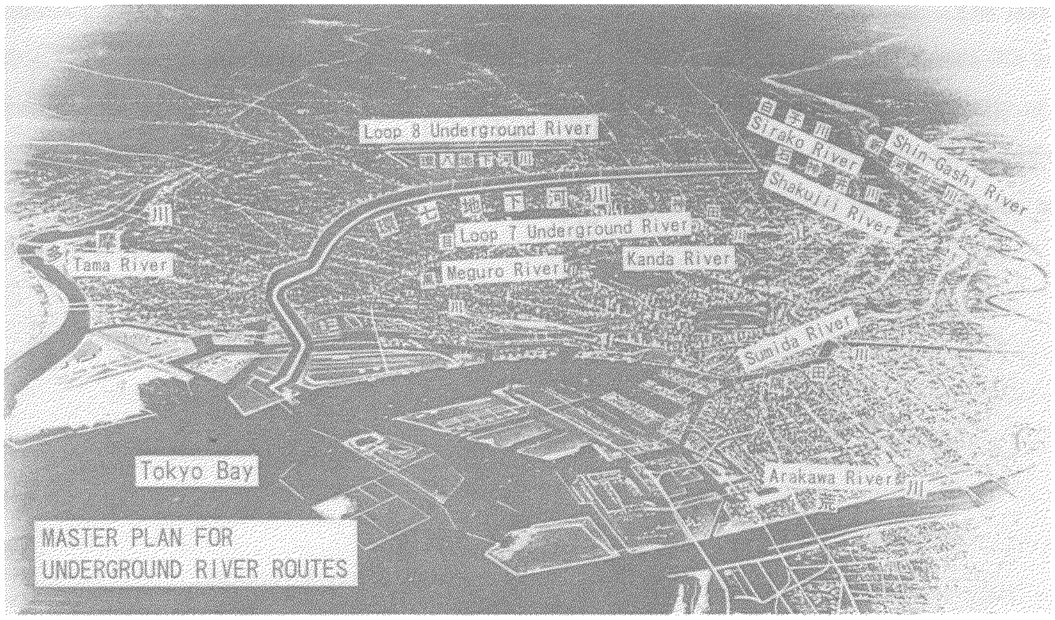

Figure 5 Bird's eye-view of underground route

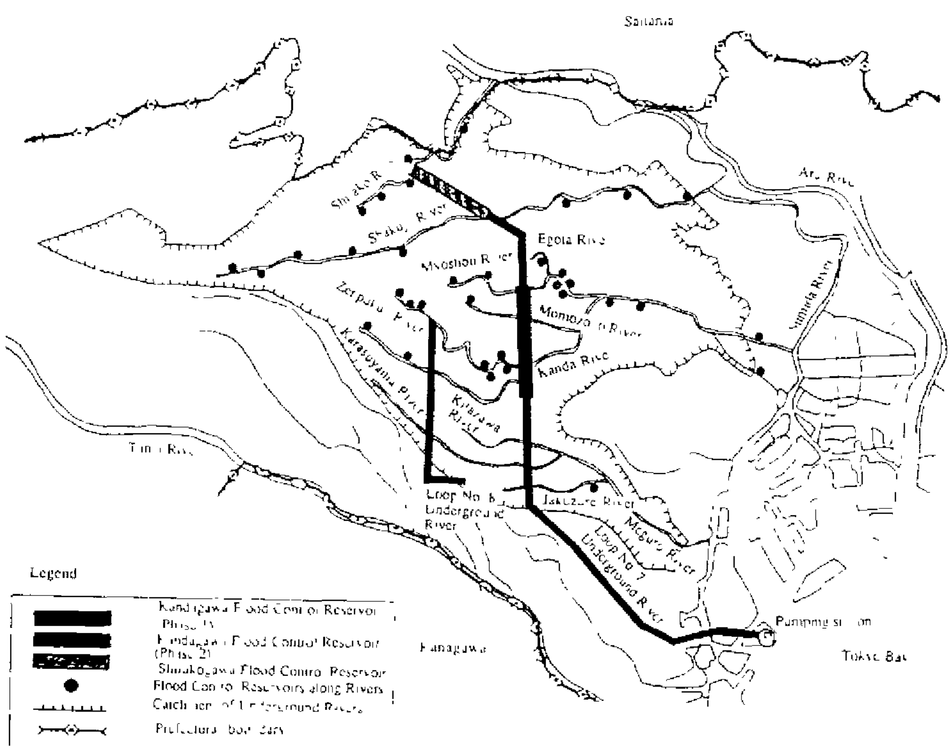

Figure 6 Plan view of underground river route

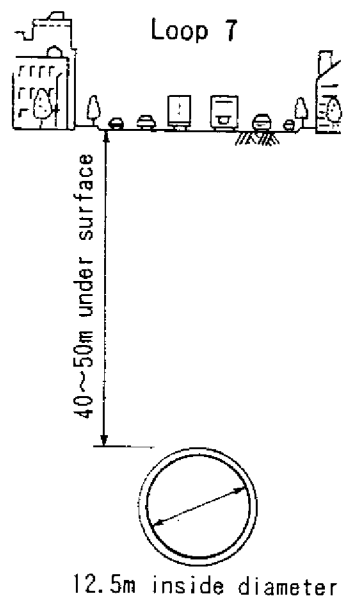

Figure 7 Cross-section view of underground river route

6. A temporary underground reservoir (Kanda River -7th loop underground control reservoir)

As described in section 3, it is recommended that the future plan may be executed for important areas in advance of the completion of the tentative plan. In the down-stream area of the Kanda River flooding has often occurred. The tentative plan for the Kanda River has still not been completed because it is difficult to obtain the land space necessary for the improvement of the river channel. To reduce possible damage from flooding, it is recognized that it might be beneficial to start executing a part of the work in the future plan without waiting for the completion of the tentative plan. Thus, the partial construction of the 7th loop road underground river is planned for use as temporary reservoir. The location of the partial construction is shown in Figure 6 by short, thick, and solid (Kanda underground reservoir) and striped (Shirako under-ground reservoir) lines. The extension of the Kanda underground reservoir is 4.5 km and the storage capacity is 540,000 m^3, Excess discharge from Kanda River and Zenpukuji River will be stored. For convenience, we call this temporary underground reservoir the Kanda River 7th loop under-ground reservoir the Kanda-7th loop underground flood control reservoir, or Kanda-7th loop reservoir in short. The construction work will be carried out by dividing the extension into two sections, as shown in Figure 8.

