

‘Disaster-resistant Waterworks Model, Connecting all to the Water of Life’ and the countermeasures against natural disasters examples

Sharing the specific measures of cooperation with major cities and mutual help to community groups

Takuya NAKAGAWA¹, Yuki WATANABE², Keisuke SAWADA³,
Wataru HOSODA⁴, Yoshiaki KONNO⁵, Kunihiko ONUMA⁶

ABSTRACT

On March 11, 2011, the Great East Japan Earthquake, the most powerful earthquake (Mw 9.0) ever recorded in the country struck.

Four years after the Great East Japan Earthquake, The Third United Nation World Conference on Disaster Risk Reduction (hereafter referred to as WCDRR) was held in Sendai City from March 14th to March 18th in 2015. Based on this knowledge, the Sendai City Waterworks Bureau held a Symposium for the WCDRR: Connecting all to the Water of Life with participants from the industry, government, academics and citizens. In light of the discussion, we proposed and sent out the message of the ‘Disaster-Resilient Waterworks Model, Connecting all to the Water of Life’ (hereafter referred to as “The Model”), which combines ①Self-Help by individual citizens, ②Mutual Help together with local communities, schools and businesses, ③Public Support from water suppliers, and ④Cooperation with entire stakeholders including plumbing constructors and the National Water Supply Utilities Network.

In this paper, we explain the correspondence between The Model which we proposed at the 3rd WCDRR and our current countermeasures against disasters. In addition, we will explain two of our measures, ‘Mutual Help’ and ‘Cooperation’ that are focused on emergency water supply. An example of the first measure, ‘Mutual Help’ is ‘Emergency Water Taps’ that enable citizens to set up a water supply station on their own after an event such as disaster. Based on the experiences of the Great East Japan Earthquake, we constructed an ‘Emergency Water Tap’ at each elementary school that is a designated refuge area since FY 2013. We explain that an outline of an ‘Emergency Water Tap’, educational campaign of an explanatory meeting for a local community residents and that progress. The second measure is ‘Cooperation’ with plumbing constructors and the National Water Supply Utilities Network. We have signed a memorandum of mutual support in a disaster with the Sapporo City Waterworks Bureau and the Tokyo Metropolitan Waterworks Bureau. We share information and hold joint disaster training with those cities. In addition, we also hold joint disaster training with other cities and The Japan Water Works Association and through this we have established various relationships.

¹ Takuya NAKAGAWA, Technical Officer, Water Quality Management Section, Water Purification Department, Sendai City Waterworks Bureau, 128 Moniwa-aza-Ueno-Harayama, Taihaku-ku, Sendai City, Japan

² Yuki WATANABE, Officer, Planning and Finance Section, General Affairs Department, Sendai City Waterworks Bureau, 29-1 Minami-Onoda, Taihaku-ku, Sendai City, Japan

³ Keisuke SAWADA, Technical Officer, Water Distribution Control Section, Water Supply Department, Sendai City Waterworks Bureau, 128 Moniwa-aza-Ueno-Harayama, Taihaku-ku, Sendai City, Japan

⁴ Wataru HOSODA, Technical Officer, Moniwa Water Purification Section, Water Purification Department, Sendai City Waterworks Bureau, 128 Moniwa-aza-Ueno-Harayama, Taihaku-ku, Sendai City, Japan

⁵ Yoshiaki KONNO, Assistant Manager, Water Quality Management Section, Water Purification Department, Sendai City Waterworks Bureau, 128 Moniwa-aza-Ueno-Harayama, Taihaku-ku, Sendai City, Japan

⁶ Kunihiko ONUMA, Director, Water Quality Management Section, Water Purification Department, Sendai City Waterworks Bureau, 128 Moniwa-aza-Ueno-Harayama, Taihaku-ku, Sendai City, Japan

1. INTRODUCTION

At the Sendai City Waterworks Bureau, we have taken various steps to create a disaster-resilient water supply, for example, reinforcing water pipes against earthquakes and enhancing cooperation with other cities and associations based on our experiences in the Miyagi Oki Earthquake (1978) and the lessons learned from the Kobe Earthquake (1995). By implementing these measures, our total water management system has steadily developed, so that all water facilities can be used flexibly and efficiently on a day-to-day basis as well as in times of disaster in order to provide customers with a stable water supply.

