SUBSESSION 3

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Ladies and gentlemen, it is my pleasure to have this opportunity to meet you here today. I am Ahn Sang-young, the mayor of Pusan and I am honored to chair this subsession. The theme for Subsession 3 is "Waterworks and Sewer Systems in the City". I would like to ask your cooperation to make this subsession successful. I also hope that the result of this subsession will contribute to the water management of the Asian-Pacific region. Now, let us move to the introduction of the participants.

INTRODUCTION OF PARTICIPANTS

PRESENTATIONS

Chairman Mr. Ahn Sang-young, Mayor of Pusan

We will now move onto the case presentation. I ask Mr. Shin Sung-kyo to present the case in Pusan.

[PUSAN] **Mr. Shin Sung-kyo, Research Fellow**

First of all, it is a pleasure for me to have this opportunity to introduce the water and sewage management status of Pusan Metropolitan City.

Like other cities, the water and sewage management problems are one of the major issues of our city. Pusan is located at the southeastern tip of the Korean peninsula, and the largest port in South Korea. Since its opening as a trading port in 1876, urbanization took place rapidly in Pusan, resulting in the city growing 4.5 times in population in the last 50 years. The current population of Pusan is 3.88 million people, and Pusan has become the center of the southeastern bloc of Korea.

Before the 1960s, Pusan's source of water consisted of blocking off the nearby valleys and using the water that was filled them up, and such water was sufficient both in quantity and quality. With rapid development of the city and drastic increase in demand for water in the 1970s, it was necessary for Pusan to utilize the water from the lower Nakdong River, which has 1/3 of our country as its drainage area. However, as the water intake site was located downstream for Pusan, Pusan began to have problems with water quality and quantity as water from the sea ran into the river during high tide and affected it. After seven years of construction, a dam was constructed at the mouth of the Nakdong River in 1990 to solve this problem. This dam currently supplies water to some eight million people in the region, and water was secured during the long draught of the last three years. Currently 93% of the water consumed by Pusan is collected from the Nakdong River, and the water supply rate is 98%. In recent times, the large and small cities as well as the large industrial complexes that use the upper Nakdong River as their source of water have been discharging large amounts of sewage and wastewater into the river, causing the lower river to become polluted. Although the wastewater discharged has been treated, the water quality of the lower area is becoming seriously polluted. Accordingly, in order to supply safe tap water, the city of Pusan has supplemented the ozone and granular

activated carbon treatment facility on the 600,000 ton per day filtration plant and supplies water that is treated with advanced treatment process, while hoping to implement the advanced treatment process on the entire treatment plant by the year 2002. In terms of securing safe tap water, a strict water quality inspection is conducted with 46 special management items in addition to 45 legal items.

Given that it will be very difficult to secure water in the 2lst century due to rapid urbanization, and the fact that the UN has classified Korea as tenth in the world in terms of suffering from insufficient water, the most effective answer to this problem is water saving. The city is developing water saving programs, distributing water saving devices and promoting campaigns throughout the city, while recommending water reuse in large buildings. Moreover, replacement of old water pipes is underway to decrease water waste from leakage, while attempting to replace all the water pipes with semi-permanent materials by the year 2000.

The phenol discharge incident of 1991 from the factories located at the upper Nakdong River caused the water supply to be stopped from the river due to the serious water pollution, and this incident has caused the people living in the lower river area to be uneasy toward the safety of the tap water. This distrust increased with the announcement by another municipal government in the upper Nakdong River region to build a new industrial complex, and the people of the lower River region, including Pusan, have been demanding nullification of the project with concern for water quality. This movement has caused serious tension between the people of the upper and lower Nakdong River regions. Under such circumstances, Pusan is proposing to the central government to build a dam at an unpolluted and slightly more distant point in the upper River to secure a source of potable water that can be transported through pipelines and secure people's trust in water quality.

The water pollution problem following urbanization and industrialization is a big issue for our city. Pusan has many seaside tourism resources including the famous Haeundae Beach, so we are constantly putting our efforts into improving the water quality of the rivers and seas by improving the sewage systems. However, as large amounts of money are needed for the sewage projects, fund securing is also an obstacle that needs to be overcome. First, the difficulty of selecting a site for the sewage treatment facility must be overcome as site selection faces confrontations from local residents taking the NIMBY (Not In My Back Yard) stance. In order to solve these conflicts, Pusan is forming a Siting Decision Committee on a case by case basis composed of the local residents, experts, and government officials to convince the residents of the need for the sites of these Locally Unwanted Land Use (LULU) facilities; and is seeking residents' understanding through Local Resident Assistance Programs which include financial compensation for land devaluation. Of the two operating sewage treatment facilities, Pusan has solved the conflict with the residents by forming an exercise park in the upper part of the facility and constructing a cultural center within the facility. Another sewage treatment facility that is due to be constructed this year had anticipated a fierce objection from the local residents in addition to the overpriced land, so it was decided to build the facility underground beneath a nearby park.

Second, most of the sewage pipe systems of Pusan were designed as storm water drainage before urbanization, so there is difficulty in transporting the wastewater to the treatment facility. The most effective method is relaying the pipes as sanitary sewers, but relaying the pipelines in a city that has undergone

urbanization is not only expensive, but almost impossible in a short period of time due to the traffic conditions within the city. In the case of newly laying sewage pipelines, Pusan is currently installing sanitary sewers; and in the case of combined sewer pipelines already laid out, separate intercepting sewers are installed on both sides of the stream to separate the water discharged from the drainage from the natural water of the stream, before transporting the sewage to the treatment facility. A total of 48.71km of intercepting sewers have been laid out in the four sewage treatment facilities of Pusan, and will be expanded to creeks as well in the future.

