



Technical Advisory Paper No. 1

Improving Global Water Quality Monitoring

UNEP GEMS/Water Programme

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c/o National Water Research Institute
867 Lakeshore Road
Burlington, Ontario, L7R 4A6 CANADA
<http://www.gemswater.org>
tel: 1.905.336.4919
email: gems@ec.gc.ca

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Improving Global Water Quality Monitoring

UNEP GEMS/Water Technical Advisory Group
contributed to this paper:

Martin Adriaanse, UNEP-Global Programme of Action (GPA), via e-mail

John Chilton, British Geological Survey (BGS)

Salif Diop, UNEP-Division of Early Warning and Assessment (DEWA)

Neils Henrik Ipsen, UNEP Collaborating Centre on Water and Environment (UCC-Water)

Seiki Igarashi, National Institute for Environmental Studies (NIES) GEMS/Water Japan

Takeo Jimbow, UN World Water Assessment Programme (WWAP)

Shigeru Kariya, National Institute for Environmental Studies (NIES) GEMS/Water Japan

Steve Lonergan, UNEP-Division of Early Warning and Assessment (DEWA)

Thomas Maurer, Global Runoff Data Centre (GRDC) WMO

Michel Meybeck, Université de Paris, International Geosphere-Biosphere Programme (IGBP) Water Group

Richard Robarts, Director, UNEP GEMS/Water Programme

Yosuke Yamashiki, National Institute for Environmental Studies (NIES) GEMS/Water Japan

Authorship was led by Sabrina Barker, in a collaborative process with UNEP-DEWA and GEMS/Water staff. The contributions of all are acknowledged and appreciated.

The target audience for this paper is national focal points and partner agencies. Readers are encouraged to send comments, feedback and suggestions to gems@ec.gc.ca.

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PART I: Introduction

The recent international water agenda has put water quality issues at the forefront, with the need for good quality water becoming central to securing the future of human and ecosystem health. The agenda and priorities contribute to the role that GEMS/Water plays as the water quality data source for the United Nations system. Since GEMS/Water is science-driven, technical issues are central to all activities.

The role of the Technical Advisory Group (TAG) is to convene every two years to examine in detail a wide range of technical aspects of, and projects for, the UN GEMS/Water Programme. The group is composed of members of the GEMS/Water Steering Committee, as well as representatives of other GEMS/Water partners. The TAG is chaired by a senior UNEP official.

The Technical Advisory Papers serve to provide background information as a guide for the discussions of the TAG meetings. The present paper represents the “corporate view” of the TAG on global water quality monitoring, and the most salient issues facing GEMS/Water. It forms the basis for determining partnership activities: on one hand, the most constructive ways in which partner organizations can contribute to the successful implementation of core activities; and, on the other hand, the best ways for meeting partners’ data and service needs.

This paper, being developed in that context, is divided into three main parts. Part I puts forth a brief overview of water quality monitoring and assessment from a global perspective. The section includes the current goals and activities of GEMS/Water in the world of water quality.

Drawing from the overview, Parts II and III highlight the most salient issues being faced, and a strategic view of issues likely to emerge over the next few years. These parts also focus on key projects in which GEMS/Water is, or should be, actively engaged. The broader international scientific and technical context helps to identify the most constructive ways in which partner organizations can contribute to the successful implementation of the four core activities. This paper will be used to guide the technical aspects of GEMS/Water for the next few years.

CONTEXT— Summary of Four Core Activities and Goals

The Strategic Business Plan 2002-2007 for GEMS/Water describes the work plan, timeline and budget for producing a series of outputs designed to help the programme successfully achieve its mandate. The rationale behind the Plan is that reliable, consistent and appropriate information is the key to understanding and improving the world’s supply and quality of inland water. There is a general consensus that our knowledge of the state of the world’s inland waters needs to be improved. Indeed, inland waters and marine waters are intimately linked in the hydrological cycle, so that an improvement in our knowledge of the quality of inland water will also lead to benefits for the marine environment. Based on this logic, the work plan was developed around four core themes: data, assessments, data quality (QA/QC) and capacity building.

Four Core Activity Areas
1. Global Water Quality Data
2. Global Water Quality Assessments
3. Data Quality (QA/QC)
4. Building Water Quality Capacity

These four core activity areas and their immediate goals are summarized below. They are intended

to highlight key aspects, but are not a comprehensive or exclusive overview of the full programme of work.

1.0 Global Water Quality Data

Activity Summarized:

- ◆ A broader database of water quality parameters that moves away from a dependence on classical parameters, with an increased number of monitoring stations, particularly in Africa, and with an increase in the frequency and timeliness at which data are submitted.

Current Goal:

- ◆ To broaden the parameters and to improve both the temporal and spatial representation of the database.

2.0 Global Water Quality Assessments

Activity Summarized:

- ◆ Data and information input to: global and regional water assessment processes such as UNEP-DEWA Global Environment Outlook, WWAP-World Water Development Report, Millennium Assessment; Millennium Development Goals and World Summit on Sustainable Development time-bound targets; UN fora, particularly UNEP-Global Ministerial Environment Forum, Commission on Sustainable Development-12, and UN-Water.

Current Goal:

- ◆ To provide reliable and appropriate data and information, on a consistent basis.

3.0 Data Quality (QA/QC)

Activity Summarized:

- ◆ Data analysis and Quality Assurance/Quality Control, including reference materials and performance evaluation (PE) samples for laboratories participating in the Programme. Technical resources include the Analytical Methods Dictionary, the PE study, and the Operational Guide.

