8th International Forum on Waterfront and Watershed Restoration

"Urban River Restoration at the confluence of Disaster Mitigation and Environment Preservation"

Lecture Record

Ochiai River (Tokyo)

Date: **11 November 2011 (Friday) 13:00 – 16:15**

Venue: **The University of Tokyo, Yayoi Auditorium**

Organizer: **Asian River Restoration Network / Japan River Restoration Network**

Supporters:

Japan River Association, Ecology and Civil Engineering Society (ECES), Foundation of River and Watershed Environment Management, Japan Water Forum, Foundation for Riverfront Improvement and Restoration, CTI Engineering Co, LTD, China River Restoration Network (CRRN), China Institute of Water Resources and Hydropower Research (IWHR), Korea River Restoration Network (KRRN), Korea River Association (KRA), Korea Institute of Construction Technology(KICT), European Centre for River Restoration(ECRR), River Restoration Centre (RRC)

ARRN Forum 2011 is supported in part by the River Fund in charge of "the Foundation of River and Watershed Environment Management (FOREM), Japan"

Contents

Objective

The annual international forum is held under the auspices of the Asian River Restoration Network (ARRN). It was held in Korea in September 2009 and September 2010, and in China in November 2008. It has been four years since it was last held in Japan.

Rivers are closely linked to people's daily life. They can bring comfort and peace to many people. Now is the time to promote information exchange and make proposals on rivers among not only those involved with rivers, including administrative authorities, NPOs, researchers and engineers, but also the general public. It is also increasingly important to have river-related interactions with other countries.

The Great East Japan Earth Quake occurred this year. In addition to earthquake damage, Japan has suffered a significant impact from the Fukushima Daiichi Nuclear Power Plant accident, etc. Taking this as an opportunity, many Japanese people are starting to worry about what will happen if their involvement in nature and life cycles go on the way they are now. Particularly in disaster response measures and energy policies, a dramatic transformation is demanded. Given these circumstances, the forum should focus on "coexistence with nature", "ties between people and communities" and "safety and security" by reaffirming the significance and necessity of river restoration.

It is 6 years since ARRN was founded in 2006 with the support of all those concerned. ARRN is promoting information exchange and collaborative activities for river restoration mainly in Asian countries, including China and Korea. JRRN (Japan River Restoration Network), founded together with ARRN, aims to contribute to the development of technologies and systems for river restoration suitable for each region as an organization that helps to share information about river basin restoration in Japan, thus expanding the range of the member community.

We would like you to use this opportunity to consider the significance of river restoration as well as the necessity of international interactions in this field. Your understanding and cooperation as regards the activities of JRRN and ARRN would be deeply appreciated.

Lecturer & Coordinator Profile

Lecturer 1

Alastair McHarg

National Water Commission, AUSTRALIA

Alastair McHarg is the Senior Manager of Water Planning, Water for the Environment and the RNWS Program of the Sustainable Water Management Group at the National Water Commission in Canberra, Australia. Alastair's expertise is in water planning, waterway health, river restoration and urban water management.

At the National Water Commission Alastair manages a number of programs that support Australia's National Water Initiative (NWI). The NWI is Australia's blueprint for National Water Reform; it represents a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities, and for the environment.

In previous roles Alastair has worked for the Brisbane City Council (Integrated Water Cycle Planning), the Fisheries Research Service in Scotland and the NSW Department of Land and Water Conservation.

Lecturer 2

Shaohua Marko Hsu

Professor, Department of Water-Resources Engineering and Conservation,

Feng Chia University, TAIWAN

Prof. Shaohua Marko Hsu received his MS and Ph.D at Civil & Environmental Engineering, University of Iowa, U.S.A. He serves as professor at the Department of Water-Resources Engineering and Conservation, Feng Chia University, Taichung City, TAIWAN.

- **Research Fields**: River Sedimentation and Modeling, River Restoration, Reservoir Sedimentation and Turbidity Currents, Groundwater Flow and Pollutant Transport, Groundwater Modeling and Water Resources evaluation

Lecturer 3

Sukhwan Jang

Professor, Department of Civil Engineering, Daejin University, Korea

Prof. Sukhwan Jang received his BS, MS and Ph.D at University of Seoul. He serves as professor at the Department of Civil Engineering, Daejin University, Pocheon Kyunggi Do, KOREA. He is currently a secretary general of Korea River Restoration Network (KRRN).

- **Research Fields**:
- Flood Analysis, Urban Hydrology, River Restoration
- **Professional Experience**:

2005~2006 Visiting Researcher in Colorado State University
2006~2009 Affiliate Professor in Colorado State University
2008~2010 Chair of Design Standard Division of KWRA (Korea Water Resources Association)
2008~2010 Vice Chair of International Cooperation Division of KDPA(Korea Disaster Prevention Association)
2008~2011 A Member of Advisory Committee of 4 River Restoration Project
2011~2012 President of Korea-Mongolia Resources Forum

Lecturer 4

Aizhong Ding

Professor, College of water sciences, Beijing Normal University, China

Prof Aizhong Ding is working in the college of water sciences at Beijing Normal University. His main research interests are groundwater contamination and bioremediation, river restoration. His research projects include scientific investigation of water contamination processes in the scale of micro- to field, and policy design on integrated water and environment management.

Prof Ding is a member of the National Committee of Environmental Emergency Management, director of China Center of River Restoration at BNU, and director of China-UK Catchment Science Center. He obtained his Master in Changchun College of Geology, MPhiL on environmental engineering in Sheffiedl University UK and PhD on environmental geology at Chinese Academy of Geosciences. He has worked in Chinese Academy of Science, UK and Belgium, and published more than 100 papers and 20 patents.

Lecturer 5

Yukihiro Shimatani

Professor, Kyushu University, Japan

Prof. Shimatani was born in Yamaguchi Prefecture and he served as director of the Public Works Research Institute, Ministry of Construction, and the Takeo Office for Rivers, Kyushu Regional Development Bureau. Now he serves as professor at Kyushu University.

Prof. Shimatani majored in river engineering and river environment, and recently he is focusing on various subjects, including citizen participatory river development, nature-oriented river management, release of Japanese crested ibis into the wild, nature restoration, landscape design for rivers, flood control of the whole basin, and improvement of engineers' skills. He has a cheerful, positive and easygoing nature, and likes to do research on rivers, and enjoys gourmet cuisine.

Books written: "Appeal of Waterfront Space and its Creation" (joint editor), "River Landscape Design", "Preservation and Restoration of Natural Environment in Rivers", "To Create Bountiful Rivers: Gakken Tanoshiku-Manabu-Gakko Series Vol. 10", "Water Quality Improvement in Rivers and Lakes by Eco-technology", "Frontline Report on Citizens' Activities for Good River Development" (joint editor).

Coordinator

Nobuyuki Tamai

Professor, Kanazawa Gakuin University, Japan

ARRN Chairperson

Prof. Tamai was born in Aichi Prefecture. He graduated from the Department of Civil Engineering, Faculty of Engineering, University of Tokyo. He assumed his post as professor at the University of Tokyo in 1983, and left the University of Tokyo in March 2002 on reaching his 60th birthday. He assumed his post as professor at Kanazawa University in April 2002, and left Kanazawa University due to mandatory retirement in March 2007. He assumed his post as specially-appointed professor at Kanazawa Gakuin University Graduate School in April 2007.

Books written: "River Ecology Environmental Engineering" (joint editor), "River Ecology Environmental Assessment Method" (joint editor), "River Planning Theory" (editor), etc.

Opening address

President, Foundation for Riverfront Improvement and Restoration
Dr. Koutarou Takemura

Welcome to the 8th International Forum on Waterfront and Watershed Restoration. I would like to send my sincere appreciation Professor Tamai and all the relevant parties who worked very hard to prepare this International Forum and I would like to appreciate their hard effort. This makes the 8th International Forum. Asian River Restoration Network has been continuing this International Forum, which I believe is of utmost importance. There is a saying in Japan, which means that continuation is the force, so continuing something for many years' matters.

In Asian countries as well as international countries, it's very important to consider the river restoration. This plays crucial role in urban planning. Today, we have leaders from around the world. I am sure those leaders and experts will take this opportunity to exchange information, opinions, and utilize this opportunity for networking.

In order to make that happen, Riverfront Improvement and Restoration would like to make utmost effort. Today, time is unfortunately limited, but I hope all of you would enjoy today's symposium. From Australia, China, Taiwan, and Korea, we have privilege to have distinguished guest speakers. I hope all of those distinguished experts will enjoy their stay here in Japan.

With this, I would like to conclude my opening remarks.

Moderator

Thank you very much. Before we move on to the presentation, we would like to briefly touch upon ARRN and JRRN activities.
As you can see from this abstract, we have time until 4:15, so we have only 3 hours or so and we have five presentations planned. The time management is going to be very difficult I believe. I would like to ask all the speakers to follow the given time and I am sure audience will have a lot of questions but please refrain from asking questions at the end of each presentation. I would like to take questions from the floor at the very end of this forum.

If you look at this booklet, actually on the very last page of this booklet, page 16, it has a brief explanation of ARRN and JRRN. ARRN stands for Asian River Restoration Network. Six years ago actually in Mexico, there was 4th World Water Forum and that was a trigger to found this ARRN. Within the Asian region, this organization is contemplating on the river planning. So, under the leadership of ARRN the member countries are exchanging information on river restoration.

If you look at this description, there are two points. Number one, ARRN operates website and use this website to exchange information, not only the government level, but also the city-community level relevant engineers can exchange information through ARRN operated website. If you look at dot number two, it talks about the guideline. We would also like to collect the case studies and update these guidelines.

If you look at JRRN as you may know, it stands for Japan River Restoration Network. This is the organization within Japan. JRRN is a forum where the relevant parties can get together to exchange information on the river improvement and restoration. The membership is free of charge. I am sure there are quite significant numbers of the member within this JRRN, but we would like to even improve the number of the membership. For Korea for China, KRRN, CRRN, these organizations do exist in those two countries.

Actual activities are written down at the bottom half of the page. Let me explain about the establishment of guideline, so in what process we are producing this guideline. From the Secretariat, Mr. Goto will give a brief speech on this.

Introduction of "ARRN River Restoration guideline ver.2"

Researcher, Foundation for Riverfront Improvement and Restoration
Mr. Katsuhiro Goto

I would like to explain about the ARRN RR guideline ver.2. My name is Goto from JRRN Secretariat. Originally, complete version 2 was supposed to be distributed to all of you at this international forum; however we weren't able to make that happen by time. But actually, almost all the contents are ready, so by the end of this month or at latest within this year, we would like to complete the version 2 guideline and post this on the webpage. Let me explain about the guideline. Actually I didn't prepare a PowerPoint, so I would like to use this handout.

If you turn to page 2, this talks about the background. Non-JRRN members are participating in this international forum, so those people may not be aware of this guideline. Let me explain about the background. Dr. Sago has just explained that ARRN was established having the 4th World Water Forum in 2006 in Mexico. In the recommendation statement it mentions the establishment of the guideline for river environmental creation.

ARRN plays importance on the creation of guideline. ARRN expert committee was established. With that, we are compiling the version 2 guideline. The purpose of this guideline as you can see is to provide the basic thinking in river restoration in Asian region. With this guideline, we would also provide the actual cases. The readers will increase or enhance their interest in the river restoration activities.

For those who are interested in river environment are said to be the expected readers. ARRN is trying to establish introductory pamphlet or guideline for the river environmental restoration. This guideline is supposed to be reader-friendly.

So 2008 February, version 1 of the guideline was made, Japanese version and English version and it is disclosed on the website. After that 2010, last year actually, each country's characteristics of the rivers and so on are compiled and become the version 1 and it's now disclosed. That is only in English available. December 2011, we are going to complete the guideline version 2 and plan to disclose soon.

What kind of content will be upgraded is written on the next page; on the table under that, the differences or comparison of the table of contents of the version 1 and version 2. There are three main contents in the version one. The left-hand side item shows the important viewpoint to know the characteristics of the river and so on and

what kind of measures you can take to restore the rivers. Those are the three major contents.

We continue to have the same three major contents. The background and the history of the river environment improvement together with the specific examples and list of the information sources and information from the Japan, Korea, and China will be updated and have the same amount from each three countries.

The red letters are the new ones; newly added items are shown in red color. Can you go on to the next page? That shows the outline of the version 2. Chapter one, introduction says the significance of the river restoration. This guideline’s position is shown there. Chapter two, what are the important prospects to know the river’s situation. It shows the basic notion which is important to know the river. Also, we added the trend of the river administration, how to improve the water quality and water compatibility and water related activities are added.

Chapter four, in order to restore the good quality riverfront, it shows the case studies of the content which is shown in chapter three. Chapter five is a newly added chapter in Japan, Korea, and China and good examples are shown.

Good example means that there are famous examples which are often appeared on the website, Sumida River, Izumi River and Kushiro River. Those case studies’ examples are shown.

Appendix 1 is shown. The measure is to help the restoration of the river environment. Appendix 2 is the technical guideline listed up. Appendix 3 is the table of the information, list of the information sources you can refer to when you promote the river restoration. The website URLs are shown there, which limited to the English ones so that only English websites are introduced there. The point here of the update is that China and Korea’s fresh information can be incorporated. That’s the big characteristics of this time update.

The version 1, there is a strong tendency to introduce only things in Japan, but version 2 we asked to the Korean counterpart “KRRN” and Chinese counterpart “CRRN” to write the topics as well, so I think it’s very valuable content – becomes very valuable content.

Lastly, in the future this guideline will become the introductory version. We are going to promote more detailed version that we are going to update once again in the future. Also, the result of the discussion includes not only the good example but also the problematic examples. Those are the comments or the feedback we’ve got. We also want to gather such kind of comments, so that we can continue to improve our guidelines in the future.

We also want to ask your opinions actively.

So, in this kind of opportunity like this forum or other emails, you can give us any comments or opinions to us. Thank you very much.

Moderator

Next, we are going to go on to the lecture, lecture number one. As I said we are pressed for time. In 3 hours we have five lectures, so we strictly limit to 25 minutes for one lecture. I would like to introduce the background of the lecturer but because of the time those background are written in the abstract, so please read them. So now, I would like to introduce the first lecturer. The response to the 2011 Brisbane River floods and national picture of river and wetland assessment, management and restoration in Australia.

Mr. Alastair McHarg, National Water Commission, Australia. He used to work in Brisbane, so he is also introducing the example of Brisbane's flood and also Australia's water management.

Lecture 1

The response to the 2011 Brisbane River Floods & a national picture of river and wetland assessment, management and restoration in Australia

National Water Commission, Australia
Mr. Alastair Mcharg

In recent years Australia has experienced unprecedented water scarcity across much of the continent, exacerbating pressures on our environmental assets, rural and irrigation communities, and urban cities and towns. Water scarcity has led to a new wave of water investments and a range of policy, institutional and regulatory reforms characterised by a significantly expanded Australian Government role in water policy and management.

The National Water Initiative (NWI) is Australia's blueprint for water reform. Through it, governments across Australia have agreed on actions to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water. The NWI represents a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities, and for the environment. Protecting and improving freshwater aquatic systems is a key component of the NWI.

The Raising National Water Standards (RNWS) Program is a $250 m (AUS) initiative of the Australian Government administered by the National Water Commission. The core objective of the RNWS Program is to provide information and tools to support better management of Australia's water resources and to accelerate the process of water reform by securing practical outcomes consistent with the implementation of the NWI.

This paper will present a national picture of river restoration in Australia, including policy initiatives, products and tools developed by the National Water Commission to drive and aid river restoration and protect and improve freshwater aquatic ecosystems.

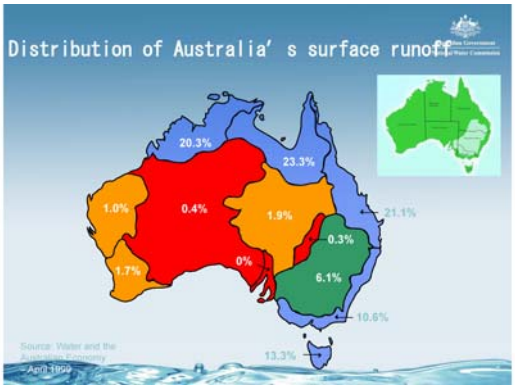
I work for the National Water Commission. In my previous role as of March last year, I worked for the Brisbane City Council. I am here today to present on the response of the 2011 Brisbane river floods and a national picture of river and wetland health assessment restoration. I am sure you can appreciate, it's a rather ambitious title to achieve in just 25 minutes and I've been told to keep my speaking pretty slow.

So, we'll try and get as much information in as we can. If time doesn't permit, I am happy to talk further about any of the topics covered in today's presentation further with you, just come up and see me after the presentation.

To start with, I'll give you a bit about myself. I grew up in a small town in the northeast of Victoria called Yackandandah. Now, Yackandandah is about there, right on the very northeast corner of Victoria. Yackandandah is an indigenous name meaning water flowing between rocks. I spent my childhood swimming and fishing in the Yackandandah Creek. That's a picture of the Yackandandah Creek there and I think that's where I get my love of aquatic science.

That's a picture of the Yack Creek under reasonable flow. It's usually quite a small stream but the fishing is good and it's quite a beautiful creek.

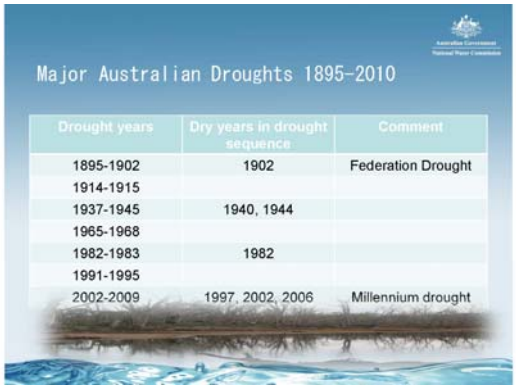
Here is the overview of my presentation. We'll just skip through it and we'll see how far we can get.



Due to the reasonably high rainfall in that part of Australia, there is generally year-around flow. However, not all parts of Australia are so lucky. This chart shows the distribution of surface runoff across Australia. You'll see a large majority of the

runoff occurs in the northern parts of Australia. You'll also note that there is large dry arid areas in Australia that basically don't produce much runoff at all.