On March 11, 2011, the Great East Japan Earthquake, the most powerful earthquake (Mw 9.0) ever recorded in the country struck. There was no major damage to Sendai City's purification plants or distribution reservoirs, but the transmission main pipe of Miyagi Prefectural Wide-area Water Supply broke. The water supply to Sendai City was cut off, resulting in suspension of service to a maximum of 230,000 households, or about 50% of water service users in the city. At the time, the Sendai City Waterworks Bureau did not have enough human resources and we were not able to provide customers with an emergency water supply, despite of the support of many other cities.

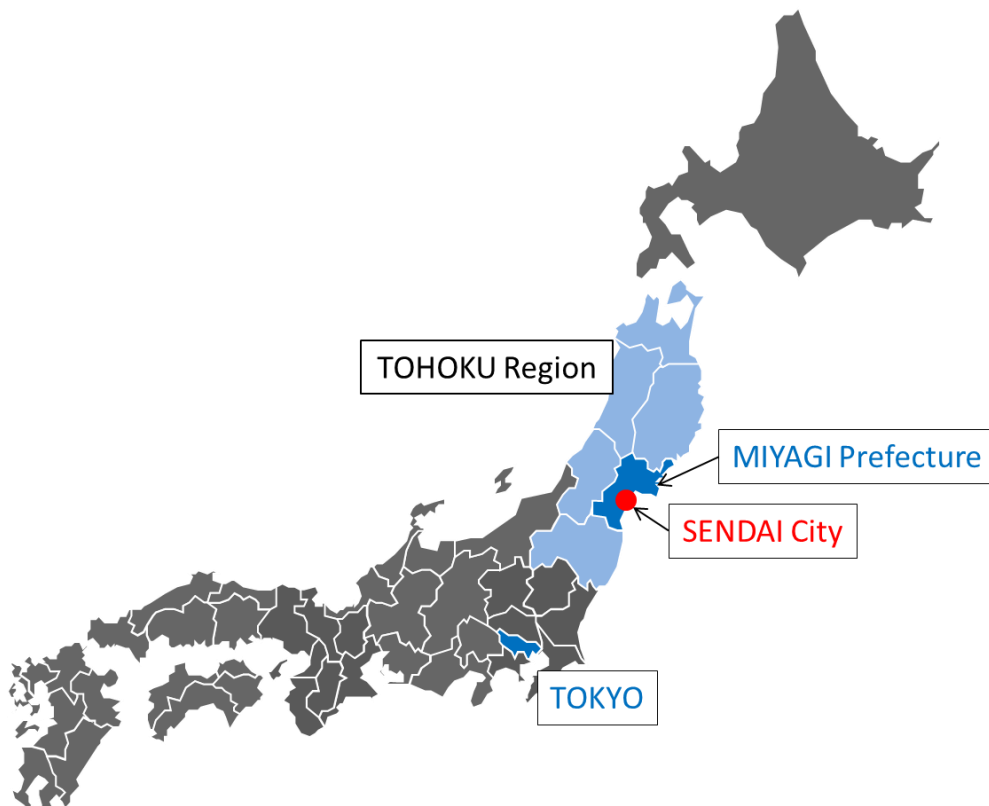


Figure 1. Location of Sendai City

2. The 3rd WCDRR

Four years after the Great East Japan Earthquake, The Third United Nation World Conference on Disaster Risk Reduction (hereafter referred to as WCDRR) was held in Sendai City from March 14th to March 18th in 2015. Finally, at the conference, the 'Sendai Framework for Disaster Risk Reduction 2015-2030' was adopted as a successor to the 'Hyogo Framework for Action 2005-2015'. Some of its features include; the first agreement on the global targets, new ideas such as the concept of 'Build Back Better', and an emphasis on the roles of various parties in disaster prevention and disaster risk reduction, including women, children and various stakeholders such as companies.

