinary disasters and to promote their implementation, to examine important matters related to disaster prevention (basic policy of disaster prevention, overall adjustment of measures concerning disaster prevention, notice of the emergency state on disasters, etc.).

## 7. Main lessons learned

- The “urban flood damage” caused by the Tokai heavy rain has revealed the danger in urban areas where assets are concentrated against unexpected rainfalls. Not only in Nagoya City, but in metropolitan areas like Tokyo and Osaka, population and assets are concentrating year after year, and there is a trend in which the damage potential increases, thus making it impossible to cope with unexpected floods by means of the conventional hardware measures. Hence, comprehensive flood control measures are required that attach greater importance to software measures.
- Regarding non-structural measures, the improvement in information networks has been incorporated into the *Special Emergency Project as the Countermeasures against Terrible Disasters in Rivers*. Also, included are such activities as the review of disaster prevention plans and others (Nagoya City), the handling of disaster prevention, the distribution of hazard maps, and others.
- The private insurance companies should consider the enlargement of the coverage of fire insurance to also cover compensation for flood damage.