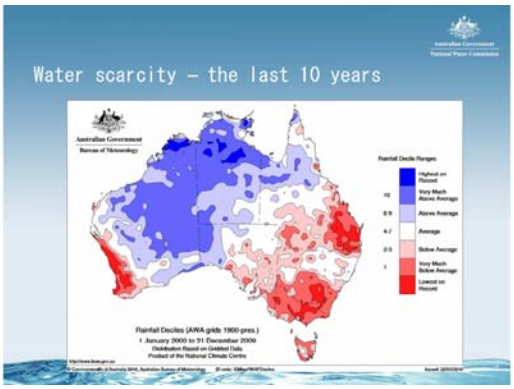
An important part of this diagram is that the Murray-Darling Basin catchment, which is the small catchment here is one of Australia's most developed water resource catchments and that runoff is only 6.1%. Across Australia the distribution of rainfall is quite sparse. On top of that, Australia is the driest continent on earth. It has the highest rainfall variability. On top of that, we've now got to deal with climate change, which will put further pressure on already stressed water resources. Just to exacerbate the already tough conditions, Australia often faces severe drought.



Drought years	Dry years in drought sequence	Comment
1895-1902	1902	Federation Drought
1914-1915		
1937-1945	1940, 1944	
1965-1968		
1982-1983	1982	
1991-1995		
2002-2009	1997, 2002, 2006	Millennium drought

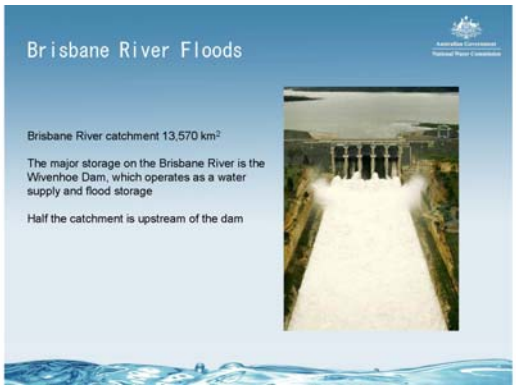
This table shows droughts that have occurred in Australia over the past 120 years. Australia's dry-wet weather patterns are connected with a climate phenomenon known as the Southern Oscillation Index, a major pressure shift between Asia and Pacific regions. When it's El Niño, a negative pressure difference between Tahiti and Darwin, we get drought. When La Niña, which is a positive pressure difference, we get floods.

As you can see, Australia has experienced many droughts. The droughts have had significant impact on the agriculture, transport, water supply and people's livelihoods. The millennium drought 2002 to 2009 was the most recent occurring between 2002 and 2009 and the following chart shows the rainfall across Australia over this period.



As you can see, most of the southeast corner of Australia experience extremely dry conditions. That's the southeast corner there. Note, the northern parts of Australia experienced above-average rainfall. Again, the majority of the food bowl of Australia, the Murray-darling basin experienced extremely dry conditions.

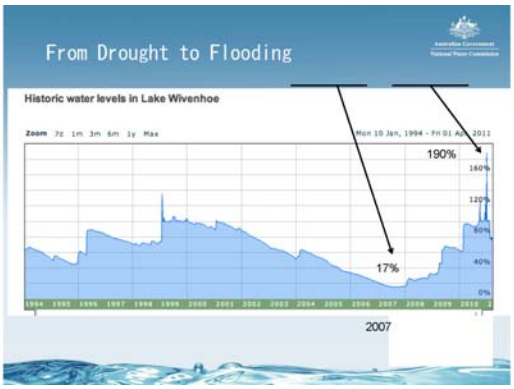
Following a decade long drought that almost crippled the country with dam water levels low and agriculture struggling across the country, many parts of Australia were then hit by extreme flood events. It seems funny that in Australia these large drought conditions seemed to be always followed by severe floods.



I was living in Brisbane, in Queensland in early 2011 when the floods hit. Well actually I was on holidays in Mexico, which was a good place to be, but technically I was living in Brisbane. This is the reason I've been asked to talk a bit about the floods in Brisbane today. First I'll give a few facts about the Brisbane floods and the Brisbane River.

The Brisbane River is a major river in the southeast of Queensland, which is in the north of Australia. It has a catchment area of 13,570 square kilometers. The major storage of the Brisbane River is the Wivenhoe Dam which operates as both water supply and flood storage. Wivenhoe Dam was built in response to a major flood event in 1974. It was a one – in – a – hundred -year event and it almost destroyed the city. During the millennium drought, the Wivenhoe Dam storage was used for water supply rather than flood mitigation.

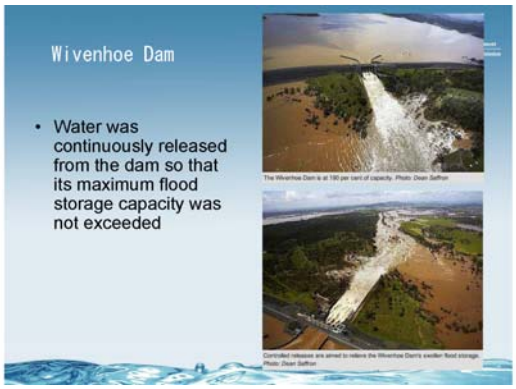
Wivenhoe has a water supply storage of 1150 million cubic meters, an additional 1450 million cubic meters of flood storage. In 2011, Brisbane River floods were instigated by rainfall of up to 150 millimeters in 3 hours across the catchments of the Brisbane River.



This chart shows the level of the Wivenhoe Dam in the years prior to the 2011 floods. You'll notice the consistently regular volumes of water in the storage pre the millennium drought.

Then we've got the impact of the millennium drought which saw significant water level reductions through to 2007. Then following the rainfall events in early 2011, which was here, you see the storage begins to approach critical water levels and actually reaches 190% of supply capacity.

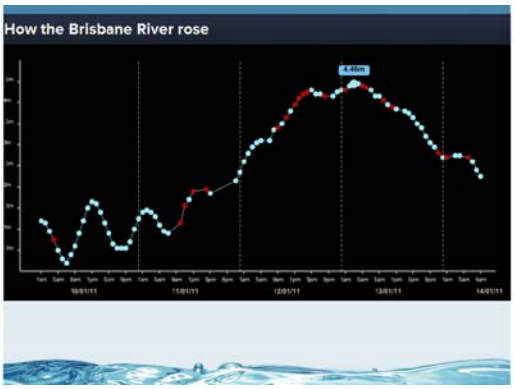
To restore the structural integrity of the Wivenhoe Dam, water was continuously released from the dam so that maximum flood's storage was not exceeded. This resulted in large volumes of water heading downstream towards Brisbane. Flooding began to hit the low lying areas of Brisbane in the morning of 11th of January and the river broke its banks at 2:46 p.m. The flood peaked in the morning of the 13th of January. This flooding was exacerbated by the occurrence of a king tide, so there you'll see the peak of the tide at 4.46 meters of the floods.



I have some pictures of the event, given the buffering capacity of the Wivenhoe Dam and the length of the river between the storage and Brisbane City, local disaster action groups had some time to prepare. It took about 32 hours for the river floods to reach Brisbane, so the flood response teams had a bit of time to prepare for the floods as they were coming, they had a little bit of warning.

These are picture of the local disaster staff here and here, and these are all my ex-colleagues from Brisbane City Council where I used to work.

I will now show you a few more pictures of the floods. This is the river in flood just near Woolloongabba, which is a suburb of Brisbane. You will notice the large residential areas that have been inundated, some 22,000 homes were flooded during the event.

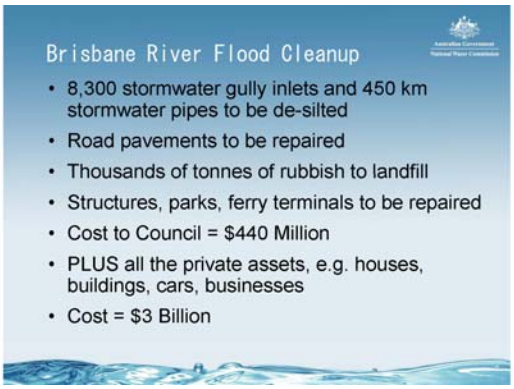


This is some flood modeling. Now this is model data showing the extent or the expected extent of the floods, so you see obviously, the river comes through here and then the flooded low lying areas in Brisbane.

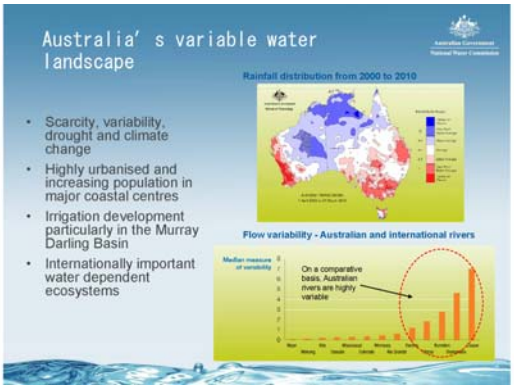
This is the Brisbane Sewage Treatment Plant in the dry and then in the flood. They say it was almost completely inundated. The flood was about one–in–a–hundred- year flood.

Some of the infrastructure was damaged. This is roads and walkways along the Brisbane River that were flooded on South Bank. A lot of the walkways and planktons along the river were all washed away out to sea.

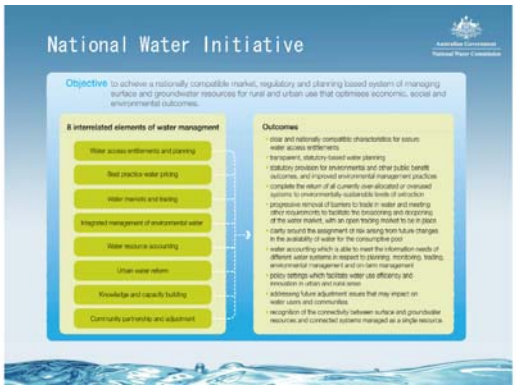
That's McDonalds. That's in Paddington, just near where I used to live in Brisbane and it's well and truly under water, roads come along here, so you can't see there. That's some more pontoons that have been washed down the stream after the flood, so that's post-flood, there is quite considerable damage.



Some facts from the flood, 8300 storm water gully inlets and 450 kilometers of storm water pipes had to be desilted. Road pavements had to be repaired. Thousands of tons of rubbish were sent to landfill. Structures, parks, ferry terminals had to be repaired. The cost to council was about Australian $440 million, so it's about what American dollars are at the moment. Plus all the private assets, houses, buildings, cars, and businesses. The total cost of the floods estimated was $3 billion.



As you see, in Australia we live in a pretty unique environment where we swing between droughts and floods. From extreme events, managing water to provide for consumptive environmental and cultural values is often difficult.



In 2004, the Australian government stepped in and developed the National Water Initiative. The National Water Initiative is Australia's blueprint for water reform. It's basically an intergovernmental agreement between Australian, State and Territory governments to improve management of the nation's water resources and provide greater certainty for future investment.

Australia is made up of six states and two territories, which is what the National Water Initiative covers. Its objective is to achieve a national compatible market, regulatory and planning based system of management of surface and groundwater resources for rural and urban use that optimizes economic, social, and environmental outcomes.

The organization that I work for, the National Water Commission, has a directive to drive the implementation of the National Water Initiative, assess its progress and provide advice to the Federal Minister and to the Council of Australian Governments.

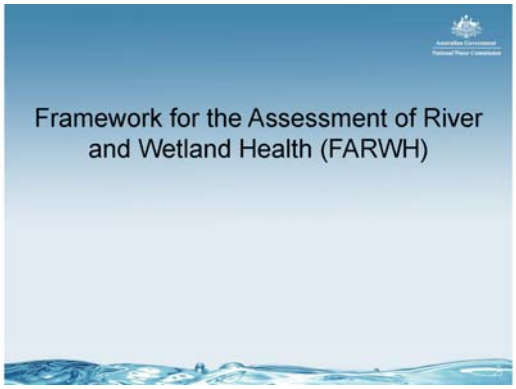
The National Water Commission is located in Canberra and has only 54 staff. The role of the commission is to provide advice on national water issues and improve and assist with the effective implementation of the National Water Initiative agreement.

The 'Raising National Water Standards Program' is a program of works that is administered by the National Water Commission, which is my agency, to direct improvements of water management, measures, plans, and process and trades for water and ultimately progress towards achieving the National Water Initiative.

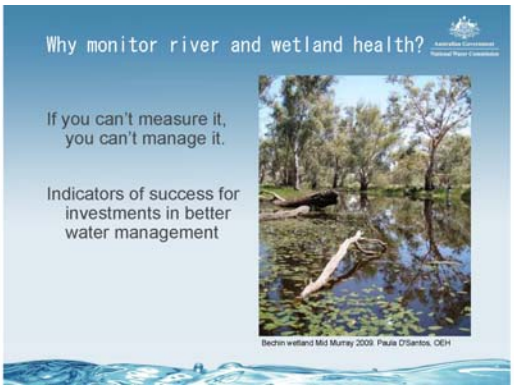
Within the Raising National Water Standards Program there are 11 themes: water accounting, water markets, irrigation, water dependent ecosystems, urban water management, groundwater, northern rivers, national assessment of water resources, knowledge and capacity building, and northern futures. Now the projects that I manage at the National Water Commission fall within the water dependent ecosystems theme.

The RNWS program has over 171 projects. Now, I wanted to present on three of these projects today, but I think unfortunately

we're not going to have much time, so come back to me when I can talk to you about them later. The ones we won't cover today is watering floodplain wetlands in the Murray-Darling Basin for native fish. It's project that looks at the response of native fish to different flow regimes in wetlands looking at recovery and response and also to some exotic fish. The Source Hydrologic Modeling, that's a hydrology modeling program the commission has jointly funded to develop a consistent modeling framework across Australia. The Framework for the Assessment of River and Wetland Health, which I'm going to talk to you today.



Why did I come all the way to Japan to present on the FARWH framework? Well, we all understand that monitoring should form the fundamental part of both river research and management, it is used to assess health, informed management decisions, prioritize investment, measure success and failure of intervention measures. Without monitoring, there is no measure for success of restoration projects. I'll explain in more detail in subsequent slides, but basically the FARWH is a monitoring framework that can be applied at a range of scales both spatial and temporal. It uses largely existing data and most importantly it allows a comparison of systems across rivers, regions, states, and potentially even countries, which makes it an extremely useful management tool.



How do we know what condition our rivers and wetlands are in? How do we know how to make effective management decisions? How do we know how effective those decisions have been? How do we prioritize restoration and management? Well it's supposedly simple. We monitor them. Information collected from the monitoring of the system provides a data we need for their effective management. As my boss says, if you can't measure it, then you can't manage it. The information we gather gives us the information of how well we are managing our water resources and whether we've been successful in the goals we set.

In Australia, there have been many programs that monitor all different aspects of river and wetland health, some of which have data that spans decades. There is a

sustainable river audit in Victoria, index of stream condition, which is also in Victoria. Southeast Queensland Healthy Waterways Monitoring Program, which is called the EHMP. There is the SEAP also in Queensland and in Tasmania, we have CFEV, Conservation of Fresh water Ecosystem Values.

Now, these are all programs that monitor different things required for different states and organizations for the data that they need. It satisfies their needs; however, there is no comparison between programs or between states. Each program satisfies its own objectives, but not the objective of a national framework.

To address this problem, the FARWH was developed and provides a framework for the consistency of reporting, so that rivers and wetland health assessments and management is consistent across Australia. Further, programs can be developed specifically to address requirements of the FARWH which further improves its coverage. Most importantly, the FARWH framework uses existing data. In most cases, it does not require the collection of new data. This is further benefits when data from multiple organizations or states can be used to form the analysis of one system catchment or a region. The savings achieved in resources can be quite large as monitoring is often very expensive.

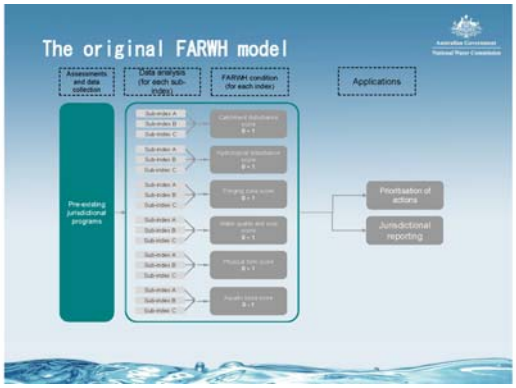
Here is how it works. I'll explain it very briefly and if you want more detail, we can talk more to it later. Basically, the FARWH uses six indices, each were chosen to represent components that make up the ecological integrity of aquatic ecosystems. Very briefly, we have catchment disturbance, which covers influences like land use, infrastructure, and the effective large-scale impacts.

We have physical form, which covers things like substrate structure connectedness, groundwater obstruction, gradient, and snagging. We have hydraulic disturbance which covers matters such as the current water regime, surface flow, and groundwater and dams and water levels. We have the fringing zone, which measures structural and condition features with the surrounding zone including riparian vegetation and other influences surrounding the river and wetland.

We have water quality and soils, which includes water and soil quality, total nutrients, concentrations or loads, salinity, and toxicity levels.

And aquatic biota, which is probably the most familiar to everyone as it covers, biota such as fish, water plants, and algae. So, each of these indices have set up to inform

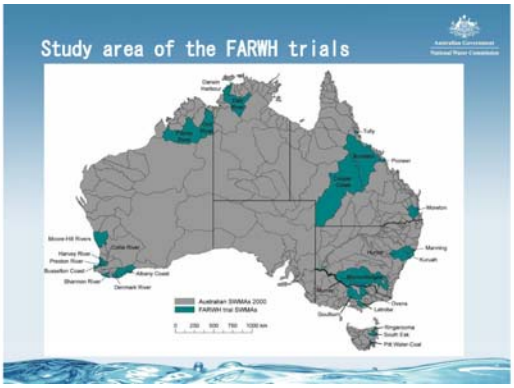
the management framework.