Third, there is a need to expand on the insufficient sewage treatment facilities and find a countermeasure to prevent the occurrence of red tides on the inland seas. Since beginning operation of the first treatment facility in 1981, Pusan has had the capacity to treat 1.29 million tons of sewage a day in the four treatment facilities, and these facilities are operated according to the Standard Activated Sludge System. In order to increase an insufficient sewage treatment rate, Pusan expects to complete the construction of five treatment facilities by the year 2002 in time for the Asian Games, and expand three existing facilities to treat 2.17 million tons of sewage a day. Furthermore, small-scale sewage treatment facilities or combined septic tanks will be installed in non-urbanized areas to make the discharging of untreated sewage "zero". Moreover, in order to maintain our reputation as a beautiful resort with clean waters, Pusan plans to preserve the water quality of the inland seas by discharging the treated waters from sewage treatment plants in the outer seas through underwater pipelines. Pusan also plans to solve the red tide damage of the fishing communities of the inland seas in the summer by implementing the advanced treatment method of removing nitrogen and phosphorus in the newly constructed treatment facilities. In order to arrange for the large amount of funds needed for the construction of the water and sewage related facilities that are being planned, serious consideration is being made to privatize the construction and operation of the facilities and induce foreign capital as well as private capital.

This concludes the outline of Pusan's water management status. We will do our best in the future to execute our duties as part of the international environmental preservation group. Thank you for your attention.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you very much, Mr. Shin Sung-kyo. I now ask Mr. Les Mills from Auckland to present his case.

[AUCKLAND] **Mr. Les Mills, Mayor of Auckland**

This was the music that I remember so well from my visit to Japan at the time of the 1964 Olympic games. Since that time I've been fortunate to come back to Japan and other parts of Asia Pacific on many other occasions. Many of you have been able to visit us in New Zealand. I'm pleased to be here again to address this conference on the management of water in our cities. Like many countries, New Zealand sometimes has too much water and sometimes too little, but we try not to let these extremes interfere with things like our national sport of rugby.

Water, pure and plentiful; it has been a wonderful source of great riches for our country New Zealand and my city, Auckland. Clean, fresh water has contributed much to the high standard of living and also to the quality of life that we enjoy in our clean and green environment. Our grassland farming, nurtured by this

bountiful resource, has been the mainspring of our economic growth and produced products which are famous around the world for their abundance and quality. Where else does the sheep population outnumber the people by 20 to 1 ?

It has also helped us to power our economy with hydroelectricity and geothermal fields. Water has also been the key to New Zealand's growing tourism industry attracting visitors around the world to our ski fields and lakes-and to enjoy holidays in our rivers, on our rivers and nowadays, even over our rivers. Though the sport of bungy-jumping requires a certain daredevil spirit more often found among our younger visitors. Like the rest of New Zealand, Auckland has been fortunate in its access to fresh, clean water. At first this came from plentiful groundwater supplies within the city tapped by the early settlers who founded Auckland in 1840. Then, from the beginning of this century, the city's needs have been met by reservoirs in the green hills to the west and south of the city. Reservoirs have so far kept pace with the growing demand of Auckland's increasing population. The first of them was built in 1910 and the tenth, also the biggest, was commissioned in 1977. But Auckland is growing fast; the population of one million is expected to double in thirty to forty years. In a few years, Auckland will be tapping into a new source of plentiful, high quality water supplies. From the year 2000, these supplies will come through a38kilometer pipeline which will connect the city with the mighty Waikato River which drains the mountainous central plateau of New Zealand's north island offering Auckland long term supply and drought security. The Waikato River project, to be completed by 2010, will enable the city to meet an estimated 30% increase in demand for fresh water over the next 25 years.

Just as Aucklanders value our fresh water, so do we want to protect our marine environment and treating our wastewater properly is an important way of preventing pollution from entering the two harbors around the narrow isthmus on which Auckland is built. For the past 40 years the city's wastewater has been piped to a large waste treatment facility based on oxidation ponds and the discharge of treated effluent to the sea. But here too, Auckland is looking to the future; we're about to start work on a360million dollar modernization project which will make the plant more efficient and increase its capacity to match our population growth. Later, satellite treatment stations will be built to provide continuing protection for the environment. Meanwhile work is continually underway throughout the city to upgrade wastewater and storm water drainage pipes. So Auckland, like the rest of New Zealand, owes much to our fresh water resources and the clean, beautiful and productive environment which this water has helped to provide. It is a resource which we have always valued and will continue to value as we build a city to be proud of in the 21st century.

Thank you for listening to our presentation. We're delighted to be here and to be taking part in this conference. Special thanks once again to the mayor of Fukuoka, Mayor Kuwahara, for the outstanding organization of the conference and for the warm hospitality with which we've been shown. We sincerely hope that we will see a lot of you in Auckland in the future. Thank you very much.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you for your presentation, Mr. Les Mills. Next I would like to ask Mr. Quinn, Deputy Mayor of Brisbane to speak.

[BRISBANE] **Mr. Tim Quinn, Deputy Mayor of Brisbane**

I have been elected councilor of the city since 1985 and have chaired the Urban Planning Committee since 1991. At the outset I would like to again sincerely thank Mayor Kuwahara, Fukuoka City Hall and the people of Fukuoka City for the opportunity to participate in this very important conference and to bring good wishes from the people of Brisbane.

