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MIDDLE EAST AND NORTH AFRICA WATER CENTER NETWORK (MENA WCN) ASSESSMENT AND DESIGN



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ASSESSMENT AND DESIGN

November 2010

Submitted by:

**U.S. Agency for International Development
U.S. Department of State
U.S. Bureau of Reclamation
U.S. Geological Survey
International Center for Integrated Water Resources Management
(ICIWaRM)/U.S. Army Corps of Engineers**

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ACRONYMS

ABRI	Advancing the Blue Revolution Initiative
ACWUA	Arab Countries Water Utilities Association
ADB	Asian Development Bank
ADWEA	Abu Dhabi Water and Electricity Authority
AfDB	African Development Bank
AFESD	Arab Fund for Economic and Social Development
ARC	Asia Regional Center of Excellence on Climate Change and Development
ASCE	American Society of Civil Engineers
AWA	Arab Water Academy
AWC	Arab Water Council
AWWA	American Water Works Association
BOD	Board of Directors
CDC	Centers for Disease Control
CEO	Chief Executive Officer
CGIAR	Consultative Group for International Agricultural Research
CRTS	Centre Royal de Teledetection Spatiale (National Center for Remote Sensing)
DOD	Department of Defense
DOS	Department of State
EAD	Environmental Authority of Abu Dhabi
EGAT	Economic Growth and Technology
EIB	European Investment Bank
EPA	Environmental Protection Agency
ESCWA	Economic and Social Commission for Western Asia
EU	European Union
EXACT	Regional Water Data Banks Project
FAO	Food and Agriculture Organization
FEWSNET	Famine Early Warning Systems Network
FTF	Feed the Future Initiative
FY	Fiscal year
GEF	Global Engagement Fund
GOJ	Government of Jordan
GDP	Gross Domestic Product
GTZ	German Technical Cooperation
GWSC	Global Water Sustainability Center
HRH	His/Her Royal Highness
IAV	Agronomic and Veterinary Institute Hassan II
ICARDA	International Center for Agricultural Research in Dry Areas
ICEMRs	International Centers of Excellence for Malaria Research
ICBA	International Center for Biosaline Research
ICIWaRM	International Center for Integrated Water Resources Management
IEA	International Institute of Water and Sanitation
IFAD	International Fund for Agriculture and Development

IFPRI	International Food Policy Research Institute
IHP	International Hydrological Programme
INRA	International Institute of Agronomic Research
IPCC	Intergovernmental Panel on Climate Change
IsDB	Islamic Development Bank
ISESCO	Islamic Educational, Scientific, and Cultural Organization
IT	Information Technology
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
JUST	Jordan University of Science and Technology
KFAS	Kuwait Foundation for the Advancement of Science
KfW	Kreditanstalt für Wiederaufbau (Reconstruction Credit Institute)
KISR	Kuwait Institute for Scientific Research
LAS	League of Arab States
LDAS	Land Data Assimilation System
MCC	Millennium Challenge Corporation
MCM	Million cubic meters
MDG	Millennium Development Goal
MEC	Morocco Economic Competitiveness Project
MEDRC	Middle East Desalination Research Center
MEM	Middle East Multilateral Program
MENA	Middle East and North Africa
MEPI	Middle East Partnership Initiative
MERC	Middle East Regional Cooperation Program
MOW	Ministry of Water
MWI	Ministry of Water and Irrigation
NARES	National Agricultural Research and Extension Systems
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NBI	Nile Basin Initiative
NCARE	National Center for Agricultural Research and Extension
NGO	Non-governmental organization
NGWA	National Groundwater Association
NIAID	National Institute of Allergy and Infectious Diseases
NIDIS	National Integrated Drought Information System
NIH	National Institutes of Health
NIST	National Institute for Science and Technology
NOAA	National Oceanic and Atmospheric Administration
NPRP	National Priorities Research Program
NSF	National Science Foundation
NWRC	National Water Research Center
OFID	OPEC Fund for International Development
OIC	Organization of the Islamic Conference
OMEF	Office of Middle East Programs
ONEP	National Office for Potable Water

ORMVA	Offices Régionaux de Mise en Valeur Agricole
ORMVAD	Office Régional de Mise en Valeur Agricole Doukkala
PEPFAR	President's Emergency Plan for AIDS Relief
PMV	Green Morocco Plan
QNFSP	Qatar National Food Security Program
QSTP	Qatar Science and Technology Park
QU	Qatar University
R&D	Research and development
RAED	Arab Network for Environment and Development
RDMA	Regional Development Mission for Asia
RFA	Request for Applications
RFP	Request for Proposals
RSB	Regulation and Supervision Bureau
RSS	Royal Scientific Society
SEMIDE	Système Euro-Méditerranéen d'Information sur les savoir-faire dans le Domaine de l'Eau (Euro-Mediterranean Information System for Water)
SEEE	Sous-secrétariat d'Etat de l'Eau de l'Environnement (State Undersecretariat for Water and Environment)
SIDA	Swedish International Development Agency
S&T	Science and Technology
TAMU	Texas A&M University
TAMUQ	Texas A&M University Qatar
TS	Technical Services
USACE	U.S. Army Corps of Engineers
UAE	United Arab Emirates
UCOWR	Universities Council on Water Research
UNESCO	United States Educational, Scientific and Cultural Organization
UNDP	United National Development Program
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USG	United States Government
USBR	U.S. Bureau of Reclamation
USG	United States Government
USGS	U.S. Geological Survey
WASH	Water, Sanitation, and Hygiene
WATSAN	Water and Sanitation
WCN	Water Center Network
WEAP	Water Evaluation and Planning System
WERSC	Water and Environment Research and Study Center
WHO	World Health Organization
WLI	Water and Livelihoods Initiative

MENA WCN BRIEF

The Middle East and North Africa Water Center Network (MENA WCN) will link technical institutions across the region to work together and with outside counterpart institutions on critical water challenges. The Network will strive to foster partnerships; build and exchange regional science and technology capacity to improve water resources planning and management; and develop and disseminate policy tools and technical and management interventions that expand water supply, manage demand, and dramatically increase its efficient and productive use. A network of cooperating institutions will facilitate collaborative activities, including competitive grants programs, capacity building, institutional twinnings, exchanges, fellowships, and knowledge management.

Overall Management Framework. Over time, the Network will bring together a number of policy, research, and training centers in the Middle East and North Africa. The participating entities will strengthen each other through information exchanges, meetings, and joint research and training programs. The Network will also link to universities, laboratories, and research groups in the United States, Europe, and elsewhere to help build capacity, introduce new ideas, and provide opportunities for growth. This Network will operate in a spirit of transparent decision-making, based on the active and open participation of member Centers of Excellence. The initial governance structure for the WCN will have two major institutional building blocks with clear roles and responsibilities that work jointly for the benefit of all participating institutions and hosting governments:

- **Board of Directors** will approve the annual technical and management work plan and the annual budget, oversee fundraising and distributions, and review expenditures, as part of its fiduciary responsibilities. The formation of long-term, productive partnerships is at the core of the Network. The Board of Directors will play a crucial role in encouraging and fostering alliances among members in the Middle East and North Africa, and between them and entities outside the region.
- **Secretariat**, composed of a small management and technical team, will facilitate, coordinate, and manage relations among the associated Centers of Excellence in different countries. In a sense, the Secretariat is the glue that keeps the network together, certainly during the initial five to ten years as the different Centers learn to work with each other profitably and productively. Over time, the Board of Directors and the member Centers may decide that the duties of the Secretariat should be subsumed by one of the Centers or rotated periodically among them, or they may decide to make the Secretariat permanent as is.

Financing Commitments and Opportunities. In order to succeed, the Network must start with sufficient, sizeable funding to mobilize staff and immediately underwrite research and training programs. If the Network is to have a dramatic impact, it must attain financial security early on. A key element of the financing plan for WCN will be an endowment or fund that the WCN interagency design team is working to establish, in partnership with other donors and foundations. Interest generated from the fund will support Network operations.

Goal and Objectives. The ultimate goal of the Middle East and North Africa Water Center Network is to:

Reverse the increasing scarcity of water in the region by adapting, developing, and disseminating policy tools and technical and management interventions that expand supply, reduce demand, and dramatically increase its efficient, productive, and sustainable use.

To do this, the Network's objectives are to:

- Improve water resources planning and management in the region through integrated approaches focused on the supply of and demand for conventional and non-conventional (brackish, treated waste, and desalinated) water sources;
- Upgrade the quality of water management applied research and research capacity in the Middle East and North Africa through training, research grants, and scientific exchanges within the region and with scientists in the United States and elsewhere.
- Improve the relevance of water sector-related research by bridging the gap between research and policy and between policy and application and outreach so that research is designed and carried out to resolve pressing real life problems and so that it better informs national and local policies by government; and
- Introduce and encourage the adaption and adoption of innovative policy and planning tools and measures focused on water management;

Program Implementation.

The WCN interagency design team proposes to complete the establishment of the Network and move forward with implementation of an initial set of activities that have engendered interest in the region among WCN partners. These components are training, collaborative research, and data and knowledge management.

- **Frontiers Program.** The Network will work with the Kuwait Institute for Scientific Research and the National Academy of Sciences to launch a Frontiers Program in the MENA region that brings together young and promising scientists to discuss cutting-edge approach methods and design joint research programs across national borders, with a special focus on water issues.
- **Collaborative Research.** More than any other priority program area, MENA WCN's reputation may well be most dependent on and most enhanced by the collaborative research efforts of its members' scientists. This is certain also to be the program area of greatest interest to members, as it is the locus for research project design, implementation, and outreach to decision-makers and the public. To have the strongest impact, we envision that the collaborative research will be done at many levels and with many groups: among regional partners; with government, civil society, and the private sector; and with

complementary entities based outside the region. To launch this program component, the USAID will support an initial set of exchanges of professional staff among the centers and with U.S. universities, with a focus on irrigation management, drought mitigation and management, and increasing agricultural productivity.

- **Data and Knowledge Management.** A key challenge across the MENA region is to improve data access, management, and analysis. To address this need, the WCN design team intends to support establishment and operation of a remote sensing data base through the Network that examines regional water balances in the Middle East. This activity will be led by ICBA, in partnership with NASA, the GEF, and OMEP. This activity will provide a foundation for the Network to build upon, leading to development of inventories of water resources data, and eventually to harmonized data collection and analysis for country-level, or even regional-level water planning and management.

Priority Technical Areas. Water resources shortages are arguably the most serious constraint to development and progress in the Middle East and North Africa. Conversations with key participants throughout the region confirmed the importance of the following high priority technical areas despite the wide variety of type of water resources and range of conditions. Subject to the availability of funds, work in some or all of these six technical areas will be implemented by Network centers through the program components mentioned above:

- **Small-scale desalination.** Explores low cost, manageable systems to augment water supply as a growing priority in the region, particularly mentioned in the Gulf countries, given that research outside the MENA region is largely outpacing investigations in the region.
- **Wastewater reuse.** Addresses issues related to the use of non-conventional water; policy and economic studies of resource replacement; assessment of public health issues related to pathogens and heavy metal contamination; best practices for soil salinity management; and treatment and energy requirements.
- **Groundwater resource management.** Addresses issues related to the sustainability of this critical but frequently mismanaged resource, particularly related to the increasing and widespread degradation of the quality of this resource due to overextraction, ineffective government policies and sanctioning systems, inadequate metering and pricing, and other troubling causes.
- **Saltwater intrusion.** Much of the data and information likely exists and the need would be to better interpret the data using newer tools such as numerical simulations, predictive groundwater flow and quality modeling, and visual displays.
- **Water use efficiency and productivity, particularly for improved irrigation management.** Addresses issues related to major water allocations, particularly to irrigation as the region's major user, looking at improved, more efficient on-farm water management technologies, innovative public-private partnerships, water pricing, and other market-based approaches.
- **Integrated water resources management for climate change adaptation.** Considers the uncertain effects of future climate change, addressing the scientific and policy gaps for incorporating climate change and variability information into adaptive, integrated water resources planning and management.

بكرة مركز ام الشرق الأوسط وشمال إفريقيا

عقدت ورشة عمل في 15 مارس 2011 في القاهرة، مصر، وذلك في إطار مشروع "تعزيز الشراكة بين القطاعين العام والخاص في مصر". وقد حضر الورشة ممثلون من الحكومة المصرية، والقطاع الخاص، والقطاع الأكاديمي. وقد ناقش المشاركون عددًا من القضايا المتعلقة بالشراكة بين القطاعين العام والخاص، بما في ذلك: أهمية الشراكة بين القطاعين العام والخاص في تحقيق التنمية الاقتصادية، والتحديات التي تواجهها، وآليات تعزيزها. وقد تم الاتفاق على عدد من التوصيات، منها: إنشاء لجنة وطنية للشراكة بين القطاعين العام والخاص، وإجراء دراسات ميدانية لتقييم الفرص المتاحة، وتطوير آليات التمويل المناسبة.

الإطار الإداري العام. عقدت ورشة عمل في 15 مارس 2011 في القاهرة، مصر، وذلك في إطار مشروع "تعزيز الشراكة بين القطاعين العام والخاص في مصر". وقد حضر الورشة ممثلون من الحكومة المصرية، والقطاع الخاص، والقطاع الأكاديمي. وقد ناقش المشاركون عددًا من القضايا المتعلقة بالشراكة بين القطاعين العام والخاص، بما في ذلك: أهمية الشراكة بين القطاعين العام والخاص في تحقيق التنمية الاقتصادية، والتحديات التي تواجهها، وآليات تعزيزها. وقد تم الاتفاق على عدد من التوصيات، منها: إنشاء لجنة وطنية للشراكة بين القطاعين العام والخاص، وإجراء دراسات ميدانية لتقييم الفرص المتاحة، وتطوير آليات التمويل المناسبة.

جلسة المناقشة، أقيمت في 15 مارس 2011 في القاهرة، مصر، وذلك في إطار مشروع "تعزيز الشراكة بين القطاعين العام والخاص في مصر". وقد حضر الورشة ممثلون من الحكومة المصرية، والقطاع الخاص، والقطاع الأكاديمي. وقد ناقش المشاركون عددًا من القضايا المتعلقة بالشراكة بين القطاعين العام والخاص، بما في ذلك: أهمية الشراكة بين القطاعين العام والخاص في تحقيق التنمية الاقتصادية، والتحديات التي تواجهها، وآليات تعزيزها. وقد تم الاتفاق على عدد من التوصيات، منها: إنشاء لجنة وطنية للشراكة بين القطاعين العام والخاص، وإجراء دراسات ميدانية لتقييم الفرص المتاحة، وتطوير آليات التمويل المناسبة.

الأمثلة الناجحة، التي سبقت في وإداس صغير رغبيل ورغبيل داسح اللبدبثين مراكز رميز أشربطخ شجج في تخف أجداد. ذي رصوير الأبخ أعاخ على أنب اصغ أ زببقي أشجج شرح طخبععضها، وخصوصاً في أع داد أ خ إ عشرة الأو. ن عمر أشجج، حتى رغيش اوض رميز أع. علس علبعل وشجج. رغ شس أ لذبي ذي. رغ يظ الأبء أشلوس الأععبء أ يشس إناطخ. رغويات الأبخ أعاخ أأد أشلوس الأععبء، أزاب ة عليش شري دس ببشيد أشلوس الأعضاء ع يعب، أ حتى بلهب وبوب د علي. ز لجدانج.

تعد هذات فرص لامتدول. وي رحك أنجاح، يجب أ رجدأ أشجج ثعذر ويل كاف رغطية عمليات رعبين ولجذء لف سرتش اظ أبدش لؤس يب. يتحتم على أشجج تحقيق رغطيل أباغ بفيخ في ش اد ع شح. حيلب تحقيق أثر حبيبي وفاء. زبجش ص ذق أ ج أ د أهم عضلش خطخ أشجج ل وبلية والتي يعف شيق تطوير أشجج أشنشن على شلبئ لبشش اوخ رغ ووععبد ع تبدبئخ أ ش. عفر لفي ص ذح أ بئخ أ تحمخ. الصندوق عمليات أشجج.

لهذف لرئس وألهذاف لهر عت. إ. أذف الأساسج لفي ش اوض آياه في شل شق الأوسط شببفيلش يقيا :

إمبف عى ظطغ شرح آياه في أنطخ عن طريق رعديل ورطوير وشش أ دادس رغ أنيسا د، الإجراءات فلك بئح اللس بئح التي رود إ! تحسب ص ببس أميا، تحفط الطلب ع أميا، تحسب اعخ ذاب د أ لاف صج ق ب عليخ شش غز ذأ.

تحقيق رقصي أ ذاف لشجج لفش عية هي:

تحسب تحطيط ولسح صبس آياه في أنطخ. خالي ظلب لي يركز ع الطلب ع رض ويدر صبس آياه أنقليديخ وغير أنقليديخ (أمياه أعفبج لبلك، آياه لعدخ أعاغخ، آياه أمحلاة).

انقليديه وغير انقليديخ (أمياه اعفبج لبلك، آياه لعدخ اعاعخ، آياه أمحلاة).

- تحسيد - عيخ ابدس اطلعيقية و امدس اد في هزا اغبي في شل شق الأوسط ش بيفيش يقيا - خالي لؤس يب، رج خطخ ثب لأبحاث، ارجدي العلمي في ا نطقة و رغ علبه في الأليات امتحدة وغيرها.
- تحسيد - ائيف عذح ابوس في غبل قطاع اميا - ره عن طريق سداف غ خ بئيد - ابوس اسياسا دبئيد - اسيا عبد تطعيم ب - از عيخ ثب حيث يتم صميم ابدس و بؤب لإيجاد الحلوي - ش بوال عيخ ب - خ، بحيث رعه عمليخ س غ اسيا عبد اوطنية و ا حليخ - ل ح - الدي ب؛
- شل ش غيغ اع - ع - تعدي - اع خ ذ ا - اداد ا تخطيط ورسد اسيا عبد ائيش ح، الإجراءت التيش ووض عا داس ح اياه.

نطب ق لئون ام ج.

مؤشخص شيق تطوير اشوخ اشن شن الازبء - رش كلب - اضي لنب في تطعيم عضة - يدئي - فعاليلوب لري لب ائيش زشوخ لؤش شوبء اشوخ في ا نطخ. رر ع - ز فلب عبات لؤس يب ابدس شل زشوخ داس ح اعلوب د ابيا بد.

- بون ام ج عهر لحدود. عقر ع - اشوخ غ - عهد ائيت بيش العلي والويد يئ اوطيخ ع - ج نوح ش ب ج عبر الحد في نطخ شل شرق الأوسط ش بيفيش يميا و ا ز يدغ علبه ج بة زميزيد ببل شخ الاسبب احنوخ اشوخ رض ميئش اظن زشوخ بؤس عئ الحد ا خوخ، غ زش كيز ع - طع اياه.

- لبح و ث لم ش ركت. عقر ع ز د ع خ اشوخ شل - ثل ثب اظا ش في ا نطخ ع - ر عرز باغ د ثل زشوخ للعبء الأعضاء بها في مجلي ابدس. - اووذ زاج بس ز غرضيخ ج شل ب ظ راد ائيش و ب ر ثب غ خ لأعضاء اشوخ، ثب هج بس ائيش عيخ لئيش بس رض ميئش اظ ابوس، رط يئب - از عيخ ثب بئيد ص بع امش اس اغماهير اعاخ. - اع تحديق لئيش لاج شفئي ب مترح ا رز ابدس اشوشوخ ظ - عرف اغ زيب د اغ عات: ظ ثل شوبء في ا نطخ، غ الحوب د، اغ غ اذني، و اقطاع اخ بص، ع بد اخ ش - خ بس ط ا نطخ. ث ذف لؤذت ز اغضء - ج شل ب ظ، عقر رذعم اويخ الاشويد ال بء ا ذلي و رغطي غ - سخ ين عمليات لئيش الاوليخ لئيش اخص بئيد - اش اوض اغ بمعات الاشويخ، غ زش كيز ع - ا طيع ائيش ا ش داس ح - غ ب شخ لؤش يقا ص ب سلغ فبف، وزيادة اولاب عيخ طرس اعين.

- إدارة لم عي ماث و لابن ائ. رعد عمليات تحسيد - تصيد داس ح زحلي لئيشانا د اعلوبد ا لحديات في نطخ اشوخ الأوسط ش بيفيش يقيا. رر غطوخ ز الحاج، يعترفم شيق رطويش اشوخ ع - د ع شل ب و ش غيل ب عدة بيا بدر ع - طريق الاوشعار ع - بعد في لئيش، اص بد لئيش في ا نطخ وئ. ع ق ي م د ز اغ د اشوخ ا ذلي ص س اعخ ا لئيش بئيش اوخ - غ وئيش ع ب فعب عئ فك لئيش اعبمية وئوت اويخ الاشويد ال بء ا ذلي لئيش اظل شق الأوسط. لؤش ز اغ - تام ب عدة التي يئ - شوخ لئيش عليها، ب يود - ل رطويش ل اعئيش بدر ز ع - علوبد ع ص بس اميا - بتعد ره توحيد عمليات رر ع وئيد ابيا بد - اع تخطيط داس ح اياه ع - اغ ز - اجذا - ا نطخ وئ.

ن ائيش ن ت راث اول وئ. زيجش ش حص بس اياه ا وئش اعولك اب ا نط س لرم ذفي نطخ شل شرق الأوسط ش بيفيش يقيا. ل ذ ا و ذد لئيش بد التي اعشيت غ شل بس وئ - لئيش يئيد - في ا نطخ ائيش ا احي فل يئ ر لئيش راد الأهمية لئيش غ - ر حص بس امياه وحبؤب. اعوبدا ع - فيوش ل غطوخ ائيش، عيتم اع - ع ميع او بعض ز ا احي فل يئ اغخ في اش اوض اشوخ ظ - اعض ائيش بظ اؤوس خاب:

- ت ائيش ن ت راث م اء عم س تي مح ذود. يئوش اظ نط غطوخ قليخ لؤفة لزيادة ص بس اميئ بوج بس ب ائيش في ا نطخ، خصص ب اؤوس ح ب في نطخ ائيش عربي، و اج بس ا لؤدس في هزا اغبي خ بس ط نطخ شل شرق الأوسط ش بيفيش يقيا ر خ بئيش اذ في ا نطخ.

- إعادة هيكلة مخدّمات مياه لعمّادته. يعبّط أغبيّ التي زرعلقب عرخذ لص بدس آياه غير اتقليديخ؛ شاعخ آ احي ال لوص ادية و اغياسنج اتعلقب عرخذاي طرب دس؛ زمبم آ احي اتعلقب صبصخ اعامه و اشروبطن ثبب زنب لأحياء لل يقة و اتعد طلقيلخ، ابس عبد طنّ في السه ملوحن زنبخ؛ آاعاخ تطلبات الطاقن رب.
- إدارة مص ادر ل مياه لحي وفت. رعبظ اغبيّ التي زرعلقب عرذا خزا اصنن اب زيعاني عء اللاسح، خصن بقبب زرعلقبون ايذا حطاط عرخذزا اصنن امائث نجت اع اغبيش، اسباع بد الحى رنج اظخ نل دغ غير اغديخ، وعمليات اقيا طر اغبير غير ابجخ، اخبه اخ شردعو مكم.
- استرس اب ل مياه ل م ح ت. اش عر فوش لى نير ابيا بد اعلوبد راد اللخ، بربى الحاخ ا ف و سيراف ع جيانا دامع اب هتب عرخذ ا اداد حننض الموبح شلل رنج، رعه جريان و عنج امياه اغفنج، اعروض اش رنج.
- لفاءة فاع ل لئس خذام ل مياه، وحنى ص ال ح سن الدارة لدر. رعبظ اغبيّ اتعلقب حننصيعات امياه لئى يسبخ، خصن ب شرب عر سولن اش اع الوب ص بدس آياه في انطمخ، انطغ ا رميات محسن خ لوش فبعه لاسح آياه في لراسع، شش و ببد عر ح بئب اقطاع اع اخبص، رنج غير آياه، واسبب اخ شرو ذ على حاجات الاسواق.
- الدارة لئس كالمه ل مص ادر ل مياهه ذفلات كفف م عر ر ل ن اخ. بس ط از اثيرات ازلخ رنج غير ا احي عر م ال، يعبظنل عشن ااد العلميه و اتعلقب شغ اغياسات لوع ع يع مع ب د رنج و زم آ احي في السح تخطيط زى ببد ص بدس آياه.

LE CENTRE DE LIAISON SUR LES RESSOURCES EN EAU POUR LE MOYEN ORIENT ET L'AFRIQUE DU NORD

Le Centre de Liaison sur Les ressources en Eau pour le Moyen Orient et l'Afrique du Nord (MENA WCN) va servir comme centre de liaison à un réseau d'institutions interrégionales d'excellence unies entre elles et avec d'autres institutions partenaires extérieures pour collaborer à lever les défis de gestion des ressources en eau. Le centre agira pour stimuler la coopération, développer et partager les capacités scientifiques et technologiques dans les domaines de la planification, de la gestion, de la diffusion des outils techniques et des politiques d'aide à la décision, pour accroître l'offre en eau, optimiser la gestion de la demande et améliorer l'efficacité et la productivité de l'utilisation de l'eau.

Un réseau de coopération entre institutions permettra de soutenir la coopération et de faciliter les activités de collaboration telles les participations conjointes aux projets de recherche compétitifs, le renforcement des capacités, le jumelage interinstitutionnel, les échanges de scientifiques et la gestion des savoirs.

Cadre Global de Management. Avec le temps le réseau va mettre en relation un certain nombre de centres de formation, de politiques et de recherche du Moyen Orient et de l'Afrique du Nord. Les institutions adhérentes vont se renforcer mutuellement par l'échange d'information, l'organisation de séminaires, la réalisation de projets conjoints de formation et de recherche. Le réseau s'attachera aussi à développer les liaisons avec les universités, les laboratoires et les groupes de recherche aux USA, en Europe et ailleurs, pour aider au développement des capacités institutionnelles, introduire de nouvelles idées et offrir des opportunités pour la croissance. Le réseau travaillera dans un esprit de transparence au niveau de la prise de décision sur la base d'une participation ouverte et active des centres d'excellence associés. La structure initiale de gouvernance du centre repose sur deux blocs constitutifs, avec des rôles et des responsabilités clairement définis, qui travailleront conjointement pour le bénéfice des institutions participantes et des gouvernements hôtes :

- **Conseil d'Administration.** Le conseil d'administration approuve les programmes techniques et le budget annuel, supervise la recherche de financement et l'allocation des fonds, ratifie les dépenses dans le cadre de ses responsabilités fiduciaires. La construction d'un partenariat productif durable constitue le noyau fondamental du réseau. Le conseil d'administration va jouer un rôle crucial pour encourager et soutenir les alliances entre les institutions membres au sein de la région Moyen Orient et d'Afrique du Nord, et aussi les alliances avec les autres institutions internationales.
- **Secrétariat.** Composé d'une équipe restreinte technique et de gestion chargée de faciliter, coordonner et gérer les relations entre les centres d'excellence associés de divers pays. Le secrétariat va maintenir et consolider le réseau, certainement durant la période initiale de 5-10 ans, pour permettre aux centres d'apprendre à mieux se connaître et à travailler ensemble d'une manière profitable et productive. Ultérieurement, le conseil d'administration et les

centres associés, peuvent décider de confier les responsabilités du Secrétariat à un des centres ou assurer ces responsabilités à tour de rôle, ils peuvent également décider de rendre le Secrétariat Permanent.

Engagements financiers et opportunités. Pour réussir, le réseau doit démarrer avec des fonds suffisants pour mobiliser rapidement le staff et immédiatement garantir le lancement des premiers programmes de formation et de recherche. Si le programme doit avoir un impact spectaculaire il doit s'assurer un financement sécurisé dès le démarrage. Un élément clef du plan de financement du centre WCN peut être sous forme d'un don ou un fond que l'équipe inter-agence de design du projet est entrain de concevoir en partenariat avec les autres donateurs et fondations. Les intérêts générés des fonds supporteront les opérations du Réseau.

But et objectifs. L'objectif ultime du Centre de Liaison sur Les ressources en Eau pour le Moyen Orient et l'Afrique du Nord (MENA WCN) est :

D'agir sur la pénurie croissante des ressources en eau dans la région par l'adaptation, le développement et la dissémination des bonnes pratiques techniques, politiques et de multiplier les interventions pour améliorer l'offre en eau, réduire la demande, et accroître l'efficacité, la productivité et l'utilisation durable des ressources en eau. Pour réaliser cela, les objectifs du réseau sont :

- Améliorer la gestion et la planification des ressources en eau dans la région par des approches intégrées centrées sur la gestion de l'offre et de la demande des ressources en eau conventionnelles et non conventionnelles (Eaux saumâtres, eaux usées traitées, désalinisation...).
- Promouvoir la mise à niveau de la qualité de la Recherche-Développement et des capacités de recherche en Afrique du Nord et au Moyen Orient par la formation, le financement des projets de recherche, les échanges scientifiques au sein de la région et avec les autres experts des USA et d'ailleurs.
- Améliorer la pertinence de la recherche dans le secteur de l'eau par la réduction des gaps qui existent entre la recherche et les politiques d'un côté, et entre les politiques et l'application et dissémination des résultats de recherche de l'autre côté. L'objectif étant de s'assurer que les recherches répondent aux besoins urgents réels du terrain et qu'elles aident à la mise en place de politiques locales adaptées et efficaces par les gouvernements
- Introduire et encourager l'adaptation et l'adoption des politiques innovantes, des outils performants de planification et des mesures cadrées sur la gestion des ressources en eau

Mise en place du Programme. L'équipe interinstitutionnelle en charge du design du Centre WCN propose de compléter la finalisation de la structure et de l'établissement du réseau et d'avancer par la mise en action d'une série d'activités qui ont déjà suscité un intérêt partagé auprès de divers partenaires dans la région:

- **Programme Frontière.** Le Réseau travaillera avec l'Institut de la Recherche Scientifique du Koweït et l'Académie Nationale des Sciences aux USA pour lancer un Programme Frontière dans la région MENA pour réunir les jeunes scientifiques prometteurs pour discuter ensemble des approches nouvelles innovantes et créer des programmes conjoints de recherche transfrontières en accordant une attention particulière aux problématiques des ressources en eau.
- **Recherche Collaborative.** Au delà de tout domaine prioritaire, la réputation du Centre dépendra et reposera essentiellement sur les efforts de collaboration de ses membres scientifiques participants. Ceci présente certainement un des domaines clef du programme pour tous les membres du centre parce qu'il constitue le moteur pour le design, la mise en place et la liaison avec les décideurs et le public. Notre vision, pour avoir le plus fort impact, est de s'assurer que les recherches collaboratives sont réalisées à différents niveaux avec plusieurs groupes incluant les partenaires régionaux, la société civile, le secteur privé et les institutions complémentaires basées à l'extérieur de la région. Pour lancer cette composante du programme, l'USAID supportera des échanges initiaux de professionnels entre les centres d'excellence et avec les universités US, sur les problématiques de l'irrigation, de la gestion et de l'adaptation à la sécheresse et de l'amélioration de la productivité agricole.
- **Gestion de l'information et des savoirs.** Un des défis majeurs de la région MENA est l'amélioration de la gestion, de l'analyse et de l'accès aux données. Pour répondre à ce besoin, l'équipe de design du centre WCN propose la création et le développement d'une base de données par télédétection, à travers le réseau, pour le suivi et l'évaluation des bilans hydriques dans la région. Cette activité va être pilotée par l'ICBA en partenariat avec la NASA, le GEF et l'OMEP. Cette première base de données va constituer une fondation pour le réseau sera suivie par l'inventaire des ressources en eau et éventuellement l'harmonisation de la collecte et de l'analyse des données pour les besoins nationaux ou régionaux de planification et de gestion des ressources en eau.

Domaines techniques prioritaires. Les déficits des ressources en eau constituent la contrainte majeure pour le développement et le progrès du Moyen Orient et de l'Afrique du Nord. Les discussions à travers la région avec les partenaires potentiels clefs confirment l'importance des domaines techniques prioritaires suivants, malgré la diversité des ressources en eau et des conditions régionales. Selon les disponibilités en ressources budgétaires le travail au niveau des 6 domaines techniques sera mené par les centres qui composent le réseau à travers les composantes identifiées précédemment :

- **Petite unités de Dessalement.** Explorer les systèmes de dessalement a faibles couts et gérables pour améliorer l'offre en eau, priorité dans la région, essentiellement dans les pays du Golfe du fait que les recherches menées à l'extérieur de la région MENA devancent largement les investigations dans cette région.
- **La réutilisation des eaux usées.** Porte sur les problématiques de d'utilisation des eaux non conventionnelles, les études économiques et les politiques de substitution de la ressource, l'évaluation de l'état sanitaire du public du aux contaminations par les pathogènes et les

métaux lourds, les bonnes pratiques pour la gestion de la salinité des sols, les besoins en traitement et en énergie.

