Water for Mega Cities: Challenges and Solutions
- A Summary of Findings from the AWRA Specialty Conference
(September 16-18, 2013, Beijing, China)

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A Successful Conference

Globally there are about 30 megacities that have a population greater than 10 million (Figure 1). Over the next thirty years the number of megacities is projected to rise to 50 with cities in Africa and Asia growing fastest. Mega cities like Beijing, a city with over 19 million and is expected to grow to 30 million in 2030, and others are facing profound challenges in securing and managing adequate and reliable water resources. Increasing urbanization, population and economic growth and major changes in hydrologic and climatic conditions all impact water supplies and water quality.

![Figure 1: Distribution of World Wide Large Population Centers with a population greater than 5 million (source: United Nations, 2002).](image)

AWRA and Beijing Hydraulic Engineering Society (BHES) co-sponsored the first international Specialty Conference on “Water for Mega Cities: Challenges and Solutions” during September 16-18, 2013 in Beijing, China (Figure 2). This conference provided a unique international forum to exchange experiences and advances in science and policy for water resources planning and sustainable water management for Mega Cities.
Figure 2: AWRA President Mrs. Carol Collier and Dr. Wang Hao from the Chinese Academy of Engineering are Keynote speakers. Over 170 scientists, engineers, managers, and university graduate students attended the 2-day conference in Yulong Hotel in Beijing, Sep 16-18, 2013.

About 170 international participants joined the conference where about 60 oral presentations and 60 posters were presented. Two field trips were organized for participants to learn Beijing City’s water supply systems at the large South-North Water Diversion Project and Miyun Reservoir (Figures 3 and 4). A Feature Collections of papers will be published in JAWRA to report the important findings from this conference and advances of water sciences related to megacities. Such a feature collection will help to promote communications among scientists, managers, engineers, stakeholders, and policy- and decision-makers on emerging water resources management challenges, to share real-world experiences in addressing water management challenges under changing conditions, and most importantly, develop guidelines and policies to address important water issues in Mega City environments. Deadline for submission was set as January 2014. For more information, please contact the authors of this article.
Figure 3: Post-conference field trip to the Miyun Reservoir, a major water supply source for Beijing City. Water supply by Miyun Reservoir has been declined dramatically in the past two decades due to prolong droughts and water uses from up streams. The current water volume at Miyun Reservoir 1 billion m$^3$ of water, much less than a total designed capacity of 4.3 billion m$^3$. The annual water inflow to the reservoir is around 200 million m$^3$ while the outflow is close to 300 m$^3$. 
Figure 4: Participants visited the Huinanzhuang Pumping Station, the starting point of the Beijing Section of the Middle Route of the South-North Water Diversion Project that will bring water from the Yangtze River Basin, 1200 km south to a thirsty Beijing. The station is located in Fangshan District, about 60 km southwest of downtown Beijing. The pump station is a key section to realize pressurized water delivery for large flow rate and to allow gravity flow for low flows. The design flow rate for the station is 60 m$^3$/s using a total of 8 units of horizontal centrifugal pump, with 2 units as backup. The total installed capacity is 58.4MW, with each pump capacity of 7300 KW. The main facilities include: inlet gate, the fore bay of the station, main building, auxiliary building, inlet and outlet pipes.

Overall we have achieved our goals as follows:

1) Present new findings in and approaches to integrated water resources management and urban hydrology;

2) Promote communications among scientists, managers, engineers, stakeholders, and policy- and decision-makers on water resources management challenges and solutions;

3) Share real-world experiences in addressing water management challenges under changing conditions; and

4) Present management applications and guidelines to address water issues in urban environments.
Oral and poster presentation were centered on three major themes:

(1) Water Resources Management
   • Developing and managing multiple water resources
   • Science, policy and finances
   • Sustainable water management
   • Integrated Water Resources Management – Mega City case studies

(2) Urban Water Supply Reliability and Quality Protection
   • Advances in hydrological science and storm water management in urban and source supply areas
   • Water supply reliability planning challenges and solutions
   • Water supply security under multiple environmental and socio-economic stresses including climate change
   • Drought contingency planning

(3) Watershed & Environmental Protection and Management
   • Climate change impacts on water availability
   • Ecosystem maintenance and integrated watershed management
   • Urban / catchment runoff control & management (flood control and mitigation)
   • Stream restoration and aquatic biodiversity maintenance
   • Source water pollution prevention and mitigation measures
   • Inter-basin water transfer impacts and mitigation

Major Findings and Lessons Learned

- Megacities such as Beijing are facing serious water security challenges. Meeting rapid growing water demand often means scarifying the environment such as groundwater and ecosystems. The groundwater table level in northern China plain that includes Beijing has dropped from 12 m to 24 m during the 2000-2012 time period.
- Growing extreme events (hurricane, rainstorms, subsidence) are some of the biggest challenges to water supply infrastructures in mega cities. It is important to increase resilience to protect mega cities from natural disasters and climate change.
- Water resource issues for mega cities cannot be adequately solved individually, but they require an integrated, multidisciplinary, multi-jurisdictional approach (Integrated Water Resources Management).
- The importance of wetlands and forests for water related ecosystem services are increasingly being recognized and addressed to address municipal water supplies.
Many cities world-wide rely on non-recharging declining aquifers. Solutions being implemented include importation of water from other basins such as the three South to North Water Diversion Projects that move water from the ‘water rich’ Yangtze River Basin to the basins in northern China that have serious water shortages.

Improvements in water use efficiency (conservation), water reuse, aquifer recharge and desalination, water price adjustment are emerging strategies to meet water sustainability.

Long-term water demand should be considered in urban planning. Water planning should be also essential part of urban planning.

Advanced technology such as integrated computer modeling, decision support systems, smart water grid are being used in water resource management for mega cities.