Brisbane is a river city of 840,000 people located in a sub-tropical environment in Queensland. The region surrounding the city includes significant environmental features such as Moreton Bay into which the river flows, and associated coastal wetlands, the tourist destinations of the Gold Coast and the natural forests referred to as Brisbane Forest Park. The weather is characterized by a high summer rainfall and a mild, dry winter. The climate supports a vibrant urban lifestyle characterized by outdoor activity. The region is growing rapidly, and while the current population is around two million people, it is expected that, within the next 20-30 years, up to 4 million people will reside in the area. Brisbane's water and sewage customers are served by four water treatment plants: water reticulation to 98% of the people, wastewater collection from 97% of homes, and 10 wastewater treatment plants.

Brisbane's city council supplies treated water to our city and six other surrounding cities as well. Water is collected in three large dams and one small one built between 1860 and 1982. Brisbane's largest treatment plants take water from the river after release from one of the large dams. Since the 1940's, the wastewater infrastructure has been developed to the point where the 10 treatment plants are at least secondary treatment level with some able to remove significant amounts of nitrogen. Industrial discharges to the sewer have been encouraged over the last 10-15 years to treat waste on their own sites to reduce loads, and to therefore keep pollutants from entering treatment plants.

Urban infrastructure development inevitably leads to pressure on the environment. In Brisbane, it is recognized that there are two major sources of impact on the water environment: firstly, wastewater systems; and secondly, urban storm water. Brisbane's wastewater treatment plants discharge to the Brisbane River or to Moreton Bay and the sewer network overflows during major rainfall events. This combines with the impact of rainfall, washing pollutants from urban areas into the city's waterways. These effects can be minimized by high-level sewage treatment and upgrading sewers, and by designing urban areas to improve storm water quality or incorporating storm water devices such as gross pollution traps. In order to execute the most effective management strategies, a scientific study involving the three levels of government is being managed. Brisbane City Council is looking after the Brisbane River and Moreton Bay Wastewater Management Study. The study outcomes will drive the future strategies of wastewater treatment and urban catchment management in the whole region.

Next, I would like to speak of the future water supply issues. Different countries have different approaches to regulating water quality and reliability issues. We've seen that in Europe and in the United States, there are quite strict standards being developed for customer service. Scientific and analytical developments around the world have lead to better measurement of the chemical and biological material in drinking water and the linkage of these elements to disease. These advances have lead to the development of tighter specifications for drinking water in many countries. We have seen that the private sector is becoming more involved in

water supply operations and many of those strict standards are becoming contractual requirements as private sector involvement increases. In Australia and in other countries, many public sector water authorities are involving the private sector under initiatives being taken to demonstrate efficiency improvements as required in Australia by the National Competition Policy. This policy dictates that the water industry must be subject to competition, ending the monopoly position of many water authorities. You can see from the previous slide of course, the Brisbane River and the Moreton Bay are important recreational areas as well as water supply areas. The current and forward investment strategies in water treatment reticulation and customer service are being driven by the changing structure of the industry; increasing community demands, and more accessible and sophisticated science. Brisbane City Council has responded by commercializing its water enterprise which deals with both water and wastewater; but at this point in time, all issues to do with water and wastewater treatment within Brisbane City are largely under the direct conduct and jurisdiction of Brisbane's City Council. Brisbane is fortunate in that it has generally reliable rainfall and good quality water. However, priority is being given to water conservation programs for both environmental and economic reasons. In economic terms, it will be important to try and defer the very high cost of new dam construction as far off as possible by conserving existing supplies. One of the significant issues that need to be addressed in the water supply then is water demand; projected population forecasts suggest water storage may be an issue in about 20 years time. The recent introduction of consumption based charging has significantly reduced domestic demand-from average household consumption of about 380 kiloliters to about 300 kiloliters. The requirement is now to move to full cost pricing or transparency of cross subsidies. Another issue with water supply in Brisbane has been blue-green algae toxins; Brisbane has suffered from some algae blooms in storage, recent blooms have included the toxic species cylindrospermopsis which needs to be managed and suppressed in storage or very expensive treatment options will be required. Dirty water is sometimes an issue with iron and manganese staining; Catchment management is certainly an issue with the necessary regulation of uses, and management of runoff is becoming increasingly important. Catchment management and control of the storage is under the jurisdiction of a separate authority. At the mouth of the Brisbane River of course is the port for the city of Brisbane, which is one of the most significant ports in the northern part of Australia. The port is constructed as seen on the right hand part of the slide at the mouth of the river where the river enters Moreton Bay.

Now, I move to the issue of wastewater and the environment. As we see there on the slide, Moreton Bay is protected from the open ocean by very large bay islands. It makes it a very beautiful bay but it also makes it a very fragile environment necessary to be carefully protected. In Queensland, the State Department of Environment is the regulator of wastewater system performance. New legislation was established in 1995 replacing a 1971 Act that regulated water quality. The new legislation both encourages environmental stewardship and penalizes willful environmental harm. Brisbane's wastewater system has been developed in a centralized way with the majority of the wastewater flows being treated in three large plants. All the city's treatment plants treat to the secondary level (i.e. removal of organic matter and micro-organisms), though not all remove nitrogen and none are designed to remove phosphorus to any significant extent. The sewage system is susceptible to inflow and infiltration from illegal connections and storm water. Both treated