- **Gestion des ressources en eau souterraines.** Explore la durabilité de cette ressource critique souvent mal gérée, particulièrement du à la surexploitation et à la dégradation de la qualité de la nappe, l'inefficacité des politiques gouvernementales et des systèmes de sanction, l'inadéquation des méthodes de suivi, de quantification et de tarification et une multitude d'autres causes contraignantes
- **Intrusion saline.** Suffisamment de données sont vraisemblablement disponibles et les besoins existent pour mieux interpréter ces données par l'utilisation des outils nouveaux performants telles les simulations numériques, les modèles de nappe pour la prédiction quantitative et qualitative des ressources souterraines et des visualisations des résultats
- **Efficienc e d'utilisation de l'eau et productivité particulièrement pour l'amélioration de la gestion de l'irrigation.** Vise à résoudre les problématiques liées aux allocations des ressources en eau, essentiellement pour l'irrigation qui constitue le principal utilisateur au niveau de la région MENA, en mettant l'accent sur les techniques de gestion efficaces au niveau des exploitations agricoles, le développement de partenariat public-privé innovant, la tarification de l'eau, et d'autres approches basées sur le marché et le marketing
- **Gestion intégrée des ressources en eau et adaptation aux changements climatiques.** Intègre les effets incertains des changements climatiques futurs, tente de solutionner les gaps au niveau des sciences et des politiques, par l'incorporation de la variabilité des changements climatiques dans des modèles adaptatifs de gestion intégrée et de planification des ressources en eau.

EXECUTIVE SUMMARY

Background

President Barack Obama announced his intention to intensify engagement with Muslim-majority countries on many levels in his June 4, 2009 speech in Cairo. Creating centers of excellence was an important part of the address. This includes the proposed Middle East and North Africa Water Center Network (MENA WCN). Secretary Clinton announced during her March 22 World Water address that such an organization would soon be established. The United States Government (USG) and partners are also in the process of creating new centers of excellence, some of which address aspects of energy in the Middle East and North Africa, climate issues in Indonesia, and malaria around the world. Specifically, the current centers of excellence are proposed in five areas: water in the Middle East and North Africa, climate change in Asia, health, renewable energy, and science policy.

“On science and technology, we will launch a new fund to support technological development in Muslim-majority countries, and to help transfer ideas to the marketplace so they can create more jobs. We’ll open centers of scientific excellence in Africa, the Middle East and Southeast Asia, and appoint new science envoys to collaborate on programs that develop new sources of energy, create green jobs, digitize records, clean water, grow new crops.”

President Barack Obama
June 4, 2009
Cairo

A center of excellence provides a platform for international partnerships to address shared challenges using locally appropriate scientific and technological solutions. A center acts as a hub of innovative and creative activity that integrates efforts from multiple disciplines. It provides training opportunities that increase the pool of professional scientists and engineers with skills in the area of focus. Existing centers of excellence in government, industry, academia, and non-profits follow several different models. The USG already supports many domestic centers of excellence which could collaborate with international partners. For new centers opened in accordance with the President’s vision, it is likely that the amount of new physical structures will be minimal; rather, existing aspects of facilities and institutions will be enhanced.

The vision for MENA WCN involves linking technical institutions across the region, which will work together and with counterpart U.S. institutions, on water challenges confronting the region. The Network’s goals are to foster partnerships with the United States and within the region; build and exchange regional science and technology capacity to improve water resources planning and management; and develop and disseminate policy tools and technical and management interventions that expand water supply, manage demand, and dramatically increase its efficient and productive use. A network of cooperating institutions will facilitate collaborative activities including competitive grants programs, capacity building, institutional twinnings, exchanges, fellowships, and knowledge management.

Purpose of the Assessment and Design Report

This report presents the findings, conclusions, and recommendations of an interagency design committee that developed the initial concept for the MENA Water Center Network. That initial concept of a network of regional and national scientific research institutions was used as the basis for a multi-country assessment conducted in December 2009 and June 2010. The focus of this report is a design that addresses the following major elements: MENA WCN's objectives, core functions, organization and management, and operationalization. The Design Committee intends to distribute this report widely and encourages suggestions, comments, and debate concerning its content. The committee seeks broad-based consensus from key stakeholders in the Middle East and North Africa, the United States, and elsewhere and recognizes that agreement on the design will come only from open discussion and modification. It welcomes and encourages that discussion.

A subgroup of the committee, called here the Design Team, conducted two extensive visits to the Middle East and North Africa region to determine regional needs and levels of commitment to the concept of a center of excellence on water. These visits included in-depth conversations with potential partners and critically interested parties in eight countries: Morocco, Egypt, Jordan, West Bank/Gaza, Israel, Kuwait, Qatar, and the United Arab Emirates (Dubai and Abu Dhabi). In all, Design Team members met with roughly 250 stakeholders and experts in the Middle East and North Africa and roughly 50 in the United States.

Strategic Priorities for the United States on Water

As described in the 2010 Senator Paul Simon Water for the Poor Act Report to Congress, the United States' global and regional water activities aim to support U.S. foreign assistance goals by protecting human health, promoting economic development and food security, advancing peace and security, and providing basic needs in response to natural and human-made disasters.

To achieve those goals, the United States is working with countries around the world to achieve water security – defined as reliable and sustainable access to an acceptable quantity and quality of water to meet human, livelihood, ecosystem, and production needs while reducing the risks from extreme hydrological events to people, the environment, and livelihoods.

To promote water security, the United States makes direct investments in infrastructure; works to strengthen the enabling environment in developing countries through capacity building and policy and regulatory reform; seeks to raise the political will to address water and sanitation issues at the national and global level; and engages in the research and dissemination of best practices and proven technologies. These activities are focused on achieving three objectives:

- **Increasing access to water supply and sanitation, and promoting better hygiene** – both short-and long-term sustainable access to safe water and adequate sanitation, as well as activities to improve hygiene;
- **Improving water resources planning and management** – optimizing the benefits of drinking water among competing uses while ensuring that human needs are met and

environmental resources are protected, as well as supporting regional efforts to manage and/or adapt to hydrological variability and the risks of floods and droughts; and

- **Increasing water productivity** – maximizing the efficient and productive use of water used in industrial, agricultural, and other consumptive sectors, as well as supporting pollution prevention programs and other programs that reduce water losses.

U.S. Scientific Leadership on Water

The United States has faced a number of significant water issues over its history that have been resolved through the application of science and technology. Responsibility for the study of and response to the scarcity, variability, and sustainability of water resources in the United States is divided among many federal, state, local and other entities. While a number of proposals have been made to coordinate these responsibilities, especially at the federal level, the development of water science, technology, and policy is disjointed. The responsibilities are shared among entities whose missions touch on specific aspects such as agriculture, public health, environment, quality, quantity, energy, distribution, as well as education. Not only are the responsibilities split, but the challenges faced vary widely across the different geographies, needs, and cultures within the country. Without adequate and sustainable local and imported water supplies, it is not unusual to see conflict arise between competing interests. Despite this diversity, or more likely, because of it, water science, technology, and policy are extremely active and productive areas of experimentation, study, and application throughout the United States.

Stakeholder-Identified Technical Gaps, Failures, and Issues

The Middle East and North Africa Water Center Network seeks to address a number of technical gaps, failures, and issues that have been identified by both scientists and decision makers in the region. The Design Team repeatedly heard pleas for more research funding to allow an existing cadre of highly trained researchers to do more field work, perform more analyses, purchase needed software, and generally have better access to the latest technologies. However, much or even most of the feedback received by the team involved issues related to the application of research into actual policies or its adaptation to real world situations. This includes the following:

- **Research not useful for decision-makers.** With little exception, government officials and others in positions of responsibility complained that research being carried out was not useful for them to set policies or solve concrete problems. There were few venues for the two to meet on a regular or even occasional basis. Even in countries where ministry or agency budgets had a line item for research, little or no funding was ever used since government officials did not seek research assistance and researchers did not directly access decision-makers to determine their high priority challenges. Eventually, those funds dried up.
- **Research is donor or project driven.** Little creative or exciting research in the water sector is being carried out because most is driven by the immediate implementation needs of donors and projects. Research entities are carrying out implementation-focused, short-fuse studies with little attention to broader implications and little regard for outside, parallel

experimentation. As a result, the research is often of inferior quality and of narrow significance without serious commitment or contribution to a scientific body of knowledge.

- **Research does not reflect national priorities.** This issue is an extension of the previous two, indicating that whatever research is being carried out does not reflect or take into account national priorities. Some countries have determined national research priorities but find that university research does not reflect these determinations. This disconnect between government and academia is common around the world, but it has particularly negative consequences in the water-short MENA region.
- **There are many lost opportunities to incorporate research into outreach.** Some research in the water sector has specific application, but researchers often do not make the intellectual leap. Conversely, the public often sees little utility in research because it has not been used for application and outreach to general stakeholders.
- **There is little or no collaboration between regional entities within a country or between countries.** There was little evidence that research entities in the Middle East and North Africa work collaboratively with each other. MENA entities tend to seek partnerships with similar groups in the United States and Europe. In part, it may be because of competition and jealousy, but it is most likely because they do not know what others are doing and see little prestige or usefulness coming from teaming with other institutions in region. As a result, there is no sharing of funds or knowledge, deepening the sense of regional isolation.
- **Research focuses on the hard-core technical rather than policy and institutions.** Engineering and other technical specialties are more highly valued than the work of policy makers and social scientists, although the core of many water problems is institutional and managerial. As a result, solutions do not work and problems fester unresolved.
- **Young and talented researchers often leave universities and government institutions to seek more remunerative work, either in foreign academic institutions or in the private sector.** Salaries and opportunities are uniformly low in the region, and researchers regularly seek employment in the Gulf or elsewhere.
- **The funding issue noted above is particularly acute for younger or mid-level staff.** These individuals are often both highly educated and highly motivated, but find there is little funding to build on their research interests and apply principles learned abroad to solve local water challenges. Those who find research funding and collaborations often find that these successes carry little weight for promotion.
- **Knowledge is scattered and not shared.** Many people claimed that there is a lot of knowledge, but it is not accessible or drawn together usefully. Individuals and institutions are often weary of others and will not share, but scientific advances require openly available information. Beyond that, results are not shared with the public.

- **Finally, there are insufficient forums for researchers to meet and share results regionally or internationally.** With limited or no funding for meetings or communications, researchers become increasingly isolated.

Organizational Needs of the Network

MENA WCN must demonstrate four attributes if it is to survive and prosper as a permanent entity:

- It must be perceived within the region and to external interested parties as an institution that adds value to the water sector and makes serious and concrete contributions to the management and use of water. There are already many institutions in the region that work on aspects of water issues. Some of those institutions have been supported financially and otherwise by the United States so it is essential to be able to explain why this new network should exist.
- Assuming MENA WCN becomes a credible entity, it must be configured in such a way that the United States is perceived as delivering on the global engagement President Obama talked about in his Cairo speech. However, it must genuinely allow space for all partners.
- The Network must be constructed so that it deepens ties between governmental, educational and technical entities in the MENA region and their counterpart institutions in the United States.
- The Network should strengthen these kinds of ties within the region as well.

A Network of Linked Institutions

The idea of creating a network was always part of the thinking of the Design Team. The challenge is how to create something that can capture the imagination of people in the region and how to operationalize a network of linked institutions. After all, the very notion of a “Center” inevitably conjures up the notion of bricks and mortar. Some team members talked about creating a “virtual” center, but this was rejected as too amorphous. As a result, we returned to the idea of a network composed of institutions, each of which is a center of excellence collaborating with a regional or American center. So how would this be different from a hub and spoke model? The key difference is that we do not plan to ask a regional institution to serve as the hub for the Center. To make this clear, instead of talking about a single “Center of Excellence,” we focus on centers of excellence forming a network.

Overall Management Framework

Over time, the Network will bring together a number of policy, research, and training centers in the Middle East and North Africa. The participating entities will strengthen each other through information exchanges, meetings, and joint research and training programs. The Network will also link to universities, laboratories, and research groups in the United States, Europe, and elsewhere to help build capacity, introduce new ideas, and provide opportunities for growth. It is

imperative that the Network operate in the spirit of transparent decision-making, based on the active and open participation of member centers of excellence. The initial governance structure for the WCN will have two major bodies or institutional building blocks that must have clear roles and responsibilities and work jointly for the benefit of all participating institutions and hosting governments:

- **Board of Directors.** The Board of Directors will be composed of ten to twelve eminent water authorities from the region, the United States, Europe and other parts of the world, representing donors, governments, the private sector, and civil society. They will meet once or twice each year to review work conducted by the Network and establish priorities. The board may issue recommendations, but ultimately, it will be up to participating institutions to determine research priorities. The board will also approve the annual budget, and each year review expenditures, as part of its fiduciary responsibilities. The formation of long-term, productive partnerships is at the core of the Network. Its organizational structure is designed to encourage and foster alliances among members in the Middle East and North Africa, and between them and entities outside the region. The Board of Directors plays a crucial role in developing these relationships and must do all it can to create a climate that stimulates partnerships first within the region and then outside it.
- **Secretariat.** The Network will require an independent entity, based in the Middle East and North Africa, that facilitates, coordinates, and manages the relations among the associated Centers of Excellence in different countries. In a sense, this Secretariat is the glue that keeps the network together, certainly during the initial five to ten years as the different Centers learn to work with each other profitably and productively. Over time, the Board of Directors and the member Centers may decide that the duties of the Secretariat should be subsumed by one of the Centers or rotated periodically among them, or they may decide to make the Secretariat permanent as is. At this point, it is far too early to know which course is the most advisable. However long the Secretariat is in place, it should be relatively small and low-cost, as the vast majority of the funds ought to be used for the research and outreach activities of the Centers. A small management and technical team will handle its operations and have fiduciary responsibilities, since funds for activities will flow from the Secretariat to the Network's members. As such, the Secretariat must have a legal status to accept and distribute funds or be tasked by donors and investors to manage fund pools, at a minimum. How that happens must still be determined.

In the future, the Board of Directors may decide to create other bodies within the Network, for example a panel of experts or an implementation committee of member centers, but they will evolve to address needs as they arise.

Financing Commitments and Opportunities

In order to succeed, the Network must start with sufficient, sizeable funding to mobilize staff and immediately underwrite research and training programs. Too often, institutions of this kind are underfunded and spend most of their time scrambling for money. It makes them unproductive and unable to justify their continuation. It is no wonder that the failure rate is high and impact is low. MENA WCN, and all of the Centers envisaged under the Cairo Initiative, must break that

mold. If the Network is to have the dramatic impact that mirrors President Obama's vision, it must start with financial security. One way to achieve this outcome is to create an endowment or trust fund for the Network that then uses the reliable income from its interest for operations. The Secretariat must develop a clear marketing message to use with potential contributors to build the endowment or trust fund.

Political Coverage

To succeed, the Network must also receive strong support from one or more recognized political umbrellas. It will not prosper as an orphan or as a largely American entity. Political coverage by regional and domestic Networks of power can advocate for the Network's agenda and results. The Network, therefore, must be integrated into or adopted by existing lines of authority in the Middle East and North Africa. One source of patronage could be the newly established Arab Council of Water Ministers that is situated in the Arab League where its secretariat is housed. Recognition by the Council of the Network's legitimacy would open doors, provide information, and reduce any hesitations by local institutions to cooperate fully. Given that the Network is actually a partnership of independent Centers of Excellence in different countries, it may also be advisable to obtain acceptance from each country's leadership.

Goal and Objectives

The ultimate goal of the Middle East and North Africa Water Center Network is to:

Reverse the increasing scarcity of water in the region by adapting, developing, and disseminating policy tools and technical and management interventions that expand supply, reduce demand, and dramatically increase its efficient, productive, and sustainable use.

To do this, the Network's objectives are to:

- Improve water resources planning and management in the region through integrated approaches focused on the supply of and demand for conventional and non-conventional (brackish, treated waste, and desalinated) water sources;
- Shape and lead a serious and meaningful dialog among and between decision-makers and researchers about concrete and practical ways to deal with water scarcity and to expand that dialog to the private sector and civil society;
- Improve the relevance of water sector-related research by bridging the gap between research and policy and between policy and application and outreach so that research is designed and carried out to resolve pressing real life problems and so that it better informs national and local policies by government;
- Introduce and encourage the adaption and adoption of innovative policy and planning tools and measures focused on water management;

- In so doing, foster the ability of Network members to contribute to water-related policy reform by providing governments in the region with expert assistance; and
- Upgrade the quality of water management applied research and research capacity in the Middle East and North Africa through training, research grants, and scientific exchanges within the region and with scientists in the United States and elsewhere.

Partnership Approach

The formation of long-term, productive partnerships is at the core of the Network. Its organizational structure is designed to encourage and foster alliances among members in the Middle East and North Africa and between them and entities outside the region. The Design Team was rather surprised to learn that few, if any, of the groups it met actually had meaningful, long-lived partnerships with other research entities in the region. They either worked in isolation or by and large with American or European groups. It is incumbent on the Board of Directors and Secretariat to do all they can to create a climate that stimulates partnerships first within the region and then outside it. The Network's approach to partnerships is to incentivize them. For example, the Network might fund only those research projects or trainings that actively engage at least two member entities in any effort. Beyond them, the Network will strive to bring together regional researchers and decision-makers with counterparts in the United States and elsewhere to their mutual benefit. The Network will also link MENA WCN members to U.S. scientific, governmental, technical, and policy institutions to support research and collaborative capacity-building aimed at addressing our common water challenges.

The design of the Network should make clear that private sector participation is invited at each stage of the process, including the sharing of scientific research by university and professional communities with the private sector; funding for scientific collaboration, education, and investment; and project development and implementation. There is a range of private sector entities that needs to be engaged: non-government, non-profit groups, as well as private interests, for-profit companies, and trade associations. However, traditional means of employing these resources, especially for-profit entities might have to be modified to fulfill the Network's goal of deploying more efficient and increased water services in the region. How to create these partnerships will itself be a critical challenge as the Network's programs evolve. And several questions still need to be answered: How can Network's members best reach out to and engage varied private sector actors? Should government procurement practices be reformed? Is the return on investment or the tenor of project finance contracts appropriate to the task of enhancing water resources and making them available to Middle East publics, both urban and rural?

The Network's Overall Core Functions

To achieve the broad objectives, the following core functions for the Network are under consideration:

- **Build Partnerships.** The Network could develop and support partnerships between academic, research, and governmental institutions in the region and the United States. This could include funding collaborative research between U.S. and foreign researchers. Other donors could do the same between the region and their national institutions.

- **Stimulate Dialog.** The Network could build on existing regional and international efforts to create a venue for water policy makers, managers and users to discuss, debate, and eventually agree on solutions for water security. The Network could serve as a forum for substantive policy, planning, management, and technical conversations among stakeholders. In effect, it could encourage an international water alliance that would support change by helping to identify both research priorities and strategies to apply and disseminate the results of that research for greatest impact. It can collaborate and build on regional international efforts and institutions, such as the Regional Water Data Banks Project (EXACT), the Middle East Multilaterals and Middle East Regional Cooperation programs; UNESCO’s Institute for Water Education, UNESCO’s International Hydrologic Program, and others.
- **Support Research.** In the Middle East and North Africa, the limited existing water research is largely focused on engineering and technology. Additional research opportunities are pressing in the areas of policy reform, systems design, management approaches, economics, and the social sciences. In partnership with local, national, regional, and international institutions, the Network could support basic applied research and analysis, studies, assessments, and evaluations to determine innovative solutions that enhance the region’s understanding of viable options as it makes critical decisions about water use for the future. Consistent with the Network’s focus on water policy, management, and socioeconomic barriers, new research under the Network is expected to form a limited portion of the Network’s portfolio, targeted toward identifying and addressing specific barriers and gaps in knowledge. Its goal would be to augment rather than to overlap with or duplicate existing successful programs.
- **Facilitate Utilization of Research Results.** The Network would likely focus heavily on putting research into practice in order to achieve its broad objectives. The Network would serve as a resource to link research results with the public- and private-sector institutions in the Middle East and North Africa that would implement these results. This would also include identifying and targeting resources toward countries and municipalities willing to adopt better water policies and management practices. The Network could also partner with established research centers based or operating in the region to affect their agenda and begin to consolidate research efforts, building on successes or taking advantage of promising directions that require additional infusions of financing or scientific support. Research results from the United States and other countries would also be considered for adaptation in the Middle East and North Africa and vice versa. The Network should make every effort to translate research results and other S&T-based best practices in water policy and management into action.
- **Manage Knowledge.** The Network could serve as a clearinghouse and resource base on water security – policy, management, technical, technology, and political – to catalogue and share good practices from across the Middle East and North Africa and elsewhere to help countries in the region to design and carry out more effective initiatives in the region. The assessment could start the discussion by performing an inventory of existing programs, their results, and other best practices in order to identify the important gaps in knowledge.

- **Build Research, Technical, and Management Skills.** Initially, the Network could provide or facilitate training and technical expertise in areas related to water security to beneficiary institutions and individuals, especially in those areas related to its research and technology-transfer agenda. Longer-term, it could create a collaborative mechanism with other existing institutions to provide degree and certified training in broad areas of water resources and management, not to duplicate successful efforts elsewhere but carving out its own unique contribution.
- **Expand Investment.** The Network could mobilize investments in innovative solutions to water challenges throughout the Middle East and North Africa by harnessing funds from USAID, other USG agencies, bilateral and multilateral donors, foundations, and regional and international partners from the public and private sectors. Within the region, the Arab Fund for Economic and Social Development (AFESD), International Fund for Agricultural Development (IFAD), the Kuwait Fund, and numerous privately operated foundations are possible partners in the creation of a water fund operated by the Network.

Program Implementation

During its early years of operation, MENA WCN will focus on implementing three program components that have engendered interest in the region among potential partners. These three components are training, collaborative research, data management, and knowledge management and use. It is important to point out that while collaborative research is one of these three, MENA WCN is not primarily a research entity. The Network will link research with three key interests of the Network: training, data management, and knowledge management and use, what we call here – outreach and application. The three program components are:

- **Frontiers Program.** The Kuwait Institute for Scientific Research (KISR) is currently working with the National Academy of Sciences in Washington, DC to launch a Frontiers Program, modeled after similar programs run by NAS in Europe, India, and China. Young scientists in these countries are brought together with their peers from the United States in a week-long meeting to discuss cutting-edge approach methods and research. Generally, NAS obtains funding in the United States for the American attendees and local institutions, often national academies of sciences, obtain the funding for young scientists from those countries. The meeting does more than introduce interesting research. In the Middle East, KISR has agreed to organize and convene the regional meetings for the coming five years, beginning in 2011. The focus of the meeting will be on medicine, engineering and science. This meeting, with a still undetermined date, offers an opportunity for the Network to play a high-profile role. It could fund some share of the costs of this and perhaps succeeding meetings, using the venue as an opportunity for the region’s most promising young scientists to work together on the initial elements of a research design. As KISR could be a core member of the Network, the Frontier Program could provide a very useful convergence of interests.
- **Collaborative Research.** More than any other priority program area, MENA WCN’s reputation may well be most dependent on and most enhanced by the collaborative research efforts of its members’ scientists. This is certain also to be the program area of greatest interest to members, as it is the locus for research project design, implementation, and

outreach to decision-makers and the public. To have the strongest impact, we envision that the collaborative research will be done at many levels and with many groups: among regional partners; with government, civil society, and the private sector; and with complementary entities based outside the region. The Network should be able to facilitate those linkages and foster long-term relationships that are mutually beneficial. The Design Team further envisions research being conducted by smaller teams of Network members, based on their skills and interests. To make the research efforts relevant and desirable, the Network will create a competitive research grant fund. Competition will improve the quality of the design and the carrying out of the research. Even now, it is clear that the basis of an award will in part depend on the inclusion of decision-makers and civil society on the team, meaning that a research team of only scientists will be inadequate since it will not advance the overall mandate of the Network to bridge the gap between research on the one hand, and policy and application on the other. We expect also that the research teams will also want to engage groups outside the region, ones which bring new methods and experience to their efforts.

- **Data Management.** The Middle East and North Africa is much like every other region of the world. Frequently, at the core of water issues is a disagreement over data sources, data methodologies for collection and analysis, and the data themselves, whether it is raw or analyzed. Beyond the fundamental issues related to data are equally intransigent issues related to the open sharing of data, be it among entities in a single country or across national borders. To address this need, the WCN design team intends to support establishment and operation of a remote sensing data base through the Network that examines regional water balances in the Middle East. This activity will be led by ICBA, in partnership with NASA, the GEF, and OMEP. This activity will provide a foundation for the Network to build upon, leading to development of inventories of water resources data, and eventually to harmonized data collection and analysis for country-level, or even regional-level water planning and management.

Priority Technical Areas

Water resources shortages are arguably the most serious constraint to development and progress in the Middle East and North Africa. Conversations with key participants throughout the region confirmed the importance of the following six high priority technical areas despite the wide variety of type of water resources and range of conditions. Work in some or all of these six technical areas will be implemented through the three programs mentioned above. Plans and activities in each of the following areas must incorporate legal, policy, regulatory, institutional and economic/financial concerns as integral components:

- **Small-scale desalination.** Explores low cost, manageable systems to augment water supply as a growing priority in the region, particularly mentioned in the Gulf countries, given that research outside the MENA region is largely outpacing investigations in the region.
- **Wastewater reuse.** Addresses issues related to the use of non-conventional water; policy and economic studies of resource replacement; assessment of public health issues related to

pathogens and heavy metal contamination; best practices for soil salinity management; and treatment and energy requirements.

- **Groundwater resource management.** Addresses issues related to the sustainability of this critical but frequently mismanaged resource, particularly related to the increasing and widespread degradation of the quality of this resource due to overextraction, ineffective government policies and sanctioning systems, inadequate metering and pricing, and other troubling causes.
- **Saltwater intrusion.** Much of the data and information likely exists and the need would be to better interpret the data using newer tools such as numerical simulations, predictive groundwater flow and quality modeling, and visual displays.
- **Water use efficiency and productivity, particularly for improved irrigation management.** Addresses issues related to major water allocations, particularly to irrigation as the region's major user, looking at improved, more efficient on-farm water management technologies, innovative public-private partnerships, water pricing, and other market-based approaches.
- **Integrated water resources management for climate change adaptation.** Considers the uncertain effects of future climate change, addressing the scientific and policy gaps for incorporating climate change and variability information into adaptive, integrated water resources planning and management.

Whatever the final agenda, the Network will emphasize high-profile and high impact activities. It needs to be responsive to the needs articulated by MENA scientists and policy makers. And it needs quickly to lead the research in the region by virtue of its own technical competence and because of its ability to fund and guide research in other institutions. The Network should eventually help set the region's agenda as an intellectual leader.

Assessment of Potential Members of the Network

The Design Team recommends that the research institutions and universities listed below be considered as an initial set of the Network's Centers of Excellence, based on the following recommendations:

- Interest in or commitment to the concept of a network of centers of excellence
- Operating infrastructure
- Reputation within the country and region
- Insights into the nature and seriousness of water resource issues in the region
- Established structure and staff
- In-house technical capacity
- On-going water-related programs in research, training, or outreach
- Evidence of institutional collaboration within the country, regionally, or internationally
- Record of information dissemination and outreach

- **National Water Research Center in Egypt.** Egypt is a critical country in the region and must be represented in the Network. The National Water Research Center in Egypt has broad-based expertise with well-trained staff and good facilities. Problems facing Egypt cover many of the issues facing the region generally. It would profit greatly from inclusion in the Network, opening it to research and researchers elsewhere in the region, providing a stimulating change, regional links, and an exciting research program.
- **Jordan University of Science and Technology.** The Design Team was very impressed with the intellectual vitality of the university management and their commitment to the concept of the Network. But it noted the lack of creative research and a focus on fees for services leading their water-related efforts to be entirely driven by outside donors and projects. The Network could give real vitality to the university and engage them in meaningful research opportunities that they seem not to have now. JUST and the Network would both gain much from a close partnership.
- **Royal Scientific Society in Jordan.** The Royal Scientific Society brings an international reputation, a clear mission, and a determination to play a significant intellectual and technical role in Jordan and the region. Its new strategic plan is evidence of that new, dynamic direction. Largely isolated from academic institutions in Jordan and with few apparent formal ties to other entities in the region, RSS could profit from participation in MENA WCN by broadening its playing field and circle of regional contacts.
- **University of Jordan.** The University of Jordan is already at the epicenter of a major development in the Jordan's water sector, since it has been named as the home for a new Center of Excellence in Water, Energy, and the Environment. The University has made a commitment to build and staff the new facility. The Network's launching coincides with this new entity, and the partnership between the two would bring resources and commitment to the Network and provide international links and research, training, and outreach opportunities to the university.
- **Kuwait Institute for Scientific Research.** KISR has visionary and imaginative management, a strong technical staff, extensive and impressive physical facilities, and a strategic plan for the next 20 years that synchronizes well with plans and technical content for MENA WCN. With a sizeable annual budget and serious ambitions to gain regional and international prominence, KISR is likely to be a strong, core member of the Network.
- **Agronomic and Veterinary Institute Hassan II in Morocco.** IAV is the preeminent academic institution working in water in Morocco and it has as proven record of excellence in technical areas. Its strong faculty could assist the operations of the Network and broaden its understanding of the region by covering the Maghreb and building links with Sub-Saharan Africa.
- **International Institute of Water and Sanitation under the National Office of Potable Water in Morocco.** ONEP IEA brings much to the Network as a member center of excellence. By virtue of its focus on water and sanitation, ONEP IEA complements the efforts of IAV. Additionally, its links to Sub-Saharan Africa brings African Muslim majority

countries and institutions directly into the activities of the Network. Its long-term relations with groups in Europe also increases the likelihood of their engagement and support for the Network. In return, the Network offers IEA links to the Middle East and provides new venues for their services.

- **Qatar National Food Security Program.** QNFSP enables the Network to tackle issues related to a core technical theme: water use efficiency and productivity. It brings in a country that has explicitly committed itself to being the education hub of the region. The Network would further QNFSP's interest in being a major player on the world stage, beginning with a demonstration of intellectual leadership in the region.
- **Arab Water Academy in Abu Dhabi.** The Arab Water Academy's focus is training for senior water sector managers, an area that is of obvious importance and relevance to the Network. We believe that both entities would profit from a partnership that brings together training on critical policy, management, technical issues through AWA and research through the WCN. The Academy could be a venue that strengths and enriches the WCN's policy and outreach efforts.
- **Environmental Agency of Abu Dhabi.** In terms of the desired direction of MENA WCN, the Environmental Agency of Abu Dhabi is a model government entity, valuing research and using it to develop policies and implementable applications in creative, concrete ways. Its participation would broaden the perspective of the Network by having a government entity squarely in its midst and ensure that the WCN does not narrowly focus on research. EAD also rightly prides itself on identifying innovative approaches to deal with cutting-edge issues.
- **International Center for Biosaline Agriculture in Dubai, UAE.** ICBA has charismatic and visionary leadership, but it is isolated from other entities in the region. Membership in the Network would bring regional resources to the Center which is largely staffed by expatriates. It would also benefit from stronger links to U.S. institutions, a stated interest of theirs. The Network could match ICBA's interest with IAV and QFNSP to make a very interesting team working on efficiency and productivity issues.
- **Middle East Desalination Research Center in Oman.** With additional financial support and engagement in Network activities, it could work towards reaching some of its goals in training, research, and knowledge management.
- **International Center for Agricultural Research in the Dry Areas.** ICARDA has far-reaching existing contacts in agriculture and natural resource management in the MENA region. Its reputation of working closely with national governments will help the WCN to tackle the over-allocation of water to the agriculture sector by helping with policies to conserve water and develop better water-use efficiency and productivity. As a center in the Consultative Group for International Agricultural Research (CGIAR), it regularly receives core funding from USAID that can help to complement MENA WCN. The Water and Livelihood Initiative is a new project that could provide a platform for intensified work in seven countries of the Middle East (Egypt, Iraq, Jordan, Lebanon, West Bank/Gaza, Syria,

and Yemen, all but Syria being USAID presence countries). Agriculture is the biggest water user – we need a WCN member that is intimate with this community – one that can also help bridge communications among Gulf States and other Arab countries. ICARDA is the best possible choice in the region to play this role.

- **International Water Management Institute.** IWMI has identified its research niche as being holistic and hence interdisciplinary, international, basin-scale focused, and public good orientated. Similar to the other international research centers, IWMI works closely with governments and advises on water policy, allowing it to share successes across countries. IWMI focuses on managing the impacts of land degradation on water resources by developing novel interventions that reduce the risk of water quality degradation at source, utilizing the concept of ecosystem services and appropriate institutional mechanisms involving upstream and downstream users.

Next Steps

During the coming months, the Design Committee intends to hold a numbers of events and carry out other efforts to move the launching of the Water Center Network forward:

Circulation of Assessment Report. The Design Committee will circulate this report widely to key stakeholders throughout the Middle East and North Africa, the United States, and elsewhere. It welcomes comments on and improvements of this draft version of the assessment and design report. It would like to have a final version, incorporating all comments in time for the first of several meetings with partners. Invitees to the meeting ought to have read and commented on the draft prior to that gathering.