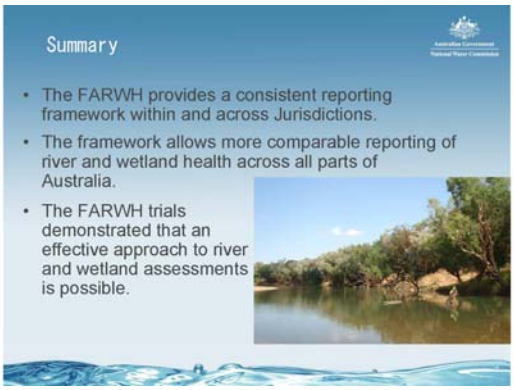
Basically how it works? Within each indices – these are the six indices we just talked to, there are sub-indices for each one, so say for aquatic biota, indices might be fish, observe or macroinvertebrate species' richness. The sub-indices are scored together on a standardized score of 0 to 1 and then that score of 0 to 1 is then aggregated to an aquatic biota score, total aquatic biota score.

Each of the indices then are then summed up together to give an overall score for the system between 0 and 1 where 1 is good and 0 is the lowest score.

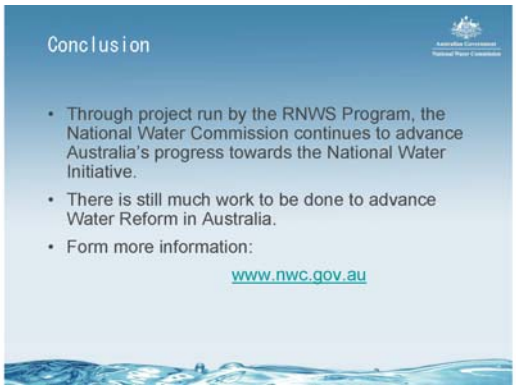
Different sub-indices can be used in different catchments, different regions, different reaches of river. It's the beauty of the system that based on local expert knowledge you develop the sub-indices that are going to feed into the ultimate indices, which will then provide the overall score, which then gives us – I can compare a wetland that I've monitored in New South Wales with a wetland that I've monitored in Victoria, so then you can then make more informed management decisions. You can prioritize project work, project money, and then also track progress at a time after management measures have been implemented.



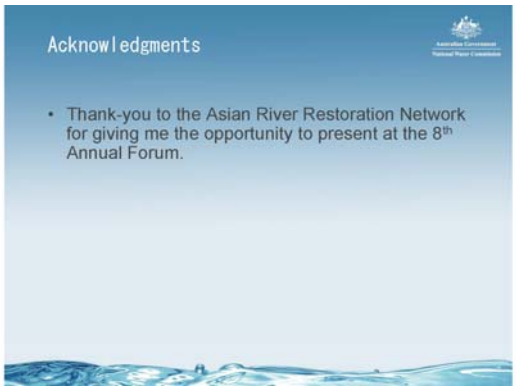
To further the FARWH framework, the National Water Commission sponsored the role out of four study trial areas. You can see them Queensland in the Northern Territory, New South Wales and Victoria and Western Australia and Tasmania was one of the initial ones.



The development of the FARWH and subsequent trials has demonstrated that the FARWH provides a consistent reporting framework within and across jurisdictions. The framework allows more comparable reporting of river and wetland health across all parts of Australia and the FARWH trials demonstrate that an effective approach to river and wetland assessment is possible. Again the beauty of the FARWH is its ability to be used at different scales, regions, local areas or even different countries.



Okay, so I am getting the windup, so in conclusion through projects run by the RNWS Program and other works, the National Water Commission continues to advance Australia's progress towards the National Water Initiative. However, there is still much work to be done to advance National Water Reform in Australia. For more information, please visit our website www.nwc.gov.au or come and have a talk with me and I'm happy to discuss further.



Thank you to the Asian River Restoration Network for giving me the opportunity to present at the Annual Forum and I look forward over the next 2 days sharing some experiences both in Australia and abroad. Thank you.

Moderator

Thank you very much. Within the given timeframe, he was able to cover everything I think. Thank you.

And next I would like to ask the speaker from Taiwan to give us a presentation on current river restoration in Taiwan on some urban cases. We have Professor Shaohua Marko Hsu from Feng Chia University, Taiwan. So Professor Hsu, please.

Lecture 2
Current river restoration in Taiwan on some urban cases

Feng Chia University, Taiwan
Prof. Shaohua Marko Hsu

Compared to Japan, concept of river restoration in Taiwan is not yet rooted into people's mind. Through history, many natural streams in Taichung city were transformed into concrete channels for better protection on bank erosion or bed degradation.

The only eco-sound river in Taichung city was Fazih river, where many species of bird could be found. Due to expansion of urban area in recent years and construction of high-speed rail way, the eco-system in Fazih river was deeply deteriorated. Some near natural constructions were introduced into Fazih river for river restoration. Expansion of the river width for flood mitigation was partially done and currently under way from the downstream to upstream. Adoption on Fazih river by our department was promoted by the author. Research by our group on monitoring eco-system, water quality, and base-flow discharge will be presented in this talk. Some background on this river, including geography, geology, and irrigation system will be also introduced. Activities with NGOs or NPOs for waking up our community with higher sense of eco-river and asking for better governmental involvement are also progressing.

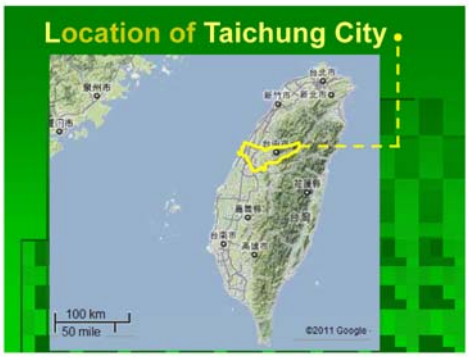
Concept of LID (Low Impact Development) is currently promoted to the city government for reducing peak discharge and better water quality from storm water drainage system into the Fazih river. Any suggestion or advices from the international communities are mostly welcome.

Good afternoon ladies and gentlemen. My name is Marko. I'm from Taiwan. My Japanese is not good yet, so I would like to speak in English from now onward.

I want to talk about the current river restoration in Taiwan for some urban cases.

This is my outline. I have six parts but because time is limited so I will skip the first one, but I will start from two.

My talk, there are two main parts, one is concrete channels in the most populated area and one is Fazih River also in the same city and then it's my research on Fazih River and some action on restoring the river and finally it's a network we have – I need to go to the last page.



Okay, I want to show you, this is a satellite view of the central part of Taiwan and this is city I live in. You can see from the photo, the white part is mostly highly populated area and that is first topic of my talk.

Then the second part of my talk will be on this river on the west part of Taichung city. Because of highly populated, so all the rivers, the natural rivers become artificial, so I will mention about three rivers: one is green stream, one is willow stream, and the plum stream. The urban planning in the old Taichung city started very early in the Japanese government era. At that time, Japanese government planned the city to have 0.2 million population, but now even in the old Taichung City, we have more than 1 million already, so it's overpopulated.

The reason for construction of road or land development, the many natural streams become straightened and became very narrowed, or sometime they covered by

parking lots and sometimes they disappeared and replaced by culvert.

I want to show, you maybe 20 years ago there is a natural stream was diverted to join a parallel stream. As a result, the downstream of the original stream became a dried ditch for many kilometers.

I will show you. This is dry creek. Originally, it goes directly to Cho River. For some reasons of land development, it was diverted to the other stream, so they can do some land development in this area, which is totally not a respect of nature.

Let's take a look of the rivers in the city. It's very common. You can find they are become very straight and sometimes they covered by land and then they turn 90 degrees.

And that is a typical photos of them. This is green stream. This is plum stream. This is willow stream. They all look similar, very straight and all concretized.

And very steep bank in drought season because not much water left, so you have a compound channel with deep central part in the middle.

Although many NGOs want their rivers back, which means river restoration, but there is so much constrain on it because the land already used for road, so you cannot do much. Some politicians did something on the waterfront landscaping improvement, but still far away from the concept of near nature.

For example, the many natural function was ignored. For example, infiltration does not exist anymore, water purification by the gravel-bed contact or by vegetation uptake, and the aeration by the natural drop.

That is how those politicians did.

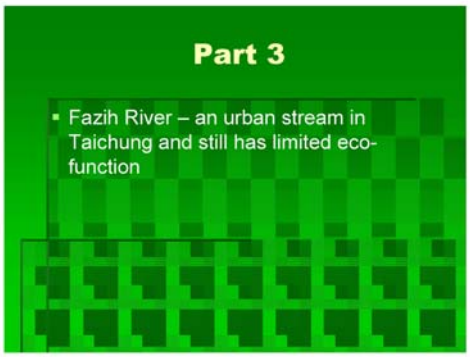
They tried to create some waterfront feature for people to get near to the river, but still the river still not so clean and they have no life in some other case. Maybe they put some vegetation on top, but still there is concrete underneath. This is very different from Australian, right.

This is also some very artificial case. Some people like it because water is clean. They made some clean water to flow, but it's not original water.

We can see from the place, the city Mayor said he will restore the Plum stream, but at first we saw they started digging and we thought they wanted to open it and become a nature one, but then they create this kind of monster because we say the gravel-bed is very good for natural contact of purification of water, but they do it like this. Why, because they only consider for flood, so I want to show you some flood events in Taichung.

You can see this is not river, this is the river and went across the bridge. It's flows overtopping the bridge and flooded into the city. Okay, you can see from the road. And this is the center part of Taichung city.

This is the other case. Okay, you can see here, the water, this is the sideward of the bridge so the water comes overtopping the sideward and go into the road. The velocity can reach 5 meters per second and that's why they come up with this kind of design.



I will go to Part 3, which is Fazih River. It's an urban stream in Taichung city, but still has some limited eco-functions.

I want to show you on the map. Here the length is about 22 kilometers and the width about 7 kilometers. This goes north; this is south; and this is the city center, highly populated area; and this has less populated. We have a wide mountain on the west and there is a high-speed rail station on the left-hand side.

The bed slope is 1 to 160, which means if you walk for 160 meters, you have 1 meter dropped, which is quite steep.

That is a photo taken 100 years ago, which is in the Japanese government era. The river used to have many water, you can see. Fazih means the vessel for transportation because at that time there was not any bridge. That's a name why Fazih river. Because at that time, the groundwater level is very high, so you have many recharge from the groundwater, so you have very high base flow.

Now if you look at the river, it becomes much less water. You can see the high-speed rail across it because high-speed rail go from south to north, so they use all the flat pan area in Fazih River. During the construction time, ecosystem was destroyed.

Because of the gradual urbanization, the channel also becomes more generalized. This photo took from west looking east. This is the center.

If you come to Taiwan, if you take the high-speed rail from north to south, before you stop on the station, the speed will slow down and that's why you can see on the river. This is downstream side of the Fazih River. It's still looked pretty good. You can see many gravel on top of the surface. You can even find central islands, which has a lot of birds.

People are still here watching birds, so the ecosystem still exists, although degrading. Those people are watching birds.

This person is a medical doctor. He took those photos in 2006. We have many kinds of birds. I just want to quickly go through this.

This is a Kingfisher. I like it most, but they build nest on the soil bank, but when the soil bank replaced by concrete, then they gradually disappear.

This is a mandarin duck. This is Moorhen. When I was in New Zealand, I saw that everywhere has this kind of the birds. Taiwan still has these kinds of birds once in a while, some come only in winter.

I want to talk about some restoration government done on this river. Okay, first time they want to enlarge the width to hold more flood water. This is a site on Tarutian bridge. This is 2008. You stand on the bridge and look upstream, you can see the concrete bank. But on the right hand side, you have island like a mountain with many vegetation, so a lot of birds stay here.

Here you have a weir which is for irrigation water intake.

This is another case on Donghai bridge and that is reconstruction of levee, so they replaced levee with something porous material, so it can be a little bit green and also milder slope. This is levee with construction also in another site, because this is inside the river, so you need very strong flood defense something, so underneath the green stuff it was constructed by very strong material like concrete and gravel materials.

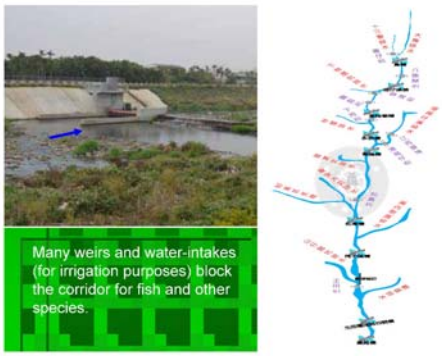
Okay, this is you go from looking downstream. This is 2011. This is on the bridge, you look upstream. You can see the river width enlarged. You have like porous media on the bank instead of concrete wall. However, the mountain disappears, so a lot of birds disappear also when you look on the downstream.

This is a levee construction with the willow technique. I think we learned this from Japan, but still we have a lot of local sculling at bridge crossing and the levee base, because when we built the high-speed rail, we need to use a lot of land so actually some of the places the river also becomes narrowed.

So, the work done on the river was much better than previously mentioned urban stream in the first part, but it is not enough

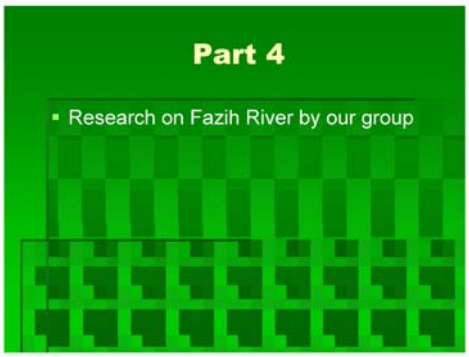
to guarantee the ecosystem can be preserved. For government, there are many different government agencies. Each agency has a different prospect. Some agencies care only about bridge, some care only about flooding and some care for only about irrigation.

Those opinions always contradictory to each other; for example, the flood control work really damage the eco-habitat and the conflicts between the environmentalist and the government become intense.



We think there is some research needed to provide the correct information to government. For example, there are many this kind of irrigation weir and water-intake. This is the main stream of the Wachee river. You can see across the river, there are many, many bridges, also many weirs which is for water intake. They block the corridor for fish and other animals. For example, this is done for flood protection, but they created very fastest flow which is not good for small fish.

For example, there is some soil bank replaced by concrete one, because they want more safe.

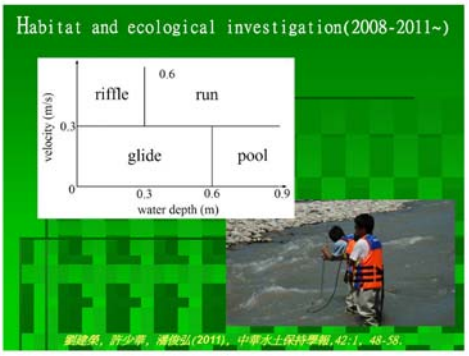


I will introduce some research by our group on Fazih River.

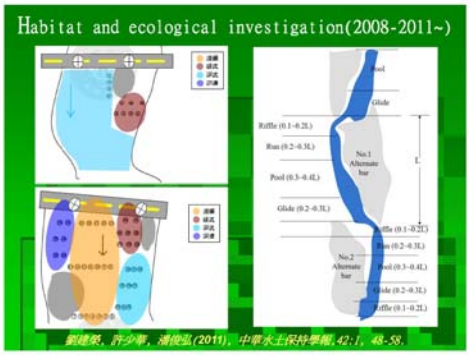
I summarize they are several. One is measurement of gravel movement which is important for morphological change; one is habitat and ecological investigation; one is physical modeling on alternating bars and field observation; one is investigation on pollutant sources and water quality measurement; and one is groundwater recharge and the base flow estimate; and

last one is the low impact development to restore surface runoff, because the last one is that I find that we cannot concentrate only on the stream, we need to go to the watershed.

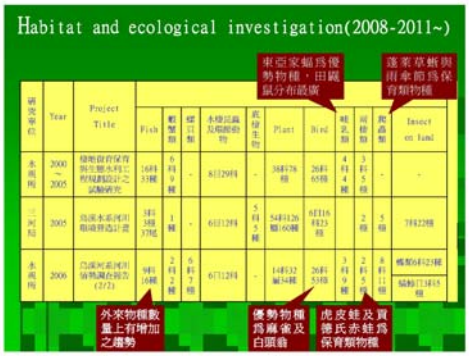
This is the case we did. I designed an equipment to measure the gravel movement.



Thi s is we measure, riffle, and pool in the river according to the water velocity and water depths.

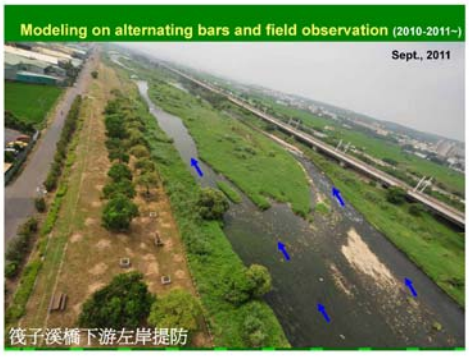


In this, we identify different eco-habitat around bridge and also we identify the different riffle run and the pool system along the river in a different scale.



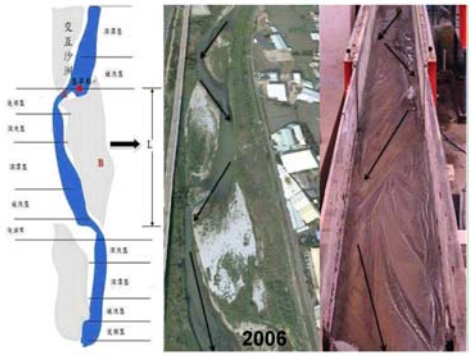
At this time, ecological investigation and then we compare with previous investigation we find that all the species, number of species decreased very fast like fish, or bird or plant or insects also.

Now, one of my Ph.D. students is working on this. It's kind of macro-invertebrate, which can represent the water quality in the river. We do something like that to identify how we can measure it correctly.