Based on this knowledge, we held some outdoor exhibitions, hands-on experience events and a Symposium as a part of the public forum.

A) Outdoor exhibitions and hands-on experience events

- ① Emergency water supply demonstration: having people experience water being supplied by a water tank truck and a temporary sectional water tank.
- ② Water storage declarations by citizens: having visitors write their water storage declarations on post it notes, and putting them on a board to raise people's awareness of the importance of storing water as a form of self-help.
- ③ Display of earthquake resilient pipes: showing people our countermeasures against disasters.
- ④ Demonstration of the restoration of leakage pipes: showing people one of our emergency responses to disasters. Held with the Miyagi Plumbing Constructor's Association (hereafter referred to as MPCA)

A total of over 5,000 people visited the site over two days.

B) Symposium for Water Disaster Risk Reduction: Connecting all to the Water of Life

Sendai City Waterworks Bureau held a symposium for water disaster risk reduction with around 300 participants from industry, government, academics and citizens.

Firstly, The Japan Water Works Association, Sendai City Waterworks Bureau, MPCA and Niigata City Waterworks Bureau gave presentations about their responses to the Great East Japan Earthquake, and their efforts that are based on lessons learnt from the disaster. Secondly, we also held a panel discussion with citizens on the theme of 'building a disaster-resilient water supply system, and the power of collaboration and cooperation'. Finally, based on the discussion, we proposed and published a model, the 'Disaster-resilient Waterworks Model, Connecting all to the Water of Life,' (hereafter referred to as The Model) which combines ①Self Help by individual citizens, ②Mutual Help together with the local communities, schools and businesses, ③Public Support from water suppliers, and ④Cooperation with entire stakeholders including plumbing constructors and the national water supply network.



Photograph 1. The Third United Nations World Conference on Disaster Risk Reduction

3. Correspondence Between The Model and Our Current Countermeasures Against Disasters of The Management Plan (2015-2019)

We have a ten year basic plan for waterworks projects, and in order to execute the basic plan, we also draw up new Mid-term Management Plans every five years. However, when the Great East Japan Earthquake occurred in 2011, it became necessary to give priority to countermeasures against disasters. Therefore, we selected ten projects which we needed to focus on from the Mid-term Management Plan (2010-2014)', improved them and created the 'Earthquake Countermeasure Projects for Promotion.' Then, in March 2015, we drew up a new version of The Management Plan (2015-2019) (hereafter referred to as The Management Plan) which includes these ten countermeasures for promotion.

In this section, we verify the correspondence between The Model and our current countermeasures against disasters of The Management Plan. The countermeasures are divided into The Models four categories, and put into a table (Fig2: Countermeasures against disasters on the vertical axis, The Model on the horizontal axis). First, we will begin with 'Self Help'. An example which falls into this category is 'Enhancing interactive publicity' which includes 'visiting lectures' and 'waterworks fairs'. 'Mutual Help' examples include; 'Enhancing cooperation with local communities', 'Reflecting customer's opinions in our policy' and 'Enhancing business operations in collaboration with customers'. An example of 'Public Support' in addition to a large number of projects about the development of facilities along with projects such as 'Passing on the lessons learnt from the Great East Japan Earthquake'. 'Cooperation' is categorized by 'Enhancing cooperation with other cities and associations' and 'Enhancing cooperation with neighboring plumbing constructors'. It is not only these groups, but also the cooperation from all of the stakeholders that is required to accomplish a disaster-resilient waterworks.

From the above, the current countermeasures are clearly categorized into four categories; 'Self Help', 'Mutual Help', 'Public Support' and 'Cooperation' which are all based on The Model. As a result, we made sure that the concept of The Model is reflected in our current countermeasures against disasters.