Regional Stakeholder Meetings. The MENA WCN Design Committee will host meetings during in early 2011 in Washington and in the Middle East and North Africa. These meetings are intended to assemble the main players in the water sector through the region to discuss this design of the Network and to provide suggestions and make commitments for the Network as it moves into start-up and implementation. The first of these meetings will be with roughly 20 to 30 major figures in government, academia and research, politics, civil society, and the private sector who have the creativity, vision, influence, and commitment to play leading roles championing this regional network from across the region and prospective donors. It is critical that the launching of the Network be used as an occasion to bring together policy makers and researchers as a way of concretely bridging what has been a longstanding block to resolving water issues in the region. To that end, the Committee will host a meeting of key ministers from the region – in water, agriculture, planning, environment, public works, and/or higher education – who will form alliances with members of the Network to advance change.

Consultations with Multilateral and Bilateral Donors

During its visits to the region, members of the Design Team met with representatives of donors in Morocco, Egypt, and Jordan. It intends to expand these meetings with donors – both multinational and bilateral – to welcome their participation in defining the management

structure, research agenda, policy directions, outreach objectives, and other key aspects of the Network.

Consultations with U.S. Universities, Research Centers, and the Private Sector

The Design Committee will continue to meet with U.S.-based interested parties that can contribute much to the formation and activities of the Network. Meetings to date, for example, with the University of Nebraska have been promising and will lead to the signing of a Memorandum of Understanding between the university and USAID for future collaboration. Other USAID/ICARDA and ICIWaRM initiatives have existing networks of universities and, in the latter case, NGOs and professional organizations of water practitioners. These meetings will expand and the pace will quicken in the months ahead. Similarly, the United States will reach out to universities, research centers, and the private sector in other countries that show an interest. We believe the Network's best chances for success and longevity are based on an alliance of like-minded entities that see the time is ripe for a regional platform to build productive relationships, tackling and resolving water issues that undermine the economy and social underpinnings of the region.

Follow-up Visits in the Middle East and North Africa

Members of the Design Committee have invited many of the key stakeholders and potential Network members, but they have not yet visited Lebanon, Tunisia, West Bank/Gaza, and other countries which could contribute to the operation and programs of the Network. In addition, the Design Team ought to revisit many of the potential members of the Network to talk in more detail now that the overall concept of the Network is clear. These trips will be used to gain commitment, clarify roles, develop work plans, and begin to bring different Centers together for joint action.

1

THE CONSULTATION PROCESS

1.1 Background

President Barack Obama announced his intention to intensify engagement with Muslim-majority countries on many levels in his June 4, 2009 speech in Cairo. Creating centers of excellence was an important part of the address. This includes the proposed Middle East and North Africa Water Center Network. Secretary Clinton announced during her March 22 World Water address that such an organization would soon be established. The USG and partners are also in the process of creating new centers of excellence, some of which address aspects of energy in the Middle East and North Africa, climate issues in Indonesia, and malaria around the world. Specifically, the current centers of excellence are proposed in five areas:

- Water in the Middle East and North Africa
- Climate change in Asia
- Health
- Renewable energy
- Science policy

1.2 Center of Excellence Concept

A center of excellence provides a platform for international partnerships to address shared challenges using locally appropriate scientific and technological solutions. A center acts as a hub of innovative and creative activity that integrates efforts from multiple disciplines. It provides training opportunities that increase the pool of professional scientists and engineers with skills in the area of focus. Existing centers of excellence in government, industry, academia, and non-profits follow several different models. The USG already supports many domestic centers of excellence which could collaborate with international partners. For new Centers opened in accordance with the President's vision, it is likely the amount of new physical structures will be minimal; rather, existing aspects of facilities and institutions would be enhanced.

1.3 Current Partnerships in Progress

In partnership with other nations, the United States has already established or is in the process of establishing various centers of excellence. Two examples focus on energy. One is the Gulf Nuclear Energy Infrastructure Institute in Abu Dhabi, established in March through a partnership that includes the UAE Federal Authority for Nuclear Regulation; the Emirates Nuclear Energy Corporation; Khalifa University of Science, Technology and Research; the Department of State; the Department of Energy; Sandia National Laboratory; and the Texas University Nuclear Security Science and Policy Institute. A second is the Middle East Energy Efficiency Center, where the Department of Energy, the Department of State, and USAID are working in

partnership with the Government of Jordan to promote and enhance regional cooperation on energy efficiency initiatives.

The National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH) announced in July approximately \$14 million in first-year funding to establish 10 new International Centers of Excellence for Malaria Research (ICEMRs). The seven-year awards will establish centers in regions where malaria is endemic, including parts of Africa, Asia, the Pacific Islands, and Latin America. Teams of scientists will be conducting research in more than 20 countries. The centers will integrate clinical and field approaches with laboratory-based immunologic, molecular and genomic methods. Their findings are expected to help inform how new interventions and control strategies are designed and evaluated in the future.

The Indonesia Climate Change Center, announced after a bilateral meeting between Presidents Obama and Yudhoyono on the margins on the G-20 meeting in June, is another example of a new partnership. The U.S. Embassy and USAID/Indonesia have been working with the GOI and with the Washington interagency group to provide assistance to a proposed center to support President Yudhoyono's commitment to reduce Indonesia's emissions to 41 percent below "Business as Usual" by 2020. The USG has identified funds to support the center, as well as additional funds for other climate change programs, from FY09 and FY10 appropriations.

In addition to the significant efforts already underway, interagency teams have been developing proposals for centers of excellence on the topics of (1) water in the Middle East and North Africa, (2) climate change in Asia – the relation to the Indonesia Center remains under discussion, (3) health, (4) renewable energy, and (5) science policy. The recommendations were based on information collected from U.S. embassies in the region, the trips of the first two science envoys, a needs assessment based on current literature and data analysis, and ongoing discussions with USAID Missions about local knowledge gaps, scientific interest, and opportunities for collaboration. USAID had also considered the topic of food security, but that is not being proposed at this time. The five proposals for centers of excellence are at different stages of development.

▪ **Asia Regional Center of Excellence on Climate Change and Development (ARC)**

In 2009, USAID's Regional Development Mission for Asia (RDMA) launched a feasibility assessment to evaluate opportunities and develop recommendations for establishing an Asia Regional Center of Excellence on Climate Change and Development (ARC). The center was proposed to build local technical capacity, foster partnerships, and identify and develop innovative science and technology based approaches to build resilience to climate change and develop a sustainable low carbon future. The assessment involved consultations with more than 450 stakeholders from the Asia and Pacific region and the U.S., including representatives from the USG, national governments, regional bodies, academic and technical institutions, donors, foundations, NGOs, and the private sector. The assessment report, released in June 2010, outlines technical and capacity gaps as well as national and regional climate change priorities, analyzes existing models of centers of excellence, and presents recommendations on possible functions and structures for an ARC. Additional analyses and discussions are currently

underway to further refine the ARC concept and identify possible challenges and problems.

- **Center of Excellence for Health**

Through the creation of a Global Health Innovation Network (GHIN), the United States can establish meaningful partnerships in Muslim Majority Countries to generate and share knowledge and build human and institutional capacity. The GHIN will provide a platform for the strategically coordinated efforts of USG technical agencies and other key research partners in the public and private sector to accelerate the advancement of health research in the Muslim World. Initial network activities will support collaborative research training between institutions in the United States and Muslim Majority Countries, sustainably strengthen research capacity in institutions, and train in-country experts in high priority health research areas.

- **Center of Excellence for Renewable Energy**

The creation of a Renewable Energy Center of Excellence will fulfill President Obama's promise to "open centers of scientific excellence... that develop new sources of energy, [and] create green jobs." As climate change and energy security become pressing global issues, many countries throughout the Muslim world have begun to ramp up the number and scope of their renewable energy initiatives. These countries recognize that tapping their latent potential for the production of renewable energy will encourage future job creation, diversification of economies away from fossil fuels, and reduction of pollution and carbon emissions. Developing the capacity to address these challenges is consistent with their desire to transition to a knowledge-based society with sustained and long-term economic growth. The goal of the renewable energy center of excellence is to help build the capacity necessary to support sustainable growth in the adoption of renewable energy technologies. The center will facilitate networking among existing regional institutions to take advantage of each of their unique assets. In collaboration with U.S. institutions, the network will help build the human capacity necessary for creating solutions that are adapted to local situations, and that bring ideas from the lab to products in the marketplace. Activities undertaken at this center could include providing competitive grants, planning workshops and conferences, facilitating technical exchanges, financing entrepreneurship and partnering with the private sector, and promoting innovation.

- **Center of Excellence for Science Policy**

Many nations seek assistance in understanding how to develop and implement strategies to invest in research and education in a manner that maximizes economic and social gains. A Center of Excellence for Science Policy would have capacity-building as its primary focus, including the ability to identify S&T research and education priorities based on national needs, fund research through merit-based peer-reviewed grants, build and maintain a high quality S&T and engineering workforce, commercialize scientific developments by fostering connections between scientists and entrepreneurs, and improve policies based on evidence collected and analyzed through robust evaluation systems. Until a center of excellence for science policy can be established, avenues for developing science policy cooperation through other mechanisms are being explored. Science policy issues will be relevant for each center of excellence that is

established. In addition, USG science agencies are continually considering ways they can further enhance collaboration with their international counterparts.

1.4 Purpose of the Assessment and Design Report

This report presents the findings, conclusions, and recommendations of an interagency design committee that developed the initial concept for MENA WCN. That initial concept of a network of regional and national scientific research institutions was used as the basis for a multi-country assessment conducted in December 2009 and June 2010. The focus of this report is a design that addresses the following major elements: MENA WCN's objectives, core functions, organization and management, and operationalization. The Design Committee intends to distribute this report widely and encourages suggestions, comments, and debate concerning its content. The committee seeks broad-based consensus from key stakeholders in the Middle East and North Africa, the United States, and elsewhere and recognizes that agreement on the design will come only from open discussion and modification. It welcomes and encourages that discussion.

1.5 Assessment Methods

The Design Committee determined that direct meetings in the Middle East and North Africa would be the most accurate means of determining regional needs and levels of commitment to the concept of a center of excellence on water. A subgroup of the Committee, called here the Design Team, conducted two extensive visits to the region that included in-depth conversations with potential partners and critically interested parties in eight countries: Egypt, Israel, Jordan, Kuwait, Morocco, Qatar, and the United Arab Emirates, and West Bank/Gaza. In all, Design Team members met with more than 250 stakeholders and experts in the Middle East and North Africa and roughly 50 in the United States.

1.6 Consultations in the Middle East and North Africa

The members of the Design Team visited the Middle East and North Africa twice: for a pre-assessment visit in December 2009 and for an assessment and design visit in June 2010. By and large, the visiting team members met with individuals or small groups in the region for a more personal and open setting and deliberately avoided holding conferences at this early point in the design process. Furthermore, nearly all meetings were held on the grounds of the institution itself. This gave the team an opportunity to meet with a wide range of staff, including junior and mid-level members, and to view the facilities firsthand, particularly laboratories.

1.6.1 Pre-Assessment Team Visit in December 2009

A pre-assessment team visited Egypt, Israel, Jordan, and Dubai and Abu Dhabi in the United Arab Emirates and met with a senior representative of the Palestinian Water Authority in Amman from December 8-17, 2009 concerning a proposed Middle East and North Africa Center of Excellence on Water. The pre-assessment team of Peter Reiss (Director of USAID's Advancing the Blue Revolution Initiative implemented by Development Alternatives, Inc.) and Allegra da Silva (USAID/EGAT/ESP/IRB) visited the Middle East to:

- Update partners on the U.S. government's interest in exploring a center on water in the Middle East and North Africa;
- Explain the assessment process, which involves U.S. government interagency participation through regular and repeated discussions with partners in the region;
- Solicit ongoing partner collaboration during the design and implementation phases;
- Begin discussing national and regional needs and opportunities in the water sector; and
- Request their welcoming of a larger interagency group to continue the discussions and co-design.

The team met with 67 people from USAID Missions, U.S. Embassies, ministries and agencies, water-related international and regional centers, foreign donors, the private sector, and an NGO. The following table provides the breakdown of visits to Egypt (Reiss alone), Israel, West Bank/Gaza, Jordan, and Dubai and Abu Dhabi in the United Arab Emirates.

Main Water Challenges in Countries Visited

- Egypt is now considering itself to be a water scarce country. It is increasingly talking about the need to institute water demand management practices and to begin wastewater reuse for agriculture.
- Current hydrological studies point to severe depletion of various aquifers in the West Bank. In many areas, the amount of potable water is not known. Data sharing between the Government of Israel and the Palestinian Authority is a continuing issue. There needs to be an updated data set in many water areas that are trusted and utilized by both the Palestinian Authority and the Government of Israel in order to carry out successful master planning.
- Jordan is among the most water-stressed countries in the world. The country is currently going through efforts to examine agriculture's usage of water and introduce water conservation efforts. A main cost of water in Jordan is for energy to pump water. The Red-Dead project is promoted by the government as a way to relieve water scarcity, though costs for desalination and pumping, feasibility, and environmental impact are key considerations.
- The United Arab Emirates relies mostly on desalinated water for municipal supply. Some farming relies on the unsustainable extraction of groundwater. The country is turning increasingly to wastewater reuse and a comprehensive water strategy to deal with water scarcity and allocations. Leadership is very interested in water issues, particularly in relation to renewable energy. Strong regional water institutions include the Arab Water Academy and the International Center for Biosaline Agriculture.

Table 1
Institutions Visited in December 2009

	USAID and USAID Projects	U.S. Embassies	Ministries and Government Entities	Universities	International and Regional Centers	Donors	Private Sector	NGOs	Total
Egypt	6	5	5	1	5	1	2		25
Israel	3	3	3						9
Jordan	4		2	2	1	2	3	3	17
UAE		2	4		9				15
West Bank/Gaza			1						1
Total	13	10	15	3	15	3	5	3	67

Conclusions and Recommendations

Reactions to the Speech and the Cairo Initiative. The reaction to the President’s speech was generally very positive. The people we talked to were uniformly welcoming of a new American initiative that would reshape relations with the Middle East and North Africa, but some asked why it was taking so long to get the initiative started. They would have liked a quicker plan put in place following the speech.

Communications with USAID Missions and U.S. Embassies. Some USAID Missions and U.S. Embassies we visited were eager to participate in the development of a center of excellence and want to be in better communication and coordination with the overall process ongoing in Washington. They suggested a list of points of contact for various topics under the Cairo Initiative or one overall. Further work should be done to address embassy and mission concerns about a center that would duplicate or complicate ongoing activities in the region.

Relation between Research and Application and Policy. Discussions about basic versus applied research and the links between research and application/policy were animated and interesting. There were obvious differences among the locations visited. In Egypt, the government ministries have a hostile or disinterested attitude toward research. They say it has not been useful, little funding is set aside, and researchers have not been able to translate their work into applications. In Jordan, there is an ongoing effort to define national researcher priorities, but it is being done outside the context of the national strategies and is not being taken seriously. In the Emirates, the ties are much closer and government agencies see the utility of applied research and its policy implications. As a result, many recommended that the Center stay out of pure research and focus on the translation of research into applications and the identification of successful management practices.

Political Sensitivities to take into Account. A few people we interviewed viewed the Center as an opportunity to tackle long-term, political stumbling blocks. But most everyone recommended that the Center focus on technical or management issues and avoid politics.

The Center's Ambitiousness. The general recommendation was to start small and build on success. People recognized that the overall program would be tied to budget, but they said that trying to do too much from the start would lead to failure. They suggested selecting a narrower mandate of one or two technical areas, working with established groups, building on lessons, and drawing together successful research and practices.

Center's Mandate: Research, Knowledge Management, Skills. A central question going forward was the Center's mandate. Possibilities mentioned included:

- Supporting research (fundamental or applied?)
- Translating research into applications and adapting existing technologies into the local context
- Developing skills (capacity building)
- Facilitating networks of people and institutions
- Managing and disseminating knowledge (“best practices”)
- Creating a neutral platform for discussing difficult political water issues within the region

Emerging Themes. During our discussions, the following themes were mentioned:

- Wastewater reuse (both technologies and developing a national strategy)
- Water and energy nexus
- Adapting to changing water resources in the face of climate change
- Water valuation and water pricing
- Water governance
- Groundwater management
- Water demand management (although less than expected)

Links between the United States and Regional Entities. U.S. institutions that may be linked include but are not limited to:

- U.S. Geological Survey (USGS)
- UNESCO International Center for Integrated Water Resources Management (ICIWaRM)
- National Oceanic and Atmospheric Administration (NOAA)
- Department of Energy Sandia National Laboratories
- U.S. Army Corps of Engineers (USACE)
- Environmental Protection Agency (USEPA)

Regional and international institutions that may be linked include but are not limited to:

- International Center for Biosaline Agriculture (UAE)
- International Center for Agricultural Research in the Dry Areas (ICARDA)
- International Water Management Institute (IWMI)
- Arab Water Academy (UAE)
- Arab Water Council (Egypt)
- University of Jordan Water and Environment Research and Study Center (Jordan)
- Middle East Regional Desalination Center (Oman)

Need for Private Sector Participation. In discussions about the Center’s sustainable operation, many partners talked about the need to bring the private sector into discussions about the Center’s design at the earliest stages. The Center may be designed to incorporate the needs of the private sector, while securing partial financial support. Companies specifically mentioned include IBM and Hitachi.

The Meaning of “Center.” In our conversations, we noted that the Center has not yet been defined. It could be a physical center working through an existing entity or entities, a hub or hubs with satellites, entirely virtual, or a grants program. There was little to no likelihood it would be a new physical center, what we called ~~“bricks and mortar.”~~ We met no one who thought that the construction of a new physical center was a good idea. Everyone agreed that funds should go into programs to the greatest extent possible.

Offers of Invitation from the Region. Initially, the Design Team considered selecting one existing entity as the Center of Excellence with others as associated entities. As such, they received offers to locate that Center in each country it visited, even though it began by saying that it might be a virtual center or only a grants program. For example, the National Water Research Center in Egypt offered to make itself ~~“international.”~~ NWRC’s Central Water Laboratory at the Center said that it hoped to be a Mediterranean center. The Library in Alexandria was offered as location since its mandate mirrors the Center’s. The Israel Water Authority offered Israel as the ~~“natural location”~~ for the Center. Jordanians offered their country, including the Ministry of Water and Irrigation, Ministry of Planning, and University of Jordan. The team believed the Jordan University of Science and Technology would have, as well, had it been able to meet with them. There was interest by the International Center for Biosaline Agriculture in Dubai and the Arab Water Academy in Abu Dhabi in playing roles to be defined in later visits.

Donor Partnerships. The team met with only two donors on the trip, but their message was similar – calling for partnership with the United States. In Cairo, the Dutch representative said it was critical that the United States work with other donors to not be seen as going alone. In Amman, the Swedish International Development Agency representatives said they prefer to work on large projects in collaboration with other donors to have bigger impact. Both would like to be engaged in the design.

1.6.2 Assessment and Design Team Visit in June 2010

Members of the Design Team from a number of government agencies visited the Middle East and North Africa to discuss an initial design concept with key parties in Egypt, Jordan, Kuwait, Morocco, and Qatar. Members had lengthy interviews with management and staff of ministries and government agencies, universities, national research institutes, international centers and regional associations, donors, U.S. embassies, and USAID missions. In all, the team met with 185 individuals from 64 different entities.

Table 2
Number of Institutions Visited by Category

Countries Visited	USAID and U.S. Embassies	Ministries and Government Entities	Universities	National Research Institutes	International Centers and Regional Associations	Bilateral and Multilateral Donors	Donor Projects	NGOs	Private Sector	Total
Egypt	2	5	0	1	2	7	1	1	1	20
Jordan	2	2	2	3	2	3	2	0	3	19
Kuwait	1	1	0	1	0	1	0	0	0	3
Morocco	2	4	1	2	1	4	1	0	0	15
Qatar	1	1	2	2	0	0	0	0	1	7
Total	8	13	5	9	5	15	4	1	5	64

Table 3
Number of People Interviewed by Category of Institution

Countries Visited	USAID and U.S. Embassies	Ministries and Government Entities	Universities	National Research Institutes	International Centers and Regional Associations	Bilateral and Multilateral Donors	Donor Projects	NGOs	Private Sector	Total
Egypt	5	9	0	15	3	8	1	8	2	51
Jordan	7	3	14	20	4	2	3	0	4	57
Kuwait	2	3	0	18	0	3	0	0	0	26
Morocco	4	10	3	2	5	6	1	0	0	31
Qatar	1	3	8	6	0	0	0	0	2	20
Total	19	28	25	61	12	19	5	8	8	185

Specifically, the objectives of the June consultations were to:

- Update U.S. embassies and USAID missions about the status of the MENA WCN to engage them in the design and creation of the Network;
- Review the initial design of the Network with governments and other key partners and solicit reactions in order to modify and refine it;
- Identify sources of political support and political coverage for the Network;

- Identify and assess entities in the Middle East and North Africa that are candidates for membership in the Network;
- Meet with bilateral donors, governments, the private sector and others that are potential contributors – financial and otherwise – to the Network and initial partners to determine interest and begin to obtain commitments; and
- Develop a final design which reflects the views of stakeholders, addresses their concerns, and encourages their involvement.

Among the questions that the team asked during its visit to the region were:

- What are the target audiences (private sector, policy makers, civil society, all of the above)?
- What should the legal status of the Network be?
- What selection process will be seen as a fair and open?
- What are critical factors in selecting the hub; the Network members?
- What should be the primary benefits of inclusion?
- What should be the research and technology-transfer priorities by region and by country focused on water use efficiency and productivity?
- What is the status of current research, e.g. what is being done and who is funding research in the region?
- Where are the gaps in capacity, research, facilities, and information sharing?
- Where are the gaps in appropriate utilization of existing research results and ability to adopt new results?
- What is the organizational structure?
- What is the interest of local, regional and other non-US funders?
- Which groups should/should not be allowed to fund it? What are the implications of private sector and non-US/non-ME funders?
- What is the interest in and opportunity for the creation of an endowment or trust fund?
- How would Israel be incorporated? What are the implications of the various options?
- What are the funding options already accessed by research centers or otherwise available?

The Design Team is composed of the following members:

- John Wilson, Director, USAID, Middle East (ME) Bureau, Office of Technical Support (TS), (Team Leader)
- Jill Shaunfield, State/Near East Affairs
- Carl Schonander, State/DGA
- Scott Christiansen, USAID/ME/TS
- Kevin Price, United States Bureau of Reclamation
- William Logan, Deputy Director, International Center for Integrated Water Resources Management and U.S. Army Corps of Engineers
- David Clark, U.S. Geological Survey
- Cindy Quezada, State/Office of Science and Technology Advisor to the Secretary
- Millie Gadbois, Office of Middle East Programs, USAID/Egypt
- Kenneth Ludwa, USAID/EGAT, Middle East Regional Cooperation Program (MERC)
- Allegra da Silva, USAID/EGAT
- Peter Reiss, Chief of Party, USAID Advancing the Blue Revolution Initiative

Major Conclusions and Recommendations

Growing Impatience with the Timeframe since President Obama’s Speech. When the Design Team visited the region, it was nearly a year since President Obama’s speech. People still reacted very favorably to the speech, but there was a noticeable impatience with the speed of implementation. People wanted more concrete results faster.

Link between Research and Policy and with Application. With rare exceptions, like Kuwait, there is a wide gulf between researchers and policy-makers and applications in implementation. On the government side, those interviewed confirmed that research in the water sector was of little use for problem solving. Researchers tended to think of their efforts as very useful, but examples of applications were harder to identify.

Research Is Largely Project and Donor Driven. In universities and research institutes, research tends to be designed around and for projects. The norm is the commercialization of research in the sector whereby research entities are driven entirely by donor funds, usually in short-term efforts. The result is a degradation of research focused on narrow studies.

Shift from National to Regional Entity. Although some entities stated that shifting from a national level institution to a regional institution would be relatively simple, it appears that the process could be lengthy with multiple steps. Issues also exist concerning the ability of a national entity, albeit one with a newly gained regional status, to distribute funds across national borders. These are some of considerations arguing against transforming an existing national entity into one that could serve others across the Middle East and North Africa.

Concept of Hub and Associated Institutions. Although the Design Team tried to downplay the importance of the hub, the groups visited could not be deflected from focusing on what entity and what country would be the “winner.” The conversations therefore often deteriorated into arguments by the entity about why it should be chosen in a competition. The team’s interest in discussing regional collaboration was of secondary importance. As a result, the conversations undermined the team’s focus on collaboration.

Funds to Leverage within the Region. Some of the countries and entities visited are already making sizeable investments in water-related research, particularly Kuwait and Qatar. The Kuwait Institute for Scientific Research annual budget is \$160 million. Jordan also intends to increase investment in water research now that the government has made a commitment to launch a national center of excellence on water, energy, and the environment. These funds present a major opportunity to the Network to encourage their participation in a joint research program.

Investment in Degree Training. Countries like Kuwait are already investing heavily in graduate degrees for their nationals since the University of Kuwait does not offer masters or doctorates. Other countries, like Jordan, are heavily subscribed with graduate students from the region. This shifting and co-mingling of students across borders is healthy for the region. Vast opportunities are also available to students in the United States, but the risks are greater for their

home institutions, as university management and faculty complain that students often do not return.

Standards of Facilities. The conditions in the laboratories are quite varied. In Qatar and Kuwait, the laboratory facilities are excellent. In those entities visited in Egypt and Jordan, the physical facilities were far less impressive. The Network will need to determine to what extent it wants to upgrade facilities or expect it to be done by the host governments or institutions.

Experience with Regional Collaboration. The team found that research entities in the Middle East and North Africa were far more likely to establish partnerships with entities outside the region, particularly in the United States and Europe, than with entities in other Arab countries.

Internal Leadership for the Network. Stakeholders supported the idea of having the Network's Board of Directors reflect broad representation, including influential government leaders and experts from outside the region.

Donor Interest Is Variable. Some bilateral donors expressed an interest in the Network and are considering participating, but others said that they were concerned about the U.S. interest, or lack thereof, in inviting other donors to play a role. They wondered aloud about whether only a U.S. flag would be flying. If other donors are to participate, contribute financially, and offer technical support, the U.S. government will need to make explicit statements of welcome and identify opportunities for investment.

Role of Israel in the Network. Israel's participation was mentioned regularly. The consistent response from the team was that membership in the Network was by entity and not by country. Israel is likely to participate through the Middle East Desalination Research Center in Oman of which it is a part.

Other Conclusions and Recommendations. Some countries, such as Qatar, have progressed far beyond the donor-developing country paradigm and are looking for partnerships with the U.S. One solution may be the elaboration of a bilateral S&T Agreement. United States Ambassador to Qatar, Joseph LeBaron, would favor such an arrangement and from this basis of cooperation we might also bring Qatar into a network of centers of excellence on water.

In order to be sustainable the original concept must be broadened to include other donors, not simply as contributors of funds, but also as potential collaborators on bilateral or multilateral bases. This might mean de-emphasizing the relationship of this effort to President Obama as it leaves little thematic territory over which others might hoist their flags. It is better to have a new idea that is sustainable instead of an unsuccessful initiative bearing President Obama's name.

A decision is needed on which countries will be included, the nature of how the institutions will work together (exchanges, technology development, generation of policy recommendations, knowledge sharing, competitive grants, problem solving task forces, etc.), and management set up allowing for successful generation of results that will avoid the pitfalls of previous collaborative efforts.

A high degree of U.S. facilitation and scientific engagement is desirable since the problems encountered likely to be long-term. Therefore, the Design Team recommends the adoption of both approaches: facilitation through the management entity and S&T engagement through project and policy recommendations.

1.7 Consultations in the United States

The Design Committee held two U.S. government consultations on May 6 and 7, 2010 and one external consultation on May 13, 2010 to discuss the vision for the Network. Given the emphasis of the Network on applied water research, the Design Committee sought engagement with water professionals in the private and public sectors, as well as in academia. The Committee invited the leadership of professional organizations with significant water resources mandates, such as the Water Research Foundation (WaterRF), National Groundwater Association (NGWA), American Water Works Association (AWWA), American Society of Civil Engineers (ASCE), Environmental and Water Resources Institute (EWRI), and the Universities Council on Water Research (UCOWR). These organizations represent professionals from public and private utilities, international consulting firms, and major universities playing a leadership role in linkages with the Middle East and North Africa around water. They covered sub-disciplines including groundwater, surface water, water quality, water availability, drinking water and sanitation, remote sensing and hydro-geological modeling, water management, water policy, and education and training. The Design Committee also reached out to USG colleagues and was encouraged by the participation of colleagues from the Team's agencies (USAID, USACE, DOS, and USBR), as well as NASA, NOAA, MCC, and USEPA.

The overall suggestions from the consultation participants were 1) to add someone from the Middle East and North Africa to the visiting Design Team to join consultations and be central to the decision-making process to get buy-in, 2) ensure support at the highest political levels (including regional platforms), such as the Arab League's new Council of Water Ministers, 3) outline a plan for financial self-sustainability, including fee-for-service functions, and 4) rapidly demonstrate relevance of the Network by picking "low-hanging fruit" projects to start up rapidly and demonstrate the relevance of a MENA-U.S. platform. Examples included training on existing free software and applications for groundwater by USGS and surface water/water management by USACE, as well as isotopic analysis of groundwater (for recharge rates, age, source of contaminants). The latter involves some investment in a partner laboratory, but the technology is standard. The opportunity is in moving information (low cost) rather than people (high cost). Interested networks from the U.S. side could be quickly established, as there are many with extensive experience in the region.

Regarding the role of MENA WCN, participants suggested it should be designed so that it strengthens existing institutions in the region and supports existing practitioners by raising their profile and giving them greater entrée into politics. MENA WCN can bring together Middle East and North Africa regional and U.S. institutions to enrich and link existing activities. One participant emphasized that just as water does not exist in separation from food security and energy, the Network must also include these themes to be successful in addressing policy. Consultants suggested that partners in the MENA region would gain:

- Connections to premier U.S. research centers
- Enhanced knowledge of which partners are valuable to work with
- Access to U.S. research

Partners in the United States would gain: access to innovations developed in the Middle East and North Africa that are of use to counterparts in arid regions of the United States for dryland and crop management; linkages to universities and networks with tremendous opportunities, especially in terms of applied research; and long-term partners in the States and MENA region for educational exchange and collaboration.

One major challenge voiced for the United States is the need to train U.S. engineers for a global future. The Network could play a role to allow U.S. students to learn both technical and cultural understanding to maintain U.S. leadership in science and engineering. This exchange can happen virtually. For example, the NSF-funded, open-source WaterHub platform brings together academic, NGO, end-users, policy-makers, and industry to share information, data, and tools. Students in the U.S. are linked with students in the Middle East and North Africa who then share designs virtually on a weekly basis. The U.S. National Groundwater Association's network may be a good platform to build on as it allows a free exchange of insights and access to other people's work.

Participants stressed that the Network should bring partners to the United States as much as possible to foster relationships and trust. One participant requested revising the goal of the Network to emphasize science and engineering tools upfront and felt it would be a mistake to emphasize policy because adapted capacity in science and engineering is lacking in the region. Another participant emphasized that the Network should conduct a basic research activity to build innovative local solutions that can be exchanged between the United States and the MENA region.

Participants pointed out that any technical challenge in the region has a possible counterpart match in the United States. While specific challenges in the region are country-specific, the top challenges are: wastewater reuse, national water management strategy, and groundwater quality monitoring. Reuse of treated wastewater is a priority for the United States and for the MENA region. In MENA, infrastructure is variable, even within advanced countries, with the main barriers being upfront investment in properly designed infrastructure and long-term investment in the agencies to maintain the infrastructure. On the research and policy side, some countries have fledgling programs while this is a strength of the United States, both among private sector water managers as well as research institutions. Additionally, national level examination of strategic water management and planning is an ongoing challenge in the Middle East and North Africa, where high quality fresh water is allocated to irrigated agriculture, cities are water-stressed, and groundwater is over-tapped. Monitoring groundwater quality is generally insufficient and therefore presents an opportunity for good fundamental applied research.

The WCN could involve a rotating leadership through various partner Centers. A separate technical advisory group would be the appropriate group to oversee the technical operation of the Network. The Network design will need to involve an expert in international institutional legal arrangements to ensure harmonization of priorities and sharing of information, including data.

The Nile Basin Initiative (NBI) is a successful example of a distributed network with hubs in different regions, training Centers, and sectoral initiatives and academic involvement that is beginning to happen. NBI is successful because it addresses a critical need for the region. The Yarmouk River, Disi Aquifer, and the Tigris and Euphrates rivers are really one water system and if the countries that depend on them are going to create a sustainable framework, then they need to consider the whole picture. This may prove to be a leverage point for defining a concrete initiative of relevance. One issue that the MENA region and the United States can work on collectively is climate change's effect on water availability as it is a transboundary/international issue that does not imply an upstream/downstream context.

