Efforts after the Great East Japan Earthquake and the current situation: Towards making water systems more resilient and efficient disaster response

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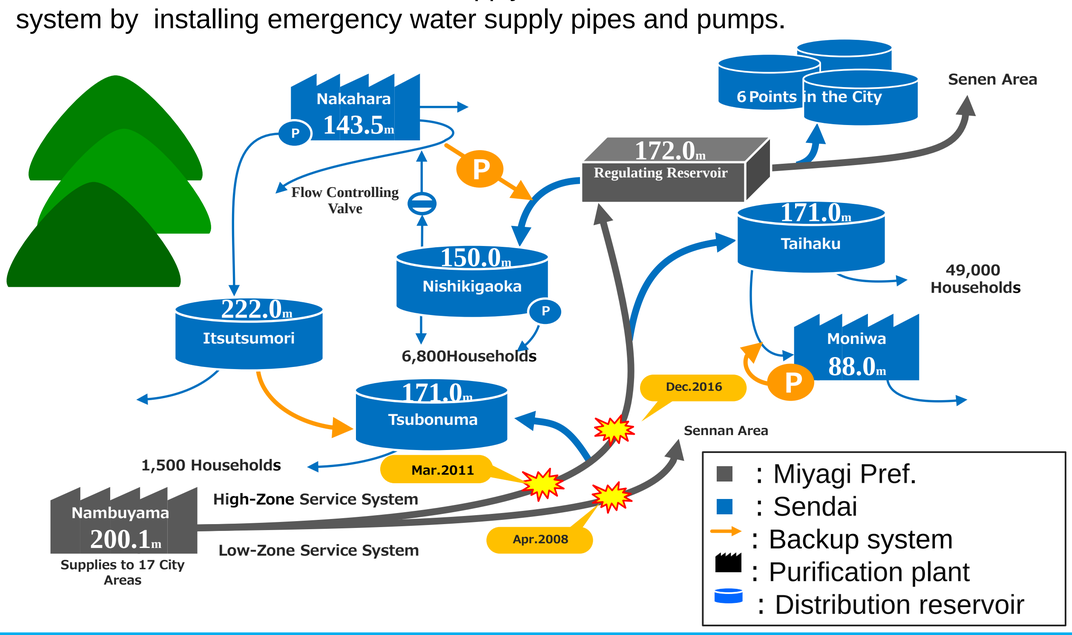
Introduction

Sendai is situated in the northeastern part of Japan. It is the capital of Miyagi Prefecture and the largest city in the Tohoku region, with a population of over one million people. Sendai faces the Japan Trench, where the Pacific plate sinks into the North America plate. Therefore, large subduction-zone earthquakes occur about once every 37 years. Sendai City Waterworks Bureau has taken various countermeasures against earthquakes, including reinforcing water pipes based on the lessons learned from the Miyagi Earthquake (1978) and the Kobe Earthquake (1995). These efforts are considered advanced even within Japan.
On March 11th, 2011, the Great East Japan Earthquake, the most powerful earthquake (M 9.0) ever recorded in the country, struck. There was no major damage to Sendai City's purification plants or distribution reservoirs, but the main transmission pipe of Miyagi Prefectural Bulk Water Supply broke. The water supply to Sendai City was cut off and there was an unexpected long-term blackout, resulting in the suspension of service to a maximum of 500,000 people equating to about 50 % of water service users in the city. It took about 3 weeks to complete restoration works on the pipeline. This earthquake showed us a lot of problems, such as a lack of human resources for emergency responses, fuel shortages, and the method for emergency water supply.
Based on the experiences of the Great East Japan Earthquake, we have focused on the following projects to realize disaster mitigation and efficient responses to disasters.

1. Dual Transmission System

The main transmission pipe of the Miyagi Prefectural Bulk Water Supply was broken and the water stoppage lasted up to 18 days.
To minimize the areas where water supply is cut off, we established a dual transmission system by installing emergency water supply pipes and pumps.