wastewater from the treatment plants and overflows from the system can lead to environmental degradation. Some of the significant issues in wastewater that Brisbane needs to address are the impact of treated wastewater on the environment, reduction of sewage overflows, treatment and disposal of bio-solids, and replacement or upgrading of infrastructure. There has recently been the Brisbane River and Moreton Bay Wastewater Management Study. This study was developed by Brisbane City Council and the neighboring six local governments, the State Department of Environment and Natural Resources and with funding from the government's National Heritage Trust. The study was done for a number of reasons: we were concerned about the lack of knowledge of water quality in the Brisbane River and Moreton Bay. As I mentioned earlier, although the bay is open to the Pacific Ocean, it is sheltered by those very large bay islands and is therefore a protected and fragile environment. We can see there some of the impact on the bay as we've measured through the study on nitrogen and phosphorus. Also, sediment is a major problem in Moreton Bay, washed down from the rural areas in the headwaters of the Brisbane River and also of course from urban redevelopment. And those issues of sediment, nitrogen, phosphorus are having a significant impact sadly we find, on Moreton Bay. We felt there was a need to develop quantifiable community expectations for the quality of waterways and a need to develop wastewater discharge standards which would lead to obtaining those outcomes. The study has found that the pollution in Moreton Bay is having a significant impact on the quality of water and also on the life of marine animals. We found that the populations of dugong, a large aquatic mammal; and of sea turtles and their habitat, namely sea grasses are threatened by essentially two parameters-nitrogen and sediment. The major sources of nitrogen are wastewater treatment plant discharge and urban and rural runoff. Nitrogen and phosphorus have their sources in domestic chemicals used in washing, washing up and those sorts of activities as well as the sewer systems of some industrial users. Sediment, on the other hand, is generated largely by urban and rural runoff of significant amounts of soil into the river and the bay. Sediment in particular is killing the sea grasses in Moreton Bay which depend on certain conditions of light within the water to grow and to thrive. And as the sea grass is killed off, of course the marine animals of Moreton Bay will also be killed off and that will have a significant impact on the environment and life of our city unless we deal with it. Of course, as you can imagine, it's a fairly complex and expensive issue to deal with as well. The water quality analysis and subsequent modeling are now leading to enough understanding of the ecology to allow a long-term water management strategy to be developed. Brisbane City Council has recently committed to expenditure to reduce nitrogen at its largest treatment plant to less than 5 milligrams per liter. Further commitment is likely as the study confirms other management options that are required to improve the water quality.

In conclusion then, ladies and gentlemen, the Brisbane City Council has a well developed public infrastructure for provision of water and sewage systems that has protected the public's health for much of this century. There are now many issues that are now impacting to the extent that further significant investment is required to deal with those matters of nitrogen and phosphorus that are likely to cost us in the order of 200 million dollars. The significant drivers for the need for this investment are environmental management, drinking water quality standards, aging infrastructure and significant population growth. Brisbane is the key area for population growth within Australia. Brisbane has been, for tens of thousands of

years-from the beginning of time-an important port for Aboriginal people who lived in Brisbane and continue to do so and then, of course when people arrived in Brisbane from other countries around the world. Brisbane has always been a great river city. We believe we have a strong responsibility to care for the environment of the Brisbane River and Moreton Bay to insure that that wonderful river, that wonderful lifestyle, and the ecology of that area is protected into the future. Thank you very much.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you very much, Mr. Quinn, Deputy Mayor of Brisbane. Next I would like to ask for the presentation of Fukuoka City.

[FUKUOKA] **Mr. Shinichi Shiki, Deputy Mayor of Fukuoka**

First of all, I would like to tell you that Fukuoka is rather an exception in Japan concerning water works and sewer systems.

Japan, with its temperate monsoon climate, is regarded as a nation that has a relatively large amount of rainfall. However, because precipitation is concentrated during the rainy season and because our nation is geographically mountainous with narrow rivers, a considerable amount of our rainfall flows out to the sea in a relatively short period of time. Japan is a narrow country with a large population. When precipitation per capita is calculated, Japan has only one fifth of the world average and can not be described as a country with a rich supply of water resources.

The City of Fukuoka, in particular, does not have any major river within its jurisdiction. Having a geography which is not blessed with rich water resources, the City, since the establishment of its water works in 1923, has struggled to secure its water supply by resorting to such measures as procuring water from outside its jurisdiction. Furthermore, because of its rapid urban development which has acutely increased the demand for water, the City, during the 75 years since establishing its water works, has expanded its facilities 18 times, a number quite frankly unheard of in other cities. However, thanks to such efforts, our capacity has reached approximately 700,000t of water per day, supplying roughly 1.3 million citizens.

Breaking down the sources of our city water, the City gets one third from dams and another third from small and medium sized rivers located nearby. For the remaining one third, we rely on water which is supplied from the Chikugo River, the largest river in Kyushu, located 30 km from the city. Just from the structure of our water sources, I think you can understand how much the City of Fukuoka has historically struggled to secure its water resources. Additionally, our nation as a whole has suffered from reduced rainfall since 1965. This has had the effect of bringing instability to the flow of our rivers thereby creating a number of life threatening crises such as water shortages which lasted 287 days in 1978 and 295 days in 1994. In order to cope with such water shortages, the City has embarked on a diversified range of water resource development, in addition to promoting water conservation-type urban planning which I shall elaborate on later.