One participant suggested that an annual or bi-annual conference to share the latest technical updates would give the Network visibility. The U.S. President's Emergency Plan for AIDS Relief (PEPFAR) Program created an initially USG-only conference and subsequently expanded to include international partners, which has been seen as an extremely positive component of the program.

This Network could also help to serve as a link between existing U.S. government initiatives. The Network would be a complement to the Millennium Challenge Corporation's (MCC) activities, which are designed to be reactive to country demands. In the region, MCC Jordan's compact is 100 percent water-related and the MCC Morocco compact has a substantial irrigated agriculture project (water resource management). MCC sees many proposals with a traditional mindset, which, if the Network helped to change over time, could help generate more interesting proposals.

Participants suggested that the Network's initial activities could focus on the tool of remote sensing and build on the NASA Resources Program, which funds projects that engage end users to solve their problems using NASA's "decision support tools." Some examples of existing projects that could be built upon or expanded include: the Nile Basin Initiative, Himalayan water resources, and Famine Early Warning Systems Network (FEWSNET). In the US, examples of programs that may be models for the Network include the National Integrated Drought Information System (NIDIS), which monitors drought at the county level, and a NOAA project at the University of Nebraska at Lincoln that integrates a range of data.

One area of NASA's partnerships in the Middle East and North Africa region that already partners with USAID is NASA's Middle East and North Africa Land Data Assimilation System (MENA-LDAS), a supercomputing facility under construction at the International Center for Biosaline Agriculture (ICBA) in Dubai, United Arab Emirates. The MENA-LDAS facility will allow remote sensing specialists to model regional water availability through NASA's technology employing remotely sensed data to monitor the water cycle via groundwater, surface water, and evapo-transpiration and also to map agricultural land use. This is used for water and land management decision-making, such as understanding needs implied by long-term, signaled climate trends or short-term weather forecasts. The tool allows researchers to demonstrate to policy-makers how conditions change over time on the local scale using archived data and how it relates to water cycle and land use changes. NOAA has complimentary programs to NASA, such as Geonetcast. The National Sea Grant College Program is a model research grants program.

NOAA also supports a low-cost weather data collection apparatus (\$10,000 per system) with satellite capability.

Participants stated that the Network will need to address financial sustainability from the outset and offered up the Bangkok Emergency Disaster Response Center as an example of a self-sustaining center started by USAID. The Center markets services and had USAID support withdrawn upon attaining self-sustainability. On the other hand, participants cited a center in Latin America that USAID created and for which it is still paying. Unless the Network receives an endowment or trust fund, it will need to market services and require a business model to outline how the Network can do this, such as a USAID project in Jordan that focused on utility services and certification. Participants suggested that a similar approach would be one where the whole region would draw on and pay to take the Network's training and further explained the need to create a financial structure that combines fees and subsidies. For example, participants from the Gulf countries could participate in the training for a fee, while partners from countries with less robust economies could participate for free.

Participants described another approach to financial sustainability used by the U.S. National Groundwater Association, which focuses on three areas: membership, publishing, and events, such as conferences, short courses, and trade expositions. Membership is attractive to member organizations because the association has a strong advocacy role. The U.S. Water Research Foundation is sustained from utility memberships that buy-into centrally-funded research. The benefit of this model is that the users demand its existence and relevance to application.

It would be ideal to go out with an open tender to be part of this Network, along with a requirement for marketable skills to join. Additionally, an effort must be directed towards including the private sector so that they have a role to play and an interest in participating.

1.8 Consultations with the Consultative Group on International Agricultural Research (CGIAR)

The International Water Management Institute (IWMI) and the International Center for Agricultural Research in the Dry Areas (ICARDA) are part of the 15-center CGIAR network, funded by USAID and other donors.

Colin Chartre, Director General, IWMI, believes the Network should be strategic and run like a think-tank, based on commissions. It should be isolated from government politics and bureaucracy. He encourages linkage with IWMI as a strategic partner.

IWMI is engaged in four pillars of work: (1) water availability, (2) water productivity, (3) water and health, and (4) water and society, including pricing and transboundary issues. Activities carried out in these areas are vast, and range from provision of water supplies, to paid environmental services schemes, to maintaining dams with less sedimentation, to land erosion mitigation, to wastewater reuse, to multiple use systems, such as drinking water with irrigation drip systems.

IWMI engages with many players in the MENA region and wants to expand its partnerships. IWMI has a number of world-renowned technical staff who could be brought in for project collaborations and leadership. IWMI is doing transboundary water work in the MENA region. In Pakistan, water contamination and wastewater reuse are key areas of engagement. IWMI and ICARDA staff are working on Iraq irrigation and water quality in central and northern Iraq with Australian funding. IWMI has done a great deal of work in the Nile basin and has published a report with IRD on changing flow in the Jordan River. IWMI has launched an innovative project at a mock-up stage in Sri Lanka and Nepal is a live database on water usage and demands based on land observations, in collaboration with the Australian Bureau of Meteorology. This type of project could be expanded.

Mahmoud Solh, Director General of ICARDA recommended that the proposed Network be a virtual center with a steering committee of main partners, including the Arab Water Council, the Arab Water Academy, the International Center for Biosaline Agriculture, IWMI, and ICARDA. He argued that each of these Centers has a comparative advantage, in education, policy, salinity, wastewater reuse, basin management, etc., which can be linked together by the proposed Network.

ICARDA is a premier water and agriculture research institution with extensive programs and partnerships with regional impact. In addition to pilot projects, ICARDA carries out water policy projects, in the areas of (1) integrated water and land management, (2) social, economic, and policy research, (3) crop production improvement and stress tolerance, and (4) diversification and sustainable intensification of agricultural production systems. ICARDA has a Dubai office which does regional water programs in the Gulf.

Dr. Solh highlighted the following major strategic areas for focus in the region: (1) creating conditions for sustainable use of shallow aquifer resources, (2) enhancing use of 'marginal' water and water harvesting (especially in Lebanon), and (3) enhancing economic output from on-farm water productivity.

One program which has gone through extensive planning and is now entering the launch phase is the Middle East Water and Livelihoods Initiative, a consortium that has renewed relations between U.S. universities and Middle Eastern institutions, with results-based planning and a bottom-up focus, exploiting comparative advantages of each partner. Its central goals are integrated water and land use management, enhanced knowledge, and improved rural livelihoods.

1.9 Major Observations

The following are brief portraits of the countries visited, in terms of their water sector, research capacities, and interest in participating in the Network.

1.9.1 Egypt

Egypt lays claim to the region's largest population, is home to many universities that have historically trained a huge cadre of water sector experts and practitioners from the region, and is positioned as the lowest riparian of the Nile Basin with an extensive network of irrigation and

water delivery systems. It is a force within the region, not to be taken lightly. Under its Ministry of Water and Irrigation, it houses 14 water-related research Centers. Under its Ministry of Housing and Utilities, it oversees 25 large water supply and sanitation utilities run by a quasi-privatized holding company, and a new water regulatory agency. As in many of the region's countries, irrigation is the preponderant user of water, and agriculture is undoubtedly the largest employer. The Ministry of Agriculture and Land Reclamation continues to be one of the government's largest entities but much of its thinking is devoted to old problems where resolution is finally making some headway, such as a formerly rigid imposition of crop rotation and limitations. It is water that has made Egypt what it is, and it has a complex bureaucratic structure to match its age old water systems.

The gap between policy and research remains wide, and in some areas is non-existent. Change is slow. Little if any cutting edge research is being carried out in research institutes or in universities. And government agencies complain that current research does not solve their problems. Small pools of research funds from budget lines of agencies or ministries, when they do exist, largely go untapped. For the most part, research is stagnating, and for this reason Egyptian government institutions have welcomed the appearance of the Network and seem ready to play an active role. Egypt faces serious problems in the near future, with an ever expanding population that is increasingly urban in nature, further stressing the water supply and sanitation infrastructure. The team found that Egyptian officials were discussing the need for wastewater reuse for agriculture and for water demand management. The importance of water conservation and more careful water use have taken on greater seriousness in recent years. If some predictions about climate change are correct or even only partly correct, Egypt also faces possible disasters along its Mediterranean coast and the northern delta. Some believe it will be flooded in the coming decades with a rise in sea levels. This change in thinking within the sector could offer great opportunities to both the country and the Network. Undeniably rich in talented people, Egypt could regain its position as an intellectual leader in the regions if actions match words.

1.9.2 Israel

Representatives of the Israel Water Authority who were interviewed in December 2009 suggested that the Network focus on convening intensive, high level conferences and professional meetings, which does not happen now. It could also organize short courses of two months duration for students. To succeed, the Network should have a technical focus and keep a low profile without a lot of publicity. It will not succeed if it becomes too political and focuses on topics like transboundary water sharing. Outside of the Middle East Regional Cooperation Program (MERC) and EXACT, created under Oslo 2 for database management in 1995, the Middle East Desalination Research Center (MEDRC) is the only regional platform in water that includes Israel. MEDRC has received \$30 million ten years ago as part of the Peace Process to fund studies.

1.9.3 Jordan

The Hashemite Kingdom of Jordan exports highly trained professionals around the world; yet the Design Team was repeatedly told that it is the third most water scarce country per capita in the world. It has world class infrastructure; yet needs assistance to bring new water to its capital

through mega-projects such as the Red-Dead Seawater Desalination Project. It has a number of institutions that could host a “hub” for a water center within the MENA region; yet, within a few consultations, its water experts indicated that a number of Jordanian water institutions working together could lead to robust S&T advances much more quickly than one lead institution.

Jordan is managing water scarcity through the development of their people, institutions and infrastructure. Much can be learned by other countries in the region and around the world. It is centrally located and has direct travel connections with many of the regional countries and western capitals. It has good relations in the region, relaxed visa requirements, excellent security, and moderate political views.

A number of its citizens receive degrees in-country and then pursue advanced degrees in Europe and the United States. It is not unusual for graduates to pursue careers outside the country. Many have risen to prominence outside Jordan. Government ministries lose some of their best and brightest to the private sector to higher paying jobs. Ways to retain talented employees, such as internal institutes not subject to pay caps, are being investigated.

Water supply issues are so critical that the capital has had to augment its supplies by importing water from long distances. Currently, the Red-Dead Project is being studied by the World Bank, as well as by the country itself, since there are no new sources of water.

Through donors working with institutions in the country, water demand management and conservation are being pursued. As in many countries within the region, policies dealing with tariffs, cost recovery, groundwater use, and agriculture are difficult to implement. There appear to be opportunities to work with other donors especially the Europeans and UNESCO to complement their initiatives.

Generally, professors at universities are under pressure to publish for promotion and tenure. The linkages between the universities and government ministries could be strengthened by supporting more applied research.

Discussions in Jordan quickly indicated the complexity of designating a hub to lead a center of excellence. Each entity brought strengths and weaknesses. Universities and other research organizations have a number of water experts and institutes that can dig deeply into science, technology, and policy.

The government has immediate issues and severe budget constraints balanced by the need to implement practical solutions which may be unique for Jordan’s particular situation.

Strengthened relationships will lead to new discoveries and more rapid implementation of solutions to pressing problems. The discussions in Jordan indicated that designating one organization in any country to host a center of excellence would lead to lost opportunities to strengthen institutions within and between countries in the region.

1.9.4 Kuwait

Kuwait is demonstrating its strong commitment to higher education. Since the University of Kuwait does not offer any graduate degrees, Kuwaiti students are pursuing advanced degrees in other countries, including the United States and Europe in large numbers, and government officials estimate that the government spends \$50 million monthly on students pursuing foreign degrees.

Kuwait's premier research institution, the Kuwait Institute for Scientific Research, has a yearly budget of roughly \$160 million. KISR is actively raising its international profile. It has spent the past three years developing a strategic plan that will reorganize KISR along several lines of centers of excellence. Kuwait has been a world leader in desalination. KISR seeks to reclaim its regional leadership role through the operationalization of its 20 year strategic plan.

1.9.5 Morocco

In Morocco, water is managed at the basin level. In each major basin, the water provider is a basin-level management entity. The water users are the irrigation basin-level water management agencies (85 percent of consumption) and the municipal drinking water utility (15 percent of consumption). In some areas, farmers are highly involved in water management, pricing, and billing.

Water has been recognized to be the key component of economic growth in Morocco at the highest levels. There are three strategic programs in Morocco with large water components: the National Water Savings Plan, the National Water Plan, and the Green Morocco Plan (PMV), which all have a focus on agriculture.

Investments are promised in irrigation (drip irrigation, including up to 100 percent subsidization), wastewater treatment and reuse, desalination, infrastructure for north-to-south water transfer, large and small dams, pricing structures, efficient/resistant crops, modernization, expanding cultivated land, subsidies for larger producers working with smallholders, and export niche crop development.

USAID/Morocco was enthusiastic about the vision of the Network vis-à-vis the Agency's evolving role in development. Morocco is transitioning from traditional "developing country" status. Moroccan institutional and intellectual capacity exists to guide development within its own borders and within the region. There would be a tangible opportunity to engage Morocco as a partner. The Network provides synergy with USAID/Morocco programs, especially the multi-year USAID Moroccan Economic Competitiveness Program that was just launched.

USAID/Morocco and DAI did not arrange meetings with Moroccan Ministers; rather, we met with technical Directors within Ministries. Upon development of a detailed proposal, USAID/Morocco will engage Ministers and the regional platforms.

Morocco offers the following strengths to the Network:

- Agronomic and Veterinary Institute Hassan II (IAV) and the National Office of Potable Water (ONEP) International Institute of Water and Sanitation offer excellent training and research facilities and programs for agricultural water technology and management (IAV) and water and sanitation utilities (ONEP) in Morocco and western Africa. IAV enthusiastically laid out a convincing case in a multiple-page proposal and presentation for how it can benefit to/from the Network around research and training in a variety of subjects, and would be interested in participating in the Network's board.
- National Office of Potable Water (ONEP) International Institute of Water and Sanitation. Substantial capacity building offerings and training facilities for utilities in Morocco and throughout Africa.
- National Institute of Agronomic Research (INRA) and University Consortium with strong research collaborations around drought-resistant crops, including with the International Center for Agricultural Research in Dry Areas, ICARDA, which has an office at INRA.
- National Meteorological Center is technically powerful in computing and focused on outreach. In the past they did a big project with USBR on cloud seeding for snowpack. The center is now training other centers in Africa on this technology.
- National Center for Remote Sensing (CRTS) with demonstrated pilot projects in remote sensing for water management with various U.S. partners.

Morocco is a natural node for francophone West Africa, as well as European interest in this region. Morocco sees itself as part of Francophone and North (or even West) Africa, rather than the Middle East. This is important in substance and in nomenclature. For example, the Design Team was advised to include North Africa in the Network's name. Several entities offered that Morocco would be a natural sub-regional locus for the Network to provide a bridge to West Africa, as well as to European interest in this region.

Morocco has gaps and would benefit from learning from best practices in the following areas: institutional relationships/jurisdictions, e.g. around introduction of water reuse, climate change implications for water management, water valuation, savings, and aquifer management, widespread farmer stakeholder participation in water allocations and decision-making, pedagogy for farmer involvement and outreach, public outreach campaigns and educational programs for water conservation.

With regard to funding, international and domestic partners will participate in supporting the Network if relevance is immediately demonstrated. ISESCO was interested in putting it in their 2011 science budget, currently being drafted; they asked for an MOU and specific budget requests ASAP. ISESCO has excellent convening power in the region; we should plan a joint event with them to start a relationship. Other potential funding partners include African Development Bank and Moroccan government ministries and research entities such as IAV and INRA. Many of the representatives we consulted stated the Network should be based on cost-sharing between donors and end users.

Several partners reiterated that the Network should have a strong central unifying entity. There needs to be a central office to actively facilitate collaborative activities between participants in the network. It would be very important to have a U.S. government presence initially.

The Network must include a component to serve the real needs of end-users and provide end-products for application. The Network must facilitate end-users' access to the benefits/lessons learned from the network. The Network should have an outreach program that involves all educational levels from elementary school to advanced research level. If the Network focuses only on the highest levels it will not have the public diplomacy impact that is a key component of Global Engagement.

1.9.6 Qatar

Qatar, along with its fellow Gulf States, could have a very important role to play in a Middle East and North Africa WCN. Its combination of a healthy economy, a forward-looking, well accepted and broadly publicized National Vision, relatively new but rapidly developing science infrastructure and institutions, and a generally enabling environment for international research, including funding, are all encouraging signs for Qatar's potential role in the network.

The global financial crisis has not impacted Qatar as much as many of its neighbors, the United States or Europe. In fact, it has maintained nine percent GDP growth in 2009 despite a slowdown in investment and development projects. Oil and gas have made Qatar the second highest per-capita income country globally. Its proven oil reserves can continue output at current levels for 37 years, and it has about 14 percent of the world's natural gas reserves (CIA 2010).

The Qatar National Vision 2030 (Government of Qatar 2008) may be unique in that a broad spectrum of water scientists and engineers in Qatar are aware of its existence and implications for their work. Internationally, it calls for a "significant international role in cultural and intellectual activity and scientific research"—especially in the Gulf and among Arab states. One of the four "pillars" of the document is the environmental pillar. The report notes that this "will be increasingly important as Qatar is forced to deal with local environmental issues, such as the impact of diminishing water and hydrocarbon resources, and the effects of pollution and environmental degradation, as well as international environmental issues such as the potential impact of global warming on water levels in Qatar and thereby on coastal urban development." International cooperation is part of the vision, including "Contribution towards international peace and security through political initiatives and developmental and humanitarian assistance." Qatar's vision is clearly expanding beyond its borders.

The first pillar of the National Vision—human development—states that "Qatar aims to build a modern world-class educational system that provides students with a first-rate education, comparable to that offered anywhere in the world." Evidence of progress toward this goal in the environmental and hydrologic sciences is quite visible in Doha. Examples include:

- World class infrastructure at the Qatar Science and Technology Park (QSTP), home to the ConocoPhillips Global Water Sustainability Center;

- The new but expanding Qatar National Food Security Program (QNFSP); it has a highly qualified international staff and will have a major water component in its research and capacity-building efforts; and
- A variety of branch campuses of universities from the United States and elsewhere, including Texas A&M University. Enrollment of women is rising rapidly, and has reached 40 percent at the Texas A&M campus and even 70 percent in some engineering programs at Qatar University.

The primary Qatari funding source for research in water is the Qatar Foundation's Qatar National Research Fund. The QNRF provides grants up to \$1.05 million over three years to a range of partners, with 65 percent going to domestic institution and up to 35 percent for the outside partners. It funds regional research, and is willing to consider megaprojects. QNRF administers funding for original, competitively selected research and fosters collaborations within academia, and through public/private partnership. Although QNRF actively seeks internationally recognized researchers, it is dedicated to funding research that meets the needs of Qatar.

Food security appears to have a very high profile in Qatar, with interest and support reportedly extending to the crown prince. The U.S. mission has also shown an interest in combining water and food security. Solar powered desalination and inland desalination with zero liquid discharge were mentioned in several venues, and Qatar is a member of the Middle East Desalination Research Center. Recycling of wastewater, primarily for landscape use and potentially in combination with aquifer storage and recovery, was also discussed. However, the unique role of Qatar may be in recycling of so-called produced waters from petroleum production; this will be a major thrust of the ConocoPhillips Global Water Sustainability Center, for example. Finally, there is some interest in the social science side of water, especially on the demand management side. Surface water topics are limited; there is essentially no surface water in Qatar.

Qatar has demonstrated its seriousness in increasing its scientific and educational capacity, and an increasing interest in engaging regionally and beyond with financial assistance. It appears to be interested in being a partner in collaboration rather than simply a partner in funding. There is mutual interest in an S&T Agreement between the United States and Qatar to formalize our bilateral relationship against which we can also create a development partnership as a part of the Qatari vision for its role in the region. Which of the various institutions the team visited in Doha might be best adapted to be part of the water network depends on the theme. If the emphasis is on water for food, then the QNFSP could be a good partner. Reuse of produced water is the theme of the Global Water Sustainability Center. In either case, Texas A&M takes its extension role seriously, and could play a role in developing training materials, online short courses, etc. Qatar University would also be an important partner.

1.9.7 United Arab Emirates

The United Arab Emirates involves several key elements in partnership – UAE government leadership in linking research to policy (Environmental Agency of Abu Dhabi), strong technical and training institutions (the International Center for Biosaline Agriculture and the Arab Water Academy), and a strong commitment to the Global Engagement by the U.S. Embassy. ICBA

has a strong technical focus, carrying out applied research on the use of saline water in agriculture, developing new salt-resistant crops on the premises of ICBA, and transferring these results globally, with joint projects with partners in 68 countries. The current research strategy is focused on integrated water resources management (IWRM) using marginal water (saline water and treated wastewater). ICBA recently has been commissioned by the emirate-level and federal governments in UAE in water and wastewater strategy and policy planning. ICBA's recommendations for such national strategies are based on empirical evidence and applied research in areas where evidence is lacking. ICBA could offer strong leadership to the Network in linking research to policy.

ICBA was created in 1999 with funds donated by the Islamic Development Bank (IsDB) and a 100 hectare land grant from the government of Abu Dhabi. It receives ongoing financial support from IsDB, EAD, the UAE Ministry of Environment and Water (MOEW), the International Fund for Agricultural Research (IFAD), the Arab Fund for Economic and Social Development (AFESD), the Asian Development Bank (ADB), the OPEC Fund for International Development (OFID), the European Union, and various research institutes.

ICBA notes it would benefit from more links with first class institutions in the United States for exchange of technologies and management techniques, and modification of these for the local context. ICBA's links with U.S. agencies has been mainly with USDA, which has played an advisory role, such as the USDA Salinity Laboratory, donated 80 percent of the 9,000 germplasm accessions held at ICBA, and cooperated for four years on a soil taxonomy system for the region. Recent collaboration with USAID and NASA has launched the creation of a regional MENA Land Data Assimilation System (MENA-LDAS) to be housed at ICBA which will assimilate remotely-sensed satellite data with land-based observations for regional water management and research.

EAD has made a strong priority of linking research to policy. Secretary General Majid Al Mansouri said water is "close to his heart," has the backing of Mr. El Bawardi who is head of the Executive Council of Abu Dhabi, and offered his support for the Network.

Abu Dhabi is the only emirate in the UAE with an environmental agency, with the other emirates following its lead. Other water-related agencies in Abu Dhabi are the Abu Dhabi Water and Electricity Authority (ADWEA), the water supplier which works closely with EAD, and the Abu Dhabi Regulation and Supervision Board (RSB). The Secretary General has made clear that Abu Dhabi would like to play a leadership role in water, climate change, environmental data management, and environmental information. EAD develops environmental policies for Abu Dhabi, including establishing a permitting process for well drilling, water quality monitoring, environmental health, fish stock assessments, and soil surveys. Its future role is in policy, regulation, and monitoring, including environmental health. In the area of irrigation, there is a push to use treated wastewater as the main source for agriculture in the next 5 years. Abu Dhabi may restructure water resources and has talked of creating a water center of excellence in the UAE for dealing with more strategic use of the reserve, groundwater extraction, and new technologies. EAD is working with ICARDA on policies and demonstrations of best practices such as xeriscaping. EAD is also building a model that saves 60 percent on water and on energy, targeted date of completion May 2010.

EAD does applied research through its Policy and Strategy Sector, which has focused on three areas for the coming three years: (1) health codes for all sectors of Abu Dhabi – an area of interest of the Executive Council, (2) fuel consumption for the transportation sector, and (3) conversion of trucks and buses to use biodiesel. Mr. Al Mansouri supports the idea of a Network that is not a large physical entity, the same approach of the Arab Water Academy (AWA).

The AWA is going through strategic planning for 2010-2012. It has set out to provide executive education for leaders, senior professionals and policy-makers from the public and private sectors. The Academy envisions its core business and identity will be to offer nine international courses a year along with extension of this training to national level "exchange platforms" which will extend courses to a wider stakeholder audience. The AWA will be governed by the Board and a Technical Advisory Committee and include a small staff, comprised of the director, a program officer, a communications and marketing officer, a finance officer, and an office manager. The AWA can be a strong partner in linking the Network to training and professional development for decision-makers.

1.9.8 West Bank/Gaza

Although the team did not visit West Bank/Gaza, it did meet with a senior official in the Palestine Water Authority in December 2009. The needs in West Bank/Gaza are longstanding and serious. They include: conflict resolution in water, access to better drinking water, wastewater treatment and reuse, desalination planning, capacity building of the Palestinian Authority in the water and sanitation sector, and improved data use and master planning in water and sanitation infrastructure. The way that the Network proceeds in future discussions is critical. This view was echoed by USAID/West Bank and Gaza which advised that any future bilateral meetings should be organized through the Palestinians.

2 WATER CHALLENGES IN THE MIDDLE EAST AND NORTH AFRICA

2.1 Water Constraints in the Middle East and North Africa

Water touches all aspects of people's lives and plays a central role in every country's progress. Its availability and quality have a direct impact on food production and nutrition, urban development and growth, income generation and livelihood, and human health and hygiene. As a moving resource, water links mountains to lowlands and urban populations to rural upland dwellers. Its management reflects the strengths and weaknesses of local, national and international governance systems and the relationships between countries that share water resources. Water can serve as a good medium for engaging citizens in participatory planning and governance around watershed protection and water management, encouraging greater transparency of local and national institutions, and promoting more equitable access to water and related services. Financing water-related infrastructure is a way to develop innovative, pro-poor, and more sophisticated financial markets. Strategies to improve the management of surface and groundwater are proving to be effective vehicles for engaging countries in dialog and partnerships that establish the foundation for broad-ranging cooperation on resource use, mutual security, and trade.

Nowhere is water more important or more scarce than in the Middle East and North Africa which controls 70 percent of the world's known oil reserves but has less than one percent of the world's renewable freshwater resources. The region is defined largely by drought and desert and suffers from a scarcity of fresh water, uneven availability, a growing gap between supply and demand, deteriorating water quality, and predominant agricultural water use. The Middle East and North Africa is vulnerable to the impacts of climate change on its water resources. Temperatures may rise by two degrees Centigrade over the next 15 to 20 years causing river runoff to decrease by 20 to 30 percent in most of the region despite increased flooding risks from year-to-year melting of snowpack. Decreasing precipitation and higher temperatures will increase evapo-transpiration. The frequency and intensity of droughts will intensify and severely affect the ability of Middle East and North Africa countries to manage their freshwater resources and coastal zones.

Home to five percent of the world's population, the region is classified as a water scarce region with an average annual per capita water supply of 606 cubic meters in 2005 and will likely fall further into "absolute" water scarcity (< 500 cubic meters per capita) by 2030 based on current trends. Extreme economic water shortages exist in places like Jordan and Yemen that had less than 160 cubic meters and 100 cubic meters per capita in 2005. Population growth rates are high, averaging 2.1 percent, increasing pressure and competition for scarce water resources that can exacerbate tensions in a region with a history of conflict. Table 4 highlights the estimated

population growth between 2005 and 2030 with water stressed and water scarce countries like Iraq and Egypt growing by 38 and 23 percent in 25 years, respectively.

Table 4
Population and Economy

	Population in 2005 (thousands)	Estimated Population in 2030 (thousands)	Annual GDP (USD billions)	Per Capita GDP (USD thousands)	Percent of Agriculture Sector Contribution to GDP	Percent of Population Economically Active in Agriculture	Labor Force Employed by Agriculture
Algeria	33,858	44,726	173,882	5.14	8.3	9.1	23.3
Bahrain	760	1,064	15,828	20.8	0.5	0.4	0.9
Egypt	80,061	104,070	162,818	2.03	14.1	8.6	30.8
Iraq	29,486	47,376	12,600	0.43	9.6	1.6	8.3
Israel	6,932	9,160	199,498	28.8	1.8	0.8	2.3
Jordan	5,941	8,554	20,013	3.37	3.1	2.0	10.1
Kuwait	2,851	4,273	112,116	39.3	0.3	0.5	1.1
Lebanon	4,162	4,925	28,660	6.89	6.7	0.8	2.8
Libya	6,169	8,447	99,926	16.2	4.2	1.3	4.7
Morocco	31,224	39,259	86,329	2.76	18.8	10.0	33.1
Oman	2,726	3,865	35,729	13.1	2.1	11.6	33.5
Qatar	1,138	1,638	52,722	46.3	0.1	0.6	0.9
Saudi Arabia	24,680	37,314	467,601	18.9	3.2	2.3	7.4
Syria	20,504	29,294	55,204	2.69	18.3	6.8	26.2
Tunisia	10,069	12,529	40,180	3.99	11.3	7.8	23.1
Turkey	73,004	92,468	794,228	10.9	9.7	12.0	43.3
UAE	4,364	6,753	163,296	37.4	1.1	2.2	4.0
West Bank/ Gaza	4,017	7,673	4,002	1	9.5	3.0	11.0
Yemen	22,269	40,768	26,576	1.19	9.7	10.1	46.4

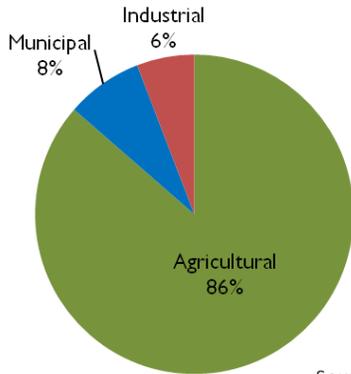
Source: FAO Aquastat. Estimated Population in 2030 figures based on UNESA Population Division forecasts.

Conflicts over water are endemic in the Middle East. The region has some of the world's most important international river systems, including the Nile, Jordan, Tigris, and Euphrates and enormous nonrenewable groundwater resources in the Nubian Sandstone Aquifer shared by Egypt, Sudan, Libya, and Chad, and the Disi Aquifer shared by Jordan and Saudi Arabia. But there are no transboundary agencies for surface or groundwater regulating use and coordinating planning. Few treaties or agreements are in place to formalize rights and access along the Nile, Jordan, Tigris and Euphrates, and there are excessive withdrawals from the Nubian Sandstone and the Disi aquifers. Still, there are some promising developments. After decades of no interaction, Tigris-Euphrates riparians are holding high-level talks, and Jordan and Saudi Arabia recently signed an agreement to regulate drilling distance from the border for the Disi Aquifer.

Worsening the contentious management of transboundary watercourses and aquifers is the excessive withdrawal of water in the region. As indicated in Figures 1-6, current water withdrawal levels are rapidly outstripping average annual renewable freshwater supplies. Withdrawals for inefficient agricultural production often dominate total water withdrawal limiting water availability and quality for other uses, most notably drinking water. Freshwater withdrawals as a percentage of total annual renewable freshwater supplies (MDG Indicator) are extremely high in the smaller Persian Gulf countries like Bahrain, Kuwait, Qatar, and the United Arab Emirates. Yet, these rates are also extremely high for countries that are less capable of

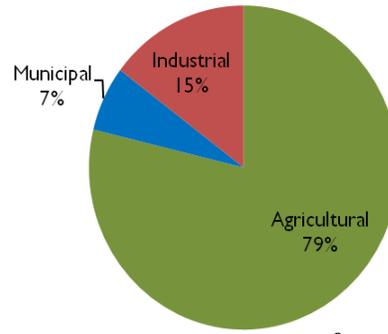
adapting to fast dwindling supplies such as Jordan, Libya, Syria, West Bank/Gaza, and Yemen (Table 5).