The tunnel drilling work for half of the extension is already finished, and the intake facilities from the Kanda River is construction. The construction work (the first period of construction) will be finished at the end of March, 1997, after which the reservoir will be operational. The second section (the second period of construction) will be under construction. When the Kanda-7th loop reservoir has been completed, the minimum safety level corresponding to a rainfall intensity of 50 mm/hr will be ensured, although the improvement of the river channel at the downstream area of the Kanda River are not finished. However, the excess discharge can be reduced in the upstream area and stored in the reservoir.

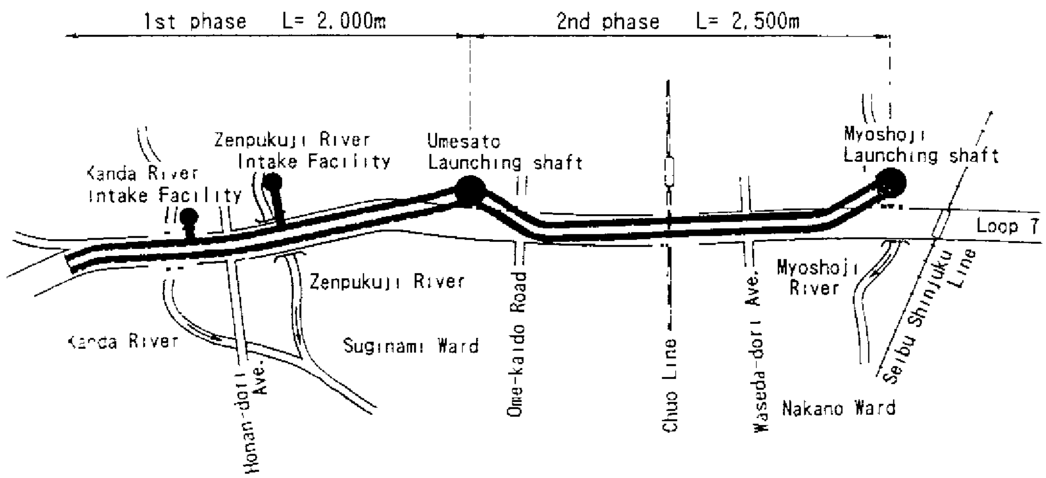

Figure 8 Plan view of Kanda underground reservoir

7. Management of underground rivers

To efficiently Utilize the underground rivers for controlling flooding, a systematic and Comprehensive management plan for the underground rivers will be needed. These measures were discussed by using the water balance analysis of the flood. The water balance can be calculated by the relationship among the inflow, outflow and retention at a point river. An attempt to develop such a management system has been by the Construction Bureau. To predict the runoff with a reasonable accuracy, a net work of rainfall observation station has been constructed together with a suitable number of runoff discharge measurement station. In addition, evaluation of the local flow capacity has been carried out for the rivers.

For the underground rivers, intake facilities that are equipped with movable weir gate allowing a controlled intake flow are being constructed

As an example, about the regulating reservoir of Kanda river (the first period of construction storage capacity of 240,000 m³) which is a part of the gradual application of the Loop 7 underground river the following points have been clarified It is shown that if we introduce the movable weir to this Kanda river regulating reservoir and match the rain condition, then for the downstream narrow parts (runoff capacity corresponding to rain intensity 30 mm, runoff coefficient 0.5), flood management standard can be maintained for the 50 mm design rainfall.