First, water intake from the Chikugo River was realized in 1983. In addition, we have been involved in increasing our water storage volume through the construction of pumping-up dams which pump water from the Chikugo River in times of abundant river water level, as well as by the dredging of the existing dam beds

for further storage. We also are involved in the development of dams at the upper stream of the Chikugo River. Now let us compare the two water shortages that Fukuoka experienced. Our 1994 water shortage has been described as "the year with the smallest amount of rainfall in a hundred years" and produced the smallest amount of precipitation in our recorded history. However, because we called on public cooperation to conserve water and because of our initiatives on water resource development which I have just mentioned, we see that although we had more days of water use restrictions during our 1994 water shortage, the time duration of such water use restrictions were reduced compared to our 1978 shortage. Furthermore, as we were able to secure tap water on a daily basis, servicing water through water wagons became unnecessary. We were therefore able to avoid mass civil confusion as was the case during our 1978 shortage, when long cues lined up to get water from water servicing wagons.

The City of Fukuoka, while advancing water resource development, is promoting the effective use of water and water conservation measures as part of its water conserving urban planning, which serves as one of the most important foundations to its city policy based on the "City of Fukuoka: Municipal Ordinance on Water Saving", which Fukuoka pioneered after the painful lesson of the 1978 water shortage crisis. Let me speak more specifically about this matter. In addition to promoting measures to prevent water leaks by making improvements on old decayed pipes, the City's "Water Distribution Control System in the Water Control Center" was completed in1981. Linked to a telephone line, a computer adjusts the water volume and pressure by remote control of electrically operated valves, which implement effective water distribution. Thanks to this centrally controlled water distribution system, the only one in Japan, we have been able to provide the city with an efficient distribution of water. The system has also been able to reduce water leakage problems. Presently, our water leakage ratio is about 4.9%, making Fukuoka the most efficient city in Japan with regard to water distribution. For large structures, we are promoting the utilization of used and treated water. These include individual efforts at circulating water within the structure using the building's reclaimed water collected from rain and sewage. There are also efforts at a wider area water circulation in the form of high grade re-treatment of secondary treated water discharged from sewage treatment plants, mainly to provide flush toilet wash water. We have been promoting such wide-area water circulation since 1979 through our "Reclaimed Sewage Water Project". Under this project, we have been able to provide a maximum water volume of 4,500t per day from approximately 140 sites to an area encompassing 770ha. We are also enhancing awareness for water conservation through aggressive public relations campaigns which involve the participation of the public. You have been given samples of water-saving packing along with the handout. This device presently has a 94.1% diffusion rate as shown in the slide. We are also promoting effective use of water through the promotion of water-conserving equipment such as water-saving toilets, and through the introduction of a progressive water rate system which effectively controls water demand. By virtue of such efforts, the average volume of water supplied to each city resident is about 20% less than the national city average. Water is a limited and valuable resource. Providing a stable supply of water is deemed absolutely necessary for orderly civic livelihood and for the development of healthy urban operations.

Learning from our water shortage experiences in the past, the City of Fukuoka, with a goal in the 21st Century of securing a stable source of water, has set a target within our master plan to increase our present

functional water supplying capacity of 704,800t to 759,100t a day by the year 2010. While continuing to promote water conservation in our urban planning, we are also taking steps to deal with the future increase in water demand as seen in our projects to supply more water. These include cooperative undertakings with the prefecture and our surrounding cities and towns in introducing measures to process salt water into fresh water as well as seeking understanding and cooperation with water districts to construct dams for the prevention of water shortages and to conduct surveys on mutual accommodation of effective application of water resources. We are also involved in exchanges with headwaters sites and committed in the area of environmental protection through the establishment of the "Fukuoka City Reservoir Area Development" which was founded in an effort to improve water capacity of forests and to promote activity in water resource districts. For every cubic meter of water used,¥1will go to this fund. We are also planning to conduct research into such areas as high-grade water treatment for the purpose of providing safe, high quality water and crisis management to strengthen our emergency water supply system for natural disasters.

When there is a concentration of population into an urban city and urban activity flourishes, this leads to pollution of our living environment, our rivers, lakes, marshes and seas, and a deterioration in the quality of water from public water works. Also, with urban progress, the underground permeation capacity of rainwater is reduced, thereby increasing the likelihood for floods. The City of Fukuoka, therefore, embarked upon the construction of a comprehensive sewage project in the1930s and has continued to service it as a major city policy. Today, it is used by 1.27 million people, or 98% of our population, and has enhanced our living environment to a considerable level. Our sewer system is improving the water environment. This can be seen by water quality improvement in our rivers and with the recent containment of an increasing trend in water pollution by eutrophication in Hakata Bay. Since1993, we have begun advanced wastewater treatment project to remove phosphorus from our sewerage. We plan on introducing this system to all our treatment plants by the year 2001. We are also deliberating on the introduction of a treatment system to remove nitrogen, as well. In addition to achieving more substantial aims such as preserving water-quality in our public water reservoirs and eliminating flooding, both of which are objectives to our sewerage project, the City is also committed to promote a comfortable water environment. As the City of Fukuoka believes the solution to the water problem is a major issue for our future development, we will move towards the research of returning treated wastewater to our rivers and expanding the use of multi-purpose water. Urban landscape design using water will also be studied. In this regard, we think that improvement of our sewage system will be deeply involved in our efforts to solve this issue in the future. Furthermore, we see that many are anticipating the development of a cyclic, energy conserving society which is not an excessive burden on the environment. There is also anticipation of a sewer system which reflects the needs of a highly information-oriented society. The City has already realized the practical application of "gas power generation", which uses sewage resources made during sludge treatment processing. It has also succeeded in creating fertilizer with sludge as well as turning incinerated sludge ash into building material, raw cement material and soil conditioner. In this spirit, we would now like to conduct research in the area of sewage treated water to produce thermal energy.