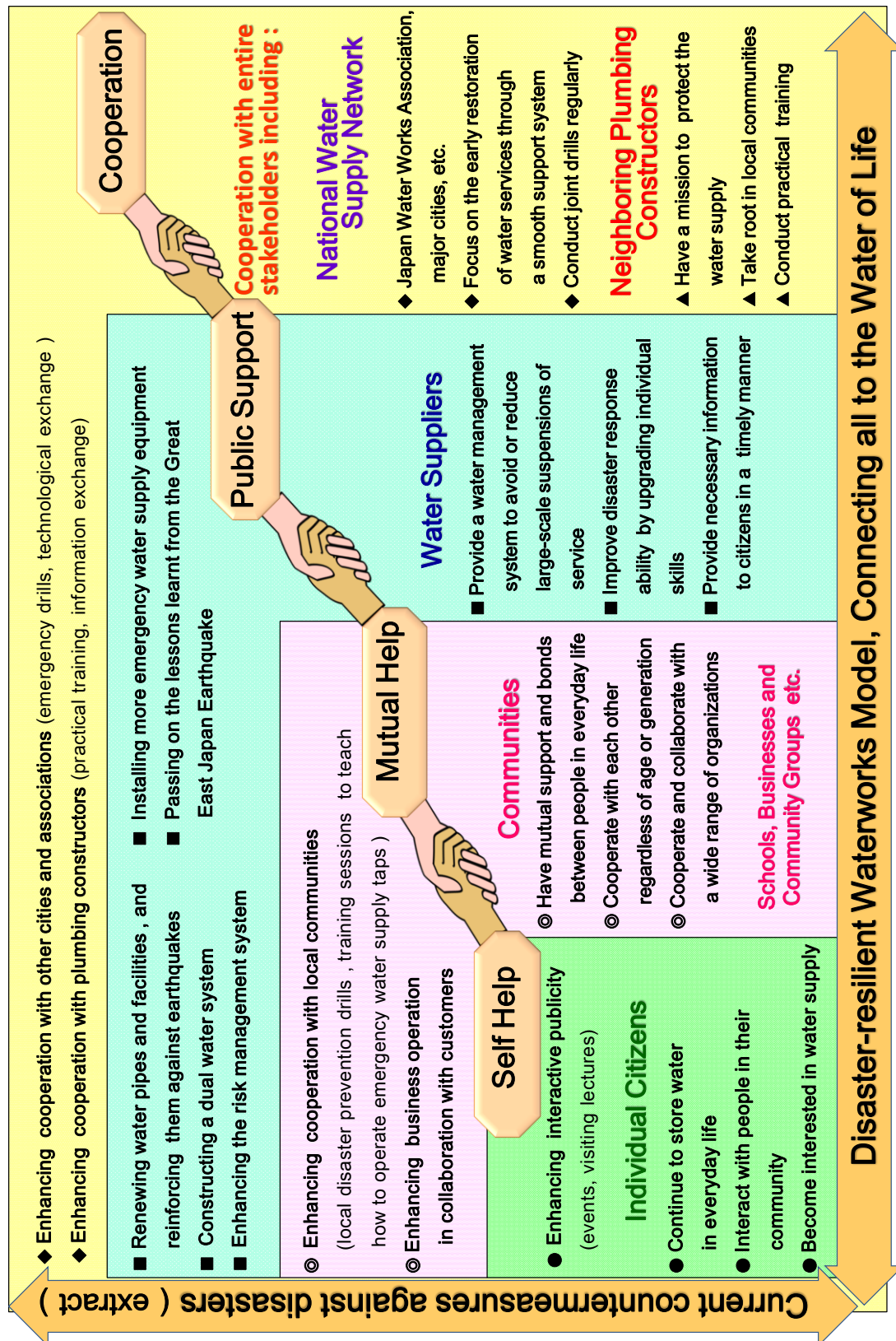


Figure 2. Correspondence between The Model and Sendai City Waterworks Bureau's current countermeasures against disasters

4. "Mutual Help" with local communities

Summary

The Sendai City Waterworks Bureau had established emergency water supply equipment in 60 places over the city before the Great East Japan Earthquake disaster.

However only Waterworks Bureau staff members were authorized to operate the equipment and due to a shortage in human resources, only twenty of the water supply facilities were able to be used.