Figure 1
Water Withdrawal by Sector
Egypt
Total 68,300 million m³



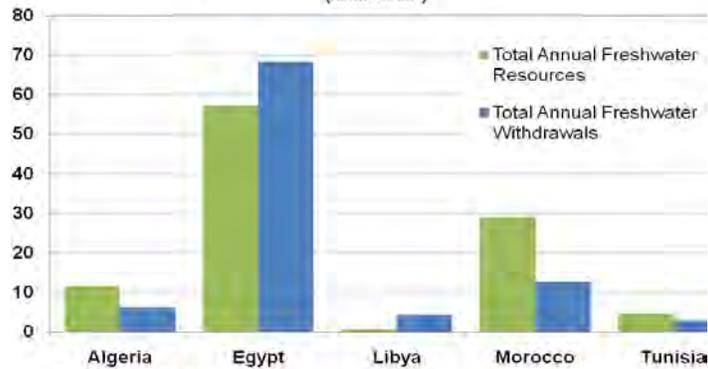
Source: FAO Aquastat

Figure 2
Water Withdrawal by Sector
Iraq
Total 6,600 million m³



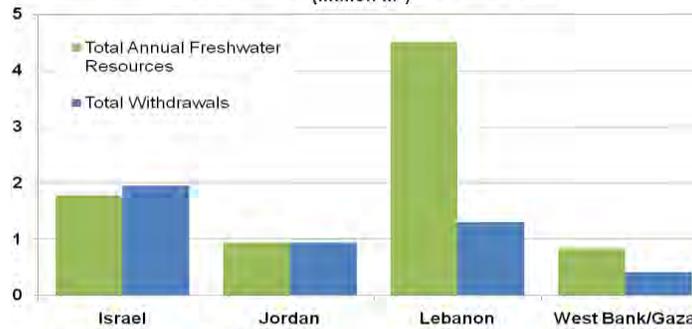
Source: FAO Aquastat

Figure 3
Water Resources and Withdrawals
Algeria, Egypt, Libya, Morocco, and Tunisia
(million m³)



Source: FAO Aquastat

Figure 4
Water Resources and Withdrawals
Israel, Jordan, Lebanon, and West Bank/Gaza
(million m³)



Source: FAO Aquastat

Figure 5

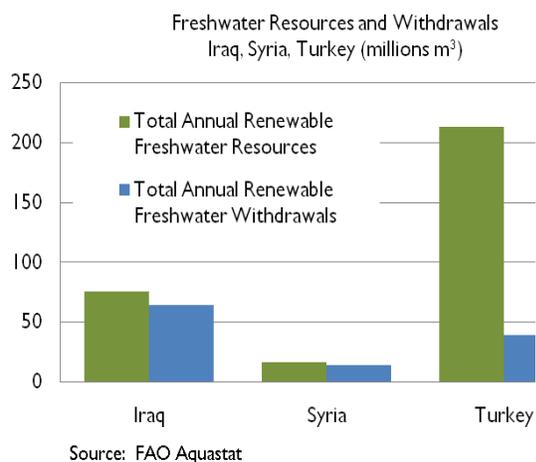
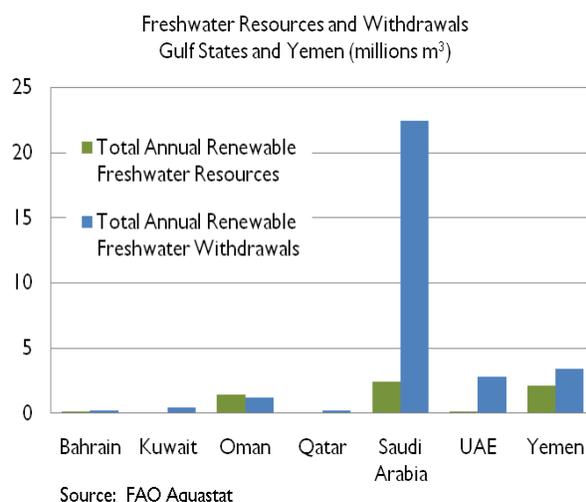


Figure 6



Agriculture remains an important component of the region's economy and the major use for water (Table 6). It contributes nearly 19 percent to the GDP in Morocco, employs a third of the workforce (Table 1), but it accounts for 87 percent of the water withdrawals by sector. In Jordan, agriculture contributes roughly three percent to the GDP, accounts for ten percent of the work force, and uses 65 percent of its water withdrawals. Growing populations and accelerating urbanization, combined with the expanded commercial cultivation of crops with high water demand have increased the use of scarce groundwater resources and degraded water quality. The over-abstraction of surface and groundwater threatens critical aquatic ecosystems in many countries in the region.

Table 5
Water Availability

	Average Annual Precipitation in Depth (mm/yr)	Annual Renewable Freshwater (ARFW) (MCM)	Annual Renewable Freshwater per Capita 2005 (MCM)	Annual Renewable Freshwater per Capita 2030 (MCM)	Freshwater Withdrawal as Percent of ARFW (MDG Indicator)
Algeria	89	11,670	345	261	51.87
Bahrain	83	116	153	109	205.78
Egypt	51	57,300	716	551	94.69
Iraq	216	75,610	2,564	1,596	85.43
Israel	435	1,780	257	194	87.19
Jordan	111	937	158	110	90.46
Kuwait	121	20	7	5	2,075.00
Lebanon	661	4,503	1,082	914	28.00
Libya	56	600	97	71	711.33
Morocco	346	29	929	739	43.41
Oman	125	1,400	514	362	83.93
Qatar	74	58	51	35	381.03
Saudi Arabia	59	2,400	97	64	936.25
Syria	252	16,800	819	573	82.68
Tunisia	207	4,595	456	367	61.28
Turkey	593	213,600	2,926	2,310	18.31
UAE	78	15	34	22	1,866.67
West Bank/ Gaza	402	837	208	109	48.75
Yemen	167	2,100	94	52	161.14

Source: FAO Aquastat

Table 6
Water Demand

	Agricultural Water Withdrawal as Percent of Total	Municipal Water Withdrawal as Percent of Total	Industrial Water Withdrawal as Percent of Total	Total Annual Water Withdrawals: Sum of Sectors (MCM)
Algeria	65	22	13	6,070
Bahrain	45	50	6	357.4
Egypt	86	8	6	68,300
Iraq	79	7	15	6,600
Israel	58	36	6	1,954
Jordan	65	31	4	940.9
Kuwait	18	15	1	2,735
Lebanon	60	29	11	1,310
Libya	83	14	3	4,326
Morocco	87	10	3	12,600
Oman	88	10	1	1,321
Qatar	59	39	2	444
Saudi Arabia	88	9	3	23,670
Syria	88	9	4	16,690
Tunisia	76	13	4	2,850
Turkey	74	15	11	40.1
United Arab Emirates	83	15	2	3,998
West Bank/Gaza	45	48	7	418
Yemen	90	8	2	0.34

Source: FAO Aquastat

While most countries in the Middle East and North Africa have made excellent progress meeting current demand for water and sanitation services, they must continue expanding water and sanitation systems to another 62 to 76 million people to meet the Millennium Development Goals (MDGs) for safe water and basic sanitation by 2015 (Table 7).

Table 7
Access to Drinking Water

	Percent of Urban Population Using Improved Drinking Water Sources	Percent of Rural Population Using Improved Drinking Water Sources	Percent of Total Population Using Improved Drinking Water Sources
Algeria	85	79	83
Bahrain	100	- ¹	- ¹
Egypt	100	98	99
Iraq	91	55	79
Israel	100	100	100
Jordan	98	91	96
Kuwait	99	99	99
Lebanon	100	100	100
Libya ²	54	55	54
Morocco	98	60	81
Oman	92	77	88
Qatar	100	100	100
Saudi Arabia	97	63 ³	89 ³
Syria	94	84	89
Tunisia	99	84	94
Turkey	100	96	99
UAE	100	100	100
West Bank/Gaza	91	91	91
Yemen	72	57	62

Source: WHO/UNICEF Joint Monitoring Programme, 2010 1) no data available, 2) last year available is 2000, 3) last year available is 1990

2.2 Stakeholder-Identified Technical Gaps, Failures, and Issues

The Middle East and North Africa Water Center Network seeks to address a number of technical gaps, failures, and issues that have been identified by both scientists and decision makers in the region. This section draws heavily on the team's own interviews, but also considers input from regional assessments such as by Arab Water Council in 2009.

The Arab Water Council report identified research needs in all the major components of the water cycle for the Middle East. Hydrological characteristics of much of the region are still poorly known, and remote sensing approaches may play an important role given the poor state of the in-situ monitoring networks and databases. Additional research was also called for in “nonconventional” components of the water cycle such as desalination, wastewater reuse, long-distance water transfer, use of saline water in irrigation, and others. Multi-year storage of water in a region where evaporation rates are on the order of meters per year is also mentioned often as a particular challenge.

The Design Team repeatedly heard pleas for more research funding to allow the existing cadre of highly trained researchers to do more field work, perform more analyses, purchase needed software, and generally have better access to latest technologies. However, much or even most of the feedback received by the team involved issues related to the application of research into actual policies or its adaptation to real world situations. This includes the following:

- **Research not useful for decision-makers.** With little exception, government officials and others in positions of responsibility complained that research being carried out was not useful for them to set policies or solve concrete problems. There were few venues for the two to meet on a regular or even occasion basis. Even in countries where ministry or agency budgets had a line item for research, little or no funding was ever used since government officials did not seek research assistance and researchers did not directly access decision-makers to determine their high priority challenges. Eventually, those funds dried up.
- **Research is donor or project driven.** Little creative or exciting research in the water sector is being carried out because most is driven by the immediate implementation needs of donors and projects. Research entities are carrying out implementation-focused, short-fuse studies with little attention to broader implications and little regard for outside, parallel experimentation. As a result, the research is often of inferior quality and of narrow significance without serious commitment or contribution to a scientific body of knowledge.
- **Research does not reflect national priorities.** This issue is an extension of the previous two, indicating that whatever research is being carried out does not reflect or take into account national priorities. Some countries have determined national research priorities but find that university research does not reflect these determinations. This disconnect between government and academia is common around the world, but it has particularly negative consequences in the water-short MENA region.
- **There are many lost opportunities to incorporate research into outreach.** Some research in the water sector has specific application, but researchers often do not make the intellectual

leap. Conversely, the public often sees little utility in research because it has not been used for application and outreach to general stakeholders.

- **There is little or no collaboration between regional entities within a country or between countries.** There was little evidence that research entities in the Middle East and North Africa work collaboratively with each other. MENA entities tend to seek partnerships with similar groups in the United States and Europe. In part, it may be because of competition and jealousy, but it is most likely because they do not know what others are doing and see little prestige or usefulness coming from teaming with other institutions in region. As a result, there is no sharing of funds or knowledge, deepening the sense of regional isolation.
- **Research focuses on the hard-core technical rather than policy and institutions.** Engineering and other technical specialties are more highly valued than the work of policy makers and social scientists, although the core of many water problems is institutional and managerial. As a result, solutions do not work and problems fester unresolved.
- **Young and talented researchers often leave universities and government institutions to seek more remunerative work, either in foreign academic institutions or in the private sector.** Salaries and opportunities are uniformly low in the region, and researchers regularly seek employment in the Gulf or elsewhere.
- **The funding issue noted above is particularly acute for younger or mid-level staff.** These are often both highly educated and highly motivated, but find there is little funding to build on their research interests and apply principles learned abroad to solve local water challenges. Those who find research funding and collaborations often find that these successes carry little weight for promotion.
- **Knowledge is scattered and not shared.** Many people claimed that there is a lot of knowledge, but it is not accessible or drawn together usefully. Individuals and institutions are often weary of others and will not share, but scientific advances require openly available information. Beyond that, results are not shared with the public.
- **Finally, there are insufficient forums for researchers to meet and share results regionally or internationally.** With limited or no funding for meetings or communications, researchers become increasingly isolated.

2.3 Strategic Priorities for the United States on Water

As described in the Senator Paul Simon Water for the Poor Act Report to Congress, the United States' global and regional water activities aim to support U.S. foreign assistance goals by protecting human health, promoting economic development and food security, advancing peace and security, and providing basic needs in response to natural and human-made disasters.

To achieve those goals, the United States is working with countries around the world to achieve water security—defined as reliable and sustainable access to an acceptable quantity and quality

of water to meet human, livelihood, ecosystem, and production needs while reducing the risks from extreme hydrological events to people, the environment, and livelihoods.

To achieve water security, the United States makes direct investments in infrastructure; works to strengthen the enabling environment in developing countries through capacity building, strengthening local and regional institutions, and promoting policy and regulatory reform; seeks to raise the political will to address water and sanitation issues at the national and global level; and engages in the dissemination of best practices and proven technologies. These activities are focused on achieving three objectives:

- **Increasing access to water supply and sanitation, and promoting better hygiene** – both short-and long-term sustainable access to safe water and adequate sanitation, as well as activities to improve hygiene.

Illustrative activities: Strengthening the capacity of small-scale service providers, improving operations and financial sustainability of drinking water and sanitation services utilities, mobilizing capital for expanding and rehabilitating infrastructure, and improving household- and community-level hygiene and sanitation

- **Improving water resources planning and management** –optimizing the benefits of drinking water among competing uses while ensuring that human needs are met and environmental resources are protected, as well as supporting regional efforts to manage and/or adapt to hydrological variability and the risks of floods and droughts.

Illustrative activities: Improving integrated water resources planning and management, addressing water quantity and quality challenges, strengthening participatory approaches to planning and governance, mobilizing financing, managing infrastructure risk; and modeling and managing hydrologic variability

- **Increasing water productivity** – maximizing the efficient and productive use of water used in industrial, agricultural, and other consumptive sectors, as well as supporting pollution prevention programs and other programs that reduce water losses.

Illustrative activities: Improving water use efficiency in agriculture; helping countries adapt to hydrologic variability and climate change, reducing water pollution by industry, and improving water use efficiency in cities

Table 8 shows FY 2008 USAID obligations for these three activities in the MENA region. MENA is second to Sub-Saharan Africa in USAID water sector obligations. Like all regions, the bulk of the obligations are for WASH programs. Priority FY 2009 MENA countries for U.S. water and sanitation activities are Iraq, Jordan, Lebanon, and West Bank/Gaza.

Table 8
Estimated USAID Water Obligations in FY 2008 by Region (millions of dollars)

	Sub-Saharan Africa	Asia and the Pacific	Middle East and North Africa	Europe and Eurasia	Latin America and the Caribbean	Central Programs	Total
Water Supply, Sanitation, and Hygiene	173.8	69.3	95.7	7.0	24.4	19.7	389.9 (79.6%)
Water Resources Management	12.7	24.0	8.4	0.8	10.0	2.7	58.6 (12.0%)
Water Productivity	25.1	3.8	2.9	0.8	2.1	4.2	38.9 (7.9%)
Total	211.7	97.1	107.0	8.6	36.5	28.7	489.6

Notes: FY 2008 budget data represent best estimates from USAID analysis of information as of May 2009. In FY 2008, the regional bureau "Asia and Near East" split into two regional bureaus, "Asia" and "Middle East."
Source: USAID.

U.S. efforts in the Middle East and North Africa at the regional level focus on promoting accountable water governance and joint management activities, providing high-quality data for water managers and decision-makers, reforming regulations and policies, and increasing access to water and sanitation. Such efforts are a central element of the U.S. Government's engagement in the multilateral track of the Middle East Peace Process. The United States often leverages its support for regional projects by gaining other international donors' support. Examples of U.S.-funded regional efforts include:

- **Regional Water Governance Benchmarking.** Assists countries in the Arab region in assessing their policy, legal, and organizational frameworks for water resources management and by enabling them to compare, guide, and monitor national progress on water governance. The resulting system will assist in preparing and monitoring national water master plans and strategies, and promote a water management vision based on participation, equity, and sustainability. The project operated in Egypt, Jordan, Morocco, Oman, and Turkey. Funded by USAID.
- **Arab Water Academy.** Provides training programs to empower Arab water leaders and decision-makers to address the water scarcity challenge. Launched in July 2008, the AWA was created with the aim of becoming a regional executive education center in water and an agent of change to transform the culture and governance of water in the region. Contributions from USAID.
- **Regional Water Cycle Monitoring.** Currently developing a water cycle monitoring model for the Arab and North African regions, using remote sensing information. The outcomes of this system will improve water managers' ability to monitor near-real time changes in water availability, provide a tool for predicting regional hydrological impacts of climate change scenarios, and provide a platform for data sharing among nations. NASA will collaborate with the Arab Water Academy and train professionals from the region. Funded by NASA and USAID.
- **Transboundary Management of the Jordan River.** Promotes cooperative management of the Lower Jordan River by assessing its water quality and flows, raising awareness about this

historic river, and mobilizing Israeli, Jordanian, and Palestinian champions to achieve concrete steps towards restoration. Funding from USAID.

- **Regional Water Data Banks Project (EXACT).** Brings together Israelis, Palestinians, and Jordanians, as well as international donors, to discuss and address, often through training, regional water issues. This training, funded under the Middle East Multilateral (MEM) program, helps to strengthen regional water expertise, enhance relations between water experts, and create a greater awareness of the limited nature of regional water supplies. Funding from the Department of State.
- **Middle East Desalination Research Center.** Based in Oman, MEDRC supports the development of cost-effective, region-specific desalination techniques by providing training courses, funding scholarships, supporting research, and facilitating information exchange. Israeli, Palestinian, and Jordanian officials are integrally involved in conjunction with international donors in this project under the MEM, where the United States serves as co-chair of the Executive Board. Funding from the Department of State.
- **Middle East Watershed Monitoring Project.** Fosters expert dialogue and technical exchanges on topics related to soil and water conservation to address challenges of degradation and desertification in Jordan, Israel, and West Bank/Gaza within the MEM framework. Funded by the Department of State.
- **Middle East Irrigation Management Information System.** Supports research, joint training, and the creation of a network of agricultural meteorological stations to address regional irrigation efficiency as part of the MEM program. Contributions from the Department of State.

2.4 U.S. Scientific Leadership on Water

The United States has faced a number of significant water issues over its history, which has been resolved through the application of science and technology. Responsibility for the study and response to the scarcity, variability, and sustainability of water resources in the United States is split among many federal, state, local and other entities. While a number of proposals have been made to coordinate these responsibilities, especially at the federal level, the development of water science, technology, and policy is disjointed. The responsibilities are split among entities whose missions touch on specific aspects such as agriculture, public health, environment, quality, quantity, energy, distribution, as well as education. Not only are the responsibilities split, but the challenges faced vary widely across the different geographies, needs, and cultures within the country. Without adequate and sustainable local and imported water supplies, it is not unusual to see conflict arise between competing interests. In spite of this diversity, or more likely, because of it, water science, technology, and policy are extremely active and productive areas of experimentation, study, and application throughout the United States.

A number of the water issues in the MENA region require either new science and technology, or adaptations of existing science and technology to respond to the scarcity, variability, and sustainability of water resources. In some cases, new scientific understandings and technology

must be developed for the region. These solutions may also be applied in the United States to solve emerging problems. In other cases, science and technology already exist in the United States that can be adapted or further developed to meet local circumstances.

The United States is a leader in water science, technology, and policy as well as processes leading to innovations. Some of the areas being addressed today include:

- Impacts of climate change and variability on water availability, drought monitoring and management, flash floods, and adaptation responses
- Understanding the environmental impacts of advanced water treatment and developing approaches to minimize the impacts relative to other water supply alternatives
- Use of satellite-based and airborne imagery, as well as ground-based sensor networks and chemical tracers, to characterize flows and stores of the water cycle
- Optimization of use of water resources including impaired sources such as wastewater, brackish water, and seawater
- Innovative programs to reduce the use of water through extensive outreach and education, reducing waste, reducing demand, and increasing conservation
- Integrated water resources planning and management, including collaborative process techniques and modeling tools such as Shared Vision Planning
- Drought forecasting, early-warning systems, monitoring, risk assessment, information management, and education
- Water data and information sharing systems, allowing for the publication, discovery and access of data using disparate databases and servers, connected through web services, to client applications
- Reducing energy use and integrate renewable energy into the creation of “new” water sources
- Expanding the scientific understanding of advanced water treatment processes to create “new” sources of water at a competitive cost
- Improving the quality and suitability of treated water for reuse including agricultural, indirect potable, and high quality industrial uses
- Developing small-scale water systems for local rather than centralized treatment and disposal
- Developing small-scale desalination and energy systems using renewable energy for indigenous peoples and rural and small communities

- Understanding and creating the science and policy behind the fate, transport, and ultimate treatment of contaminants of emerging concern from wastewater, for example personal care products, pharmaceuticals, herbicides and pesticides, endocrine disrupting compounds
- Innovating, developing, and marketing new classes of treatment technology including advanced membranes, carbon nanotube membranes, forward osmosis, biomimetic membranes, nanomaterials, ion concentration on a chip, microbial fuel cells, advanced concentrate disposal techniques, energy recovery, and high efficiency pumps
- Creating industry, university, and public sector research centers as part of science policy.

3

ORGANIZATION AND MANAGEMENT

3.1 Organizational Needs

The Middle East and North Africa Water Center Network must demonstrate four attributes if it is to survive and prosper as a permanent entity.

First, it must be perceived within MENA and to external interested parties as an institution that adds value to the water sector and makes serious and concrete contributions to the management and use of water. There are already many institutions in the region that work on aspects of water issues. Some of those institutions have been supported financially and otherwise by the United States, so it essential to be able to explain why new entity should exist.

Second, assuming the Network becomes a credible entity, it must be configured in such a way so the United States is perceived as delivering on the global engagement President Obama talked about in his Cairo speech. At the same time, it must genuinely allow space for all partners, such as other nations' development agencies, UNESCO, and other international organizations.

Third, the Network must be constructed so that it deepens ties between governmental, educational and technical entities in the MENA region and their counterpart institutions in the United States.

Fourth, the Network should strengthen these kinds of ties within the region as well.

3.2 Organizational Options

The Design Team has looked at many different permutations for how to establish a regional water organization, but essentially they break down into three broad categories. First, stand up a physical enter somewhere in the MENA region. Second, establish a "hub and spoke" system. Third, focus on creating the administrative and political support structure for establishing a network of water institutions.

3.2.1 Standing up a Physical Center

This option was considered in pre-trip planning but rejected quite quickly once the team was in the field. The reality is that the MENA region is host to many different institutions dealing with water issues, some of which are indeed excellent. Moreover, some of these institutions have been supported financially over the years by the United States. The challenge has been to find a formula for the United States to leverage modest amounts of financial assistance, coupled with the expertise of U.S. technical agencies, arguably the most important thing the United States can contribute, to harness the activities of American and regional institutions in a way that adds value to ongoing water activities in the region. Standing up a Center has the advantage of being immediately visible, but it would not necessarily provide the value added that would justify as

U.S. foreign assistance investment. In addition to being expensive, choosing a location for a Center would be politically very difficult. The challenge is that institutions in the region do not collaborate sufficiently. The choice of establishing a Center in one country would inevitably be perceived by other countries in the region as American favoritism towards that country. We would not get the regional cooperation we seek to foster.

3.2.2 The Hub and Spoke Model

The Design Team's idea was to choose an institution in the region to serve as the hub for a network of linked institutions. For a variety of reasons, Jordan seemed to be the right country for a hub. Jordan has at least three institutions that could serve as a hub: the University of Jordan, Jordan University for Science and Technology and the Royal Scientific Society (RSS). Moreover, it is relatively easy for people to obtain visas to travel to Jordan and Jordan has relatively good relations with all of the MENA countries, including Israel. However, choosing an institution even within Jordan proved fraught with difficulties as the potential hub institutions competed with each other. Again, our goal is to find a way to incentivize cooperation within countries and between countries. As Design Team members traveled in other countries in the MENA region, it became increasingly clear that a hub and spoke model would not foster this cooperation. Virtually all of the institutions we visited wanted to be the hub, even if the hub's real task would be to provide administrative support. The very nomenclature – "hub and spoke" – inevitably suggested to our interlocutors a hierarchical construct, despite the Design Team's repeated articulation of a much flatter structure. As a result, the Team decided to reject the hub and spoke concept.

3.2.3 A Network of Linked Institutions

The idea of creating a network was always part of the thinking of the Design Team. The challenge is how to create something that can capture the imagination of people in the region and then to operationalize the networked institutions. After all, the very notion of a "Center" inevitably conjures up the notion of a bricks and mortar building. Some Team members talked about creating a "virtual" center, but this was rejected as too amorphous. As a result we returned to the idea of a network composed of institutions, each of which is a center of excellence collaborating with a regional or American center. So how would this be different from a hub and spoke model? The key difference is that we do not plan to ask a regional institution to serve as the hub for the Center. To make this clear, instead of talking about a singular "Center of Excellence," we intend to call it the Middle East and North Africa Water Center Network.

3.3 Vision for the Work of the Network

The Network will encourage institutions to work together and with U.S. institutions on water reuse, small scale brackish water desalination, groundwater availability and management, water efficiency and productivity, water quality, and integrated water resources planning and management and adaptation to climate change. The Network will develop and carry out competitive grants programs, capacity building, institutional twinings, exchanges, fellowships, and knowledge management. The University of Jordan, Jordan University for Science and Technology, the Jordanian Royal Scientific Society, the Kuwait Institute for Scientific Research,

the Qatar National Food Security Programme, the International Center for Biosaline Agriculture in Dubai, the International Center for Agricultural Research in Syria, the International Water Management Institute, the International Center for Agricultural Research in Dry Areas, the Environmental Agency of Abu Dhabi, the Institute of Agronomic and Veterinary Institute Hassan II in Morocco, the Egyptian National Water Research Center, and the Middle East Desalination Research Center in Oman are interested in participating in Network activities. So far the following institutional collaboration appears likely:

- National Academy of Sciences – Kuwait Institute for Scientific Research’s Frontiers Program brings together young researchers from the United States and region.
- Bureau of Reclamation –small scale desalination of brackish waters.
- NASA/USAID- ICBA project on monitoring the water cycle in the MENA area may be extended; NASA/USAID in planning with World Bank about developing remote sensing and earth science data platforms that would benefit Lebanon, Jordan, Tunisia, West Bank/Gaza, Morocco and Egypt.
- USGS works with Abu Dhabi, Iraq and Jordan on groundwater resource assessments – work will likely be expanded to other MENA nations.
- International Center for Integrated Water Resources Management (ICIWaRM) – a –Category 2” UNESCO Center housed at the U.S. Army Corps of Engineers – a series of workshops on topics such as climate change adaptation strategies for water resources in arid/semi arid regions could be conducted at UNESCO’s offices in Amman or Cairo. ICIWaRM is now the Technical Secretariat for UNESCO’s arid zone water resources program —GWADI”.
- Sandia National Laboratories/Borlaug Institute – Qatar National Food Security Program research and development on solar technology to desalinate water – work could be disseminated regionally.
- ICARDA’s Water and Livelihoods is a partnership with startup funding from USAID including National Agricultural Research and Extension Systems (NARES) systems, organized through work at benchmark sites across three major Agro-Ecosystems: (I) Irrigated (Egypt, Southern Iraq, Yemen); (II) Rainfed (Northern Iraq, Syria, Lebanon) and (III) Badia/rangeland (Jordan, Eastern slopes of the West Bank). It is associated with five U.S. university systems (Texas A&M University, University of California at Davis and Riverside, University of Florida, University of Illinois, Urbana-Champaign (UIUC), Utah State University (USU) and three regional hub universities organized to link with national universities within the agro-ecosystems, i.e. Irrigated: American University in Cairo (AUC); Rainfed: American University of Beirut and the University of Jordan (UJ). Two other CGIAR centers are also involved: IWMI and the International Food Policy Research Institute (IFPRI).

3.4 Overall Management Framework

Over time, the Network will bring together a number of policy, research, and training centers in the Middle East and North Africa. The participating entities will strengthen each other through information exchanges, meetings, and joint research and training programs. The Network will also link to universities, governmental and non-governmental laboratories, and research groups in the United States, Europe, and elsewhere to help build capacity, introduce new ideas, and provide opportunities for growth. It is imperative that the Network operate in the spirit of transparent decision-making, based on the active and open participation of members. The governance structure for the Network will have two major bodies which must have clear roles and responsibilities and work jointly for the benefit of all participating institutions and hosting governments:

- Board of Directors
- Secretariat

In the future, the Board of Directors may decide to create other bodies within the Network, for example a panel of experts or an implementation committee of member centers, but they will evolve to address needs as they arise.

The Network will follow some or all of the following guidelines as the basis for internal organization:

- The Network is an association of a number of Centers dealing with water from across the Middle East and North Africa, each with discrete and overlapping interests and responsibilities. Bringing these Centers together is an externally-run Secretariat, primarily playing an organizing or facilitation role. The Secretariat will be based in the region, in a country still to be determined. It could be organized and run by one of many options, including a U.S. government agency, a U.S. research institute or university, or to a private sector entity under a USAID contract or grant following a competitive request for proposals.
- The Network will require an international Board of Directors that oversees and approves its annual work plan and its budget in a supervisory capacity. Members should include representatives from donors, governments, the private sector, and civil society. The chair of the board should be someone who is outside the daily operations of the Network and is not an employee.
- Within three months of the launching of the Secretariat, it should submit a working document which identifies what needs to be done and what particular challenges should be anticipated.
- Within six months of its launching, the Secretariat should submit a detailed Institutional Plan and Timeframe that provides a step-by-step process for establishing the entity, in terms of necessary government authorizations and approvals, staff retention and expansion, program development, committee formation, and formalized procedures and operational manuals.

- During its first year of operations, the Secretariat will work with the Centers to develop a business plan that formalizes the Network’s vision, mandate, strategic goals, structure and staffing, communications plan, knowledge plan, action plans, budget and revenues. The plan should be formally approved by the Board of Directors.
- During its first year of operations, the Secretariat should issue a call for proposals, including research, technology transfer, and policy development activities.
- During the first two to five years of operation, the Network will depend heavily on the intervention of experts from the United States and other countries. The U.S. Government, through the U.S. Agency for International Development in partnership with the U.S. State Department and other federal agencies, will take the lead in determining the best approach for providing this support.
- The Secretariat will have a five-year timeframe to develop a plan for the long-term structure. It will explore different options, including the formalization of the Secretariat into a permanent entity or the identification of one of the Centers as its home, until a tenure arrangement is established for the Secretariat to shift to different Centers every given number of years, or other arrangements.
- The Network should reflect a broad geographical spread from the Maghreb to the Gulf. It should be careful to reflect the region’s cultural and intellectual diversity.

Member centers of excellence should have defined roles and responsibilities that are both discrete and overlapping. Some of the Network’s members could participate in any of the following: research, training and human resource development, and knowledge management and dissemination. The assignment of roles needs to be settled early in the Network’s development. However, the designation of longer term responsibilities will take time as members demonstrate the quality of their performance. There should be readjustments of responsibilities during the Network as member Centers define and redefine themselves.

3.4.1 Board of Directors

The Board of Directors (BOD) will be composed of ten eminent water authorities from the region, the United States, and Europe representing donors, governments, the private sector, and civil society. They will meet once or twice each year to review work conducted by the Network and establish priorities. The board may issue recommendations, but ultimately, it will be up to participating institutions to determine research priorities. The board will also approve the annual budget, and, each year, review expenditures, as part of its fiduciary responsibilities.

The chairperson of the board should be someone who is outside the daily operations of the Network and is not an employee. Ideal candidates should possess an international reputation, stature with other directors, understand the Network and the operating environment, add value during board deliberations, and have sufficient time to fulfill this commitment. The board members will elect the chairperson every two years on a rotating basis. They will be nominated

by leading international and regional entities knowledgeable about the Middle East and North Africa's water sector.

The formation of long-term, productive partnerships is at the core of the Network. Its organizational structure is designed to encourage and foster alliances among members in the Middle East and North Africa, and between them and entities outside the region. The Board of Directors and the Secretariat play a crucial role in developing these relationships, and must do all possible to create a climate that stimulates partnerships first within the region and then outside it.

The deliberations of the board and the panel should be focused on the work plans, action memos, and other decision-based products of the Network's members. The work of the board and the panel ought to be directed at smoothing the way for productive and exciting research and outreach. The board will likely meet semi-annually.

The board has ultimate decision-making authority over the Network's technical program and the budget. Annual work plans should be formally approved by the Board of Directors.

The Board of Directors will have the following specific roles and responsibilities:

- Approve the annual work plan of the Network;
- Approve the five-year strategic plan for the Network;
- Approve the annual budget in line with funding;
- Identify new and diversified funding opportunities and follow-up leads with multilateral and bilateral donors, the private sector, and other sources;
- Identify potential new members for the Network; and
- Elect a chairperson every three years.

3.4.2 Secretariat

The Network will require an independent entity, based in the Middle East and North Africa, that facilitates, coordinates, and manages the relations among the associated member Centers in different countries. In a sense, this Secretariat is the glue that keeps the network together, certainly during the initial five to ten years as the different Centers learn to work with each other profitably and productively. Over time, the Board of Directors and the member Centers may decide that the duties of the Secretariat should be subsumed by one of the Centers or rotated periodically among them, or they may decide to make the Secretariat permanent as is. At this point, it is too far too early to know which course is the most advisable.

However long the Secretariat is in place, it should be relatively small and low-cost, as the vast majority of the funds ought to be used for the research and outreach activities of the Centers. A small management and technical team will handle its operations and have fiduciary

responsibilities, since funds for activities will flow from the Secretariat to the Network's members. As such, the Secretariat must have a legal status to accept and distribute funds or be tasked by donors/investors to manage fund pools, at a minimum. How that happens must still be determined.

But the general lines of authority are increasingly clear. Network members, as the core players, will be charged with determining and implementing the technical direction of the research and outreach efforts. Their input and agreement on business, strategic, and annual work plans is critical to success.

The Secretariat will:

- Ensure that decisions are implemented in line with approved plans;
- Convene all meetings of the Board of Directors;
- Keep records of all agreements which it will circulate to all members;
- Assess implementation, raising issues as necessary to the Board;
- Identify resources needed to accomplish goals;
- Coordinate fundraising;
- Schedule meetings of Network members, including annual conferences;
- Prepare annual work plans with Network members;
- Coordinate efforts with other regional Centers of Excellence arising from the President's speech in Cairo during June 2009, including those on Climate Change, Health, Renewable Energy, and Science Policy; and
- Design and manage the Network's website and publications.