Figure 9 shows a cross-section of an intake facility. Two methods for operating a movable weir gate are considered. One method is to release a constant discharge at the downstream section, maintaining a water level in the surface river so that flooding is avoided

The other method involves releasing a maximum discharge that does not cause flooding in the downstream section of the river in order to keep the storage capacity of the underground river at its maximum The management system that includes all of the above components is temporarily known as "the integrated management system for flood control"

In other hand, in case of typhoon when rainfall prediction is possible, the water level of the narrowed part of the river can be estimated. Before heavy rainfall, the river's flow capacity should be used to the full, while the regulating reservoir's volume be left for the incoming large flow due to the heavy rain. Or, flush out some water, and regulate the flood while controlling the narrowed part's elevation.

On the other hand, at the present stage, it is difficult to predict thunderstorm rainfall. However, since the flow it brings can be normally handled by the regulating reservoir, it is possible to upgrade the safety at the narrowed part by keeping a constant water level at the movable weir. In so doing it is possible to actively take out some water and control the flood.

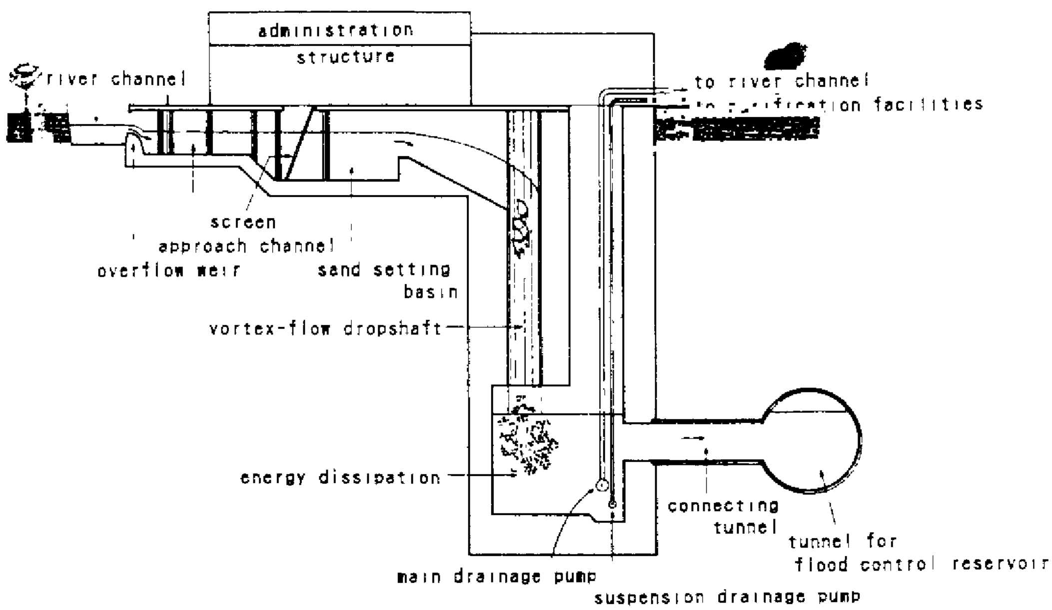

Figure 9 New measure by using a movable weir in the water for intake facility

8. Conclusion remarks

The mainly conclusion of this paper is as follow.

(1) This flood control measures is planned based on the characteristics of urban flood by using flood records in long term.

(2) The flood water balance was able to be analyzed by the modified rational formula and observed data, so that the way of comprehensive flood control was established.

Then, we calculated water balance for flooding and we got clearly overflow volume. So, we made the way of comprehensive flood control measures.

(3) It is shown that if we introduced the movable weir to the Kanda river regulating reservoir. Also, it is possible to upgrade the safety for narrow part river under match rain condition by this movable weir.

In addition, the extension of the 7th loop road underground river is about 30 km long.

Three sections encompass long 3.2 km are under construction at present. The construction is scheduled to be completed before the 21st century. The underground river project is an important part of the flood control program in the Tokyo Metropolitan area. The Tokyo Metropolitan Government aims at constructing a "city where people can live safety and comfortable" completion of the flood control system is one important measure for achieving a safe and comfortable city. The Construction Bureau strongly intends to progress with the flood control.

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Dissemination of Disaster Information and Peoples Behavior in the Flood Disater of Kagoshima Prefecture in 1993

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The floods of July to September 1993 in Kagoshima ,Japan,caused suffering of many people. To mitigate such flood damage,early evacuation of thepeople in endangered areas is of critical importance. In order to do this, itis important to desseminate information, such as weather warnings,and evacuation recommendations and orders,in a timely and accurate manner.

Since the issuance of meteorological information,such as typhoon information,heavy rain warnings, and heavy rain information,is by no means rare in Japan, the meteorological agencies already have established systems for releasing such information and accumulated knowledge of how to do it.In reality, however, there remain many problems yet to be solved. Particularly pressing is the problem of how to make effective use of forecasts of sudden localized downpours (short-range forecasts based on AMeDAS composite images) and record rainfall information.

The behavior of users of such information,that is,the public,also poses a problem because they have become too used to weather warnings. Disasterinformation including weather information must be both accurate and appropriate. However accurate released information may be,disasters cannot be prevented if people do not become aware that a very serious situation is taking place. Disaster information , therefore , must not only be accurate (although this is of primary importance) but also be presented in such a manner that people take it seriously.

AUTHOR INDEX