Because we don't have a financial support for this research, so we did some very simple ones. We want to look at the river

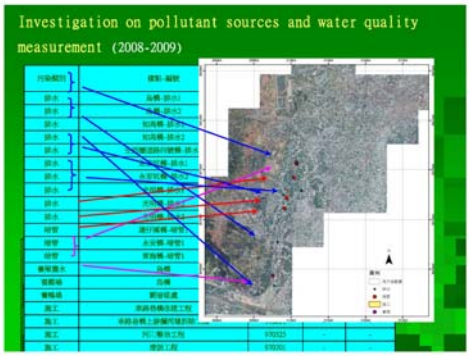
from the top, so that's the picture we took.



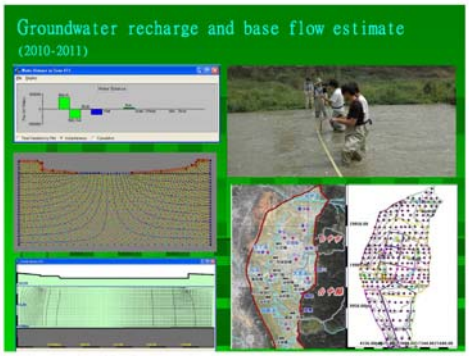
We can see it's the poor system, because it is the alternating bar system.

We go to the laboratory and we can reproduce by field experiment to reproduce the reality by a smaller scale and then we can watch how the morphologic change and which affects the eco-habitat.

We go to the field to identify some pollutant source and then inform our government to get regulation



And that is some part – we take water quality test every 500 meters. We find out in the upstream, the water quality is really serious and the downstream is much better. That's because of groundwater recharge.

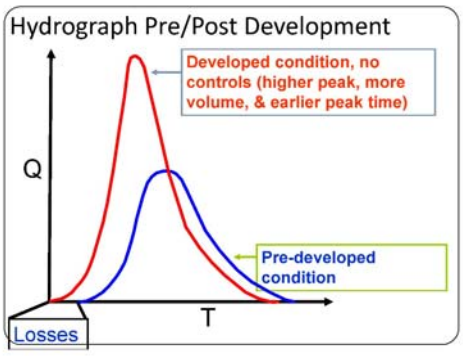


Then we do the groundwater modeling, try to identify how much is the base flow and also we go to the field to measure the base flow.

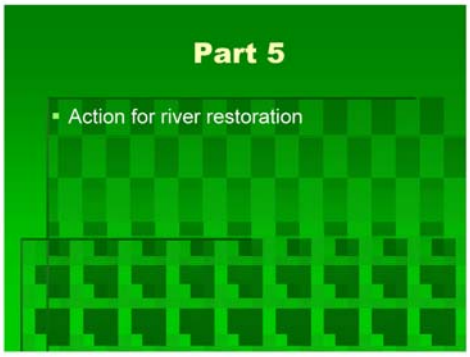
And then we find out in dry season and in wet season the line change; for example, on this line the groundwater recharged this river and above this water recharged groundwater; so we can identify in different season.

Then the last one is we want to promote low impact development, because that will increase the infiltration, because we think that the capacity of the channel will never

enough if we keep digging up the land. We cannot just do river restoration on the channel, we need to care with the watershed.



That is the idea. We want the discharge to go back to the original predevelopment condition.



The part five is the action, because only research you cannot improve with water, you only know something. We want to conserve all living creatures in Fazih River and we want to popularize the idea of ecosystem protection to our neighboring residents. We want to combine all people in the organization to reach the goal.

Action one, we establish an interdisciplinary group in my university. I establish an information platform on the Fazih River. We devote our academic studies on the topics related to Fazih River. We exchange idea through many discussions between various groups, some NGOs, some government people also and some people from consulting firm, because I have many students, they work in consulting firms now. Then we visit local leaders around Fazih River, try to identify the problems, and how we can improve. We want to combine with local people. Also, I designed some course materials related to Fazih River, so my students will go to touch the water and feel the velocity when they cross weir and they can know and they can measure everything there.

Then we have site observation lesson on the engineering ethics. This lesson is on electronic engineering because they produce many pollutants to the river, so I want them to know in the future they will try to minimize this kind of exchange. And we also have clean up lesson for students. Then if some of my friends came, I always ask them to go with me to the river. Then we provide knowledge and work with local non-governmental organizations. We have

activities for public involvement. I try to bridge the gap between government and NGOs, so here we have some people from government, some are NGOs, because they have extreme ideas.

In part six, now we have the Taiwan restoration network and this is created by Water Resource Agency. We try to incorporate together in technology and management experience with other people.

That is some typical photo and pictures in the website. This is the website of ours.

I think to end my talk is that I came here and I think we can use some help from ARRN and I think we want to connect with ARRN and other people doing water restoration. Thank you very much.

Moderator

Thank you very much. We were able to hear actual cases of urban river restoration. Next I would like to move on to the Korean presentation, development of technology for waterfront creation and case study of continuous block system. We have Professor Suk Hwan Jang from Daejin University, Korea. Professor Jang, please. The professor is also the Secretary General of KRRN.

Lecture 3
Development of technology for waterfront creation and case study of continuous block system

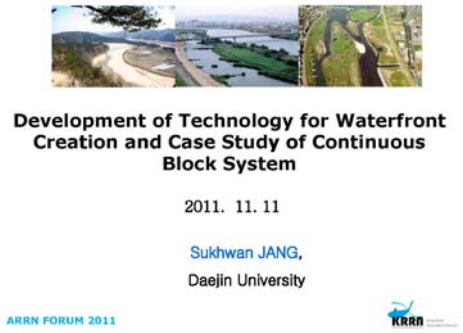
Daejin University, Korea
Prof. Sukhwan Jang

For last a few decades, stream management based on government-led planning was mainly performed considered with the use of water and flood-control oriented streams in urban areas. Recently, development of nature friendly waterfront technology to improve ecological dynamic, function of ecological path between river and land including hydrological safety is to improve aesthetic function nearby waterfront and securing nature-friendly leisure and resting places for the residents.

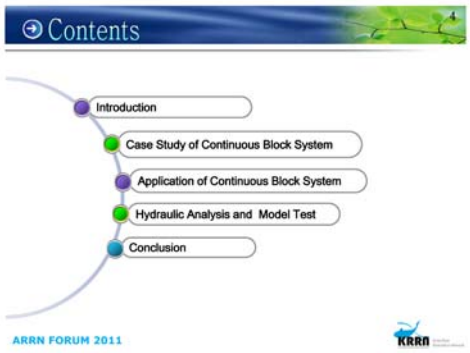
This study has its objective in reviewing the hydraulic characteristics of Grass-Con, continuous block system in the river slope, which is developed for cast-in-place vegetation block system in order to improve the stability and maintenance against the high flood condition in comparison with pre-cast concrete block. Physical hydraulic model test was carried out at first and 1-dimensional numerical modeling with HEC-RAS and 2-dimension numerical modeling with RMA was adopted to compare the result of the hydraulic model experiment with numerical simulation results in terms of with vegetation or without vegetation; so that we can come up with a solution for the reduction effect in case of a flood. In the hydraulic model experiment, a river in Kyungsangbuk-do, Korea was applied to a scaled model, which discharge is supplied from a dam. Discharge in a laboratory supplied to the model by rectangular weir and water velocity and depth were measured to investigate flow pattern or hydraulic characteristics with or without vegetation in the artificial channel. The experiment discharges were 200m^3/sec, 100 year design flood, 400 m^3/sec and 600 m^3/sec, probabilistic maximum flood.

For the applied field's measurement verification, data of actual velocity and water stage were compared with the numerical simulation results in each section through the HEC-RAS (Hydrologic Engineering Center-River Analysis System). Also, through SMS (Surface water Modeling System), which is the 2-dimension flow analysis, flow pattern in the stream was examined with and without vegetation. Roughness coefficient is a main issue to calibrate the simulation model. The physical model was built as a scale of 1:50 by Froude similitude measuring the water levels and the water velocities with and without vegetation and the effects were analyzed after reviewing the results.

In consequence, the water velocities were observed to decrease and the water depth were determined to increase in case of the of design flood. The results of the numerical simulation, under the condition of roughness coefficient calibration, show similar results of the physical modeling. These results show that the results of hydraulic modeling and the predicted results of numerical modeling corresponded reasonably each others. This research will come in pretty handy in reinforcement of the current constructing close-to-nature rehabilitation as well as maintenance against flood. Also, the computation of tractive force and the resisting force of water flow on river bank vegetation protection is needed in further study.



Thank you Dr. Shaohua. My name is Suk Hwan Jang from Korean River Restoration Network. I am a professor in Daejin University. First of all, I would like to thank JRRN to give me a good presentation here and this is first visit at the Tokyo University as well.



What I would like to present today is the development of technology for waterfront creation and case study of continuous block systems. Before presentation, I would like to give a short background of my topics. We have a big research group in Korea, which is called Ecostar Projects sponsored by the Ministry of Environment to develop the technologies.

For the previous two presenters today would present the large scale the concept or technology, but I would like to speak about very small scale and the specific technology for the waterfront creation case studies.

I will skip the contents. As you know well, for the last decades before 21st century, the stream management based on government-led plan had been mainly considered with the use of water and flood-control in urban areas. As a results the ecology of urban streams was more deteriorated due to such as drying, straightening, concrete covering, artificial riverbed, and water pollution etcetera.

Our research team's objectives are to develop nature-friendly waterfront technology to improve the ecological function as well as hydraulic safety between river and bank slope and to restore aquatic ecosystem and improvement of the diversity in waterfronts and improve also the aesthetic function nearby waterfront and securing nature-friendly leisure and resting places for the residents.

In our team, we have developed six technologies for the waterfront and riverbeds to slopes. The first one is the mattress groyne system composed of natural materials in the streams. The second one is soft-bag system for the creation of natural waterfronts. The third one is geo-green loess fiber block. The next is soil-layered systems reinforced with fibers for vegetation; and the grass-con system of continuous block system which I would present one of the cases of those six developed technologies. The last one is frame system composed of burned woods.

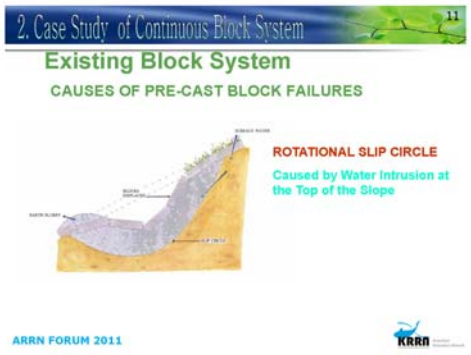
At first for the grass-con, the continuous block systems the background of this technology. As you know, the river restoration propelled the rehabilitation after the 90s were by the government thread and just to prevent the damages. But, the problems for the rehabilitations on the river bank slope are hydraulic safety problem, especially for the existing slope protection for the close-to-nature application.

The next one is 'The sustainable water drainage systems.' I would like to review the existing block application system, which I called the Pre-cast Block Systems for slope protection in river banks. We have developed for the hydraulic safety as well as eco-friendly bank slope too. I verified the hydraulic analysis for those technologies.

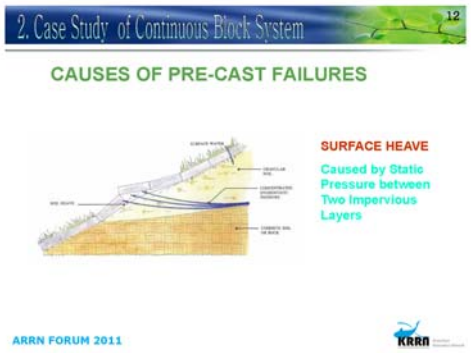
As you can see, I started thinking of the availability of co-existence between hydraulic safety and vegetation, eco-friendly slopes. As you know, in monsoon countries such as Korea as well as Japan and China, the rainy season from June to August, more than two-thirds precipitation focused on these rainy seasons.

In our country, the annual precipitation is 1300mm, but more than 2/3rd, about 900mm were concentrated on the June to July. So, there are many disasters in the urban area streams like this. So, when we apply to the eco-friendly or nature-friendly block systems, there had happened inundated and flooded and

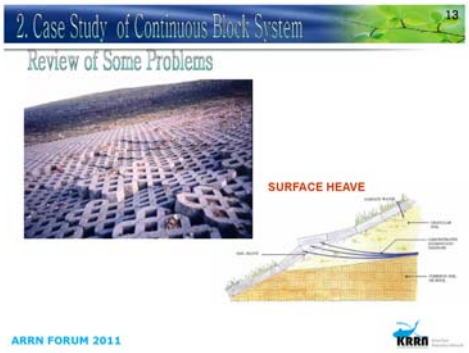
destroyed like this. So, how could we meet the two conditions, the hydraulic safety and vegetation conditions?



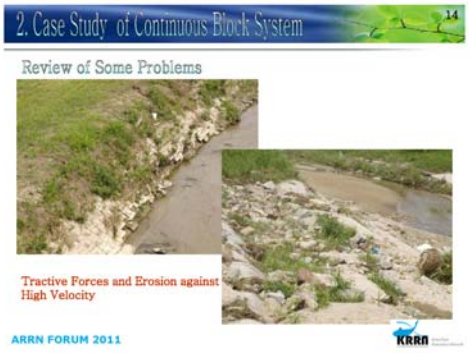
Let's see the existing block system for the failure, especially the causes of pre-cast block system. One of the major causes of the failure is the rotational slip circle caused by water intrusion at the top of the slope. This is the interlocking between the unit blocks. And just one unit is destroyed, it influence the whole slopes.



Second one, second major causes of pre-cast failures is that the surface heave caused by static pressure between two impervious layers especially when the melting or the swelling in the winter seasons.

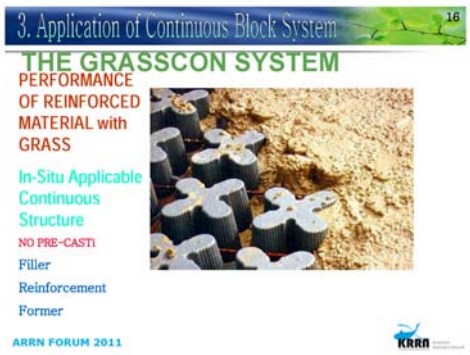


This is the typical failure pictures of the surface heave. You can see the picture, especially in the bottom of these slopes.

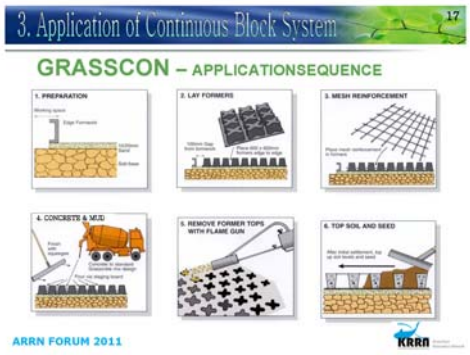


It's also applied the vegetations and the water slope protection here. After flood seasons we can see many times and many cases in the river in Korea.

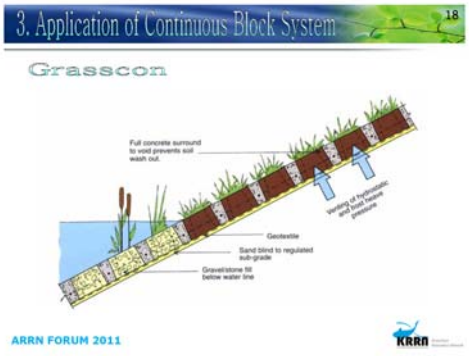
It shows that the tractive forces and the erosion against the high velocity in the flood season. Also this is another picture for the interlocking problems between the units.



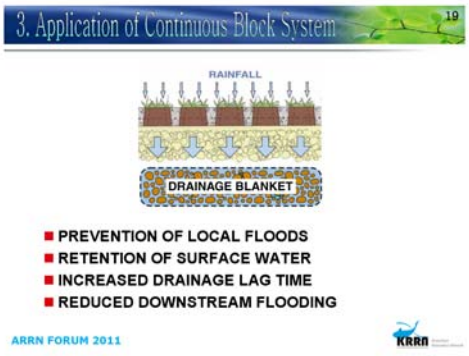
Now, I will talk about new technologies we have developed. Those are six developed technologies. We named the grass - con, grass-con means grass plus concrete or concrete materials, something like that. This is not the pre-cast block, but continuous one body and there are three components. The major component is the filler. Filler means that this is the filling materials. It's a concrete and yellow mud. It's a mixture of concrete and yellow mud. And the second one is the reinforcement bar here and the third one is you can see the black ones, this is the former which functioned as scaffold in those things. This is performance of reinforced material with grass. This is in-situ applicable continuous structure, not the pre-cast structure.



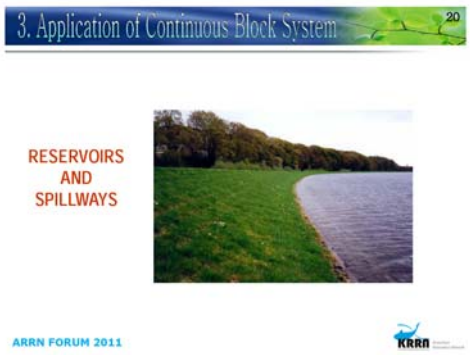
Now let me show you the application sequence of those. First, the lay formers, which function the scaffold here and also mesh reinforcement among the void here and then pours the concrete with mud here and after mature you can see void was removed the former tops and it makes holes and voids here with guns or by hands or by another methods. And then fill the soils and the seed here. This is some materials by filler, concrete and mud here. The black spot is the reinforcements and the red one is soils and the seed here.



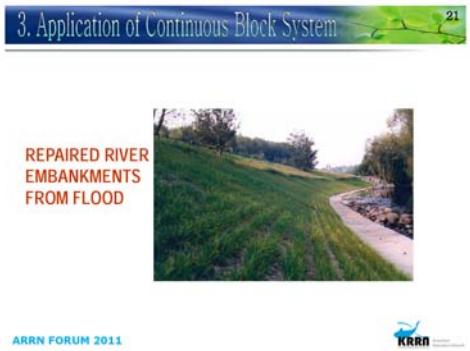
This is a typical cross-section in the Bed Rivers here. As you can see, this is the soils and vegetations here. This is the reinforcement bar and the material is filled here. But this is not pre-cast but it's the whole body in the total system.