Structuring and Operationalizing the Secretariat: Six Options

There are a number of options available for structuring and operationalizing the Secretariat. The following are six possible arrangements, although others exist, as well. Some of these options are more desirable than others, and the first option has already been rejected by the Design Committee but is included below to give a sense of the process for thinking through their appropriateness. Options 2 through 6 indicate that some outside group – a U.S. government entity, grantee, or contractor – will manage the Secretariat. The final determination of the best course of action will be decided by the Department of State and USAID in consultation with key stakeholders from the region in a number of anticipated meetings in Washington and the Middle East and North Africa. The (+) and (-) denote the advantage or disadvantage of using that option.

Option 1: Country-Led “Hub and Spoke”

- Simple to get started and puts onus on partners to implement (+)
- Devolves management responsibility to hub (+)
- Upstream-downstream balance hard to achieve because of character of hub country desires (-)
- Ability to respond to quality control and independent scientific judgment offered by a member country Board of Directors could be variable (-)
- The name suggests a winner and loser as a consequence of the assessments (-)
- May not have the necessary convening power to bring all countries together; choice of one may alienate others (-)
- The selected hub may not have sufficient excellence to attract premier participants (-)
- Other donors are less likely to invest as there is a strong U.S. label (-)

Option 2: USAID Office in Washington or in a Presence Country

- USAID technical capacity is strengthened and keeps a focus on development (+)
- USG elects to play a strong facilitating and convening role (+)
- Can design subcontracts for specialized roles for independent peer review that can add objectivity and independent scientific rigor (+)
- U.S. ownership may make it harder to attract other donors without a special effort to reach out (-)
- USAID Missions are personality driven which may yield variable support over time (-)

Option 3: 3. 632a or 632b Agreement through State or USAID to allow a U.S. government agency to Serve as the Facilitation Entity

- USG elects to play a strong facilitating and convening role with specialized agency reach-back to experts (+)
- Can design subcontracts for specialized roles such as independent peer review from NAS that can add objectivity and independence (+)
- U.S. technical agency leadership may not have sufficient international authority and would depend on State and USAID for sustainable funding (-)

- Over-reliance on U.S. expertise might make it more difficult to generate an exit strategy over time (-)

Option 4: Assistance Mechanism (RFA-Grant) for NGOs/Universities to be Selected Based on a Competitive Proposal Process

- Competitive approach encourages creative ideas (+)
- Could write a statement of work (SOW) to allow diverse teams to address desired facilitation, S&T engagement, coordination, proposal review, reporting and financial management (+)
- Procurement timeframe could be lengthy (-)
- Prospects for international cooperation from donor countries will be limited (-)

Option 5: Acquisition Mechanism (RFP-Contract) for a Consultancy Company to Be Selected Based on its Best Offer to Organize a Management Entity

- Buys time – allowing the enabling environment for national and international cooperation to gel (+)
- Could write SOW to allow diverse teams to address desired facilitation, S&T engagement, coordination, proposal review, reporting and financial management (+)
- More expensive owing to profit margin of contractor; procurement process slower as well (-)
- Prospects for international cooperation from donor countries likely to be limited (-)
- Assumes the Contractor will encourage an exit strategy that allows country led takeover of management (-)

Option 6: Project Implementation Order (PIO) Grant to the CGIAR system to set up a mega-program that would collaborate, coordinate, and manage the interaction among participants

- Uses a fully international model that the United States continues to support, reinforcing support to the CGIAR (+)
- Several CGIAR Centers have research and capacity development expertise; e.g. ICARDA, IFPRI, IWMI (+)
- Already possesses a science council, oversight boards, international audits and close to 70 government and foundation donors (+)

- Very quick and easy procurement process through PIO grants to the CGIAR (+)
- Development capability not the CGIAR focus, large project management weak, missing strong links to private sector (-)
- Focus is on agricultural research instead of on water (-)

Staffing the Secretariat

The number and composition of center staffing will ultimately depend on the particular option chosen for structuring and operationalizing the Secretariat and the centers for excellence. As discussed above, the Network is an association of a number of centers of excellence from across the Middle East and North Africa, each with discrete and overlapping interests and responsibilities. Bringing these Centers together is an externally-run Secretariat, primarily playing an organizing or facilitation role.

Staffing needs should be relatively small and low-cost, as the vast majority of the funds ought to be used for the research and outreach activities of the Centers. The management and technical team should include the following positions:

- **Director of the Secretariat** – a strong leader able to develop and effectively implement the Centers for Excellence mission
- **Research Coordinator** – to oversee and coordinate grant operations and communication among Centers
- **Communications and Outreach Coordinator** – to oversee publications, awareness campaigns, and other stakeholder communications
- **Logistics Coordinator** – to assist communication among researchers and organization of meetings of the Board of Directors
- **Administrative/Financial Officer** – to handle financial responsibilities, as funds for activities will flow from the Secretariat to the Network’s members

The staff could be USAID employees, either direct hires or U.S. personal services contractors (USPSCs). What is essential, however, is that the staff works full-time on the Center. Skills in Arabic language are recommended. The Secretariat will also benefit from two types of water experts: U.S. Government-sponsored post-doctoral fellows and USG experts seconded from various government agencies with significant expertise in the water sector, including the U.S. Geological Survey, U.S. Department of Agriculture, U.S. Army Corps of Engineer International Center for Integrated Water Resources Management, National Oceanographic and Atmospheric Administration, National Aeronautics and Space Administration, and Bureau of Reclamation for periods of roughly three months to a year.

The participation of these experts, who may be initially based at the Secretariat, while traveling frequently to the Centers in the region, will broaden the scope of research, and increase the scientific rigor of the research undertaken. The multiple agency model will result in a cross-fertilization of ideas across the numerous disciplines involved in addressing water challenges in the MENA region. The increased communications among center experts and the heightened connections which result will ensure that the Water Center Network will not be viewed solely as an internal USAID effort. A serious buy-in from other agencies will assist in keeping up the momentum and the engagement of the various players and disciplines. Several of these agencies, such as NASA and the ICIWaRM, have a history of receiving donor funds from multi-lateral institutions, such as the World Bank and UNESCO, which could increase the ability of the network to attract the interest of other non-U.S. donors.

Building an interdisciplinary staff is increasingly viewed as an important component of institutions involved in knowledge generation, as documented in the feasibility assessment undertaken for establishing the Asia Regional Center for Excellence on Climate Change and Development (ARC). Also noted is the often forgotten need to include social scientists in the centers, whose participation is crucial in closing the gap between policy and science.

At the present time it is not anticipated that the network will fund general salaries in cooperating centers of excellence throughout the region, but rather to provide funding for research, meetings, seminars, or workshops on key topics and to discuss results of the research undertaken.

Once the Secretariat and the Centers develop a business plan during the first year of operation, the Network's vision concerning staffing will be further detailed based on the strategic goals, action plans, budget and revenues available, and when staffing needs become apparent.

3.5 Monitoring and Evaluation – Initial Indicators

3.5.1 Institutional

The Network will start with a core group of members from across the region, but it will grow in size and importance based on the work it does and the operations it carries out:

- Number of key entities that agree to join the Network
- Number of Board of Trustee members and number and substantive quality of their meetings
- Ability of the Secretariat to facilitate and coordinate Network operations, as designed

3.5.2 Capacity-Building

MENA WCN seeks to strengthen the capacity of researchers in the water sector, particularly in association with line agency or ministry staff to bring research and application together:

- Number of researchers and fellows participating in MENA WCN programs
- Number of participants in training programs
- Competition for places in training programs
- Number of collaborative research projects designed as direct follow-on to the trainings

- Number of peer reviewed publications in international journals based on MENA WCN projects
- Engagement of government staff in joint research efforts

3.5.3 Financial

An increasing financial independence for the Network is a sign of financial sustainability, but the Secretariat will need to carry out regular fund-raising to finance efforts:

- Percent of the annual budget that is covered by interest from the endowment or trust fund
- Rate of increase in contributed funds from year to year
- Change in funding specifically for research and outreach
- Amount of financing committed to support MENA WCN
- Number of partners – multilateral, bilateral, host governments – providing financial support to the Network or to Centers for Network-based activities

3.5.4 Private Sector Participation

The Network should foster an alliance among government, the research community, and the private sector to bring about the sought-after changes in sector behaviors and operations:

- Number of private sector entities that are engaged in Network activities
- Amount of financing provided by the private sector for joint research programs or for activities inspired by them
- Number of proposals that originate in the private sector
- Number of private sector representatives that participate in research projects
- Percent of Board of Directors who are from the private sector, including from civil society groups
- Number of civil society groups participating in Network activities

3.5.5 Sector Impact

The Network should eventually have a measureable impact on the supply of and demand for fresh and non-conventional water in the Middle East and North Africa. It should demonstrate a reduction in water scarcity in the region by virtue of its efforts. Even at this early date, it is useful to begin to identify measurable indicators for MENA WCN, but any attempt to develop hard targets should be preceded by an agreed-upon baseline against which progress is measured. Furthermore, these initial indicators are certain to change during the course of the detailed design. That said, they do point to a direction for the Network's concrete achievements and offer interesting points for discussion during the design process:

- Percent of freshwater reallocated from agriculture to other sectors in participating countries
- Percent increase in treated wastewater used for agriculture
- Percent of or MCM decrease in non-revenue water for urban water utilities
- Percent of desalinated water used for agriculture or other purposes
- Percent of non-conventional water used against freshwater resources

- Number of water demand management policy reforms across the region and in participating countries
- Number of hectares growing highly salt-tolerant crops
- Number of MCM water saved with salt-tolerant crops
- Percent of or MCM increase in supply to poor inhabitants who were previously unserved by a utility network

These preliminary targets do not include specific numbers. Those must be decided upon in conjunction with the development of the baseline.

3.6 Financing Commitments and Opportunities

In order to succeed, the Network must start with sufficient, sizeable funding to mobilize staff and immediately underwrite research and training programs. Too often, institutions of this kind are underfunded and spend most of their time scrambling for money. It makes them unproductive and unable to justify their continuation. It is no wonder that the failure rate is high and impact is low. The Middle East and North Africa Water Center Network, really all of the Centers created under the Cairo Initiative, must break that mold. If the Network is to have the dramatic impact that mirrors President Obama's vision, it must start with financial security.

One way to achieve this outcome is to develop an endowment or trust fund for the Network which then uses the reliable income from its interest for operations. The United States will encourage sizeable contributions from other countries, foundations, and the private sector. The Secretariat must develop a clear marketing message to use with potential contributors to build the endowment or trust fund. An early issue with engaging donors is the perception that MENA WCN is an American entity. Potential donors indicated that they would expect a voice and recognition in the Centers if they contribute financially.

3.7 Political Coverage

To succeed, the Network must also receive strong support from one or more recognized political umbrellas. It will not prosper as an orphan or as a largely American entity. Political coverage by regional and domestic Networks of power can advocate for the Network's agenda and results. The Network, therefore, must be integrated into or adopted by existing lines of authority in the Middle East and North Africa. One source of patronage could be the newly established Arab Council of Water Ministers which is situated in the Arab League where its secretariat is housed. The Network represents the highest political level among all of the countries in the region. Recognition by the Council of the Network's legitimacy would open doors, provide information, and reduce any hesitations by local institutions to cooperate fully. Given that the Network is actually a partnership of independent centers of excellence in different countries, it will also be advisable to obtain acceptance from each country's leadership.

3.8 Anticipated Achievements of the Network

The creation and strengthening of the Network will be a long-term process. There are no quick fixes that will result in a fully operating Network in the space of a few years. However, there

must be some achievable results in the short-, mid-, and long-term to build interest and commitment.

3.8.1 Short-Term (One to Two Years)

During the first year or two of operations, the Network should:

- Develop and start to implement a technical agenda to support the Network's mandate
- Survey policy initiatives, research and training capacities and opportunities in the region
- Create partnerships with institutions in the Middle East and North Africa, the United States, and elsewhere as a source of new ideas, solutions, and challenges
- Create and fund two competitive research programs
- Create and fund at least two programs to provide scientific, policy, and management support to government entities undertaking policy reforms

3.8.2 Mid-Term (Two to Ten Years)

During the first two to ten years of operations, the Network should:

- Operationalize a robust applied research program
- Undertake multiple policy-based initiatives
- Develop and carry out training programs for researchers, policy makers, and water ministry staff in member countries
- Expand network membership to include additional entities in the region
- Make significant linkages with the private sector to encourage participation and/or investment

3.8.3 Long-Term (More than Ten Years)

By the end of its first decade of operation and beyond, the Network should:

- Have tangible evidence of successful research leading to identifiable policy reforms and concrete advancements in water management
- Create a generation of new research leaders in the region who, in turn, are developing promising technical and management approaches to solve the region's water problems
- Convene and participate in numerous scientific, policy, and management conferences and published numerous scientific articles internationally
- Be recognized regionally and internationally as a permanent resource to the region and the sector
- Establish numerous partnerships in the region and internationally.

4 PRIORITY TECHNICAL AREAS FOR PROGRAM IMPLEMENTATION

4.1 Goal and Objectives

The ultimate goal of the Middle East and North Africa Water Center Network is to:

Reverse the increasing scarcity of water in the region by adapting, developing, and disseminating policy tools and technical and management interventions that expand supply, reduce demand, and dramatically increase its efficient, productive, and sustainable use.

To do this, the Network's objectives are to:

- Improve water resources planning and management in the region through integrated approaches focused on the supply of and demand for conventional and non-conventional (brackish, treated waste, and desalinated) water sources;
- Shape and lead a serious and meaningful dialog among and between decision-makers and researchers about concrete and practical ways to deal with water scarcity and to expand that dialog to the private sector and civil society;
- Improve the relevance of water sector-related research by bridging the gap between research and policy and between policy and application and outreach so that research is designed and carried out to resolve pressing real life problems and so that it better informs national and local policies by government;
- Introduce and encourage the adaption and adoption of innovation policy and planning tools and measures focused on water management;
- In so doing, foster the ability of Network members to contribute to water-related policy reform by providing governments in the region with expert assistance; and
- Upgrade the quality of water management applied research and research capacity in the Middle East and North Africa through training, research grants, and scientific exchanges within the region and with scientists in the United States and elsewhere.

4.2 Partnership Approach

The formation of long-term, productive partnerships is at the core of the Network. Its organizational structure is designed to encourage and foster alliances among members in the Middle East and North Africa and between them and entities outside the region. The Design Team was rather surprised to learn that few, if any, of the groups it met actually had meaningful

or long-lived partnerships with other entities in the region. They either worked in isolation or with American or European groups, by and large. It is incumbent on the Board of Directors and the Secretariat to do all they can to create a climate that stimulates partnerships first within the region and then outside it. The Network's approach to partnerships is to incentivize them. For example, the Network might fund only those research projects or trainings that actively engage at least two member entities in any effort. Beyond them, the Network will strive to bring together regional researchers and decision-makers with counterparts in the United States and elsewhere to their mutual benefit. The Network will also link MENA WCN members to U.S. scientific, governmental, technical, and policy institutions to support research and collaborative capacity-building aimed at addressing our common water challenges.

The design of the Network should make clear that private sector participation is invited at each stage of the process, including the sharing of scientific research by university and professional communities with the private sector; funding for scientific collaboration, education, and investment; and project development and implementation. There is a range of private sector entities that needs to be engaged: non-government, non-profit groups, as well as private interests, for-profit companies, and trade associations. However, traditional means of employing these resources, especially for-profit entities might have to be modified to fulfill the Network's goal of deploying more efficient and increased water services in the region. How to create these partnerships will itself be a critical challenge as the Network's programs evolve. And several questions still need to be answered: How can Network's members best reach out to and engage varied private sector actors? Should government procurement practices be reformed? Is the return on investment or the tenor of project finance contracts appropriate to the task of enhancing water resources and making them available to Middle East publics, both urban and rural?

4.3 The Network's Core Functions

To achieve its broad objectives, the following core functions for the Network are under consideration:

- **Build Partnerships.** The Network could develop and support partnerships between academic, research, and governmental institutions in the Middle East and North Africa and the United States. This could include funding collaborative research between U.S. and foreign researchers.
- **Stimulate Dialog.** The Network could build on existing regional and international efforts to create a venue for water policy makers, managers, and users to discuss, debate, and eventually agree on solutions for water security. The Network could serve as a forum for substantive policy, planning, management, and technical conversations among stakeholders. In effect, it could encourage an international water alliance that would support change by helping to identify both research priorities and strategies to apply and disseminate the results of that research for greatest impact. It can collaborate and build on regional international efforts and institutions, such as the Regional Water Data Banks Project (EXACT), the Middle East Multilaterals and Middle East Regional Cooperation programs; UNESCO's Institute for Water Education, UNESCO's International Hydrologic Program, and others.

- **Support Research.** In the Middle East and North Africa, the limited existing water research is largely focused on engineering and technology. Additional research opportunities are pressing in the areas of policy reform, systems design, management approaches, and economics and the social sciences. In partnership with local, national, regional, and international institutions, the Network could support basic applied research and analysis, studies, assessments, and evaluations to determine innovative solutions in order to enhance the region's understanding of viable options as it makes critical decisions about water use for the future. Consistent with the Network's focus on water policy, management, and socioeconomic barriers, new research under the Network is expected to form a limited portion of the Network's portfolio, targeted toward identifying and addressing specific barriers and gaps in knowledge. Its goal would be to augment rather than to overlap with or duplicate existing successful programs.
- **Facilitate Use of Research Results.** The Network would likely focus heavily on putting research into practice in order to achieve its broad objectives. The Network would serve as a resource to link research results with the public- and private-sector institutions in MENA able to implement these results. This would also include identifying and targeting resources toward countries and municipalities willing to adopt better water policies and management practices. The Network could also partner with established research centers based or operating in the region to affect their agenda and begin to consolidate research efforts, building on successes or taking advantage of promising directions that require additional infusions of financing or scientific support. Research results from the United States and other countries would also be considered for adaptation in the Middle East and North Africa and vice versa. The Network should make every effort to translate research results and other science and technology-based best practices in water policy and management into action.
- **Manage Knowledge.** The Network could serve as a clearinghouse and resource base on water security – policy, management, technical, technology, and political – to catalogue and share good practices from across the MENA region and elsewhere to help countries in the Network to design and carry out more effective initiatives in the region. The assessment could start the discussion by performing an inventory of existing programs, their results, and other best practices in order to identify the important gaps in knowledge.
- **Build Research, Technical, and Management Skills.** Initially, the Network could provide or facilitate training and technical expertise in areas related to water security to beneficiary institutions and individuals, especially in those areas related to its research and technology-transfer agenda. Longer-term, it could create a collaborative mechanism with other existing institutions to provide degree and certified training in broad areas of water resources and management, not to duplicate successful efforts elsewhere but carving out its own unique contribution.
- **Expand Investment.** The Network could mobilize investments in innovative solutions to water challenges throughout the Middle East and North Africa by harnessing funds from USAID, other USG agencies, bilateral and multilateral donors, foundations, and regional and international partners from the public and private sectors. Within the region, AFSED, IFAD,

the Kuwait Fund, and numerous privately operated foundations are possible partners in the creation of a Water Fund operated by the Network.

4.4 Program Implementation

During its early years of operation, MENA WCN would focus on implementing three program components that have engendered interest in the region among potential partners. These three components are training, collaborative research, and data and knowledge management. It is important to point out that while collaborative research is one of the three, MENA WCN is not primarily a research entity. The Network will link research with training and data and knowledge management, what we call here – outreach and application.

4.4.1 Frontiers Program

The Kuwait Institute for Scientific Research is currently working with the National Academy of Sciences in Washington, D.C. to launch a Frontiers Program, modeled after similar programs run by NAS in Europe, India, and China. Young scientists in these countries are brought together with their peers from the United States in a week-long meeting to discuss cutting edge approaches, methods and research. Generally, NAS obtains the funding in the United States for the American attendees and local institutions, often national academies of sciences, obtain the funding for young scientists from those countries. The meeting does more than introduce interesting research.

Perhaps more important, it serves as a venue for scientists to meet and begin to design joint research projects. Those projects are sometime presented at later meetings. The meetings are held annually. In the Middle East, KISR will organize and convene the regional meetings for the coming five years, beginning in 2011. The focus of the meeting will be on medicine, engineering and science. This meeting, with a still undetermined date, offers an opportunity for the Network to play a high-profile role. It could fund some share of the costs of this and perhaps succeeding meetings, using the venue as an opportunity for the region's most promising young scientists to work together on the initial elements of a research design. As KISR could be a core member of the Network, the Frontier Program could provide a very useful convergence of interests. Of course, more detailed conversations between the Network and KISR and NAS are needed to determine if this venue is mutually advantageous.

4.4.2 Collaborative Research

More than any other priority program area, MENA WCN's reputation may well be most dependent on and most enhanced by the collaborative research efforts of its members' scientists. This is certain also to be the program area of greatest interest to members, as it is the locus for research project design, implementation, and outreach to decision-makers and the public. To have the strongest impact, we envision the collaborative research will be done at many levels and by many groups: among regional partners; with government, civil society, and the private sector; and with complementary entities based outside the region. We have noted several times in this report that research institutions and universities generally do not collaborate with other entities in their countries or within the region. The Network should help to create strong research relations

among Middle East and North Africa institutions. These Centers would also like to strengthen research ties with entities in the United States and elsewhere. The Network should facilitate those linkages and foster long-term relationships that are mutually beneficial.

The Design Committee further envisions research being conducted by smaller teams of Network members, clustering around their skills and interests. In Section 4.5 below, we identify six priority technical areas of focus for the Network. We do not expect that all members will have the capacity to work in all six areas, nor should they. The Network seeks to encourage scientific and technological excellence, and no center should lay claim to being excellent in all areas. It would be a drain on their resources and redundant of their efforts. Instead, we anticipate the clustering of institutions around specific research problems. Some have already expressed a limited focus, like MEDRC in desalination and wastewater reuse and ICBA and IVA in water use efficiency and productivity. Others have indicated a broader brush, like KISR with its ambitious strategic plan and Egypt's NWRC with its many centers, but, even with these, the Network is likely to encourage a concentration in engagement during the initial five or more years.

An important question that remains is just how these member entities will make decisions about technical areas to work in. We expect that the Board of Directors and the Secretariat will help guide those decisions. When there seems to be an imbalance in interests, as when too many centers want to work on a particular problem and too few in another, the matter can be resolved by working through the details, highlighting the complexity, and having clusters take discrete pieces of the problem. Surely, the water issues in the region are highly complex and can be broken down into manageable pieces. Other technical areas may drop out or be postponed if there are few or no members interested in working on them.

To make the research efforts relevant and desirable, the Network will create a competitive research grant fund. Competition will improve the quality of the design and the carrying out of the research. It will also give members an opportunity to best articulate what they want to accomplish and how they will do it. The Network will need to create a neutral awards panel, probably sanctioned by the Board of Directors and supported by the Secretariat. The Secretariat will help develop the terms of the competition, proposal content, and criteria for awards. And the Secretariat will help research teams design realistic and fundable proposals, a more general noticeable need in the region.

Even now, it is clear that the basis of an award will in part depend on the inclusion of decision-makers and civil society on the team, meaning that a research team of only scientists will be inadequate since it will not advance the overall mandate of the Network to bridge the gap between research on the one hand, and policy and application on the other. Any research proposal must address the related policies and be explicit about how the research will answer or address the longstanding water issue. At least initially, until it has built its international reputation, the WCN must focus on applied research with concrete results. Pure research may come later when the coffers of the Network are fuller. At the same time, institutions and scientists must take care not to repeat their past approach to provide fee-based research or studies that are essentially tied to a donor's agenda. The approach has stultified research in the region. Collaborative, applied research funded by the Network must fall squarely between donor-driven

studies and abstract research. For many, it will present a new and challenging demand, but it is one, if done correctly, that will justify the Network's existence and be more likely to ensure its continuation.

We expect also that the research teams will also want to engage groups outside the region, ones which bring new methods, additional expertise, and rich experience to their efforts. As in all research efforts, no research should start at zero, since in all cases some work, often interesting and sometimes promising, has already been carried out. These additional resources must be built into the design of the effort and into its conduct. The Board and the Secretariat will be able to provide useful suggestions.

4.4.3 Data Management

The Middle East and North Africa are much like every other region of the world. Frequently, at the core of water issues is a disagreement over data sources, data methodologies for collection and analysis, and the data themselves, whether it is raw or analyzed. Beyond the fundamental issues related to data are equally intransigent issues related to the open sharing of data, be it among entities in a single country or across national borders. The Network will not attempt to resolve this issue with its many political strands. There have been attempts made in the past, none terribly successful.

To address this need, the WCN design team intends to support establishment and operation of a remote sensing data base through the Network that examines regional water balances in the Middle East. This activity will be led by ICBA, in partnership with NASA, the GEF, and OMEP. This activity will provide a foundation for the Network to build upon, leading to development of inventories of water resources data, and eventually to harmonized data collection and analysis for country-level, or even regional-level water planning and management.

4.5 Priority Technical Areas

Water resources shortages are arguably the most serious constraint to development and progress in the Middle East and North Africa. Conversations with key participants throughout the region confirmed the importance of the following six high priority technical areas despite the wide variety of type of water resources and range of conditions. Work in some or all of these six technical areas will be implemented through the three program areas identified in the Section 4.4. Plans and activities in each of the following areas must incorporate legal, policy, regulatory, institutional, and economic/financial concerns.

- **Small-scale desalination.** Explores low cost, manageable systems to augment water supply as a growing priority in the region, particularly mentioned in the Gulf countries, given that research outside the Middle East and North Africa is largely outpacing investigations in the region.
- **Wastewater reuse.** Addresses issues related to the use of non-conventional water; policy and economic studies of resource replacement; assessment of public health issues related to

pathogens and heavy metal contamination; best practices for soil salinity management; and treatment and energy requirements.

- **Groundwater resource management.** Addresses issues related to the sustainability of this critical but frequently mismanaged resource, particularly related to the increasing and widespread degradation of the quality of resource due to overextraction, ineffective government policies and sanctioning systems, inadequate metering and pricing, and other troubling causes.
- **Saltwater intrusion.** Much of the data and information likely exists and the need would be to better interpret the data using newer tools such as numerical simulations, predictive groundwater flow and quality modeling, and visual displays.
- **Water use efficiency and productivity, particularly for improved irrigation management.** Addresses issues related to major water allocations, particularly to irrigation as the region's major user, looking at improved, more efficient on-farm water management technologies, innovative public-private partnerships, water pricing, and other market-based approaches.
- **Integrated water resources management for climate change adaptation.** Considers the uncertain effects of future climate change; this should emphasize addressing the scientific and policy gaps for incorporating climate change and variability information into adaptive, integrated water resources planning and management.

While these six technical themes are undeniably important to the MENA region and among its most critical issues in the water sector, there are too many for the Network to tackle at once and from the start. On the one hand, working in several areas simultaneously would deprive the Network of a clear focus and reduce its political and technical impact. On the other hand, the Network could lose interest and commitment if its research agenda is too narrowly drawn. The above six themes are then a longer-term menu that can and should be addressed over a number of years, depending on regional priorities, funding, partnerships, and opportunities to make a significant contribution. To succeed initially, the Network needs a small number of clear technical foci that are universally understood to be profoundly critical for the region. The Network will address these key issues with a special focus on dramatically improving water management through policy, technical, and training interventions that affect how people and institutions conceptualize and use this limited resource.

4.5.1 Small-Scale Desalination

Desalination or desalting has been defined, in U.S. law, as the 'use of any process or technique for the removal and, when feasible, adaptation to beneficial use, of organic and inorganic elements and compounds from saline or biologically impaired waters, by itself or in conjunction with other processes' (P.L. 104-298). This definition recognizes not only the action of creating improved water qualities, but acknowledges the necessity of creating useful products from the remaining non-water portion of the water source. Desalination is expensive, energy intensive, and concentrates contaminants such as salt. Yet, without desalination man could not maintain a

quality life as he lives in deserts, on water stressed islands, travels across the oceans, contemplates longer and longer stays in space, and responds to increasing climate variability.

Origins and Challenges

Sixty years ago desalination was exorbitantly expensive and was only used in very specialized circumstances. A number of countries, with the majority of funding spent by the U.S. government, began an intensive series of S&T programs which led to the development of improved and new desalination techniques. Old technologies were significantly improved and new technologies were invented. After the large public investments, research continued as industry needed high quality water for the manufacture of semiconductors, pharmaceuticals, medical devices, and other products. In desalination membrane technology, the costs over the past twenty years have decreased by half for the membrane, the amount of purified water created has doubled, the ability to remove salt has doubled, and the overall amount of energy used has decreased from six to eight times theoretical to just over two times.

Today, the world and the United States are facing a number of similar water resource challenges such as: aging infrastructure, population growth, depletion of groundwater resources, impaired water quality associated with particular land uses and land cover, water needed for human and environmental uses, increased competition for limited resources leading to water-use conflicts, as well as responding to climate variability and change. Desalination technologies are a piece of the puzzle as society confronts these challenges. Currently, the worldwide online desalination capacity is 56,000,000 cubic meters per day with 26,800,000 cubic meters per day in the Gulf and 2,520,000 cubic meters per day in North Africa (desaldata.com). Approximately, 52 percent of the existing desalination capacity in the world is in the MENA region. For comparison, North America has 14 percent of the world's capacity. Desalination capacity is expected to increase in the region in the near future, especially in North Africa.

Setting Priorities

Recently, the National Academy of Sciences (NAS) in the United States published a report, *Desalination: A National Perspective*. While the report addressed U.S. issues, the observations and recommendations are valid for the much of the world. The report found in the United States: water scarcity will intensify in the coming decades, desalination will have a niche in water management portfolios, and strategic research can help make desalination a more practical option for communities facing water shortage. One U.S. agency's response to this, the Bureau of Reclamation, was a reformulation of their research goals to focus funding to: reduce environmental impacts, integrate renewable energy into desalination processes, reduce overall costs, expand the scientific understanding of the processes, as well as increase coordination and outreach. The agency has also prioritized inland brackish desalination investments. Many of the research needs described by the NAS are applicable to the MENA region.

Research Opportunities in the MENA Region

A number of highly sophisticated research efforts are being carried out by organizations and governments of wealthy countries in the region as well as in other parts of the world including

Korea, Japan, Singapore, China, Australia, Spain, and others. These efforts are expected to spur innovation and provide significant commercial benefits in the application of large-scale desalination.

A similar high-level coordinated effort for small-scale systems is needed for the MENA region. It is important to note that the U.S. government has identified the development of small-scale desalination, reuse, and energy systems as a priority and has recently completed the construction and begun a research program at the Brackish Groundwater National Desalination Research Facility in Alamogordo, New Mexico in partnership with New Mexico State University. A similar effort has begun at the Center of Excellence in Desalination at Murdoch University in Australia. In each case, there is a desire to improve technology and reduce environmental impacts and costs so that indigenous peoples and small communities have a greater chance to maintain their unique cultures as their existing water sources become inadequate and begin to affect public health and quality of life.

S&T activities that are needed include:

- Transferring innovations from large-scale research to small-scale systems
- Development of robust systems with reduced maintenance for small-scale, geographically disperse systems
- Reduced costs, particularly related to energy use
- Management or beneficial use of small quantities of concentrate or byproducts
- Integration of renewable energy
- Development of new separation processes that directly use renewable energy sources such as heat, photons, electrons, etc.
- Development of small-scale agricultural practices that integrate into small-scale desalination and energy production
- Creation of a x-prize to spur revolutionary research and innovation for small systems
- Maps of sustainable and unsustainable impaired water sources
- Pilot-scale and demonstration-scale projects
- Outreach centers, education programs, and literature

4.5.2 Wastewater Reuse

Wastewater reuse and recycling are described in a number of ways. One of the best descriptions was used for the 2006 report to the U.S. Congress by the Congressional Research Service, *Title XVI Water Reuse Program: Implementation and Legislative Issues*. —. *reuse* connotes planned beneficial use (e.g., landscape watering, agricultural irrigation, and industrial cooling) of treated municipal wastewater. *Reclamation* is the treatment of other impaired surface water (e.g., seawater) or groundwaters (e.g. groundwater with high levels of contaminants, such as arsenic, or salts) to make it usable or reusable. *Recycling* connotes the capture of wastewater and its redirection back into the same water scheme, such as the multiple reuse of water in a manufacturing facility.”

Reuse is generally limited within the MENA region to landscape watering and agricultural irrigation. There are a number of reasons for this including cultural restrictions on its use as well

as the high cost required for purification. For new drinking water supplies, the region currently looks to desalination to treat seawater (impaired surface water) or groundwater contaminated by salts. Today, many ground waters and even some seawater sources contain wastewater and require specialized attention or restricted use after treatment.

A number of projects in Southern California, Singapore, and other areas around the world recognize wastewater as an essential resource. They are treating it to standards higher than those required for drinking water rather than letting it return to the sea. These projects not only look at the highly treated municipal wastewater as a drinking water source, but through aquifer storage and recovery as a way to store high quality water and at the same time prevent seawater intrusion into coastal aquifers.