In consideration of this issue, we have been carrying out the installation of 'Emergency Water Taps' at municipal elementary schools which are designated as refuge areas (excluding municipal elementary schools where emergency drinking water storage tanks are installed) and taps that local residents can set up and operate themselves since 2013. The 'Emergency Water Tap' is modeled on ground type fire hydrants that are connected to a pipe branched from an earthquake resilient pipe. The 'Emergency Water Tap' is easily installed by connecting the tap and a temporary water supply faucet to a Food Sanitation Act compliant water supply. In addition, the necessary equipment is kept in a disaster prevention stock warehouse on the premises.

By local residents setting up an 'Emergency Water Tap', the regional emergency water supply system is strengthened. Along with this it is considered to improve the human resources of the Waterworks Bureau to aid the early restoration of water facilities and emergency water supply to medical facilities etc.

Content of enlightenment activities for local residents

We request that local residents set up an 'Emergency Water Tap' when a designated refuge area is established after the occurrence of an earthquake measuring more than a lower 6 on the Japanese scale, regardless of whether or not the water supply is cut off. Sendai City Waterworks Bureau holds briefing sessions on how to use 'Emergency Water Taps' for evacuation center management committee members (consisting of local residents who operate the evacuation center, staff in charge of evacuation center, and school facility administrator), so that they can smoothly operate the equipment during or after a disaster. We also conduct enlightenment activities for citizens through our website and public information magazines by the Waterworks Bureau.

Progress status of 'Emergency Water Taps' installation

As of March 2017, 'Emergency Water Taps' have been installed in 78 out of 110 municipal elementary schools. We plan to finish installing these taps to all municipal elementary schools by March 2019. Furthermore, we plan to carry out installation to, in total 175 locations at elementary schools, junior high schools and high schools.



Photograph 2. Emergency water tap



Figure 3. Enlightenment activities from a public information magazine

5. “Cooperation” from local plumbing corporations or network of water supply utilities from all over Japan

Summary

In the past, every time an earthquake disaster occurred, the Sendai City Waterworks Bureau implemented an emergency water supply and emergency restoration to the water supply. In response to this, we have repeatedly re-examined and improved our system for sending personnel support. We then utilize these experiences for rescue activities at many disaster affected areas in Japan.

At the time of the Great East Japan Earthquake in 2011, Sendai City suffered serious damage, and about 50% of the water supply was cut. Sendai City received support in the form of water tank trucks from private companies and water supply utilities from all over Japan. It was due to this support that Sendai was able to carry out emergency water supply on a continuous basis and was able to achieve the early restoration of water services.

Based on experiences of rescue activities in the past and receiving support from other cities after the Great East Japan Earthquake. We will describe the mutual support system between major cities in Japan.

The JWJA mutual support framework

When an earthquake disaster occurs in Japan, the disaster affected water supply utilities make a “request for help” to the Japan Water Works Association (JWJA) based on the “Guidance for Response to Earthquakes and other Emergencies”. To correspond to the request, it is preferential that the neighboring communities and prefectural branches provide cooperative communication, emergency water supply, support and aid in restoring the water supply after a disaster. The JWJA mutual support framework consists of water supply utilities from all over Japan, which enables the assembly and dispatch of a large number of water tank trucks.

The framework of mutual support between major cities

Sendai City Waterworks Bureau has joined the “Memorandum of Understandings on Mutual Disaster Support between Waterworks Bureaus of 19 Cities”. When a disaster hits a major city, support is requested on a large scale from participating cities, putting in place the framework of mutual support

between major cities.

The memorandum specifies designated leader cities and their roles when a disaster occurs. The designated Leader Cities take an initiative to collect information on the affected city, and convey their requests for support to other alliance cities.

By acting on behalf of the affected city, the Leader Cities will carry out support in the initial phase, it is expected that this leads to the early restoration of water services as the disaster affected city can concentrate their work on other restoration activities.

In the case of Sendai City, the Leader City of the first priority is Sapporo City and the following Leader City is Tokyo Metropolitan Government.