A sewage system is a network facility linking the residence to the pumping station and treatment plant. For this reason, experts are proposing the development of an information network using space in the sewage

system. In order to prepare and provide a water environment which can deliver a stable, safe and pure supply of water for urban activity, the City of Fukuoka is moving forward with its urban planning by enhancing its water works and sewage systems so that residents have access to both a comfortable urban lifestyle and an abundance of nature for their future. Thank you for your attention.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you very much, Mr. Shinichi Shiki, Deputy Mayor of Fukuoka. Next I would like to ask Mr. Le Thanh Hai, First Deputy Chairman of Ho Chi Minh City, to speak.

【HO CHI MINH CITY】 **Mr. Le Thanh Hai, First Deputy Chairman of Ho Chi Minh City**

First of all, on behalf of the people and the government of Ho Chi Minh City, I would like to extend our warmest greetings to all the participants in the 3rd Asian-Pacific City Summit and our special thanks go to the City of Fukuoka as well as to Fukuoka Mayor Keiichi Kuwahara for this precious opportunity as well as your generous hospitality for us to participate in this subsession and this summit to meet and exchange with all of you.

Politically, Ho Chi Minh City is second to Hanoi, the capital of Vietnam, but economically, Ho Chi Minh City is the country's largest economic center with a population of nearly six million people. The annual GDP growth rate is over 10%; however, we are faced with scores of infra-structural problems, particularly in water supply and drainage. That's why we have registered to participate in this Subsession 3 in order to learn more from your experiences as well as the lessons that you could provide for us in order to improve our water supply and drainage management in the city. And now I would like to leave the floor to my colleague to continue our presentation.

(Mr. Pham Xuan Hoang An, Officer of the Foreign Affairs Office)

As we have mentioned, Ho Chi Minh is Vietnam's largest economic center with a population of about six million people and it has a very strong impact on the development of southern Vietnam. However, in order to promote the development of the southern region, we are badly in need of better infrastructure and in this respect, water supply and drainage are the two most burning issues for our city as well as for the whole southern region. Right now in Ho Chi Minh City, only 60% of the population have access to clean water and per capita consumption of water is also low-only 90 liters per day. The problems mainly stem from transmission, distribution and treatment of water. In order to solve those problems, over the years the city has focused on the following; first of all we have to make our people use water more economically and efficiently. In order to do so, we have tried to set up an appropriate pricing policy to reduce and eventually eliminate government subsidies. We are also trying to solve the apparently contradictory situation whereby the poorest are taxed the most because they live in areas beyond or in the periphery of the national or central distribution network. At the same time, among the measures that we have taken so far; we also apply surcharging in order to make people use water more economically and, if they use excessive water above the limit, then they are charged more. In order to improve the water supply we also need more investment and

our financing sources include government budget, the surcharging, and at the same time we are also looking for international aid. For example, right now the United Nations has sponsored some small projects in the outskirts that are semi-rural in the city in order to exploit underground water.

Our goals for water supply in the year 2005 are to double the amount of clean water, and to reduce water loss by 50% and if we can achieve these goals then we'll be able to meet the water demands for both domestic and industrial purposes. However, besides the measures that I have mentioned earlier about water supply, we are still facing several other problems and we hope that at this subsession and summit we can learn more lessons and gain experience from you. Particularly, right now, we would like to learn how to preserve and use raw water resources more efficiently and effectively because as you know, industrial development often pollutes upstream raw water. Its effect can already be felt and secondly; adequate technology and sufficient financial support are also problematic for us. Generally, domestic and international investments can be found for water treatment projects, however they are much scarcer for transmission and distribution projects. Here we can see how the private sector fits into the picture, however we would like to experience in privatizing this service and that is why we would like to learn more from you on how to privatize this service in order to provide better service to the people in our city. In this regard we hope that we have more of a chance to talk to you about this and we would also like to call on your investment in our city if you happen to have that idea in mind.

To conclude this part on water supply, we would like to put on the table some of our ideas; first of all we propose to set up an assistance fund for an Asian-Pacific city network and secondly, we also propose to set up a data bank because we think that these measures can help the needs of developing cities such as Ho Chi Minh City.

Now I would like to move to the water drainage systems. In Ho Chi Minh City, we have five main canals with a total length of 56 kilometers and we also have about 36 kilometers of river tributaries. At the same time, there are about 980 kilometers of pipeline for both rain and wastewater drainage. However, we have to admit that our canals as well as our tributaries are heavily polluted. The system of sewerage in our city was built at the turn of the century and it has become ancient and outdated. So far, very little has been upgraded or replaced and at the same time we are also suffering from another problem; it is widespread squatter's housing along the canal banks dating from wartime. In order to solve this problem we have set immediate targets for the city to dredge these heavily polluted canals as well as the rivers and tributaries. And secondly, in order to do so, we have to offer an attractive settlement package to relocate all the squatters away from the canal banks.

Financial support is also very important in order to reinvest as well as to invest anew in the development of the sewerage system in our city. Among the financial sources is the city budget as well as the revenues from the development of reclaimed banks and at the same time we are also completing procedures for the application to technical and financial assistance from the World Bank as well as bilateral aid programs.

Another immediate target of our city is to accelerate existing projects on treatment of liquid waste in industrial parks. There are about 20 industrial parks in our city. Beside the immediate plan for the drainage system in our city, we also set a long term to relocate all industrial enterprises in specialized zones where

solid and liquid waste can be treated separately. But at the same time, the government is also trying to set up new incentives in order to help new businesses and the private sector to participate in the development of the sewerage system in our city because we think that it is in both the interests of the national economy as well as of the enterprises. Another matter is to extend cooperation with other cities in the area of technical and financial assistance.