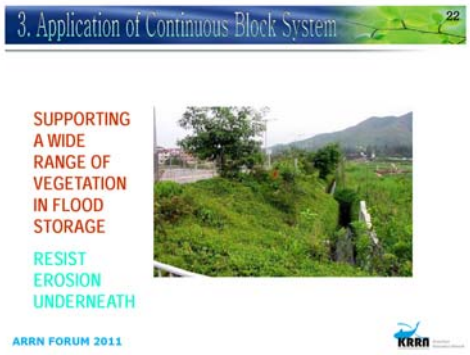
Also, if we apply these systems in a pavement on the road or in the parking lot, the function of the sustainable urban drainage systems to prevent local floods and retain the surface water and increase the drainage lag time as well as reduce the downstream of flooding too.



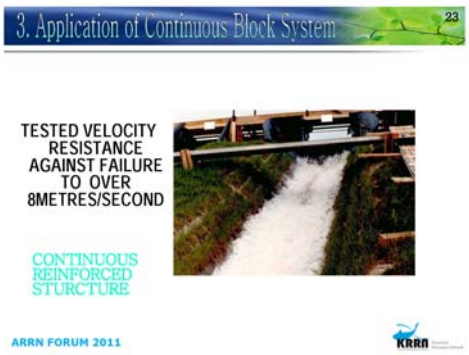
Here are some pictures to apply to the reservoirs and spillways here. This is the picture that was applied after 2 years after this grass-con system.



Here the another picture of the repaired river embankment from floods.

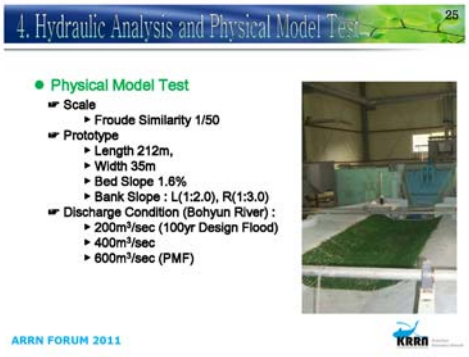


Here is urban area restoration stream, very small stream and resist erosion underneath. This supports a wide range of vegetation in flood storage too.



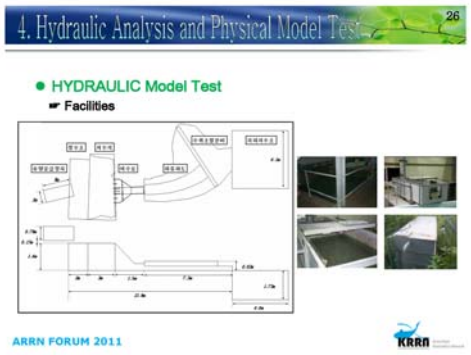
In the hydraulic safety, we have tested for the resistance for the velocity, and tested velocity resistance against failure. It couldn't destroy to over 8m/s, so it's very resistible for the high flood and high velocity in the flood seasons.

This is the typical section. We apply the drainage gate and the spillways and reservoirs and sometimes in the parking lots or some pavements there.

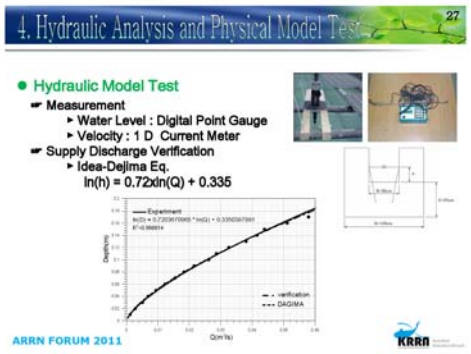


Let me talk to the hydraulic analysis and physical model test of these systems. I applied to the physical model test and under the scale of Froude Similarity, the 1

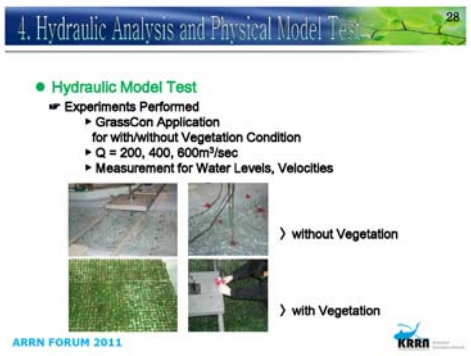
to 50. This is the channel. This is dam spillway. Dam spillway discharges under the condition of 200m^3/s and 400m^3/s and 600m^3/s and the lengths of the river is 200 meter and the width is 35 and bank slope is 1:2 and 1:3.



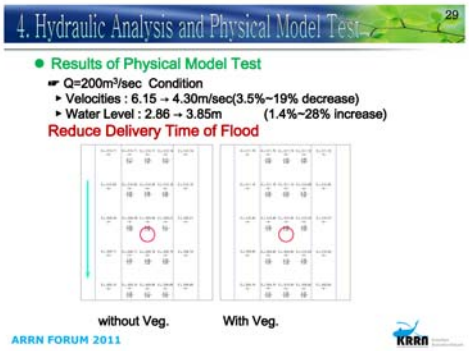
This is the layout of the physical model facilities here.



We tested and measured basically the water level and velocity for those physical models.

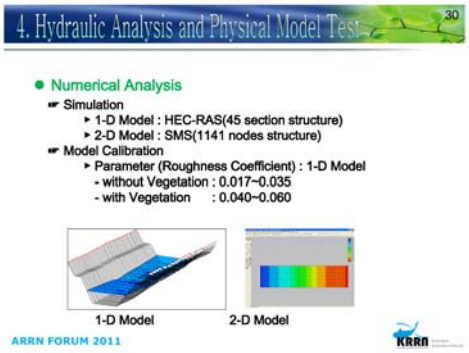


And we also experiment performed under the conditions without vegetation and with vegetation. We measured the grass-con conditions with vegetations for the discharge of 200, 400, and 600, the measurement for water levels and velocities.

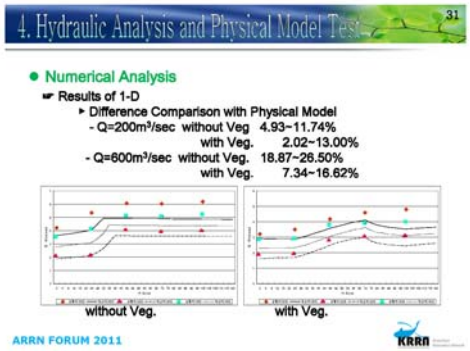


For 200 m^3/s is the design flood of this river, so the basic, the standard is 200m^3/s. The difference comparison with vegetation and without vegetation, the velocity decreases 3% to 19% and the water level increases 1% to 28% increase.

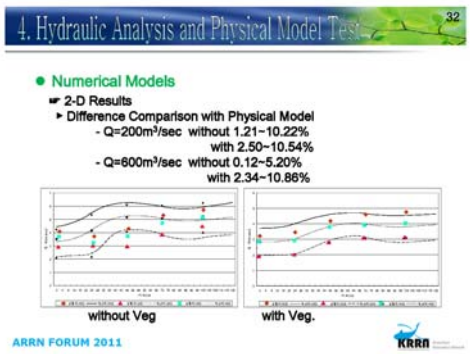
That means from the physical experiments reduced the lag time, so reduce the flood, the peak floods there.

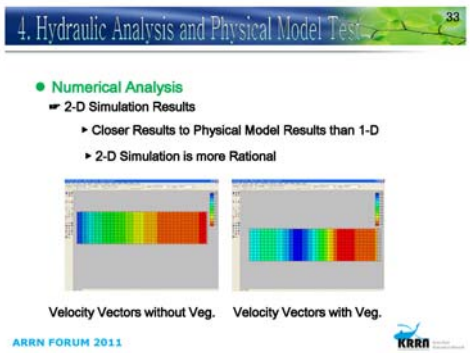


Second was numerical analysis was performed with the 1-D model and the 2-D model. From the physical model test, we calibrated from roughness coefficient parameters without vegetation condition and with vegetation condition.

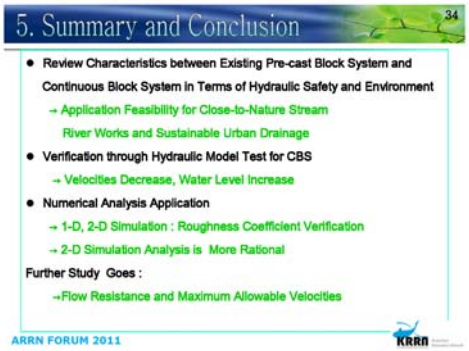


The result of the 1-D, the numerical analysis is that the difference comparison with physical model is that without vegetation is 4% to 11% and with vegetation 2% to 13%.





And 2-D results as well for 200 cubic meter per second, so without vegetation condition is 1% to 10% with 10% as difference. That means the closer results to physical model results than to 1-D, so 2-D model test is more close to the physical results, so we can apply the 2-D model when we simulate the vegetation condition, it's more rational there.



Let me summarize our topic. We reviewed the characteristics between existing pre-cast block and continuous block system in terms of hydraulic safety and environment. We can apply also the feasibility for the close-to-nature stream river works, especially for the river restorations in urban area.

Also we verified the Hydraulic Model Test for continuous block systems, the velocities decrease, water level increases, and numerical analysis applied as well. We are still ongoing studies on these technologies for the flow resistance and the maximum allowable velocities too.

Thank you.

Moderator

Thank you very much. He talked about hydrologic analysis of the slope establishment. I would like to have 10 minutes break until 2:40p.m. and then we would be starting the second part of the presentation.

Moderator

Now I'd like to resume the lecture, the lecture number four. It's the Feng River Restoration - from Land to Water. Professor of the Beijing Normal University, Professor Dr. Aizhong Ding, please.

Lecture 4
Feng River Restoration – from Land to Water

Beijing Normal University, China
Prof. Aizhong Ding

Feng river is one of the eight rivers flowing through Xi'an city, the 1st tributary of Wei river which is a 1st tributary of Yellow River. Feng river originates from Qinling mountain with length of 78km and basin area of 1460km^2. The population lived in the river basin is about 0.66M with density of 483/km^2. Most of the residents are living in the downstream where Xianyang and Xi'an are located.

The monitoring data showed that Feng river has been polluted with ammonia and COD at the middle to downstream. The main sources of the contaminants are from industrial discharge, municipal wastewater and agricultural activities. The field investigations indicated that ecological status decreases from the upstream to downstream, habitats were destroyed by human activities like sand mining.

To restore Feng river, a project supported by the Major Science and Technology Program for Water Pollution Control and Treatment was carried out in 2008. Regarding to water pollution control, river restoration is not only within river channel itself, the sources of water pollutants from the land need to be controlled in the basin scale. Therefore, the research included

(1) municipal wastewater treatment using low-cost technology like constructed wetlands for rural area,

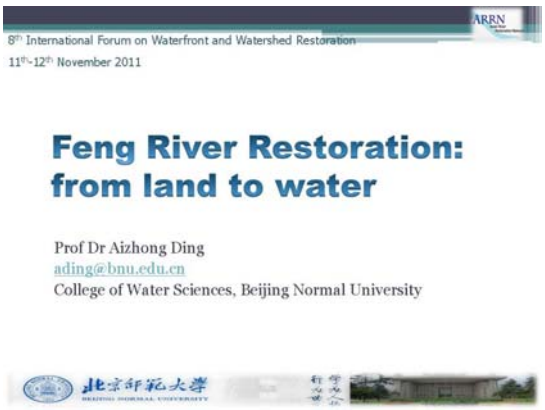
(2) impacts of solid wastes on river water quality and its reuse,

(3) diffuse pollution identification and control with buffer zones,

(4) river water quality polishing using ecological engineering such as ecological ponds, and

(5) habitats restoration with consideration of aesthetic purpose simultaneously.

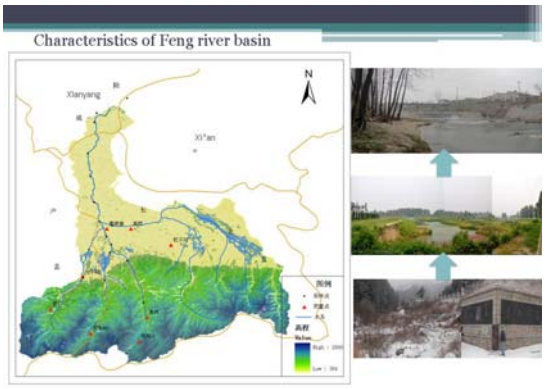
To assess the progress of the restoration project, river water quality are being monitored accordingly and incorporated into water quality model for prediction. Ecological status is to be investigated biannually.



Good afternoon, everybody. My name is Aizhong Ding from Beijing Normal University. Today, I would like to you talk you about as the river restoration issues in China. First of all, I would like to thank ARRN to invite me to give my presentation here.

The title of my presentation is Feng River Restoration. It is a small river in China close to Shiyan City. In China, we have many, many rivers, more than 20,000 rivers in China from very big largest scale like Yangtze River, Yellow River, and to small rivers in city or around the city.

From Land to Water, what I mean is with total amount of river restoration – I mean it's not river itself. They should think about the human activity on the land. The human activity have very influence on the river degradation. I think the river restoration is an issue of watershed management – catchment scale issues, not just river itself.



The Feng River is here original from the Qinling Mountain. The Qinling Mountain is very famous in China is the diversion of the north and south of China. Many rivers originated from the north of the Qinling Mountain to Shiyan City. You can see some pictures of Shiyan City, the famous tourist city.

The Feng River is one of eight rivers flowing by Shiyan City. The local government want to restore the eight rivers one by one. This river Baier River and Jiang River was already restored. Now they are doing Feng river restoration.

The length of the river just the 8 kilometers is small, relatively small in China and the area of the catchment is about 1500 square kilometers. This river has very, very typical features from the mountain to the city. In this section of the river is in the mountain area, so very few people live there. But nowadays urbanization of the Shiyan City, the people moving to the mountain area, there appeared some villas in this area for the vacant holidays.

Then the river – in the middle of the river some university campus build a new branch

in this area and some villagers living in this middle section of the river and downstream of the river flow to Baier river, then finally flow into Yellow river.

The city area, the river won't modified by human. You can see the picture from the upstream to the downstream, is original in the mountain. The building was the logo of the two water system, here is Yangtze River system. This is yellow river, so changed the version of the two big water systems. This middle area, many villagers are living in this area.

At the downstream you can see with some creeks, banks, and sometimes people will get water from the river. For this kind of river, the Chinese government issued a big project for Feng river restoration project founded by Ministry of Science and Technology. The budget of our research is more than 20 million China RMB.

Research project how to restore this river, I divided the research group in three.

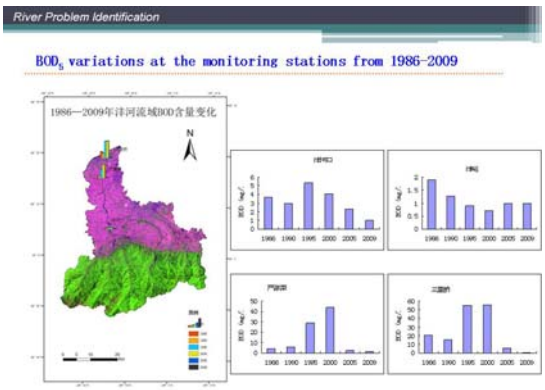
One is for 'River Problem Identification.' We needed to know what is the problem. Then some river health evaluation assessment, ammonia source tracing, they must know that ammonia comes from the poisonous source or nonpoisonous source because in China the ammonia is a big environmental problem in rivers. Also with some sediment investigation and analyze the impact of human activity on rivers.

The second group is 'Pollution Control Technology Development.' For this kind of small river catchment, in city we can collect the wastewater from the building from the industrial municipal but in rural areas the people live very far from each other. How to collect the wastewater and treated wastewater for community of survey should be developed low-cost technology for community wastewater treatments.

Another problem is the solid waste in catchments. The solid waste way, some pictures show the solid waste flow to the rivers. For this kind of some restoration engineering design, planning and design and implementation.

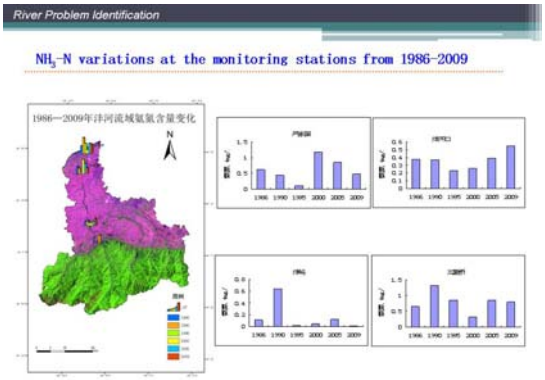
For river problem identification, we use long series of water quality data to find its activity on the river quality, taken from 1980 until now. You can find the river quality changes with time.

During the last 30 years, the government do some pollution control measures to reduce the pollutants from this bank, like shutdown some small factory, to remove some polluted industry in other area.

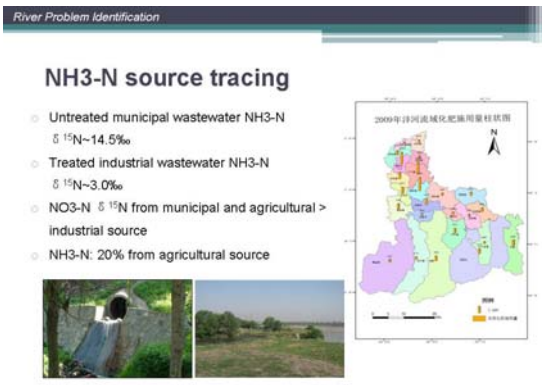


This is biological, obviously the amount changed during the last 28 years. As ammonia, we can find ammonia – in some areas ammonia increased due to the chemical fertilization.