Setting Priorities

The use of recycled water for drinking water or environmental augmentation has been contentious in many parts of the world because of the potential public health and environmental impacts. The United States is a leader in developing regulations and standards through research. Two significant efforts are helping to identify significant knowledge gaps and set priorities.

The WaterReuse Foundation, for the past ten years, has been funding an aggressive research program that identifies gaps in the scientific understanding and funding research to improve the scientific understanding for better decision making. They have identified five areas for investment: policy, social sciences, and applications; microbiology and disinfection; chemistry and toxicology; treatment technologies for water reuse; and desalination. This has led to a number of research reports available to the public that range from understanding the fate and transport of contaminants of concern, to methods for the detection of extremely low concentrations of chemicals, to use of recycled water on playgrounds and fairways, to economic analyses, guidance documents, guidebooks, and the development of regulatory protocols. The Water Science and Technology Board of the U.S. National Academies is currently finishing an *Assessment of Water Reuse as an Approach to Meeting Future Water Supply Needs*, which is anticipated to be finished in early 2011 and will address a number of issues. It will look at the uses of recycled water for purposes such as drinking water, nonpotable urban uses, irrigation, industrial process water, groundwater recharge, and water for environmental purposes. It will study the technical, economic, institutional, and social challenges as well as research needs in order to provide guidance to decision makers evaluating water supply alternatives. This report will be of importance to the MENA region as the region looks to higher value uses for treated wastewater beyond landscape watering and agricultural irrigation.

Research Opportunities

Because of the geographical and sociological diversity of the MENA region, the application of reused water will vary. Wastewater is currently an underutilized resource that has significant value beyond current uses. Just as in the United States, research is needed to identify gaps in scientific understanding, especially in the social sciences that are unique to the region, in order to provide practical guidance to decision makers evaluating their water supply alternatives.

S&T activities that are needed include:

- Partner with the WaterReuse Foundation and the Water Science and Technology Board to tailor their findings to potential research topics unique to the region
- Create research roadmaps to meet specific outcomes where the outcomes may vary due to geography, demographics, scale and needs of the economy, and culture
- Conduct research studies that reduce gaps in knowledge which currently limit the use of recycled water in the region
- Develop aquifer storage and recovery using highly treated municipal wastewater for drinking water storage, increasing strategic water reserves, and prevention of seawater intrusion
- Conduct research leading to cost reduction and technologies for urban users to treat for higher value uses and higher value environmental purposes, rather than lower value agricultural uses
- Conduct research on user adoption and constraints and develop strategies for acceptance
- Explore the economic and financial issues related to costs and subsidies
- Explore the institutional constraints and frequent orphan status of treated wastewater
- Develop guidance documents implementing knowledge gained from S&T
- Deepen the current cultural appreciation for the importance of water through outreach similar to Singapore's involvement of the public

4.5.3 Groundwater Resource Management

Proper use and allocation of groundwater resources depends on having an understanding of the location and size of the resource, and the rate at which the resource can be extracted without long-term degradation and damage to the aquifers. This understanding is especially critical in arid areas, where groundwater contained in the aquifers may be replenished very slowly, or may even be fossil water that cannot be replenished under present climatic conditions. If water resource managers and planners do not understand the production limits on aquifers and incorporate that information into long-term water-supply planning, there is a real possibility that productive aquifers can be irreparably damaged or take decades to recover. Sustainable groundwater production requires a balance between aquifer recharge and natural and artificial withdrawals. In addition, there has been too little attention given to the institutional, legal, economic and financial aspects of groundwater, but they are key to our understanding of use and misuse. The Centers should fill that vast vacuum by undertaking research leading to policy reformulation.

Estimate Volumes of Fresh, Brackish, and Saline Water

A first step in understanding existing and future problems associated with groundwater use and management is to quantify the existing resources. This can be accomplished in many cases by using existing data or making scientific estimations. In many cases in the region this vital step has not been taken in a rigorous scientific evaluation. Research would involve the collaboration of computer scientists, hydrologists, and geologists. A final product would be maps, perhaps 3D models, indicating current and potential volumes of groundwater of various qualities.

An assessment of the volumes of water held by the major aquifers will be important when compared to the water needs of each area. The volume calculations should be categorized by water type. Fresh water will be of primary interest because it can be used directly to supply drinking water to municipalities. Moderately brackish water resources will also be useful because many plants in arid areas are salt tolerant, and because of its potential as feedstock to small-scale desalination plants. Accurate volume estimates require knowledge of the specific yield or storage capacity of the aquifer. This information will be the most difficult to acquire or estimate. Aquifer transmissivity estimates will be needed to estimate the rate at which aquifers can yield water to production wells.

Some additional background research may be needed to estimate the quantity of groundwater including understanding the extent and characteristics of groundwater aquifers, understanding the movement and direction of flow of groundwater, and defining the recharge sources and discharge areas.

Define Extent and Characteristics of Aquifers. The basic information required to develop an understanding of the extent and hydraulic characteristics of the major aquifers in each country probably already exists, but may be scattered among various government agencies and private companies. Certainly, the first step towards this goal will be to conduct an inventory of existing water wells and acquisition of basic lithologic and hydrologic data for each well. Lithologic data from well cuttings can be used to determine the upper and lower boundaries of the aquifer. Water-level measurements made when the well was drilled can provide information on natural and current conditions in the aquifer. Production-test and aquifer-test data can indicate the potential water yielding capacity of the well. Conductance measurements on and chemical analyses of water samples should be used to assess water potability and detect the presence of harmful compounds. All of the collected data should be incorporated into a text-based geohydrologic database that can be accessed and used by different groups having different technical and computer capabilities.

Define Groundwater Flow Paths. As sufficient hydrologic data is collected, maps of historical and recent water-levels should be prepared to determine groundwater flow directions as they existed under natural conditions, and groundwater flow paths as they have been altered by extraction of groundwater for domestic consumption or agriculture. The maps will provide information on aquifer recharge and discharge areas and identify areas of substantial drawdown that may be indicative of groundwater mining.

Define Recharge Sources and Discharge Areas. Knowledge of recharge area characteristics is important for the assessment of long-term aquifer viability as a water source. Recharge is a crucial aspect of groundwater systems, yet determining recharge has long remained one of the more difficult challenges in hydrologic science. Groundwater systems are seldom at steady state, particularly in dry regions where precipitation and temperature are highly variable. Water-resources planning in such regions rely not only on identifying the timing, locations, and amounts of recharge but also on understanding the interacting processes that modulate recharge. An improved understanding of recharge dynamics can enhance the ability to assess and potentially mitigate the susceptibility of groundwater resources to natural and anthropogenic climatic and vegetational shifts.

Recharge rates can be estimated from records of rainfall in the recharge area and estimates of rainfall infiltration and percolation rates. These rates can be quite difficult to estimate for arid areas. However, there are published rates from studies in arid environments that may be applicable to this region. Generally, percolation rates are extremely low (less than 5 percent). Knowledge of discharge areas can be useful to assess probable negative impacts of groundwater withdrawals on surface water bodies. Excessive groundwater withdrawals can reduce surface-water flow, which may be used as an alternative water source.

Research opportunities and collaboration on the topic of calculating the volumes of groundwater could involve organizing existing water level, water use, water chemistry, and geologic data into a usable format for computer assisted calculations. Field data collection and research on groundwater recharge areas and quantities could involve U.S. based researchers and regional experts. The possibility exists that climate change may dramatically affect the volumes and locality of natural recharge in arid regions and this could be a focus of the simulation research. Understanding the resource is vital to managers, planners, and engineers responsible for delivering water to the region. Training and research on the systemic methods to best estimate the resource could be vital in a region so lacking in natural groundwater.

Evaluate Sustainable Production of Major Aquifers and Predictive Modeling for Sustainable Management

Sustainability of the groundwater resources in the region may be a wishful yet unpractical goal, as a large portion of the groundwater maybe fossil or non-renewable water. This makes an evaluation of the long-term production from groundwater aquifers even more important. The evaluation would involve a synthesis of all of the collected information used to characterize the aquifer geometry, hydrology, and hydraulics along with current and potential future water use patterns. Sustainable production requires understanding the consequences of withdrawals on the resource and determining the most efficient way to utilize and protect the resource for future generations. Estimates and predication would primarily be made using a variety of computer simulations. Collaboration, training, and research would involve U.S. based researchers and experts within the region.

Sustainable production estimates should be continually checked against newly-collected hydrologic data and corrected as necessary. The method of evaluation can be based on basic calculations and estimates of groundwater volumes and aquifer yield rates, or on complex groundwater flow models. It is also necessary to meet with water resources managers from all levels of government to describe and explain technical aspects of the groundwater investigations in terms that can be understood by a non-technical person.

Monitor Well Network and Database Structure. The steady production of groundwater from wells causes long-term changes in water levels and water quality. These changes cannot be properly assessed by measurements in the production wells. A monitoring well network should be established for each major aquifer, and water levels in the wells should be measured monthly, biannually, or annually depending on the particular pumping situation and aquifer sensitivity near the monitoring well. Selected production wells should also be incorporated in the

monitoring well network and specific conductance of groundwater pumped from these should be monitored biannually or annually. These measurements will provide warning of groundwater quality changes caused by pumping. Water samples may be analyzed onsite and submitted for chemical analysis if water quality changes are detected. All of the collected data should be incorporated into the geohydrologic database so that can be easily accessed and used by investigators to track changes in the aquifers and conduct advanced analyses of water-level and water-quality trends.

Assess Groundwater Use Patterns and Distribution. Groundwater use can be difficult to assess, but it is necessary to understand the impact of populations on groundwater resources. Historical water use can only be estimated using recorded information usually associated with larger users such as municipal water departments and companies. It may also be necessary to extract much of the information from paper records. Current water use can be determined by eliciting the cooperation of large users by periodically visiting these users to update the water use database. Water use by private users and farms will likely need to be estimated from average per well extraction rates and estimates of the number of wells in each area. Water use is an essential component in the calibration of groundwater flow models.

Assess Aquifer Vulnerability to Contamination. Contaminants can be introduced into a water-supply aquifer through many situations, such as return flow of agricultural irrigation water, seepage of petroleum and cleaning hydrocarbons in industrial and commercial areas, and inadequate and dilapidated sewage treatment facilities. One aspect of aquifer protection is to identify areas where the aquifer is vulnerable to contamination and perhaps limit certain types of development in those areas. Vulnerability assessment includes a characterization of the hydraulic characteristic of soils and unsaturated zone above the aquifer, identification and characterization of confining units, if present, and mapping of land use according to facilities that potentially be sources of contaminants to the aquifer.

Research, training and collaboration on the topic of sustainable use could be applied across the region. Practical issues include database management and organization, data collection techniques, and understanding whether or not the resource is sustainable. Some aspects can be accomplished by collaboration within the region and others, such as the use of newly developed groundwater flow, water management, and predictive computer models, will require training and collaborative research work with U.S. based or regional experts. Hydrological and water management modeling play an increasingly important role in the management of catchments with respect to floods, water resources, water quality, and environmental protection.

Potential Effects of Climate Change and Increasing Population on Groundwater Resources

Groundwater is a crucial natural resource and a primary source for agriculture and domestic water supplies in many countries in the region. Recent increases in population in the region have and will continue to cause deterioration of groundwater resources. In addition, a very real potential exists that global warming will cause changes in groundwater recharge rates, and rising sea levels will cause saltwater intrusion. In order to maintain the sustainable uses of groundwater resources, evaluations of changes in not only groundwater storage but also groundwater fluxes (recharge rates and discharge rates) are necessary and extremely important.

Addressing the potential effects of climate change on water resources requires an understanding of changes in climatic conditions, such as changes in temperature and precipitation, water availability and quality, agriculture, and the socioeconomic factors that may result from climate change. Research into assessment and future forecasting under the various pressures of humanity and climate changes would be the principal aspect of this program. Coastal areas in the region may have concerns for both sea water rise and population growth whereas internal areas may be more affected by larger populations depleting natural supplies and climate change effecting rainfall and recharge patterns. Research would involve collaboration between entities in the region and U.S. counterparts in data collection and aspects of predictive modeling. A goal of climate change research would be to identify the major groundwater resources in the region most likely to be highly stressed by climate variability/change and population increases and to coordinate efforts to understand future climate impacts and management options to enhance groundwater sustainability.

Research and collaboration would involve primarily data evaluation, management needs, and need for additional data. The initial goal would be to describe and delineate groundwater management areas potentially affected by climate change and/or population growth across the region, including areas extending across national borders and determining what criteria are needed to make this assessment. Water management simulation modeling could assist in these evaluations.

The potential effects of climate change on groundwater resources criteria may include:

- Changing rainfall patterns – is the current weather station network adequate to determine potential changes?
- Effects of temperature variability on groundwater recharge, evaporation, and other issues
- Potential for increases in wind and dust storms and effect on water use
- Sea level rise and effects on groundwater quality and availability
- Possible temperature and water quality changes in the Arabian Gulf and Mediterranean Sea and effects on water use
- Need for additional data collection such as weather stations and groundwater monitoring wells in the coastal areas

The potential effects on population growth on the groundwater resource:

- Increased pumpage and non-sustainable use
- Changing land use – urban areas expanding into areas of groundwater resources

- Changes in recharge areas and rates of recharge – paving over natural recharge areas, storm runoff going directly to the sea instead of into the groundwater reservoir
- Water quality degradation including emerging contaminants
- International conflicts on shared water resources such as the Nile, Jordan, and Tigris and Euphrates rivers and the Nubian and Disi aquifers

Research into the potential effects on climate change and increased population would be conducted in order to give managers some ideas and criteria on future infrastructure and emergency plans; to develop data collection networks to better address the potential problems; and to increase collaboration between and amongst U.S. based scientists and regional experts.

4.5.4 Saltwater Intrusion – Effects on Quality

Saltwater intrusion into freshwater resources falls primarily into two categories, seawater intrusion in coastal and deltaic areas and upwelling of brackish or saline groundwater into overlying freshwater aquifers. Both of these conditions exist in the region and both may have substantial effects on water quality of freshwater resources and are likely the result of human activities or potentially climate change.

Seawater Intrusion in Coastal and Deltaic Areas

Groundwater degradation from seawater intrusion is an actual and potential result of groundwater pumpage near major coastal population centers, due to sea level increases. Groundwater development in coastal and deltaic areas may need to be curtailed or restricted due to the effect and potential effect of seawater intrusion. The risk is that excessive pumping of groundwater in these areas may induce seawater to flow into the aquifer thereby contaminating the water source and making it unusable for most uses.

Sea-level rise in the region is especially critical in those low lying coastal areas where groundwater occurs and is subjected to current and future human impacts. Certain areas in the region may be more susceptible, including areas where coastal sediments are permeable, deltaic areas such as the Nile delta, coastal sand dunes areas, and barrier islands such as off the coast of Morocco, Tunisia, Libya, Egypt, and Saudi Arabia. The impact on sea level rise in these various locations is not well understood and further classification of the vulnerability of coastal aquifers needs to be addressed.

The vulnerability of groundwater resources in coastal areas to sea level rise can be assessed relative to the following concerns:

- In areas with large freshwater aquifer reserves – changes in the volume or chemistry of fresh water may have large impacts on domestic, agricultural, and industrial supplies and have significant environmental impacts.

- The potential for sea-level rise or seawater intrusion to increase the extent and severity on socioeconomic activities in coastal areas already impacted by overpumping of groundwater. An assessment of predictive human activity could help managers evaluate the problem areas.
- The distance between the coastline and vulnerable areas such as low-lying agricultural areas is the principal factor in assessing possible effects of seawater intrusion. Potential groundwater level rise associated with sea-level rise is a function of the characteristics of the aquifer.
- Even in aquifer systems where water flows rapidly, the effect of sea-level rise and seawater intrusion on freshwater systems is not immediate, instead occurring years or decades after initial actions, thus giving managers and engineers some time for decision making.
- The potential effects of sea-level rise on groundwater resources are predominantly controlled by aquifer properties and therefore knowledge of these properties is critical. Those properties may include:
 - type of aquifer: confined, unconfined, or semi-confined
 - occurrence of confining or semi-permeable layers which inhibit saline intrusion
 - aquifer thickness
 - hydraulic conductivity
 - porosity
 - groundwater level in the aquifer especially in relation to the coastal sea level

Research into the potential effect of seawater intrusion covers a large range of topics and includes those involving climate change. The principal need is the understanding of the locations where the situation already exists and determination of likely locations where seawater may intrude into fresh groundwater resources. Much of the data and information likely exists and the need would be to better interpret the data using newer tools such as numerical simulations, predictive groundwater flow and quality modeling, and visual displays. In some places additional data would be required, including drilling new monitoring wells in vulnerable areas, collecting groundwater samples for chemical analysis, and collecting additional water use data. Researchers and collaboration would involve U.S. based scientist and regional experts working on data assimilation, processing, and use of state-of-the-art simulation techniques.

Research topics and recommendations include:

- Develop methods to accurately determine the fresh/saline groundwater interface
- Develop guidelines to protect groundwater from chemical deterioration
- Develop methods for conservation and proper use of runoff water
- Develop an early warning monitoring network for seawater intrusion

Groundwater Degradation from Excessive Pumping

In many areas throughout the region the sparse fresh groundwater resources are vulnerable to degradation by excessive pumping which results in the migration of contaminated or saline water

from adjacent or underlying aquifers. Once an aquifer has been contaminated it is difficult if not impossible to repair the damage and return the aquifer to its previous condition. Therefore, great care is needed to assure that these valuable resources are not damaged. In many cases throughout the region aquifers have already been depleted or have become unusable because of non-sustainable pumpage or because of lack of data or knowledge of the groundwater systems. What is needed to avoid further or new degradation is a better understanding of the aquifer's physical and chemical processes.

Much of the necessary data may already be available and the need might be to assimilate the data in a useable format and to try newer methods of data interpretation and predictive simulations. Researchers should be able to collaborate on data interpretation and simulation techniques which would be similar throughout the region. Predictive simulations would include groundwater flow and chemical movements as a result of increased pumping in existing and projected locations. Predictive results of flow and water management models, would give managers a tool or tools to best determine allocation of resources and understanding of the potential consequences of unsustainable groundwater use.

However even in the best of cases it is likely that some additional data would be needed, especially water chemistry data, water use data, and data on aquifer properties. U.S. based scientists and regional experts would be able to determine the best locations for this additional data collection by first understanding the available data and second by understanding the areas most likely to be impacted in the future.

Research topics and recommendations include:

- Develop methods to accurately determine the fresh/saline groundwater interface, including the depth to saline water over broad areas and differences in water chemistry
- Develop predictive computer models that will simulate current and future groundwater withdrawals and the effect on the movement of saline water
- Develop monitoring systems that will provide an early warning if water chemistry in the aquifer is deteriorating
- Use techniques to visually demonstrate the potential effects of overpumping on the quality and quantity of groundwater in order for managers to more fully understand the consequences of their decisions

4.5.5 Water Use Efficiency and Productivity, Particularly for Improved Irrigation Management

Most countries in the dry areas are facing increasing water scarcity. In some cases, such as Jordan, per capita availability of fresh water has already dropped to 170 cubic meters per year, well below the internationally recognized water scarcity standard of 500 cubic meters per year. Future projections of population growth indicate a further decrease in per capita water resources. In the Middle East and North Africa, for example, current per capita renewable water resources

of 1,100 cubic meters per year are projected to drop to 550 cubic meters per year by 2050, which will trigger a higher water withdrawal rate with both ecological and human livelihood implications.

Water scarcity and quality are potentially serious threats to food security and health in dry areas. The proportion of the population without access to reliable, uncontaminated water in the MENA region can reach nearly 80 percent, depending on location. Irrigation accounts for 80-90 percent of all water used in dry areas. However, increasing competition for water among various sectors will likely reduce the share for agriculture to about 50 percent by 2050.

Satisfying new demands for water requires the transfer of water from relatively unproductive agricultural uses, including the production of non-food crops, such as cotton, in situations where drinking water for urban areas is critical. In the U.S., farmers have sold or leased millions of cubic meters of water to other users, yet aggregate farm revenue, held constant for inflation, has not declined. Farmers adjust to using less water by being more efficient and there is plenty of room for improvement worldwide. When farmers sell or lease water rights, they fallow the least productive fields on the farm, shift the crop mix, or change the irrigation system. Increasingly, the water right itself is more valuable than an agricultural crop when the water is diverted to other sectors; however, socioeconomic repercussions are often serious. Many farming communities cannot survive without an alternative source of income when wholesale water transfers are approved. For this reason, there is need for dialogue and win-win solutions.

Research has demonstrated that substantial increases in crop yields and water use efficiency/water productivity are possible in all agroecosystems of the dry areas. Supplemental irrigation in rain-fed areas, for example, increases water productivity 2 to 4 times that of rainwater or full irrigation. Water harvesting in dry rangelands saves 40-50 percent of the runoff otherwise lost to evaporation. Deficit irrigation combined with appropriate cropping patterns in irrigated areas can double economic water productivity. In addition, molecular and other biotechnological tools and applications to enhance and complement conventional plant breeding offer new prospects for increased yield per unit of water; improved heat, cold and salt stress tolerance, and resistance to a wide range of pests and diseases.

Uncontrolled exploitation of groundwater has led to falling water tables, abandoned wells, dried-up springs and qanats, and salt-water intrusion. Opportunities for expanding cultivated lands are, therefore, minimal. Sustainable increases in food supplies must come from increased productivity of both rainfed and irrigated agriculture, i.e. producing "more crop per drop". The need to improve water use in agriculture is not only vital for agricultural productivity but also for ecosystem health in dry areas, some of which also include important wetland biodiversity reserves.

Given the complexity of causal factors of land degradation, an integrated approach including broad stakeholder participation is essential if the livelihoods – and security needs – of the people inhabiting dry lands are to be improved without further degrading their environments. Technological, institutional and policy options are required to prevent further land degradation and build viable livelihoods.

Therefore, emphasis for water use efficiency and water productivity activities should be on sustainable, equitable, efficient, and economic use of scarce water resources in agricultural production and within rural communities, with due concern for watershed management and wider environmental and societal implications, including water transfers.

Assess available water resources and costs of their use. An assessment is needed at the field, farm, watershed, and basin levels that includes precipitation, surface water, groundwater and marginal water, and the productivity, benefits and costs of their use. These assessments are essential for the calculation of water productivity and serve to inform policy decisions.

- Options and strategies for sustainable use and improved water productivity of rain, irrigation, shallow water aquifers, and marginal-quality waters in rain-fed and irrigated systems through water harvesting, supplemental irrigation, agro-management, improved germplasm, and integrated agricultural production systems.
- Methods, options, and strategies for drought characterization, preparedness, and mitigation.
- Policy and institutional options such as ways to tax use of water for luxury consumption or to limit its use for speculative purposes.

Related research topics that could be considered for design by Network members include:

- More efficient irrigation water management technologies and tools
- Water valuation for decision-making about water allocations
- Virtual water to explore cropping patterns and market options, including expert trade policies
- Using brackish water and other non-conventional water to supplement freshwater resources
- Water demand management policies and tools
- Reducing non-revenue water
- Introducing or expanding the use of salt-tolerant crops

4.5.6 Integrated Water Resources Management for Climate Change Adaptation

Few regions of the world, with the exceptions of the polar regions and so-called “small island developing states” (SIDS) are potentially as vulnerable to climate change as the MENA region. A 2007 Intergovernmental Panel on Climate Change report notes that “semi-arid and arid areas are particularly exposed to the impacts of climate change on freshwater (high confidence)” and that “many of these areas (e.g., Mediterranean Basin...) will suffer a decrease in water resources due to climate change (very high confidence)” (Kundzewicz et al. 2007). The same report projects decreases in runoff to streams and groundwater recharge in much of the MENA region.

Water storage, flows, quality, and overall availability are influenced by many climatic drivers and changes in these drivers will naturally affect the water resource. Among these are changing spatial and temporal precipitation patterns, increased evapotranspiration and decreased groundwater recharge and runoff due to increases in temperature or wind velocity and salt-water intrusion due to sea-level rise.

Thus, it is prudent for the Network's water science and policy activities to consider the uncertain effects of future climatic and hydrologic changes in the region. However, there are many disagreements as to how to best incorporate climate information into water resources planning and management. Global climate models do not represent all physical processes, and have many sources of uncertainties. They also provide information on a very coarse scale, whereas water planners and managers usually need information on a local or regional scale. Downscaling of such models to a regional scale may provide assistance, but there are inherent, irreducible uncertainties in climate models and these are added to the uncertainties in how the hydrologic system may respond to them.

Further, human-induced climate change is likely not the only driver altering the water cycle in the MENA region. Others presumably include natural climate variability, land use changes such as conversion of cropland to urban areas, or conversion of scrublands or wetlands to irrigated agriculture, population and economic growth, and groundwater overdraft.

Therefore, much of the preparation for adaptation to changes in hydro-climatic conditions can be done by insuring that current water policy, planning and management is robust to a broad range of plausible futures, however those futures are determined. The 2009 Senator Paul Simon Water for the Poor Act Report to Congress identifies three reasonable principles for incorporating uncertain climate change into water activities:

- Identify and implement “no-regret” solutions— activities that will have significantly positive water and sanitation impacts regardless of climate change.
- Focus on building resilience into existing or planned activities. Reducing vulnerabilities to hydrologic variability will also further long-term adaptation goals.
- Seek win-win solutions that yield both mitigation and adaptation benefits—mitigation opportunities in energy, agriculture, and forestry can also serve water adaptation efforts.

Water resources planning has evolved a great deal in recent years with one of the more important developments being “shared vision planning” (SVP). SVP is a collaborative approach to formulating water management solutions that combines three disparate practices: 1) traditional water resources planning, 2) structured public participation, and 3) collaborative computer modeling. SVP is well adapted to climate-based scenario analysis, having been developed during the National Drought Study of 1989-1993. It facilitates a common understanding of a natural resource system and provides a consensus-based forum for stakeholders to identify tradeoffs and new management options. Additionally, SVP creates user-friendly and understandable computer models that are relevant to stakeholder interests and adaptable to changing conditions.

Drought management is another area of water resources management that has made significant strides in recent years. Statistical techniques have evolved that use even poor and incomplete datasets to help answer typical questions managers ask, such as “What is the drought that we must make contingency plans for?” “How unusual is the current drought?” And, “What is the likelihood that the current drought will last another X months?” Such advances seem particularly relevant to the arid MENA region and provide another example of how the network could help

build resilience to climate variability and change in collaboration with scientists and decision-makers from the region, assisting them with closing the gaps between water supply and demand.

In addition to the above, MENA WCN could support activities such as the following:

- Build resilience into human-built infrastructures through human capacity-building, research, and technology transfer programs to help engineers evaluate inefficiencies and vulnerabilities in infrastructure design and operation and provide a basis for more robust design.
- Develop regionally appropriate methods to downscale global climate change models to the regional scale for the benefit of water planners and managers.
- Develop best practices for risk management-based decision-making under conditions of deep uncertainty.
- Conduct climate-informed vulnerability and impact assessments, including identifying the most vulnerable groups and infrastructure that is at increased risk.
- Strengthen community-based preparedness and hydro-meteorological early-warning systems to reduce current vulnerability to climate variability while increasing resilience to climate change.

5 ASSESSMENT OF POTENTIAL NETWORK MEMBERS

Following visits to the region, the Design Team recommends that the following research institutions and universities, arranged alphabetically by country, be considered as an initial set of the Network's Centers of Excellence:

1. National Water Research Center in Egypt
2. Jordan University of Science and Technology
3. Royal Scientific Society in Jordan
4. University of Jordan
5. Kuwait Institute for Scientific Research
6. Agronomic and Veterinary Institute Hassan II in Morocco
7. International Institute of Water and Sanitation under the National Office of Potable Water in Morocco
8. Qatar National Food Security Program
9. Middle East Desalination Research Center in Oman
10. Arab Water Academy in the United Arab Emirates
11. Environmental Agency of Abu Dhabi
12. International Center for Biosaline Agriculture in the United Arab Emirates
13. International Center for Agricultural Research in the Dry Areas
14. International Water Management Institute

The following criteria were used to consider inclusion of entities in the region:

- Interest in or commitment to the concept of a network of centers of excellence
- Operating infrastructure
- Reputation with the country and region
- Insights in the nature and seriousness of water resource issues in the region
- Established structure and staff
- In-house technical capacity
- On-going water-related programs in research, training, or outreach
- Evidence of institutional collaboration within the country, regionally, or internationally
- Record of information dissemination and outreach

The Design Committee is aware that no entity will have all characteristics. Its recommendation is based on the overall assessment of the institution.

5.1 National Water Research Center (NWSC) in Egypt

The Center was started in 1975 to conduct applied research in all aspects of water, organized into 14 sub-centers, laboratories, and institutes:

- Water Management
- Drainage
- Water Resources Research

- Nile River
- Hydraulics
- Channel Maintenance
- Groundwater
- Construction
- Mechanical and Electrical
- Survey
- Coastal
- Environment and Climate
- Central Laboratory for Environment Quality Monitoring
- Strategic Research Institute

The Research Institute for Groundwater Center (RIGW) is 50 years old and measures monthly water levels in 5,000 wells across the country. Groundwater provides 8 billion cubic meters per year for various uses and is projected to exceed 12 billion in the near future. The country is therefore relying heavily on the Institute and others to find good plentiful sources of water. The Center has a very well established, scientific water-quality monitoring network of 200 wells initiated as part of a Dutch research program, including analysis of 50 parameters.

RIGW is working on several methods of aquifer storage and recovery using treated water or surface water to augment depleted groundwater supplies. The research is technically sound but they could certainly use some assistance. A real problem for the RIGW is lack of funds to purchase simple things like computer software and readily available equipment that would greatly enhance their research.

RIGW needs assistance in assessing the potential of an expansive carbonate aquifer which underlies most of Northern Egypt. The water is desperately needed for Egypt's future but is currently being exploited with little understanding or planning. The aquifer is a fault driven system and RIGW does not have the expertise or technology to correctly assess the aquifer's capacity. RIGW is currently trying to conduct monitoring of potential seawater intrusion in coastal areas with an inadequate budget. RIGW has dedicated staff which would appreciate any assistance from MENA WCN.

The Drainage Research Institute (DRI) has a well qualified and dedicated staff. They conduct research on various aspects of drainage including, treatments and filters but a huge part of the research concerns water resources and water quality. DRI established a monitoring network with Canadian assistance and currently collects monthly water quality samples from 125 stations throughout the country that are each analyzed for 25 parameters, constituting a huge number of samples and expense. They use an up-to-date Microsoft Access database and make a yearly assessment of the monitoring network in an annual report.

Channel Maintenance Research Institute conducts innovative research on some of the 50,000 kilometers of irrigation channels in the country. Issues include infestation by weeds and sand clogging. All chemical treatment for weeds was stopped in 1992 and the Institute has been at the forefront of new research and technology to rid the channels of weeds including mechanical and biological treatment. They have devised huge traps and weirs to remove weeds and conduct

research on different types of weed eating fish. They use remote sensing to map and control weeds in Lake Nasser, and have devised innovative ways to determine which areas and channels are more susceptible to sand clogging from moving dunes.

The Central Laboratory for Environmental Quality Monitoring is relatively new and impressive, with a large number of well-staffed and well-equipped labs. The lab is the first phase of creating a Center of Excellence for the NWRC. It is both a training center and a lab for analytical techniques. It is the only internationally accredited lab in the Middle-East. A goal for the lab is to become the Mediterranean Center for Water Quality Studies. They currently conduct three to four month training programs and currently support a lab in the Southern Sudan for Water Quality Technicians. Funding for this training is by Egyptian Aid to Nile Basin Countries from the Office of the Prime Minister. The lab has set National Water Quality Standards for Egypt, which are generally in line with regional standards. They have connections for training at the Bari Water Quality Institute in Italy.

The labs have a qualified staff and up-to-date equipment, but almost all the labs, with the exception of the training lab were empty or inactive. The principal reason for the inactivity is that to achieve accreditation the lab is required to do an extensive amount of quality assurance analysis. Quality assurance accounts for 45 percent of the cost for an analysis. The lab charges about 500 Egyptian pounds for a routine but thorough analysis whereas outside low-quality private companies may charge as little as 20 pounds. Therefore it is very difficult to get outside business.

Assessment: Egypt is a critical country in the region and must be represented in the Network. The National Water Research Center in Egypt has broad-based expertise with well-trained staff and good facilities. Problems facing Egypt cover many of the issues facing the region generally. It would profit greatly from inclusion in the Network, opening it to research and researchers elsewhere in the region, providing a stimulating change, regional links, and an exciting research program.