To conclude our presentation, we would like you to share with us more of your experiences as well as the lessons you have learned. This is not only to improve our management of water supply and drainage in the city, but also at the same time a good opportunity to strengthen the cooperation and friendship between all the cities in this region. Thank you.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you very much for the report on both your struggle and efforts towards future plans. Next I would like to ask Mr. Jeremy Harris, Mayor of the City of Honolulu, to speak.

【HONOLULU】 **Mr. Jeremy Harris, Mayor of Honolulu**

I am delighted today to represent our city at this 3rd Asian-Pacific City Summit in historic Fukuoka. I would also like to thank our hosts, Fukuoka City and especially, Mayor Kuwahara, for inviting Hawaii to participate in this very important conference.

Honolulu is a city of approximately one million people, by population the 9th largest city in the United States encompassing the entire island of Oahu which is about 1560 sq. kilometers in size. Our geography is unique; we're separated by over 3,500 kilometers of water from the rest of the United States. As an island community, water is key to our quality of life, our survival and growth are based on preserving this most vital resource.

Hawaii's water is some of the best in the world. It begins as evaporation from the Pacific Ocean; it condenses over our mountain ranges, and makes its way as rain into the porous volcanic rock which forms our natural underground storage system. Today about 753 million liters are withdrawn daily from a system of 180 artesian wells for human, agricultural and industrial use. It's pumped through an island-wide system with over 3,000 kilometers of pipes, to a storage system of 163 reservoirs, and into more than 152,000 homes and businesses. Another 160 million liters is diverted from surface water for agricultural use. Hawaii's economic base is changing; once almost entirely agricultural, our economy today is lead by tourism and military spending with agriculture playing a diminished role.

Those forces, coupled with increasingly stringent environmental regulations, demand changes in the way we handle our limited water supply including the need to reuse our wastewater effluent. Wastewater systems in the United States are heavily regulated by both the Federal and State governments. They're also very costly. The challenge is determining how to develop systems that are both effective and affordable. We believe that innovative technology can produce systems that meet both these criteria. Honolulu's wastewater system serves over 140,000 residential and 10,000 non-residential customers through a network of about 3,200 kilometers of sewer lines. Raw sewage travels through the system for processing at 8 major treatment plants. Four of

those plants send about 435 million liters of treated effluent each day to four deep ocean outfalls located between 1.6 to 4 kilometers offshore at depths of between 30 to 80 meters. In the process nearly 13,000 tons of suspended solids are removed each year and disposed of in our landfills. Like most municipal plants, Honolulu's wastewater plants are designed to remove organic material and suspended solids by several types of processes. At two of our plants, primary treatment removes floating debris and solids by screening and sedimentation before receiving further treatment. Discharge of the effluent requires a waiver from the federal government and a strict monitoring program to ensure that discharges into the environment, especially our oceans, are not harmed. Since we have no continental shelf, deep ocean currents rapidly dilute and disperse the effluent. Our plant at Sand Island in Honolulu uses a dissolved air flotation process (DAF) as well as chemically enhanced primary treatment (CEPT) to increase coagulation and increase removal of solids. We're currently designing an ultraviolet or chlorination disinfection system to further improve that facility. Another plant at Honouliuli uses a combination of primary and secondary treatment while the rest of our plants process at the elevated secondary level reducing organic content of the treated effluent. One of the oldest and most efficient plants located in the interior of the island empties secondarily treated water into a nearby reservoir that's used for fishing, boating and agricultural irrigation.

For half a century, the United States government has been concerned about the condition of its waters. The Water Pollution Control Act back in 1948 was the first comprehensive law of its kind. It focused on eliminating pollution of interstate waters. Other laws followed in the 50s and 60s and in 1972, the Clean Water Act was passed to restore and maintain the chemical, physical and biological integrity of our nations' waters. The Clean Water Act doesn't allow any point source discharge in any inland or marine body of water without a National Pollution Discharge Elimination System (NPDES) permit. The permit imposes strict standards on each of our treatment plants including specific limitations associated with the physical, chemical and biological parameters in the area where our deep ocean outfalls are located. Because of this, Honolulu has spent millions of dollars to develop a monitoring program to ensure that our plants cause no harm to the environment including an exhaustive study of the effect of our operations on the Waikiki coastline. I am pleased to report that the study conclusively proved that our operations have no adverse effect on health, safety or on marine life. Our eight-member dive team takes water samples at varying depths at each outfall location. They also conduct near shore and shoreline bacteriological monitoring along 40 kilometers of our coast. The monitoring is done at each of our sites five times every month. In addition, sediment cores are collected for laboratory analysis; gas chromatograph, mass spectrometer are used to check water samples for the presence of chemicals and toxic material. We also record weather and sea conditions and other variables at each site. Additionally, the team collects benthic bioaccumulation and sediment samples, surveys fish and coral reefs for changes and inspects our ocean outfalls with a video camera system. Monitoring at the deepest site is done by our remotely controlled submarine. Our program also includes pathological evaluations of marine creatures living in the affected ecosystems. Three species of fish undergo constant microbiological analysis at our laboratories. As part of our comprehensive study, a computer model has been developed to predict the effluent plume of our largest plant. A great deal of management information about all facets of our city is maintained on our computerized geographic information system (GIS) including information on

our water and wastewater systems.