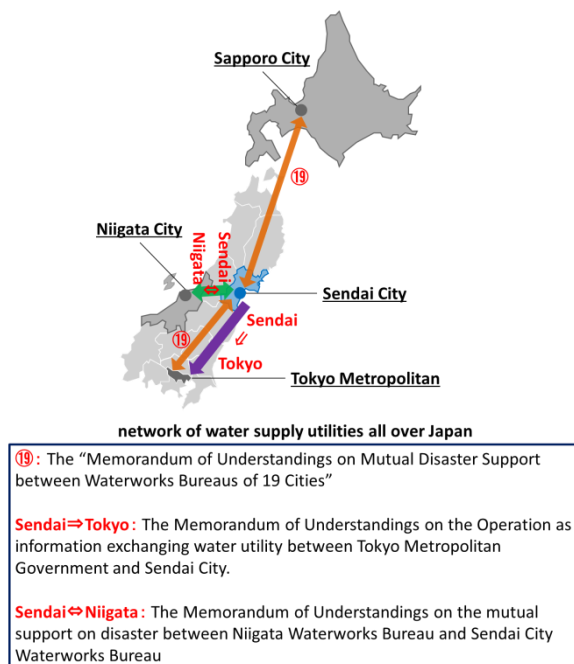
The other memorandums and agreement

Taking into account the geographical conditions, Sendai City has concluded the “Memorandum of Understandings on Mutual Disaster Support” with Niigata City, as there is a low possibility of an earthquake occurrence in both cities at the same time. In this Memorandum, the support city has the role of planning an emergency water supply, early restoration of water services and supplies fuels.

Furthermore Sendai City Waterworks Bureau has concluded with the Bureau of Waterworks, Tokyo Metropolitan Government the “Memorandum on Activities as a Waterworks utility responsible for Information Coordination between Tokyo Metropolitan Government and Sendai City”. Although Tokyo is positioned as the second Leader City to Sendai in the mutual support agreement, in the case that an earthquake with a seismic intensity larger than 6.0 occurs, independent support can begin, and has the advantage of a rapid initial response.

Additionally, in the occurrence that Sendai City is stricken by an earthquake disaster, Sendai City Waterworks Bureau has concluded the “Agreement of Restoration of Water Supply Facilities in Disasters” with the Miyagi Plumbing Sanitary Association (MPSA) for the early restoration of water services. In this agreement Sendai City Waterworks Bureau can request the MPSA to perform relief activities such as emergency water supply activities, emergency restoration and providing materials for restoration.

Beside this, Sendai City Waterworks Bureau has also concluded agreements with privately owned companies that provide engineers for leakage investigation and the dispatch of pressure type water tank trucks.



Photograph 3. Practical training with other cities, private companies and citizens (Sapporo City and Niigata City)

Figure 4. Network of water supply

6. CONCLUSION

This paper introduced and put together a comparison of the relationship between the Disaster-resilient Waterworks Model, Connecting all to the Water of Life proposed at the 3rd WCDRR, and our current countermeasures against disasters. We have highlighted the four necessary efforts; ‘Self Help’, ‘Mutual Help’, ‘Public Support’ and ‘Cooperation’ which together create a disaster-resilient water supply.

Sendai City Waterworks Bureau has made various measures to construct a disaster-resilient water supply, based on experiences from the Great East Japan Earthquake. However in this paper we only explained two of our measures ‘Mutual Help’ and ‘Cooperation’. On the topic of ‘Mutual Help’, we explained that we have built a relationship of trust with citizens by constructing ‘Emergency Water Taps’ that enable citizens to set up a water supply station on their own after an event such as an Earthquake disaster and we explain to community residents how to use them. On the topic of ‘Cooperation’, we showed that we have established various relationships, for example we have signed memorandums of mutual support in a disaster with many cities and associations and hold joint disaster training with them.

In the future, we will continue to further our current countermeasures against disasters steadily, based on “The Management Plan (2015-2019)”. Moreover, we will strive towards constructing a disaster-resilient waterworks in cooperation with various parties such as citizens, local communities, water suppliers, plumbing constructors and other cities. In order to achieve the above, we aim to raise everyone’s awareness of disaster prevention including “Self Help” and “Public Support”, two other necessary efforts of our city which were not addressed in this paper which enhance disaster prevention drills, and improve public relations.