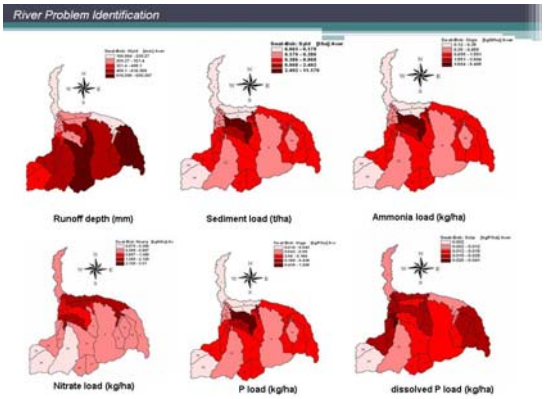
In China, a typical time is 1980, before the use of chemical fertilizers. After that the agricultural reform, every home use more chemical fertilizer to improve the production of the rice and cost.



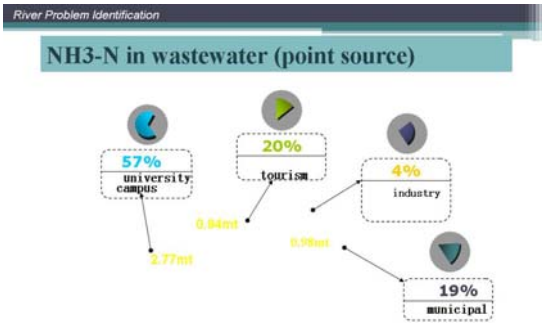
To trace ammonia source from the land, we use some data. The result shows that the untreated municipal wastewater has a different isotope composition with treated industrial wastewater and nitrites other different isotope concentration from the ministry of agriculture. We used a different computation of isotope data to determine the ammonia source in the rivers



Finally, we find that 20% of the ammonia from agricultural source in this area.



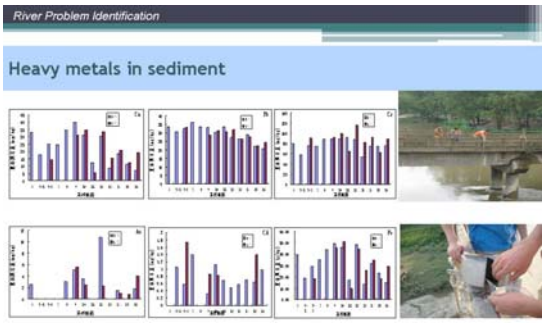
There will be some model to find which area are the critical zones for different kind of pollutants load like sediments, ammonia, nitrate, phosphorus, and dissolved phosphor.



Sorry, some figures are lost because of different system.

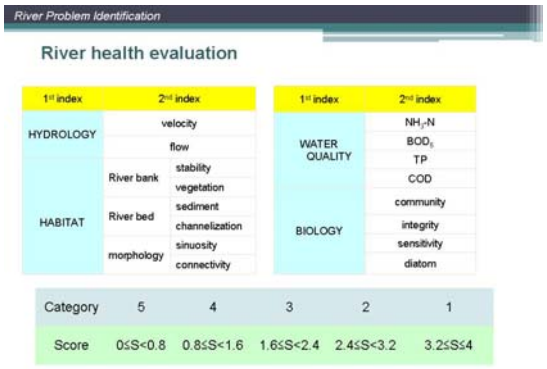
From the point source like waste water is a different composition of ammonia from

more than 57% from University campus because the university builds a new campus in the middle of the stream; 20% from the tourist and 19% from municipal and homes.



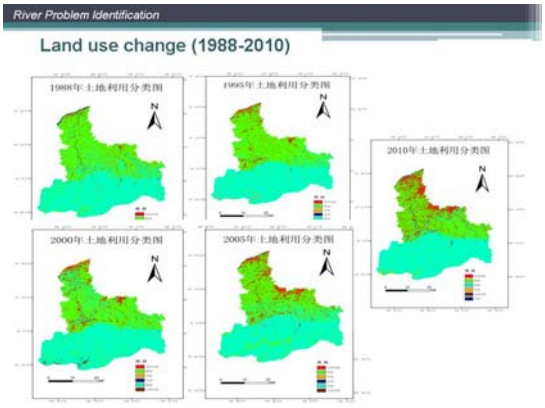
Also the investigated the sediment pollutant, we test to some analysis of heavy metals in sediments and find the different location. We collected the sample from the headwater to the downstream. In different section of the river, the heavy metal concentration are different. We can find which source – where are the sources of the heavy metal to the sediments.

Also, the biological investigation – what kind of biological one in water pollute and sequence in this area in this river. We used some biological index to relate the community of the biological with the water quality; we can find from the headwater to the downstream, the biological index decreased. This is a different biological index.



We think about all these kinds of things together like hydrology, quality and biological together for water. For river issues we do some river case evaluation. Use different scores. Score 1 means the river is healthy; the 5 means the river will get worse.

So, the results show that from the headwater to the downstream, the score decreased. That means the downstream river is not healthy than the upstream of the river. The different paths mean different seasons. We can find in each site in different seasons healthy condition doesn't change a lot. In wet seasons the river is more healthy, than in dry and normal the river healthy condition is not so good.



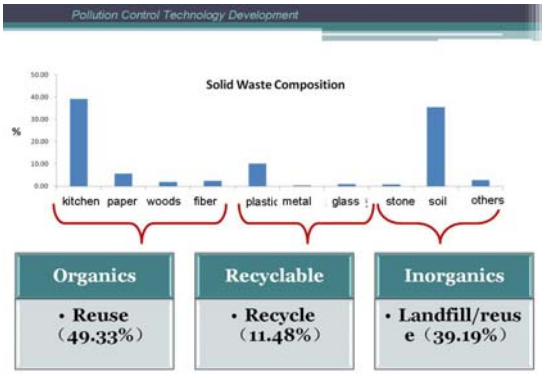
We do some land use change to compare different times the people, the human activity on the river quality from the 1980s to 2010. The findings that people, because of the development of the city and the population increase, the people use more land for city building.

Some land and water bodies get lost from the expending of city, but we can see the relation between the land use with water quality. We can see the land use are closely link with related to river healthy we think about the hydrology or something together is not just related to water quality only.

From the river problem we used different way to restore the river. Just like I talked before, in different section of the river the problem – especially in the middle of the river the problem is water quality and the pollution from the university campus from agriculture. The downstream of the river, the main problem is ecological because of the bank, building, and the dams.

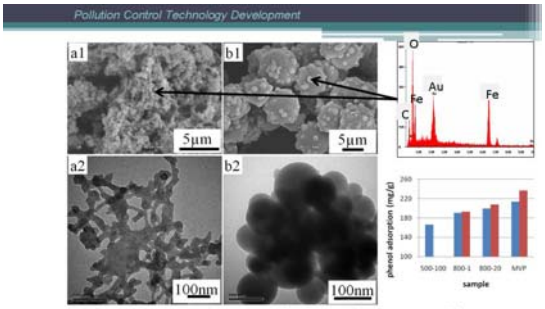
The second part of the project is pollution control technology development; the first one is rural wastewater treatment. The study constructed wet land for waste water treatment. Studying treatment to improve the efficiency of constructed wet land.

For the university campus, they build the CASS reactor and they used the treated water for irrigation, for plant irrigation, for campus use, or toilet flushing. So, in the university campus the combined water treatment, and waste water treatment were used together.



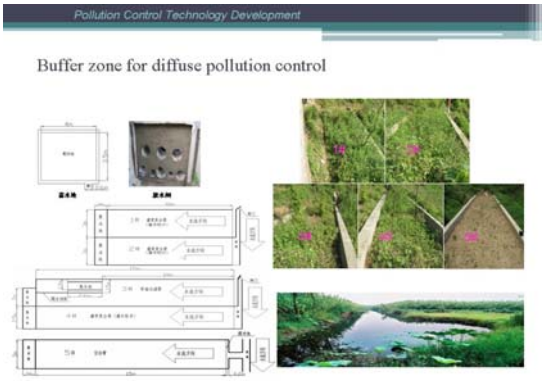
Then, the solid waste, we have done some site investigation to find the different kind of composition of the solid waste.

For organics like kitchen, paper, wood and fibers can use the reused, we can take it later. Then for plastic, metal, and glasses it can be recyclable, more than 10%. For stone, soil and other selected construction, solid waste can be used for reuse and landfill which takes 40% in this area.

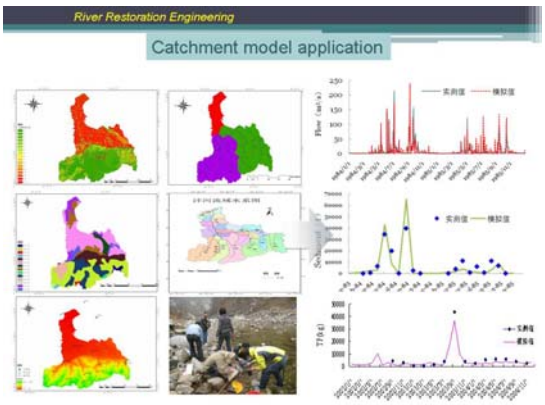


Kitchen wastes can be reused as adsorbing material for wastewater treatment

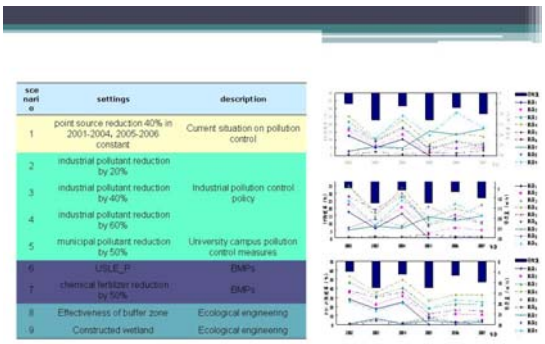
This picture shows the result of the use of fabric to develop absorbing material for waste water treatment. You can find this kind of porous media for heavy metals and organic contaminants from waste water and this shows the different experiment and result.



When we control the point source from the human homes and we also started the buffer zone for diffusion pollution control with some different kind of buffer zones, different figures, size, and how to control the ammonia and phosphorus retention and degradation.

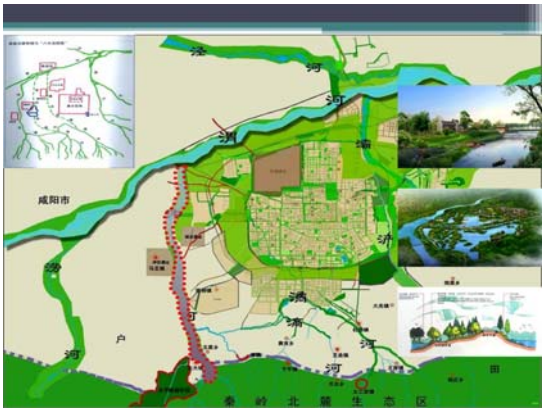


What we consider this problem in the catchment area, then we use the different kind of treatment technology together, we found the catchment model to link the human activity with the water quality, then we can combine the technology, what kind of technology can be used to improve the river water quality. The right is the modeling result is flow filled with narrow and modeling result is quality, sediment, and phosphorus. You can as the model can be good to predict the water quality with the human activity on the land.

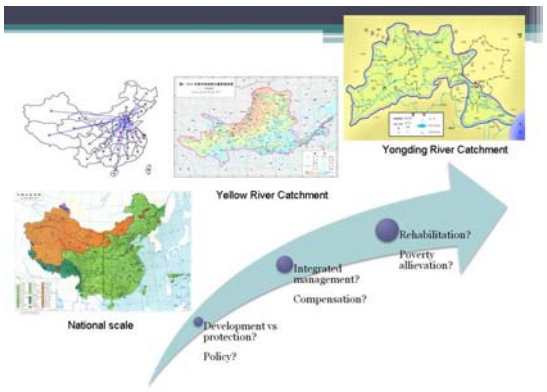


scenario	settings	description
1	point source reduction 40% in 2001-2004, 2005-2006 constant	Current situation on pollution control
2	industrial pollutant reduction by 20%	Industrial pollution control policy
3	industrial pollutant reduction by 40%	
4	industrial pollutant reduction by 60%	
5	municipal pollutant reduction by 50%	University campus pollution control measures
6	USLE_P	BMPs
7	chemical fertilizer reduction by 50%	BMPs
8	Effectiveness of buffer zone	Ecological engineering
9	Constructed wetland	Ecological engineering

We make some scenarios to evaluate the control measures, what kind of control measures can better to improve the water quality. We think about the point source control, industry waste water reduction and BMG of the agriculture activity and buffer zone's ecological engineering and constructed wetland. Different kinds of technology give some modeling result and model can predict the water quality of different kind of technology obligation.



It just shows my design my part of this area. Shiyan City with different. This chart shows very briefly of the design map. In some areas there is a bank building and ecological restoration, and more things about the catchment management and the water river restoration. Let's just talk about is the whole project briefly.



To my understanding, in China the river restoration is not – as I said before, it is not river itself. And we think 3 things we should think about in the future for river restoration in China.

The fourth one is development versus protection. This attitude of the government and human is issue of policy. In China, in the last 20 years the economic developed very fast, so what kind of river we want for human. The second one is the integrated management in catchment. In some areas in China, people live and work in poor condition, but in some area the people is more like Beijing, big city, is living better than the people in the middle area. What kind of the government should do, I think the compensation. In the upstream in some area upstream of the river, the China government should protect this headwater of the river but some people living there, they have not tried to build some, to make some industry or some industry activity. They lost some job so for the balance, the government should think about is the poor people.

The third one is rehabilitation of the river, the poverty alleviation. At present the first problem with the river is the quality I think.

The second is the quantity of the river. In some rivers in different section of the river, they want to get more and more water from the river. The downstream of the river getting dried up. So, that's a problem. The third one is ecological. We don't have a flow, we don't have a good water quality, how can we talk about ecological, the fish. I think in different areas the problems are different what I'm talking about is the project.

The fourth is problem identification. In China, from the south to the north, the ways are different, the geography different, the economics are different, the people, culture, I think everything are different. So we think the first think they should find is the problem in different river catchment.

I just show some the work group. I worked in China in different areas. This small river in Beijing, the river is getting drier because of the people using more and more water in upstream of the river, so everything. I think for river restoration in China is challenging. A lot of things together and hope to – and China river network and other Asian countries can work together to improve the river issue.

Thank you.

Thank you for your attention!

Moderator

Thank you very much. The Chinese actual current technology and situation is explained in a very easy to understand manner. Now, the next lecture, the last lecture is concerning Japan.

The title is the 'River basin flood control and restoration as innovations from Hii River.' Professor Yukihiro Shimatani.

Lecture 5
River basin flood control and restoration as innovations from Hii River

Kyushu University, Japan

Prof. Yukihiro Shimatani

On July 24, 2009, torrential rain hit Fukuoka City, where hourly rainfall exceeded 100 mm locally. Temporary evacuation orders were issued when the Hii River flowing through the central area of Fukuoka City was flooded, and the river basin area suffered serious damage. To respond to it, we organized the Hii River Basin Flood Control Citizens' Council on October 4, 2009, and started to work with citizens to tackle flood control. The Citizens' Council has already has 20 meetings, and will continue to hold meetings.

Due to urbanization, water-retaining capacity and seepage force have decreased in urban areas. As a result, the flood arrival time has shortened remarkably and the peak flow has more than doubled. How should we deal with this urban flooding?

One option is to develop flood control facilities that can respond to increasing flow. They include river channels built through excavation, large-scale underground discharge channels, and large-scale flood control basins created along a river. This is a conventional method which is a so-called flood flow responsive method.

Another option is to control the whole rainwater runoff from watershed areas, and to redesignate the area where floods cannot be controlled as a flood area. Water stored at low cost in such facilities as houses, public use land and public facilities will be allowed to percolate down or used effectively as water for daily life. Flood control projects will accept participation by citizens, and at the same time will contribute to regional development. To achieve this, it is necessary to promote cooperation with citizens and companies, as well as administrative departments and agencies in various fields.

We think that the latter is a method that offers a direction for national land development in the age to come. Flood control measures should not be implemented just for flood control, but for encouraging many people to think about their own communities and participate in activities toward the creation of a more sustainable society. In addition, it is necessary to improve the environment for children so that they can have contact with living things in the midst of rich greenery.

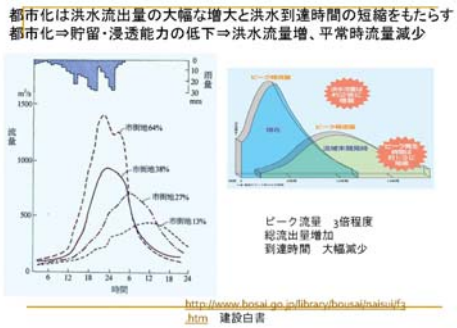
That is why the Hii River Basin Flood Control Citizens' Council was set up. It aims to promote citizen-participation efforts for flood control led by residents in river basin areas in order to control runoff in all watershed areas by way of water retention and storage, percolation, etc. Those efforts are not mere flood control measures, but aim to improve regional landscape and natural environment during the process of implementing flood control measures in basin areas. It is expected that such improvement will serve the public welfare and contribute to regional development.

In this lecture, I would like to talk about how to proceed with a meeting of the Citizens' Council, flood control effects created by water storage, water storage effects in an earthquake disaster, water storage effects in a drought, how to store water at various locations, citizens' awareness which has changed by storing water, the problems now facing us, and so on.

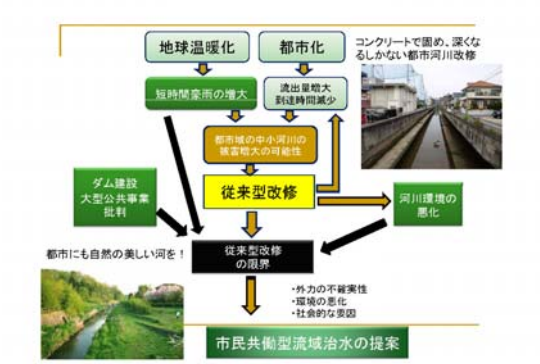
福岡市の中心部を流れる樋井川で氾濫
市民共働の流域治水市民会議

Thank you very much for the kind introduction, I am Shimatani. I am involved in the activities in Fukuoka Prefecture. Hii river is a very small river and flood control civic council is one I am involved.