5.2 Jordan University of Science and Technology (JUST)

JUST was established in 1986 on 11 square kilometers outside Irbid. The campus of Yarmouk University was going to move there, but in the end Yarmouk stayed in place offering arts and humanities and some technical fields. JUST is purely technical with 20,000 students from 50 nationalities. It has 30,000 graduates. It has 11 faculties in 55 departments, including faculties in communications and information technology, agriculture, medicine, dentistry, veterinary medicine (the only one in Jordan), pharmacy, nursing, and science and arts. It offers M.Sc. and PhDs in 97 specializations. It has 700 faculty with Ph.D.s. It gives the utmost priority to basic and applied research. It has a Center for Science and Technology focused on the private sector in industrial zone factories offering workshops.

The President said that the Network could fill a space between the government and universities, but it should be housed at a university. The Network should move ahead – don't wait until things are perfect because that moment may never arrive. It is not easy to change university by-laws. He

advised to start slowly, picking a pertinent topic and seeing how it can be developed over the course of a year and then make corrections and expand as appropriate.

JUST would be happy to work with the Center of Excellence. It does not have much connection to North Africa but it is interested in expanding its linkages; as for the Gulf States, it is more capricious – for example, six years ago Qatar stopped sending students for some reason – but they already have significant enrollment of students.

In a discussion of technical issues, he recommended water management, water rights, water demand management, wastewater reuse, and groundwater. The Center should work on social and education components. JUST has agreements with many U.S. institutions but few are active. There are activities with North Carolina State, Iowa and University of Illinois, Chicago.

The Queen Rania Center for Environmental Sciences and Technology was created in 1996 and does training, organizes workshops and promotes awareness. It does not do any research, but typically earns revenue through consultancies for donor-funded projects. Its greatest strength is wastewater reuse. It lacks lab equipment for experiments.

The last word from Vice President Al-Jarrah: —JUST is interested in the Center [sic] whether it is in Jordan or any other place.”

Assessment: The Design Team was very impressed with the intellectual vitality of the university management and their commitment to the concept of the Network. But it noted the lack of creative research and a focus on fees for services leading their water-related efforts to be entirely driven by outside donors and projects. The Network could give real vitality to the university and engage them in meaningful research opportunities that they seem not to have now. JUST and the Network would both gain much from a close partnership.

5.3 Royal Scientific Society (RSS) in Jordan

RSS is the largest national applied research institution in Jordan. It was founded in 1970 by King Hussein, as a not-for-profit NGO, containing 7 technical centers that house 38 nationally and internationally accredited laboratories. The society receives no government or royal court funding; but in the past, when Prince Hassan was Regent he provided a stream of government funding. RSS is now maintained largely on fees for services, amounting to about 70 percent of its income with the balance from consultancies.

RSS is part of a larger scheme and landscape: El Hassan Science City will eventually be home to RSS along with (a) Higher Council for Science and Technology, established in 1987 to set science and technology policies, strategies, plans and programs, increasing awareness of the significance of scientific research and development and directing its activities toward developmental priorities; and (b) Princess Sumaya University for Technology, established in 1991, a not-for-profit specialized university of information and communications technology. The 30 hectare campus is half empty, but the plan is to grow a zone of S&T incubation where private and public sector entities can interact across sectors and disciplines, covering applied to basic approaches.

RSS tests all materials that enter the country or are locally produced, including food and building materials. They are all certified in RSS labs. It also has been contracted by the Ministry of the Environment to do real time water quality testing in Zarqa, King Talal dam, and King Abdullah canal. Much of this testing appears to duplicate the work of other entities, including the central lab of the Water Authority of Jordan. It has recently spent \$1.5 million on lab upgrades. It conducts tests for energy efficiency of household appliances, and has a clean technologies center developed with USAID support – probably IDARA (Instituting Water Demand Management in Jordan – managed by DAI).

There are various entities and joint ventures hosted within the RSS. An example is the Cooperative Monitoring Center linked with Sandia National Laboratories. It is essentially independent, with RSS providing administrative functions. A Water Center Network could be accommodated, interacting with the existing staff and working with HRH Princess Sumaya and her advisory committee, and thence to HRH Prince Hassan who chairs the Board of Directors for the RSS. Naturally, and to be expected, at the staff level there are high expectations for increased levels of staff and operational funds.

Assessment: The Royal Scientific Society brings an international reputation, a clear mission, and a determination to play a significant intellectual and technical role in Jordan and the region. Its new strategic plan is evidence of that new, dynamic direction. Largely isolated from academic institutions in Jordan and with few apparent formal ties to other entities in the region, RSS could profit from participation in MENA WCN by broadening its playing field and circle of regional contacts.

5.4 University of Jordan (UJ)

The university was established in 1962 and now has 19 faculties and 37,000 students and 1,500 faculty. Currently, 250 students are enrolled in the United States and European universities in masters and Ph.D. programs. It has roughly 150,000 graduates.

Ten percent of the budget in 2010 is set aside for medical research but three priorities for applied research are in water, energy and environment. They spoke of the Open Mind Academy which focuses on global issues of high priority to Jordan.

On 30 May the UJ launched the Center of Excellence on Water, Environment, and Energy with a conference. The conclusions: there is a need for a Center, capacity building and applied and basic research. It could be expanded to be a regional Center in the future. The Cabinet in April approved a motion by the Minister of Higher Education to move forward.

The President said that this effort is of great interest to UJ: —Come and let's talk" about was to bring together government, universities, the private sector and donors. He said UJ will provide financial support to the Center and is preparing to break ground for a building where the Center will be housed. The university budget has a line item for research that can be used to make a Jordanian contribution. The university is pushing ahead with joint ventures. He said the new

Center should be independent and free of university by-laws and regulations. He needs approval from different councils but it can be done easily.

The Center will need a business plan and an action plan. It will bring together different existing entities including the Center for Strategic Studies. It is not clear how and if its Water and Environmental Research and Study Center (WERSC) will fit into this plan.

It is no problem for UJ to open participation to other institutions. It will take the responsibility for bringing together these institutions and keeping them involved but it is unclear whether funding in the Center can be used for other institutions in the region.

Assessment: The University of Jordan is already at the epicenter of a major development in the Jordan's water sector, since it has been named as the home for the new Center of Excellence in Water, Energy, and the Environment. The university has made a commitment to build and staff the new facility. The Network's launching coincides with this new entity, and the partnership between the two would bring resources and commitment to the Network and provide international links and research, training, and outreach opportunities to the university.

5.5 Kuwait Institute for Scientific Research (KISR)

KISR is one of the most impressive centers visited by the design team. It has a visionary and charismatic leader who has articulated clear and ambitious goals for the institute. KISR has an excellent staff, the vast majority being Kuwaiti. It has world class laboratories and equipment.

KISR, now 42 years old, works in many areas. It has just completed a rigorous exercise to develop a 20 year strategy for 2010-2030 called a roadmap for 2030 for KISR's transformation. The KISR Transformation Project, a.k.a. the seventh strategic plan since 1980, has almost completed its first phase – vision, mission, strategy and organizational planning. The second phase is on schedule and will be completed by the end of this year: reviewing current systems and processes, building systems and processes, implementing planning, and developing a marketing plan.

Through the Network, KISR can initiate or expand its collaboration with regional and international partners and demonstrate its significant research strengths. In ten years, they want to achieve world class capabilities and be recognized as a regional center of excellence. In 20 years, KISR wants to be an international center of excellence with an international reputation.

It will do this in part by reorganizing into four Centers of Excellence in (1) water, (2) petroleum, (3) energy and building and (4) environment and life sciences. In the future, it may also create Centers of Excellence in infrastructure and economics. Rather than organize by traditional departments and divisions, it will organize each Center under program supervisors to be as flexible as possible, allowing it to draw in members from other Centers, if needed.

Kuwait has the second highest per capita incomes (about \$67,000) in the region and they are making large investments in education, spending \$50 million per month on graduate students getting degrees outside the country (Kuwait University – the only university in Kuwait – does

not offer PhDs). KISR believes that its strategy fits President Obama's vision presented in Cairo last June.

In terms of the water program, KISR is breaking ground now for a \$50 million Water Research Center. It has a staff of 130 with 40 Ph.D.s and an annual budget of \$25 million.

The programs of the Center will include:

- Natural resource management
- Integrated water resources management
- Innovative desalination technologies and systems
- Optimizing existing desalination technologies
- Developing and optimizing wastewater treatment

Clearly, KISR could be a key partner in the MENA WCN. In a presentation it explicitly wrote, –KISR will incorporate the design team's concept into its [own] new Water Center of Excellence facility, and it offers the following:

- Experienced program managers with leadership skills to attract regional partners
- Establishment of a Kuwaiti Science, Technology, and Innovation Council
- Championing an inclusive plan to allow each of the region's Water Center partners to contribute in their areas of expertise
- Establishment of an international training center for water research

Concerning their Frontiers Program with the National Academies of Science, the people responsible said that they are still at an early stage in the design and funding of the effort. KISR is responsible for the first five years and will host an annual event. The plan is to bring together 100 young scientists from 30-45 years of age and U.S. scientists in action-oriented meetings rather than just panels or presentations to start to develop research programs. It will probably take place in 2011. The sessions will be organized by an ad hoc committee of scientists from the region. The audience is the 22 countries of the Arab League, but KISR does not have contacts in each country and will use its professional ties and networks to identify people. It does not think that all 22 countries will attend.

KISR is already building a Center of Excellence for water and has strong indigenous staff, has a long track record of research and development, good facilities, and collaborations with IAEA, USGS and others. They appear interested in being part of the Water Network.

Assessment: KISR has visionary and imaginative management, an impressive technical staff, extensive and outstanding physical facilities, and a strategic plan for the next 20 years that synchronizes well with plans and technical content for MENA WCN. With a sizeable annual budget and serious ambitions to gain regional and international prominence, KISR could be a strong, core member of the Network.

5.6 Agronomic and Veterinary Institute Hassan II (IAV) in Morocco

IAV has 1,200 students between two campuses in Rabat and Agadir. It is the biggest engineering school in Morocco and one of few institutions in Morocco to award Ph.D.s. IAV coordinates the National Drought Mitigation Center, developed with the help of USDA and the University of Nebraska. IAV officials want to develop a stronger link to Nebraska and Nebraska is a strong candidate as a U.S. participating institution in the Network.

IAV also coordinates with the International Irrigation Center, an extension of Utah State University, providing irrigation technology development and training for Morocco and Western/Francophone Africa. IAV hosts students from other African countries: ten percent of the students are from Western Africa. Morocco's Ministry of International Development pays their tuition and expenses.

IAV does crop research and produces varieties for distribution via extension. The Agronomy and Plant Genetics Department receives little or no funding from the US.

Morocco is a natural hub for Western/Francophone Africa, as well as European interest in this region, and IAV would be a strong base for Moroccan inclusion in the Network. Being part of the Center would allow IAV access to needed irrigation technical and policy expertise from outside Morocco. Likewise, IAV enthusiastically laid out a convincing case for participating as a key institution in the Network, possibly as a –sub-hub” for connecting to Western and Francophone Africa.

The Gulf States have an agreement with Morocco to develop irrigation technology. IAV is involved.

IAV as a Network member would also provide linkages to two other Moroccan institutions doing strong work in the water sector: INRA and the School of Meknes. IAV, INRA, and Meknes School of Forestry signed an agreement in 2009 to collaborate on issues pertinent to the Green Morocco Plan.

Assessment: IAV is the preeminent academic institution working in water in Morocco and it has as proven record of excellence in technical areas. Its strong faculty could be strong additions to the operations of the Network and broaden its understanding of the region by covering the Maghreb and linking to Sub-Saharan Africa.

5.7 International Institute of Water and Sanitation under the National Office of Potable Water (ONEP IEA) in Morocco

The International Institute of Water and Sanitation under the National Office of Potable Water (ONEP IEA), created in 1978, provides training, research and development, knowledge sharing, and technical assistance in water and sanitation infrastructure, operations, and management. IEA conducts training of technicians, managers, and engineers, as well as providing technical assistance to utilities (in Morocco, MENA and Sub-Saharan Africa). The vision for ONEP is south-south cooperation and to be a resource to the MENA/Sub-Saharan Africa regions. Like

IAV, ONEP would be a natural base for the Network's connections to Western/Francophone Africa.

IEA also operates two mobile training units to train in the field where operators cannot leave their post. IEA is linked to UNESCO-IHE (Institute for Water Education) and the International Water and Sanitation Center in Delft; Global Water Partnership; and UN Habitat. IEA is the only official Collaborating Center of the WHO in the area of Drinking Water and Sanitation. They also are a founding member of ACWUA and chair the capacity building working group. IEA organizes major events for the Arab region, including with UNEP, and has facilities for training and conferences, including conference center, hotel, multimedia classrooms, laboratory, hands-on workshops, and wastewater treatment pilot plant.

Assessment: ONEP IEA brings much to the Network as a center of excellence member. By virtue of this focus on water and sanitation, ONEP IEA complements the efforts of IAV. And because of its links to Sub-Saharan Africa, it also brings Muslim majority countries and institutions directly into the activities of the Network. IEA expands the possible. Its long-term relations with groups in Europe also increases the likelihood of their engagement and support for the Network. In return, the Network offers links to the Middle East to IEA and provides new venues for their services.

5.8 Middle East Desalination Research Center (MEDRC) in Oman

The Middle East Desalination Research Center (MEDRC) was first conceptualized in 1994 as part of the Multilateral Water Working Group and started in December 1997. At the time, more than 20 countries pledged to take part as members, including Saudi Arabia, Bahrain, and the UAE. The original concept was that each country would donate \$3 million to the Center for a \$60 million endowment. The Center was to operate using the interest of about seven percent with an annual budget of about \$4 million which would make it financially self-sustainable. But when it actually started, only ten members remained, each making its own kind of contribution over the years: the United States, Japan, Korea, the EU, Oman, Holland, Qatar, Jordan (no payment required), and West Bank/Gaza (no payment required).

The result was a total contribution of \$24 million over ten years which was exhausted until Spain recently joined. The center is currently operating on voluntary contributions from member states. Despite fund raising efforts over the past decade, MEDRC raised only \$150,000 from the private sector, in three \$50,000 contributions from Suez and two other companies. In 2008, the Executive Council took the decision to begin reforming the organization and focus projects on the core parties (Jordan, the Palestinian Authority, and Israel).

MEDRC organized two committees for operations: (1) Executive Council with two representatives from each member country, one political and one technical member and (2) the Research Advisory Council (RAC).

The main activities of MEDRC have been on research and training. The Center has four patents and 120 publications in international journals from funding four to five research projects per year with a limit of \$100,000 per project, totaling about 75 projects. It has held training courses in

countries in the region. MEDRC is finally reaping the rewards of the reform and focus on the core parties. Under the MEDRC umbrella, in August, Israelis conducted a training program for Jordanians and Palestinians on wastewater reuse and will conduct a similar hands-on training on desalination.

Currently there is no new research being funded by MEDRC. It has laboratory space built but no equipment. MEDRC has also begun working in wastewater reuse.

Assessment: With additional financial support and engagement in Network activities, it could work towards reaching some of its goals training, research, and knowledge management.

5.9 Qatar National Food Security Program (QNFSP)

The Qatar National Food Security Program's integrated framework on food security focuses on self-sufficiency to the extent possible through proper inventory of land resources, optimization of adapted stable crops, fruits and vegetables and cropping systems that feed the population or be processed and exported. Indigenous production must be complemented with cooperation internationally to produce food that can be imported to Qatar. The strategy is supported with a land use master plan, analyses of future food reserves, value chain analyses for various food production systems like such as hydroponics and winter cropping sequences, an agro-processing park with subsidies for foreign direct investors, and balancing of crop, livestock and aquatic food resources.

QNFSP management spoke about the importance of the United States as a source of expertise. Qatar wants to be a player on the world stage and he cited their investments in sports, education (Education City) and diplomacy (Darfur Peace Talks; \$300 million contribution to the rebuilding of Lebanon) as examples. The QNFSP is just now finishing its first phase of planning and will be moving into implementation about the same time that the Center of Excellence is expected to be born and there may be potential for collaboration. The QNFSP brings expertise from around the world and assembles the people under one umbrella. The timing is also good because the Ministry of Cooperation is just now starting to develop their thinking about international programs.

QNFSP is governed by a Supreme Council, often used in Qatar when a subject has overlaps between regular line ministries. Entities under Supreme Council are streamlined and can act fast while ministries are considered bureaucratic and slow.

Assessment: QNFSP participation enables the Network to tackle issues related to a core technical theme: water use efficiency and productivity. It brings in a country that has explicitly committed itself to being the education hub of the region. The Network would further QNFSP's interest in being a major player on the world stage, beginning with a demonstration of intellectual leadership in the region.

5.10 Arab Water Academy in the United Arab Emirates

The Arab Water Academy (AWA) was created with the aim of becoming a regional "center of excellence" for executive education in water. The Academy's focus is on strengthening the knowledge and skills of MENA decision-makers to address and manage effectively the region's water challenges. The Arab Water Council (AWC) initiated the Academy in discussions with the World Bank roughly around 2006 and proposed that it be located in Egypt. The Academy was eventually based in EAD headquarters in Abu Dhabi, which supports the Academy, along with the IsDB and the World Bank. AWC and AWA share board members and work closely together but the AWA is a separate legal entity and is autonomous from EAD. In 2008 a launch workshop involving 25 decision-makers decided priority courses for the Academy. The courses held in 2009 were water governance, water diplomacy, and remote sensing for water management.

The Academy finished its 2010-2012 Strategic Plan in January 2010, which will include three axes: 1) what the Academy can do for the region, 2) a framework for courses and activities of the center, and 3) positioning the academy to be intellectually and financially independent and sustainable. The Academy would like to become a central "one-stop shop" to either offer products or refer clients to partners which are already offering those products. The framework will map the water sector by: (a) target audiences – decision-makers, influencers, and implementers, (b) subject areas – governance, water technology and (c) modes of impact – networks, training, expert advice. Within this framework, the Academy will identify the areas covered by other institutions and areas AWA should focus efforts, so that the Academy empowers existing efforts by building a regional, integrated approach.

AWA will be governed by the Board and a Technical Advisory Committee and include a small staff, including the director, a program officer, a communications and marketing officer, a finance officer, and an office manager. The Academy envisions its core business and identity will be to offer nine international courses a year along with extension of this training to national level "exchange platforms" which will extend courses to a wider stakeholder audience. Initial "exchange platforms" are being developed at neutral institutions in Morocco and Egypt. Three participants from each country come to international AWA courses and bring the course back to their country, along with two international contributors. The director pointed out that there is a lack of case studies in the region for teaching material, which will be developed at the AWA. The initial courses offered will include water governance, water diplomacy, remote sensing for water management, utility reform, non-conventional water resources, and groundwater management.

Assessment: The Arab Water Academy's emphasis on training for senior water sector managers is obviously of importance and relevance to the Network. We understand that AWA's director wants to focus the program during its early years, but we believe that both entities would profit from a partnership however limited for the present.

5.11 Environmental Agency of Abu Dhabi (EAD) in the United Arab Emirates

Abu Dhabi is the only emirate in the UAE with an environmental agency, with the other emirates following its lead. The Secretary General has made it clear that Abu Dhabi would like to play a

leadership role in water, climate change, environmental data management, and environmental information. EAD develops environmental policies for Abu Dhabi, including establishing a permitting process for well drilling, water quality monitoring, environmental health, fish stock assessments, and soil surveys. Its future role is in policy, regulation, and monitoring, including environmental health. In the area of irrigation, there is a push to use treated wastewater as the main source for agriculture in the next 5 years. Abu Dhabi may restructure water resources and has talked of creating a water center of excellence in the UAE for dealing with more strategic use of the reserve, groundwater extraction, and new technologies. EAD is working with ICARDA on policies and demonstrations of best practices such as xeriscaping.

EAD has made a strong priority of linking research to policy. EAD does applied research through its Policy and Strategy Sector, which has focused on three areas for the coming three years: (1) health codes for all sectors of Abu Dhabi – an area of interest of the Executive Council, (2) fuel consumption for the transportation sector, and (3) conversion of trucks and buses to use biodiesel. EAD's Director General supports the idea of a Network that is not a large physical entity, mirroring the approach of the Arab Water Academy (AWA).

Assessment: EAD is a model government entity, valuing research and using it to develop policies and implementable applications in creative, concrete ways. Its participation in MENA WCN would broaden the perspective of the Network by having a government entity squarely in its midst and ensure that the WCN does not narrowly focus on research. EAD also rightly prides itself on identifying innovative approaches to deal with cutting-edge issues.

5.12 International Center for Biosaline Agriculture (ICBA) in the United Arab Emirates

The International Center for Biosaline Agriculture (ICBA) has a strong technical focus, carrying out applied research on the use of saline water in agriculture, developing new salt-resistant crops on the premises of ICBA, and transferring these results globally, with joint projects with partners in 68 countries. The current research strategy is focused on integrated water resources management (IWRM) using marginal water (saline water and treated wastewater). ICBA recently has been commissioned by the emirate-level and federal governments in UAE in water and wastewater strategy and policy planning. ICBA's recommendations for such national strategies are based on empirical evidence and applied research in areas where evidence is lacking. ICBA could offer strong leadership to the Network in linking research to policy.

ICBA was created in 1999 with funds donated by the Islamic Development Bank (IsDB) and a 100 hectare land grant from the government of Abu Dhabi. It receives ongoing financial support from IsDB, Environment Agency Abu Dhabi (EAD), the UAE Ministry of Environment and Water (MOEW), the International Fund for Agricultural Research (IFAD), the Arab Fund for Economic and Social Development (AFESD), the Asian Development Bank (ADB), the OPEC Fund for International Development (OFID), the European Union, and various research institutes.

ICBA notes it would benefit from more links with first class institutions in the United States for exchange of technologies and management techniques, and modification of these for the local contexts. ICBA's links with U.S. agencies has been mainly with USDA, which has played an

advisory role (USDA Salinity Laboratory), donated 80 percent of the 9,000 germplasm accessions held at ICBA, and cooperated for four years on a soil taxonomy system for the region. Recent collaboration with USAID and NASA has launched the creation of a regional MENA Land Data Assimilation System (MENA-LDAS) to be housed at ICBA which will assimilate remotely-sensed satellite data with land-based observations for regional water management and research.

Assessment: ICBA has charismatic and visionary leadership, but it is isolated from other regional entities. Membership in the Network would bring regional resources to the Center which is largely staffed by expatriates. It would also benefit from stronger links to U.S. institutions, a stated interest of theirs. The Network could match ICBA's interest with IAV and QFNSP to make a very interesting team working on efficiency and productivity issues.

5.13 International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria

The mission of the International Center for Agricultural Research in the Dry Areas (ICARDA) is to contribute to the improvement of livelihoods of the resource-poor in dry areas by enhancing food security and alleviating poverty through research and partnerships to achieve sustainable increases in agricultural productivity and income, while ensuring the efficient and more equitable use and conservation of natural resources. It has a global mandate for improvement of barley, lentil and fava bean and serves the nontropical dry areas in the improvement of on-farm water use efficiency, rangeland and small ruminant production. In the Central and West Asia and North Africa (CWANA) region, ICARDA contributes to the improvement of bread and durum wheat, kabuli chickpea, pasture, forage legumes, and associated farming systems. It also works on improved land management, diversification of production systems, and value-added crop and livestock products. Social, economic and policy research is an integral component of ICARDA's research to better target poverty and to enhance the uptake and maximize impact of the research outputs. ICARDA is committed to the advancement of agricultural research; free exchange of germplasm and information for research; and the protection of intellectual property rights, including indigenous knowledge of farmers.

ICARDA was established in 1977 as an autonomous, non-profit, international research center, one of 15 international research centers supported by the Consultative Group on International Agricultural Research, co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the International Bank for Reconstruction and Development (IBRD) and the United Nations Development Programme (UNDP). The CGIAR centers, including ICARDA, are autonomous institutions, each with its own charter, international Board of Directors, director, and staff. ICARDA's management and operations are monitored by its Board of Directors. Board members include representatives from ICARDA's mandate region as well as from developed countries and from international agencies. The Center maintains an internal audit office, which monitors all operations, and its financial operations are subject to annual review by internationally recognized external auditors.

A portfolio of eight projects in dry areas updated annually in its medium-term plan: (1) Conservation of Agro-biodiversity; (2) ICARDA-CIMMYT Wheat Improvement Program for CWANA; (3) Barley Improvement; (4) Food Legume Improvement; (5)

Strengthening National Seed Systems; (6) Diversification and Sustainable Intensification of Production Systems; (7) Improving Water and Land Management; and (8) Poverty and Livelihood Analysis and Impact Assessment, all supported by service units in Geographic Information Systems (GIS), capacity building, communication, documentation and information services; and computer and biometrics services.

With its main research station and offices stationed in Aleppo, Syria, and a staff of over 500 scientists and support personnel, ICARDA works through a network of more than 100 partnerships with national, regional and international institutions, universities, nongovernmental organizations and ministries in the developing world, and with advanced research institutes (public and private) anywhere. ICARDA has official agreements with the countries with which it cooperates. Their strategy is to conduct joint research with NARS partners, thereby strengthening their capacities. They play a bridging role in encouraging shared research action by linking different NARS to enhance complementarity. ICARDA facilitates both national and regional coordination meetings with its partners to discuss collaborative research and training activities and to develop future work plans and budgets. ICARDA has long-term associations with regional and international organizations and cooperates with advanced research institutes (ARIs) and centers of excellence.

Assessment: ICARDA has far-reaching existing contacts in agriculture and natural resource management in the MENA region. Its reputation of working closely with national governments should help the WCN to tackle the over-allocation of water to the agriculture sector in policy formulations to conserve water and develop better water use efficiency and productivity. As a center in the Consultative Group for International Agricultural Research (CGIAR), it regularly receives core funding from USAID that can help to complement MENA WCN. The Water and Livelihood Initiative is a new project that could provide a platform for intensified work in seven countries of the Middle East: Egypt, Iraq, Jordan, Lebanon, Syria, West Bank/Gaza, and Yemen.

5.14 International Water Management Institute (IWMI) in Sri Lanka

International Water Management Institute (IWMI) began its activities in December 1984. The Institute is a legally registered and recognized institution with special privileges granted to it by the act of Parliament and its charter. IWMI is registered in the United States as a 501(c)(3) non-profit organization. It has offices in 12 countries of Africa and Asia. IWMI's research agenda focuses on water and related land management challenges that affect the livelihoods, nutrition, and health of poor communities, as well as the integrity of ecosystem services on which they depend. Its goal is to generate and disseminate freely available public goods based on groundbreaking research which benefit poor people in developing countries and improve their food and livelihood security.

There are four major research themes at IWMI: water availability and access, productive water use, water quality, agriculture and the environment, and water and society. IWMI has over the last 20 years been developing, testing and applying best practice frameworks that enable explicit inclusion of water management as a sector in building up of sustainable livelihoods, attempting to identify, contextualize and promote policies and management practices that improve agricultural productivity and poverty alleviation while minimizing ecosystem degradation.

IWMI has research projects running in two dozen countries and with a multi-cultural, multi-disciplinary research team. With over 75 scientists from 16 different countries representing both the north and south, IWMI is well placed to make cross-comparisons of results and learn from the knowledge and experience generated in different hydro-ecological and socio-cultural environments. IWMI works with a broad range of international organizations, NGOs, national research agencies and advanced research organizations in different countries. This provides IWMI access to state-of-the art scientific knowledge and also to indigenous knowledge well matched to local conditions.

The Water Center Network would find leverage in IWMI's core strategic objective entitled Policies for People, which promotes policy and institutional change that will stimulate growth and equity to benefit the poor, especially the disadvantaged.

IWMI aims at improving water productivity through, among others, increasing productivity of irrigation water at system to field scales and thus benefiting food production and livelihoods, and formulating adaptive management strategies and institutional and policy reform to improve irrigation system performance. It focuses on managing the impacts of land degradation on water resources by developing novel interventions that reduce the risk of water quality degradation at source, utilizing the concept of ecosystem services and appropriate institutional mechanisms involving upstream and downstream users. Moreover, IWMI is at the forefront of efforts towards making an asset out of urban wastewater by assessing and reducing possible human health and environmental impacts for irrigated agriculture in the urban-rural interface.

Of great relevance to this effort would be IWMI's expertise at improving Integrated Water Resources Management (IWRM) in a basin perspective through formulation of location specific policies and institutional arrangements, and performance and sustainability of water management systems, e.g. public surface and private groundwater irrigation through identification of better governance strategies.

Lastly, the overall aim of IWMI is to strengthen the capacity of water and land management professionals by enhancing their knowledge and skills to identify and address issues in these sectors, acquire expertise needed to solve problems and to implement change that will satisfy stakeholder needs and have impact. These are achieved by providing high quality post doctoral opportunities; capacity strengthening of NARES in developing countries through provision of technical support activities, training, specific technical assistance and resource networking; and IWMI's involvement with CGIAR sponsored Global Open Food and the Agriculture University (GO-FAU).

Assessment: IWMI has identified its research niche as being holistic and hence interdisciplinary, international, basin-scale focused and public good orientated. Similar to the other International Research Centers, IWMI works closely with governments and advises on water policy, allowing it to share successes across countries. IWMI focuses on managing the impacts of land degradation on water resources by developing novel interventions that reduce the risk of water quality degradation at source, utilizing the concept of ecosystem services and appropriate institutional mechanisms involving upstream and downstream users. Of great relevance to the

Water Center Network would be IWMI's expertise at improving IWRM in a basin through formulation of location specific policies and institutional arrangements. A feature of IWMI's research is its orientation towards betterment of the policy environment. IWMI is leading work to better equip stakeholders with institutional structures and strategies which protect the rights of the users as well as the resource itself.

6 NEXT STEPS

During the coming months, the Design Committee intends to hold a numbers of events and carry out other efforts to move the launching of the Water Center Network ahead.

6.1 Circulation of Assessment and Design Report

The Design Committee will circulate this report widely to key stakeholders throughout the Middle East and North Africa, the United States, and elsewhere. It welcomes comments on and improvements of this draft version of the assessment and design report. It would like to have a final version, incorporating all comments in time for the first of several meetings with partners. Invitees to the meeting ought to have read and commented on the draft before that gathering.

6.2 Regional Stakeholder Meetings

The MENA WCN Design Committee will host meetings in early 2011 in Washington and in the Middle East and North Africa. These meetings are intended to assemble the main players in the water sector through the region to discuss this design of the Network and to provide suggestions and make commitments for the Network as it moves into start-up and implementation.

6.2.1 Regional Meeting of Champions

The first of these meetings is planned for 20-30 major figures in government, academia and research, politics, civil society, and the private sector who have the creativity, vision, influence, and commitment to play leading roles championing this regional network from across the region. These participants will be joined by the members of the Design Committee and senior officials of the U.S. government from the engaged Federal agencies. Some of the invited guests could be the core of the Network's Board of Directors.

6.2.2 Network Members – Directors of the Centers of Excellence

The Committee will invite directors of research institutions interested in joining the Network to a series of meetings with the Design Committee, USG agencies, and other groups involved in launching the Network.

6.2.3 MENA Ministries and Senior Management and Network Members

It is critical that the launching of the Network be used as an occasion to bring together policy makers and researchers as a way of concretely bridging what has been a longstanding block to resolving water issues in the region. To that end, the Committee will host a meeting of key ministers from the region – in water, agriculture, planning, environment, public works, and/or higher education – who will form alliances with members of the Network to advance change. We anticipate that every institute will be matched by one or two ministers. We expect that the

composition of each country team might look a bit different, but that the Minister of Water or the Secretary-General or Director-General will attend. Some may have already attended the first meeting in Washington.

6.3 Consultations with Multilateral and Bilateral Donors

During its visits to the region, members of the Design Team met with representatives of donors in Morocco, Egypt, and Jordan. It intends to expand these meetings with donors – both multinational and bilateral – to welcome their participation in defining the management structure, research agenda, policy directions, outreach objectives, and other key aspects of the Network.

6.4 Consultations with U.S. Universities, Research Centers, and the Private Sector

The Design Committee will continue to meet with U.S.-based interested parties that can contribute much to the formation and activities of the Network. Meetings to date, for example with the University of Nebraska have been promising and have led to the signing of a Memorandum of Understanding between the university and USAID for future collaboration. Other USAID/ICARDA and ICIWaRM initiatives have existing networks of universities and, in the latter case, NGOs and professional organizations of water practitioners. These meetings will expand and the pace will accelerate in the months ahead. Similarly, the United States will reach out to universities, research centers, and the private sector in other countries that show an interest. We believe the Network's best chances for success and longevity are based on an alliance of like-minded entities that see the time is ripe for a regional platform to tackle and resolve water issues that undermine the economy and social underpinnings of the region.

6.5 Follow-up Visits in the Middle East and North Africa

Members of the Design Committee have invited many of the key stakeholders and potential Network members, but they have not yet visited Lebanon, Tunisia, West Bank/Gaza, and other countries which could contribute to the operation and programs of the Network. In addition, the Design Team ought to revisit many of the potential members of the Network to talk in more detail now that the overall concept of the Network is clear. These trips should be made throughout 2011, since it will take repeated visits to gain commitment, clarify roles, develop work plans, and begin to bring different Centers together for joint action.