The Wastewater Information Management System (WIMS) is part of the geographic information system and it includes a comprehensive database to support planning, monitoring and maintenance of our collection systems. We can determine hydraulic capacities, track sewer connection permits, schedule preventative maintenance, generate work orders and schedule maintenance crews all through WIMS. We also utilize an island-wide, flexible and expandable remote telemetry system called the Supervisory Control and Data Acquisition System (SCADA). This remote telemetry has allowed us to move from controlling pollution to preventing pollution. It alerts us when our plants are affected by unforeseen power failures or heavy flow caused by storms and it allows us to respond before a spill develops. Additionally, when problems do occur in our lines, we can verify the nature and the place of the problem by using our portable, remote video cameras that are inserted into the system and then travel through the pipes under remote control. Repairs are then made by inserting plastic liners into existing pipes to seal them.

Like many cities, we face problems of inflow and infiltration. During heavy rainfall, rainwater enters into our system through cracks in the sewer lines and dramatically increases processing plant input. Honolulu is addressing this problem with a major renewal program. By the time the process is completed over the next few years, we will have invested over1.6billion dollars to contain rainwater and to keep it out of our sewage system. Much of the renewal uses the value engineering process which requires contractors to offer alternative construction methods to meet design objectives at lower cost. Some of our recent projects have used micro-tunneling and jet grouting to install lines. Micro-tunneling uses small, high-technology tunneling equipment which eliminates the need to trench and minimizes traffic disruption. Jet grouting uses a high-pressure water or air jet to simultaneously cut and mix soil with cement grout in the area surrounding the new pipe which stabilizes the soil and minimizes settling without the use of piles. These processes saved us one million dollars in one small project alone along a major highway.

Our future however, will be linked to how well we care for our environment and how well we conserve our resources. That's why I'm firmly convinced we must reuse both our effluent and our solid byproducts from our wastewater systems. Let me just take a moment to tell you about Honolulu's efforts in these areas. Through land use controls we're channeling urban growth into a well planned secondary city called Kapolei on the leeward coast of our island. Kapolei borders an industrial area with oil refineries and our newest resort development is located nearby. A second campus of the University of Hawaii will be built there and we're developing a major sports complex with world class facilities for use by local, national and international teams. The surrounding land is dedicated to agriculture, to preserve our open space, provide food for our tables, crops for export, and jobs for our people. All of this will create a great need for water to support homes, business, industry, agriculture, and of course, recreational uses. Our second largest wastewater treatment plant serves this area. It processes 49 million liters per day of effluent that undergoes secondary treatment. Additional tertiary treatment with infiltration and disinfection systems will soon be added to ensure high quality effluent for use at two nearby golf courses and by industry in the adjoining industrial park. Because of its high nitrogen content, the rest of the water will be used as irrigation water for diversified agriculture in the region. We're also developing a pilot program to compost our sludge for use in parks, for

lawns and home gardens or by our diversified agricultural industry.

In closing, I would like to extend an invitation to all of you to visit Honolulu, to share information on our respective wastewater systems and to be able to discuss shared technology firsthand. I'd also like to invite all of you to the first Mayors' Asia-Pacific Environmental Summit which is going to be hosted by Honolulu in February of 1999. Conferences such as this Asian-Pacific City Summit and the Environmental Summit in Honolulu next year, I believe, are an effective forum for sharing both successes and our ongoing challenges in these environmental areas. I look forward to continuing the friendships that we've established in these meetings and to sharing ideas for the benefit of our people and the benefit of our future. I hope to welcome all of you in Honolulu in February. Thank you once again.

Chairman Mr. Ahn Sang-young, Mayor of Pusan

Thank you very much, Mr. Jeremy Harris, Mayor of Honolulu. I see that wastewater treatment plants that are not quite in harmony with nature cause rejection. It was a wonderful report about your beautiful city. Next I would like to ask Mr. Yoshinori Akasaki, Mayor of Kagoshima City, to speak.

【KAGOSHIMA】 **Mr. Yoshinori Akasaki, Mayor of Kagoshima**

I would like to talk on the theme of "Cities and Water Distribution and Sewerage" in relation to Kagoshima City. The water distribution and sewerage system of a city provides the basis for its day to day life and the well being of its citizens. In order for cities to develop healthily and sufficiently, the improvement of those systems is of the utmost importance. I would like to give a brief chronological introduction to the water distribution and sewerage system in Kagoshima City, mentioning three phases from the establishment of the municipality to the present day. It can be divided into three phases:

Phase One is the creation of the city to the end of the war. The administrative district of Kagoshima City was established with the organization of the municipalities in 1889. The population at that time was approximately 58,000.

By 1943, following the city's development and the integration of surrounding towns and villages, the population had increased to 200,000. At the time of the establishment of the municipality, the waterworks were those that had been constructed by the Lord of Satsuma. Water was conveyed via stone ducts to public buildings such as the City Hall, the Prefectural Office, the Court and schools, as well as to specific places such as distilleries and factories making soy sauce and soy bean paste. A modern waterworks system was not constructed until 1915. In 1919, spring water was first used as a source for the water supply. However, only about 2,500 had running water. As the population of the city rose, the areas to which water was supplied gradually increased and, in 1943, approximately 130,000 people had running water. On the other hand, it was not until 1937 that the first assessment was taken into constructing a sewerage system.

Phase Two is the development of the city from after the war to the year 1970. During World War II, 93% of central Kagoshima City was burnt to the ground. Due to the war, the population fell to 93,000 people; however in the following ten years as the reconstruction of the city progressed, it recovered to 270,000. In the following ten years, the population reached 400,000 partially due to the integration of the surrounding