I am really surprised to this. In Toga river, 2 o'clock, 1.3 meters water level increase occurred in less than few minutes – several seconds. The Fukuoka Prefecture also in the Hii River, two meters level increased in 10 minutes occurred.



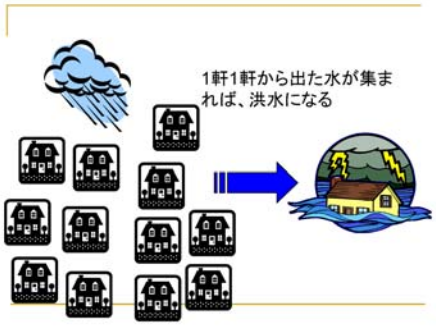
Urbanization bring about the amount of the water, the flow increase, and also the time to flat the level is shortened. If the urbanization is 13% and 54% if is compared in this graph, it shows that there is a difference of the threefold. If the urbanization goes on, the flat damage becomes bigger, flow increases; therefore, the urbanization and how to deal with the flood problem is what we have to do. And this is the picture we can often see the water comes really quickly.



In urban situation, when we want our children to play safely, it becomes more and more difficult. We have to tell our children that you have to quickly flood if the lighting comes and not only the amount of rainfall increase but also the global warming leads to an increase in brief down powers and so on. So, there is a great possibility of the larger damages and along small to midsized river in cities. So if we do apply, the transitional river improvement, this kind of river you can see.

And at the opening picture, this picture is used for our pamphlet. This is the picture of the Isumi River in Yokohama Prefecture. This is the dream picture of us who are

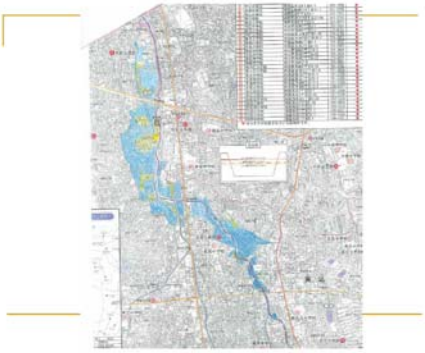
involved in the river restoration. We have to explore how we can have this kind of river restoration.



Basically, the smaller amount of the water comes from one house but if we got to gather in total, it will be a huge amount of water. Two years ago, there was a huge torrential rain. The 90 mm first hour rainfall and 152 mm per hour at the Fukuoka Airport; the Fukuoka Airport was flooded. The airplane was okay because it has huge tires but trucks cannot come to the airplane so we cannot go inside the airport.

This river goes through the Fukuoka City and they come from the Aburayama Mountain. It's the source and it goes through in the very middle, the center of the Fukuoka City. Here is a baseball stadium and the biggest park in the middle of the Fukuoka City and this is upscale residential area.

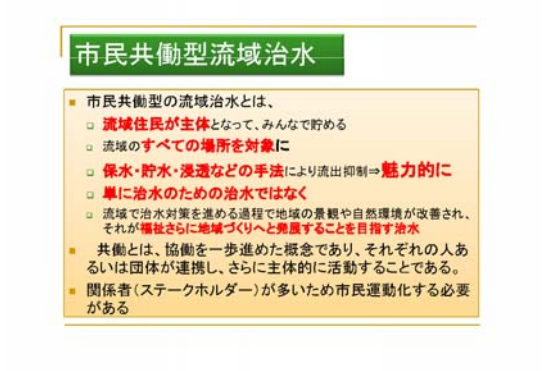
This is Japan's seaside and Sun Mountain is here and this line is low land area.



The mount 80,000 people lived in the area and a very small river but the evacuation order is issued and huge damage was occurred; 410 houses are under water.

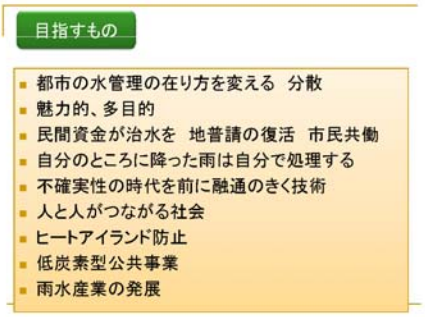
What we thought about the measure to restore the beautiful river like that picture, we have to reduce the amount of flow in the flat, so we so we started activity to store the water by each one of the citizens. There, we have to utilize a lot of different places, which means the people who are involved are ordinary citizens and many people so we

involve the citizens. So, this kind of citizens' collaboration is the citizens in the water basin area from proactive organization and various measures are used attractive way.



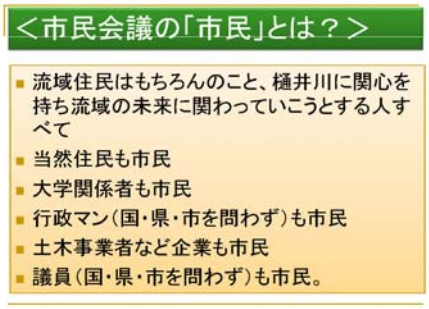
This is a very important point. The compressive measures so far, if we store the water, then it is not convenient for the school to use the land. The attractiveness is very important point. It is not just the flood control – the aim is to control the flood but not only controlling the flood but also it have to bring about the merit like benefit like we can utilize the water to water the plant and green is increasing and community has become more active because of those water usages and it has a good impact on the natural environment and the community building and so on and so forth. That is also considered in this attractive control of the flood.

In Fukuoka City collaborative work is considered. Not only work together but also act together. We use the Japanese character. In English probably we can say this is not just collaboration but the proactive collaboration.

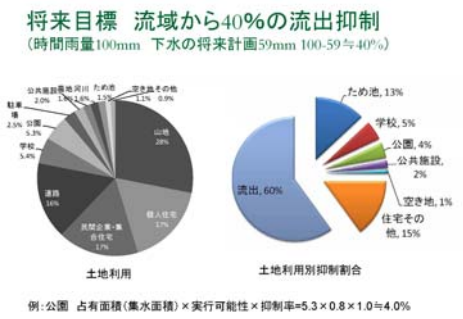


And what we are aiming at is that we want to change how to manage the water in the city area. The concentrated water management system is used in which the very attractive and multipurpose way of using the water.

The cost is incurred by the civilians. Probably, the cost is high but it is considered as one industry, so I want to have the scheme where the usual people can pay some money to protect the river. In Edo period, we had such a scheme that kind of voluntary protection of the river. Basic way of thinking is that the rain falling on your area, you have to treat those water. Basically, if the rain falls on the school, the school have to store those waters; park is the same that they have to treat the water by themselves. This is the technology suited for the uncertainty and they also – it is a flexible way of doing the measure and the people are reliable. We have to have the people's communication and at least to the protection of the heat island also and low carbon society can be realized.



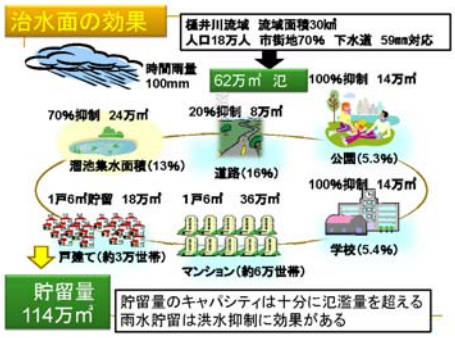
This citizen is a very broad notion of citizens, so not only the residents but also people who are involved in the Hii River including the college, workers, and the businessmen and so on.



How to do that is that just keep the water falling on your place.

Left-hand side says the use of the land, mountain is the largest amount, so the water falling on the mountain, we cannot have any way to store those waters. Aburayama Mountain here in Fukuoka Prefecture, the condition of the mountain is well protected – well conserved, so it is important to keep that way. We don't have the positive way to change that. And followed by the school use and so on and the reservoir is 18%. There are a lot of reservoir but those not used for the agriculture. If we can keep the water in the reservoir as it is, then we can save a lot of water. But the reservoirs are not used for the agriculture so it is degragaded, so the farmers are not controlling that but reservoir is a good target. And the school has a large area; you can see this pie chart. They calculate the area and the feasibility is calculated and times 80% of the feasibility we calculate the probability of this achievement.

The starting point of the river is used in the past to calculate this amount but the sewage or the drainage pipe directly impacted, so we can promote this one by changing the prospect of these kind of measures have the quick winds if we apply to the other area.



Actually, this is a rough estimate. For example, in Hii River, 30 square kilometers, 70% is the city area. If we think about the city area alone, 100 mm amount of water is shed, then 40 mm becomes the flow of – if the 620,000 tons are the overflow, that is the calculation. This is the very small river basin, so water goes down really quickly. It's enough to think about 100 mm per hour or 200 mm per hour but they often occurs right now. We have to agree on the amount of the rainfall on about 100 mm per hour, so the reservoir can play a role and the road can maintain the water as some amount. And if we sum up all the things, 1.14 million capacity is there, but one house has to store 6 ton, so it's equivalent of the one car

parking lot area.

If you are building a new house, that is the area you need to have. So, 6 tons can be used for the daily use like toilet and so on.

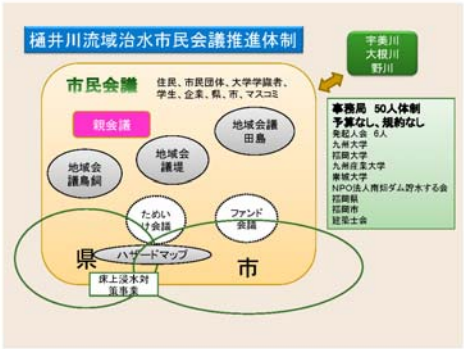
So, about 30% of the tap water is used for such usage, therefore if you store the water at your houses, you can utilize that water to flush the toilet and so on.

We also want to improve the technology utilizing the IT technologies like the systems where if the torrential rain comes, automatically the water is stored so that this can be very convenient device.

And at the time of the earthquake disaster, this is the Tohoku area, the earthquake picture. There is scarcity of the water at the time of the earthquake disaster.

In the schools or the evacuation center, we really want them to store the water. If they store the water – if we make a reservoir under the floor of the gymnasium, we can store huge amount of water, 2 tons per person amount of water can be stored.

The Hanshin Great Earthquake, 20-30 liters of water can suffice for one person for time being. If we store the water under the floor of the gymnasium, it can be really useful at the time of the disaster of the earthquake.



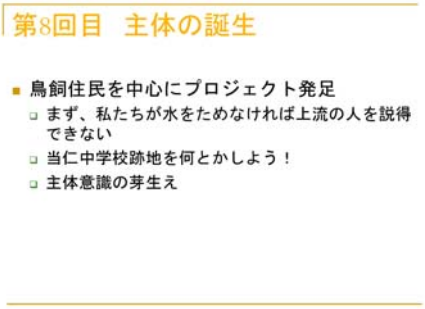
We advised that in the government also, and this is the organization of the flood control and they are divided into various small

groups and so on and the prefecture level and municipal city levels also collaborating.

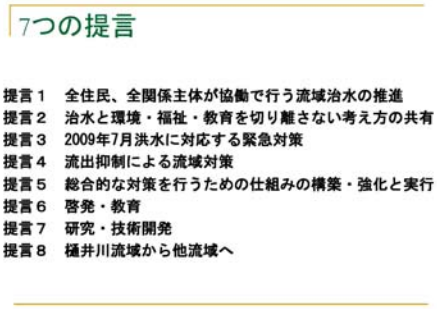
Torrential rain occurred 24th of July and the council started in September 9th and 22 times of meeting were held so far.

The meeting was held in Fukuoka University and especially the people who are the victim of the flood are participating. The local residents know a lot. This is the picture of the meeting.

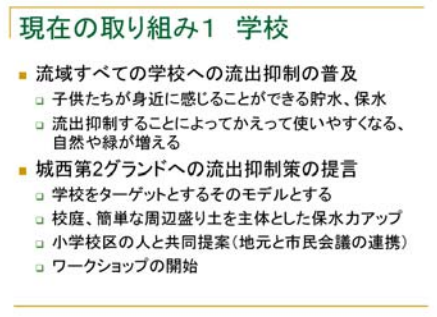
First, when we talk about that, the victims say that your action is so slow, they need also conventional type of measures but they understand that restoration needs the quick action.



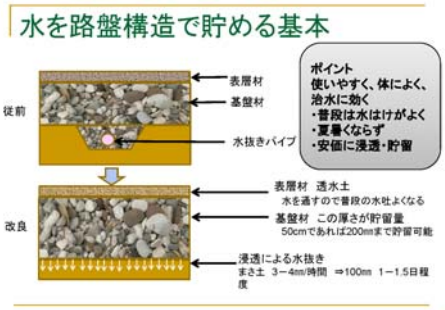
But about the 8th meeting, they understand they have to do what they have to do. They are now the center of the project.



And January 28th we issued recommendation document but we will skip those things.



For schools, I think all the schools need to do their best to store water and we created a model school for water storage case.



And normally when you develop the ground, you have like a surface soil and you have supporting materials underneath.

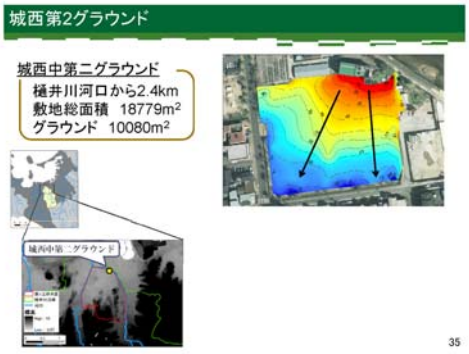
The question is whether or not we have a good technology for percolation. If the thickness is about 50 cm and then we can store around 200 mm and then we would use the percolation for drainage and in Fukuoka, 3 mm to 4 mm can a percolate into the below layer. If it is like 100 mm, it takes a day. If we can have pervious soil, and then we can make sure that the surface water can percolate to the below layers and then by doing so, we can store 200 mm equivalent of water just on this ground.

This is a case of football ground at the Fukuoka University. On top, we have artificial lawn and then underneath we have a cushion material and we have an improved soil underneath and we have some type of soil with concrete for the water retaining capability improvement and then we have a roadbed at the very bottom. If the rainfall is like 300 mm, only 30 mm will outflow. It has a very good water retaining capacity and it has a very good percolation.

Throughout the year, Fukuoka University soccer team can practice. And Mr. Nagai became Olympic player and he actually entered Fukuoka University after the university created this special ground.

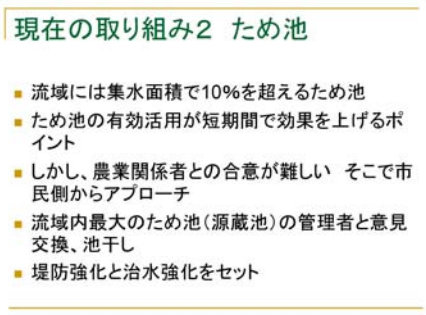
The point here is about the water storage capacity and also the ground itself is quite easy to use. So, I am wishing all the schools will apply this kind of ground and if you measure the temperature in summer, since this ground has very good water retaining capability, so the temperature on this

ground can be kept lower. It's good for children.



This is another view. We have an embankment here and if you apply the drain, normal times the water is outflowing to the drainage piping, but around the flood we can store the water.

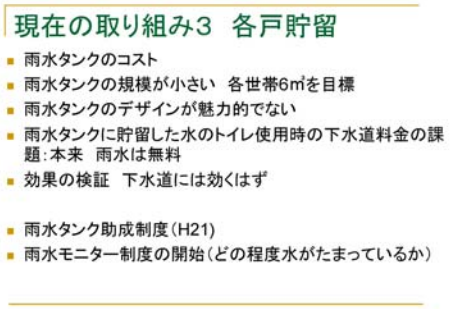
And normally if we apply special equipment for the water storage and then it would acquire like ¥20,000 per cubic meter, but with this technology it will cost only like ¥300.



It has a very good cost benefit as well and the reservoir is another difficult task because we need to gain the consensus from the agriculture workers.

This is typical reservoir in Fukuoka City. Just alongside the reservoir, we see a lot of residential houses, once the reservoir was flooded, immediately the damage will be imposed on the residence. And this is a very gigantic reservoir and whenever rain would fall, he would go down to make sure that the reservoir will discharge the water to the neighboring drainage.

This area is quite difficult because we need to gain the consensus from agriculture workers and from the flood control administrative authority. This year for the first time in 22 years, we dried this reservoir to improve the underneath bed.

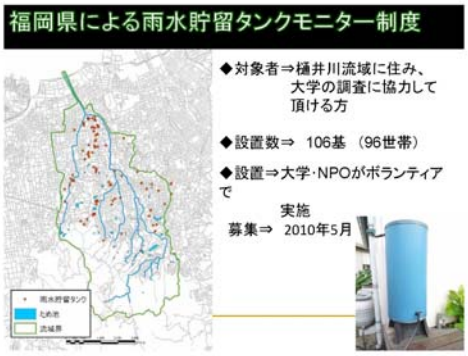


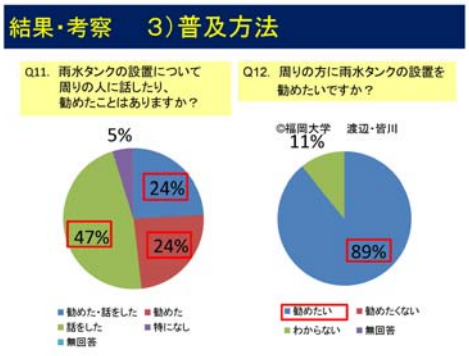
Also, individual house is trying to store 6 tons of water, I just mentioned. When you flush the toilet, sewage water fee will be charge; if it is not charged, the situation will be quite different.

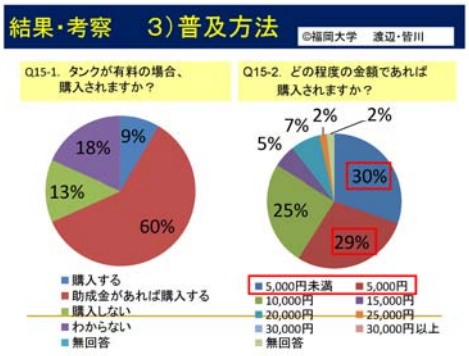
This is an actual house with the water storage capability. Once you can store more and more water and then you can grow vegetation.