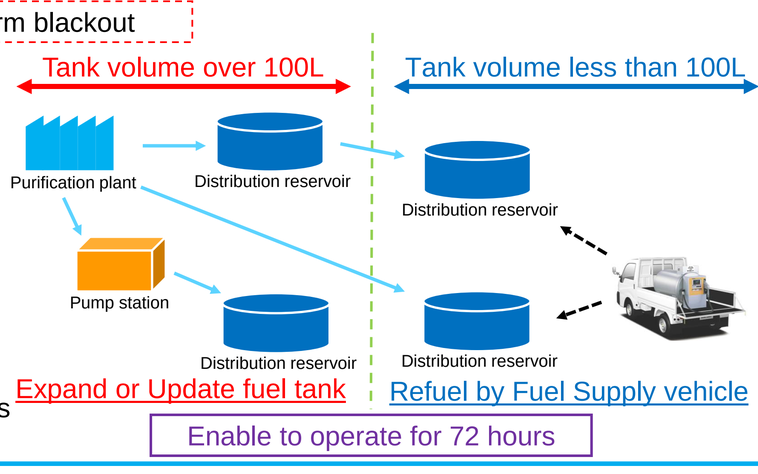
2. Emergency Power Generators

As a measure of long-term blackout

Extend operating time from 24H to 72H at key facilities

To procure fuel easier, we changed the type of oil from heavy oil to light oil.

Purchase fuel supply vehicles and refuel on our own

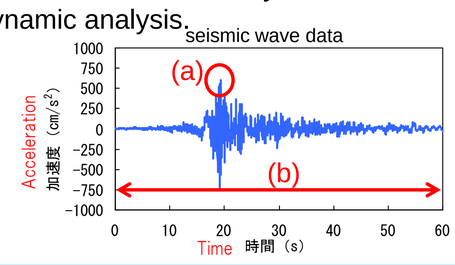


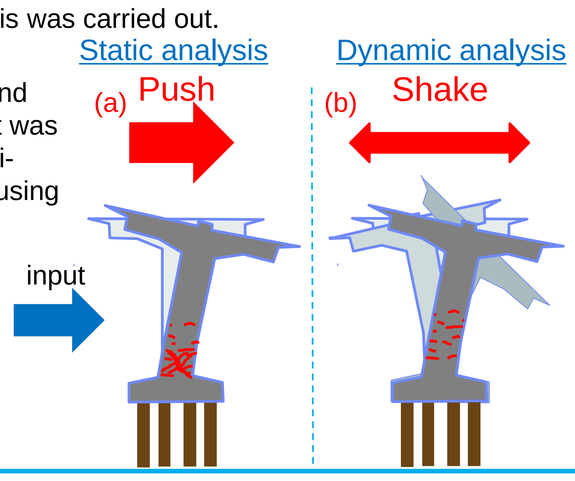
Enable to operate for 72 hours

3. Disaster-resilient Facilities

There was no critical damage to our purification facilities, which were not determined as "earthquake-resilient" by static analysis before the Great East Japan Earthquake.
That tells us that there was a divergence between the assessment and the actual damage.
Therefore, verification by dynamic analysis was carried out.

As a result, since the damage situation and analysis result were roughly consistent, it was possible to perform more appropriate anti-seismic reinforcement by reexamination using dynamic analysis.

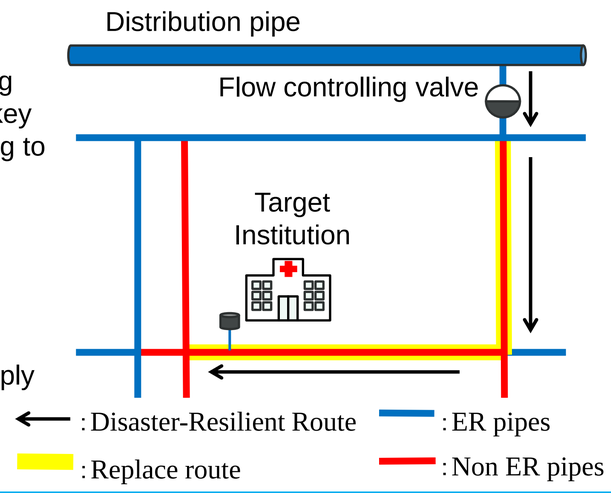




4. Key Medical Institutions

We have been preferentially reinforcing water distribution pipes connected to key medical institutions and facilities aiming to secure a water supply route during a large disaster.

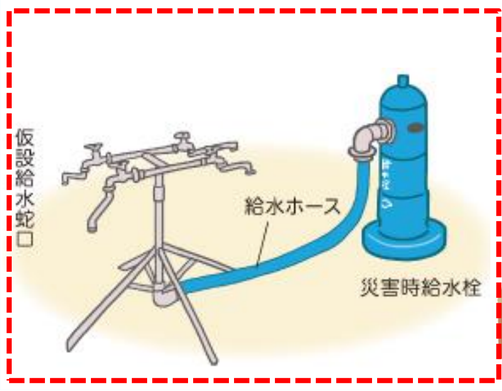
These efforts are carried out to form a disaster-resilient route and prevent malfunctions which stop the water supply to medical institutions.

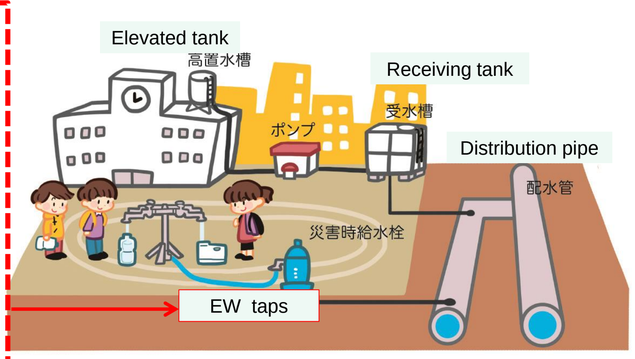


5. Emergency Water Taps

Emergency water taps can be set up and operated by local residents themselves when a disaster occurs. We have been carrying out the installation of emergency water taps at municipal elementary and junior high schools which are designated as refuge areas.

Reduce the amount of staff who engage in emergency water supply activities
Put sufficient human resources into emergency restoration





6. Risk Management Manual

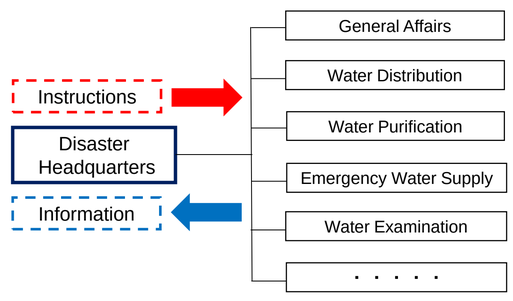
All of the essential roles such as gathering large amounts of information, directing and commanding were all centralized at the disaster headquarters, but it did not function well.

We reorganized our management system in times of disaster by dividing into four groups. Each group can make their own decisions and take actions, which will lead to the realization of flexible and quick disaster responses.

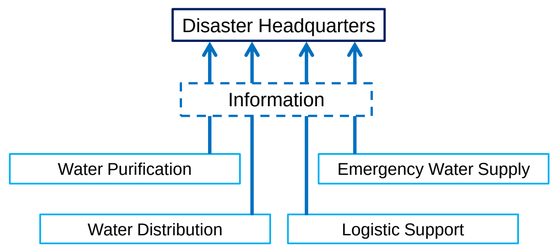
Risk management manual

Before 3.11

All information is centralized



After 3.11



Each group can make their own decisions

7. Enhancing Cooperation

At the disaster prevention drills carried out by neighborhood associations, we arrange for briefing sessions on how to use emergency water taps.

We regularly hold joint disaster prevention drills and signed memoranda with other cities.

Both efforts can contribute to:
- Securing human resources
- Efficient emergency water supply
- Strong cooperation and sharing of information

Conclusion

In the Great East Japan Earthquake, major damage and confusion occurred in many ways. We will continue the efforts introduced above. It is necessary that we urgently construct a strong water supply system that can withstand various disasters, including earthquakes.
Additionally, in order to maintain a stable water supply even in an emergency, the cooperation of residents and other cities is necessary, and it is also necessary to promote efficient disaster response while trying to cooperate with external entities