So, if the city can store more water and then the city will have more vegetation; underneath the deck you can put the water storage small devices.

And we are trying to use a lot of green so that we can conserve the nature at the same time and this is massive housing lot, 105 tons of water is going to be stored with 17 households.







With this kind of community, we are trying

to set up the retention water storage facility. And also, we are trying to install the rainfall storage tank. What's interesting here is that we asked, do you want to recommend to install the rainfall storage tank and then 80% said that with this initiative, my interest into the flood control and water storage went up. Through the introduction of this kind of rainfall storage tank, we were able to kind of change the people's mindset. With that, I would like to conclude my presentation. Thank you very much.

Moderator

Thank you. The comprehensive flood controls were the things considered in the past. The new way is the entire river basin area's improvement together with the citizens. We would like to do the discussion. ARRN chairperson and Kanazawa Gakuin University, Professor Tamai will coordinate the discussion. Now, we are preparing.

Discussion by all lecturers

Chair: Prof. Nobuyuki Tamai

Prof. Nobuyuki Tamai

Thank you for the kind introduction. I'm Tamai from ARRN.

We have a very tight schedule for this discussion. We have to finish by 16:15, so about 40 minutes we have. I want to proceed effectively as possible.

We listened to five lectures but we didn't have any question and answer time, so I want to use 10 minutes or so for this discussion time for the floor people to ask questions and then after that we'd like to discuss under two themes. The flood and environment protection, the water quality is discussed by Professor Ding.

How the speaker thinks about the human activities and the environmental water quality and also flood control, those things. Second is the large area like countrywide measures and like Professor Shimatani's lecture, the municipal local activities are going on. What do you think about the large areas activities and the local activities?

Those are the two themes I'd like to do as a discussion theme. Before that, I'd like to ask the floor people to ask some questions. Please name your name and you want to ask who, to whom, and about which lecture and where are you from.

Questioner 1

I'm working as a writer concerning Zoo. Professor Shimatani mentioned the various relationship in the entire water basin, the Taiwan, Korea and Australia, they are focusing on the urban area. But the river is coming from the upstream.

So, I didn't understand the relationship of those residents who live in the upstream. Like Taiwan or Australia, the habitats natural aboriginal people.

Prof. Nobuyuki Tamai

How about Taiwan's condition from that point of view?

Prof. Shaohua Marko Hsu

What I talk today is not related to mountain areas. People in mountain areas, they suffered a lot because their land is very limited and all their land is dangerous if you have debris flow because that was the debris flow created the land previously. All the land they have is kind of dangerous. In the year 2009, we have very major flood which came

from Typhoon Morakot and within 3 days we have 3000 mm of rainfall, so that create a lot of erosion on mountain areas. And in south part of Taiwan some village was covered by deep erosion.

But today what I mentioned is in the center part of the tide zone which was not affected. But I agree on Professor Shimatani's topic because in my talk I also mentioned about the Low Impact Development (LID), which means the watershed, we need to consider the whole watershed, not only the river itself. We need to consider both pollution and also the water itself.

For Professor Shimatani, he mentioned about how to reduce the flood water and after we do the computation, it is very good for middle and small flood, although in huge flood it may not be very effective. But I think I agree on Shimatani's point, we should do this on the land development and to reduce the flood. In the channel, then we can do something else to create the nature. We can do like a step track and we can use big rock instead of a concrete, that's my point.

Prof. Nobuyuki Tamai

Thank you Marko.

I'd like to ask Alastair, are there some regulation in Australia for land use, too much you say the development. In Australia, what is the current situation?

Mr. Alastair Mcharg

Certainly in Australia there is land use control on how far you can develop down to the waterfront and into a flood zone for sure. That's also changing as we speak, after the Brisbane floods they are revising that. They are looking at where you can build and also on the gradient of the slope as well there are restrictions on where you can build.

Questioner 2

Thank you for the very interesting and informative lectures. I have two questions. One is for Mr. Mcharg from Australia. Actually, in November's newsletter, I was on the November newsletter. I went to the Brisbane International Symposium held in September and I heard the social experiment conducted in Brisbane. I am the only one Japanese participated in the symposium. Do you have anything about the symposium first? Do you have any?

Mr. Alastair Mcharg

Thank you. I was at the River Symposium also in Brisbane this year and I thought it was a great event. It used to always be held in Brisbane every year and it gets bigger from all around the world and I've spoken to a few of the presenters here today who have been to it before.

Last year I believe it was in Perth, so they alternate between Brisbane and other city. They are trying to encourage more and more international participation, so I guess if you are interested contact me and I can put you in contact with the appropriate people.

Questioner 2
Thank you.

Prof. Nobuyuki Tamai
The second question, please.

Questioner 2
Aizhong Ding from China, you explained about the diffuse kitchen waste, you are using kitchen waste to absorb wastewater and for the pollution you use some measurement in the river.

I want to ask you to explain a little more about that kind of measurement. And the second one, diffuse pollution is, is that similar to the river water purification facilities which installed in Japanese river?

Prof. Nobuyuki Tamai
Professor Ding, please.

Prof. Aizhong Ding
Because that's a big project, I mean as a PI office presented, the waste water and solid waste was studied by one of the professor from the Chinese Economy of Science, he graduated from Japan, I don't know which university. He used some low temperature carbonization and something we also like that to extract the fibers from the kitchen's solid waste to maybe some absorbing materials to characterize the property of the materials and start the effect of the materials for remove effect of heavy metals and fibers from waste water.

Also, he is doing the research on use of construct solid waste to build porous for pavement or building for this research project. From the investigation, I'm going to show you some pictures of the solid waste pollutant problem.

The village people disposed their solid waste just around the bank of the rivers. They construct, build a disposal there – construct like soils on the tee of the rivers. That's a big problem I think and for China rivers to deal with solid waste the resource project just to find some ways to ways to release the solid.

Prof. Nobuyuki Tamai
I think you wanted to have a one-to-one discussion later on after this symposium for more details I guess. The time is running out, so I would like to get back to the two themes I wanted to discuss today.

Because of the change in land use, I think we have now new challenges in the river restoration or river management or environmental conservation. On this point, I would like to ask each one of the five speakers to make brief comment starting in the order of presentation. So, can I have few comments from Mr. Alastair Mcharg, please.

Mr. Alastair Mcharg
I guess the comment I'd like to give there is based on some experiences in Brisbane where Brisbane City Council now looks towards what they call Creek Orientated Development and it's basically in new developments trying to incorporate water

sensitive urban design features and water treatment features and flood mitigation measures into the landscape.

It's a really interesting design concept and I am happy to pass on some of the graphics that Brisbane City Council have put together on this. Looking at big open spaces like playgrounds and park areas where the people use it during times of no flooding which has wet lands and creeks incorporated into its design with the ability to treat a flood event of up to 3-month ARI. But then once you get the large floods come through, those area act as flood mitigation measures.

Prof. Nobuyuki Tamai

So, you already have concept and Brisbane City Council has already kicked off that kind of initiatives and they've made the announcement on the overall direction; so the city council is the one who is taking the leadership, is that correct?

So the Brisbane City Council is the major stakeholder, not the state government, not the federal government. Brisbane City Council is the leadership?

Mr. Alastair Mcharg

I guess Brisbane City Council took the leadership because they had the interest in it, it didn't come from the state. But equally that design could be applied anywhere, so I think it's has been used throughout. There is also Norman Creek catchment which is in one of the Brisbane catchments is currently undergoing a redesign and they are trying to get it back to a more natural state, lowering water levels, opening up the floodplain, getting the floodplain back engaged with the creek again.

They are actually trialing the stuff that they've designed, so happy to pass them the details.

Prof. Shaohua Marko Hsu

Actually in my slide, the first part I show that the original river in Taichung City was nature and this kind of meandering is kind of wide, but because of land development and also because of road construction and also because of flood prevention, we make the river become a concrete channel.

That was done before as in the error the engineer decide in the design and now we learn as time passed, we know that we need to respect more nature. We cannot decide something very narrowed like engineering thinking. We need to think more widely and more wisely and how the nature was doing. The nature actually does a lot of the service like infiltration, like natural purification. If we can utilize this kind of natural functions which include the ecosystem, then I think the river will be getting better and it is possible, it's not impossible. I think that's my experience. Thank you.

Prof. Nobuyuki Tamai

You now have holistic approach? Professor Jang, please.

Prof. Suk Hwan Jang

When we talk about the flood and environmental is that the concept between flood and environment is like the development and conservation. This is both sides of the shield – both sides of coin, which means that is not reverse but complimentary. We should meet the climate change especially in monsoon area, so we should adopt the kind of two points both together.

The second one is what we think when we think about river rehabilitation and river restoration. The river is like a live animal, river is alive. So let it go freely. When as much as we can, the first thing we do when we do river restoration is to find the former trace and it gives you room for the river, something like that. We should find the former old trace and navigations and we try to morphological and line the navigation. So, I think flood and environmental is both things we should get along with in these days. Thank you.

Prof. Nobuyuki Tamai

Thank you very much. You used the word room, so instead of containing river in a very small concrete room, I think it's important to provide more natural rooms to the rivers so that we can restore the original status of the river.

Prof. Aizhong Ding

Yes. In my presentation I am talking about the river restoration scale for catchment. To my understanding, river restoration is not just a river, it is we should think about as a human activity from the land. We can do some river restoration engineering now, just find some green slope, have data for the fish. But I think we need to think about the future. What's the future of our rivers? Because with the development of urbanization, the human population, everything changes with time and I think what kind of river condition I should take for the future. Like the urbanization, the people use more land for buildings, homes, so I think about is the future, that's my first point of my presentation.

The Chinese towns have divided the rivers in different zones. Yangtze River something in Brisbane was in September. Some area of the river should be kept, some area of the river should be reserved, and some section of river will be used by the human. So how to balance the development between the human and the nature, to balance between sections of the river, I mean everything is a balance, harmony with river's development with nature. In the future, I think the target of the river restoration is more important I think. Thank you.

Prof. Nobuyuki Tamai

Thank you. So striking a balance and harmonize is very important. That notion is shared by many people. In China also that concept is held by Chinese people. That notion that striking a balance is very important is very popular in China. For example not only the researches but also the usual general public people already think that it is very important to strike a balance

between the environment and development and so on.

Prof. Aizhong Ding

The people think about is nature very important in principle because everywhere and not just China, as countries evolved the people are always fighting with the nature. Also, the people are always fighting with each other. I mean, it very important to think about velocity in terms of.

Prof. Nobuyuki Tamai

Because Chinese people have very deep philosophy.

Prof. Aizhong Ding

Attitude to this kind of the development force some years ago and the people also including public change.

Prof. Nobuyuki Tamai

Your slide also shows the change. Thank you very much.

Prof. Yukihiro Shimatani

As you already know, the rivers are subjected to flood. I mean, the flood created the environment. We cannot separate flood and the environment problem. If there is a lot of land to be used, then we can allow some are to be used for the nature but sometimes it is very difficult. We cannot afford to have free space for nature. The urbanization grows.

In Japan, our growth stopped and our way of thinking about the river changed. For the past 10 years, our history of river engineering changed so that we can take care of the environment aspect as well, but in the regional area, the situations are different. The torrential rain made the people think about the applied concrete to the river but we definitely have to take the approach to reduce the flow amount before apply the concrete to cover the river. We have to solve the problem by thinking about both sides.

Prof. Nobuyuki Tamai

Thank you very much. In your presentation also it should be multipurpose and attractive. What you said right now is also one of the examples of those attractiveness.

The second point or the topic I want to raise is the standard and each river's characteristics. The rivers in the rural area and the rivers in the urban area are different or not. My question is that are there any universal ways of looking at the river characteristics? Please go from this, Dr. Shimatani, the organization problem can be seen all over Japan. Those should have been solved by each rural area. I mean, now the local government has a lot of power.

Prof. Yukihiro Shimatani

Of course there are unique characteristics in each river, so we cannot have the entirely same way or measures. However, we have to have some consistent measures nationwide otherwise we cannot promote the measures. Not the completely across the board kind of way in the things, like the

measures that we had in the past is not so good but we also have to have some kind of drivers because local government only cannot achieve very big thing. So, I also think that national government needs to take some role. Completely separate is impossible, so probably combination of both of two players.

Prof. Nobuyuki Tamai
Professor Ding, please.

Prof. Aizhong Ding
For the river it is there we should think about is what the river need for himself: water quality, ecology, quantity, for different rivers they have different characters like hydrology, everything are different. But I think for different rivers in different section of the rivers, like in urban area the river already modified by human. This kind of river cannot be restored to the original condition. I am now doing a project to see the management target like river quantity, quality, and ecology for the Chinese government. So, I was thinking about the kind of issues on rivers.

Prof. Nobuyuki Tamai
May I interrupt? In Shiyan City, you mentioned the actual case in Shiyan and its neighboring area and from historical point of view, Shiyan City has like a long history. And you have the kind of historical characteristics and you have different characteristics for Feng River. This river is located near Shiyan, does this make a lot of difference or does this fact make the river characteristic unique itself?

Prof. Aizhong Ding
8 rivers flow around the Shiyan City. At that time, it seems the flow, the water quality are better than now. The current situation the government wants to restore the rivers but we have different objectives for the 8 rivers. People want to live in a good condition, clean water, good river landscape, everything. I think though up to now, the river restoration, the issue in China they have multiple targets for this kind of rivers, partly the rivers and water characters they originate from the mountain and flow by the transition zones between the city and then to the city.

Prof. Nobuyuki Tamai
Professor Jang, please?

Prof. Suk Hwan Jang
As I said before, I would like to emphasize on 2 points in river restoration, especially in urban area. The first one is the room for the river and because for the last urbanization period, many populations and the buildings and something materials invaded to the riverfront and river area, so we should return – we try to return. But likewise in Tokyo, Seoul is very developed city, so it's very difficult for us to restore the whole rooms.

The second one is rehabilitate the navigations. When we compared the present satellite picture with the former like 100 years ago, the picture of satellite to former is very different which means the river is

alive, so we should try to find that trace, that kind of trace.

The third one is when we restore and rehabilitation in the urban area, so we should give some theme for the rehabilitation theme or the title of that kind, so that ordinary people can know the philosophy of the rehabilitation of the kind of the urban area I think.

Prof. Nobuyuki Tamai

Thank you very much. Listening to Professor Jang, I got a very important message which is river is alive and when the neighboring area changes, of course the river would change accordingly. So we have to take that into our consideration when we do the river rehabilitation and restoration.
Next, Marko please.

Prof. Shaohua Marko Hsu

In my case in Taichung City, I think the urban river actually is connected to the rural area. For example, why the water in the flooded river getting down? because we have too much pumping on the groundwater and also we reduce nature infiltration because of urbanization. We need to think about the nature. When we do the land development, people think about money. They want to increase the land they have but which creates some problem later on. When I say river restoration in the urban area, I did not say that we want the river go back to the original form is impossible, but still we can make it much better in terms of good to other living creature. Even in the concrete ditch, we can still find fish, so we want to think that human being is not the only creator in the earth.

I read the newspaper a couple of months ago that in Mainland China some farmer has to – because the bee and the butterfly disappear, so they have to powder themselves to the fruit otherwise they cannot grow fruit. Nature does a lot of service on human being but we take it for granted and when it ceases the service then we realize it is very important.

What my point is that we don't want to make the river become the original like 100 years ago but we can do our best to create certain situation to make the natural process exist and back to the part of the nature process, that is my point. Thank you.

Prof. Nobuyuki Tamai

Thank you very much. Alistair, please?

Mr. Alastair Mcharg

Thanks – thank you. Just I guess further to that, it's kind of what the society is prepared to be happy the restoration of the waterways. A waterway may function well but not be in a completely natural state. When we restore systems, they don't necessarily follow the same trajectory to restoration from what they came through degradation so they end up in a different spot anyway.

I guess it's what society is content with, with the waterways as a resource. I'd just also

like to add that in regional areas in Australia water allocation planning occurs which allocates water to the environment, water to consumptive use and water to cultural uses as well and cultural uses might be billabong flooding at a certain time of year that might have been instigated in an indigenous ceremony or something like that and also triggering, abrading a bit. But I think that's a really interesting concept when you got the balance of those three and getting the balance right is the difficult thing in Australia at the moment; especially with water planning we've got the growers of food and irrigation district screaming up for more water and at the same time we are trying to give the environment more water as well, so it's a tough game.

Closing address

Chairperson, Asian River Restoration Network
Professor, Kanazawa Gakuin University, Japan
Nobuyuki Tamai

Thank you very much. I wanted to have a discussion with the audience in the floor but unfortunately time is running out and this venue will be used for a different purpose after this, international symposium, so I really have to close this symposium on time.

So, if I may wrap up what I've heard from all the presenters, I think the summary is like this. The diversity is important, for example, concrete channel – I mean, in natural river with the introduction of concrete channel, the diversity was reduced. And when it comes to river restoration which is the theme of this forum, cannot really ignore that fact. Rivers do have unique characteristics, urban versus rural. I mean, there are different features and characteristics in urban area and rural areas. Within that framework of diversity, I think we were able to hear some engineering and technological presentation today.

There are some kind of rules that needs to be there and also we have to strike a balance in very different aspect. That is the conclusion I can say from this forum. And in that sense this ARRN and guideline with exchange of information, those what we are aiming in and what we are doing in ARRN to keep the diversity and to realize the better involvement in urban area or other areas as well, that is the direction we want to go.

For the five lecturers, a good lecture and good discussion. Thank you very much. A big applause to express our gratitude, thank you very much.

That is the end of the 8th forum of these activities, thank you very much.

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Foundation for Riverfront Improvement and Restoration
Shinkawa Chuoh Bldg., 7th Flr., 17-24, Shinkawa 1cho-me,
Chuo-ku, Tokyo 104-0033, Japan
Tel: +81-3-6228-3860 Fax: +81-3-3523-0640
E-mail: secre@a-rr.net, URL: http://www.a-rr.net/

Editing

Takuya Kaneko

Graduate School of System and Information Engineering
University of Tsukuba
Prof. Shirakawa laboratory


ARRN
Asian River
Restoration Network