Current Goal:

- ◆ To provide a suite of technical services designed to ensure credibility of the data sets, provide a basis for comparability and to strengthen water quality monitoring activities at the local level.

4.0 Building Water Quality Capacity

- ◆ A workshop series on modern water sampling and analysis techniques, within a framework of IWRM, targeted at laboratories in developing countries, particularly in Africa.

Current Goal:

- ◆ To strengthen water quality monitoring activities at the local level, thereby increasing the reliability of contributed data and to enable more countries to participate in the Programme.

The implementation of the four core activities presents both challenges and opportunities. Accordingly, they should be the focus for technical advice, and emerging options and solutions.

Part II: Activities, Issues and Recommended Actions

1.0 Global Water Quality Database – Challenges and Opportunities

“Scientists and engineers have made significant progress in many areas related to assessing water resources, water flows and water quality. Particularly, advances in remote sensing, remote data collection and geographic information systems provide powerful tools to complement hydrological and hydrographic data-collection systems. Unfortunately, the national systems for collecting water data are declining in many developing countries due to a lack of financial resources to maintain or expand them... This trend needs to be reversed. It is also of major concern that the knowledge of water quality remains fragmented and practical knowledge of water-related ecosystem services minimal. Efforts to determine and establish the environmental flows required to maintain ecosystem services should be encouraged and reinforced.” – No Water No Future, August 2002.

“Different issues have impacts at short-term or long-term levels, and so the time span should drive what should be monitored, and different chemicals need to be monitored, i.e. pathogens – short term versus endocrine disrupters are long-term in effect, so which variables need to be monitored.” – Stockholm Water Symposium participant

“Until all eco-regions of the world adequately and frequently provide data, then global coverage will not be achieved. Data sources need more incentives to participate, or some type of legal or binding mandate (carrot or stick approach).” – Stockholm Water Symposium participant

“Many of the 600+ original stations of GEMS/Water no longer participate, and the system is not in any sense a comprehensive water quality database that could be used to answer many water-related policy questions.” Earthwatch Critique, 1998.

Today, GEMS/Water has 873 stations, in 104 countries. While coverage has improved, there are still gaps and lags in data submission.



- What is the optimal number of stations to achieve acceptable global coverage? How can they be realized? Should data sources be diversified, e.g., national governments, universities, consultants and contractors?
- Which data are needed for what purposes?
- How can appropriate ecological water quality requirements be defined (versus pristine quality)?
- How can the frequency and quality of data collected be sustained?
- How can countries be encouraged to participate? What would encourage/entice them to actively engage?

Data Needs: The breadth of data types should be guided by foreseen needs, that is, determining what sorts of information will be needed in five to ten years. In this sense, data needs should be directly tied to decision-making and governance.

At present, global coverage of coastal zones is about 40%, but only about 5% for human use.

Land use is increasingly being used to determine parameters for monitoring, particularly for organics. GEMS/Water has about 50 stations which could be combined with land use information from GIS/satellite information. These sources could be used to do a trend analysis and evolution of the state of water resources over 20 years. Land use is more important for monitoring the potential of polluting sources than is measuring the impacts (using sampling-type monitoring) after the pollutants are present. Links should be established with FAO AQUASTAT, land use and agriculture, and surface water quality related to fisheries.

It is easy to build a case for inclusion of groundwater in GEMS/Water, the role for which should be determined in cooperation with IGRAC. The division of roles between GEMS/Water and IGRAC should be determined, to avoid duplication in groundwater monitoring and assessment activities. The emphasis on groundwater resources is necessary if the Millennium Development Goals are to be drivers of GEMS/Water's work in water quality and health.

From the water and sanitation perspective, as viewed by UNEP-GPA, there is a need for quantitative information on pollution loads of rivers to receiving seas. There is a need for data on metals, POPs, biota, and micropollutants, which can be used to measure impacts, and to inform practical implications of human activity on water quality. A global overview is needed of river discharges and annual fluxes of nutrients and sediments and POPs in river mouths of major rivers.

Geospatial coverage: Many data users are particularly interested in developing countries, where little water quality data is available; but recent information (last five years) is needed. Three quarters of the world cannot afford full-scale water quality monitoring infrastructure and will not afford it in the foreseeable future.

The question was raised whether the strategy to collect water-quality information from national monitoring agencies, the way that GEMS/Water does, is old-fashioned or not. Is it advisable to encourage developing countries to collect data through resource-intensive monitoring laboratories? Nowadays relevant quantitative information could be collected in a more efficient and reliable way, using alternate approaches and appropriate technology. (Limitations of the latter must be taken into consideration. It is possible to collect limited water quality information using different approaches than are currently being used, however, there is much potential for development for the future.)

Developing countries could produce valuable information with alternative low cost approaches, based on smart indicators, calculations (diffuse pollution loads, etc.), rule of thumb approaches, step-wise approaches, rapid assessment, and others. However, guidance for implementing such approaches does not yet exist. The Operations Guide on water quality monitoring and assessment was an important achievement in the past. In the same tradition, GEMS/Water could develop guidance on alternate approaches, setting a new standard for water quality assessments and in the meantime prepare its own parallel, proactive strategy.

Linkages with related organizations with shared interests would be mutually beneficial. An ideal data collection scenario would be for GEMS/Water and GRDC to have stations jointly located and data acquired together – harmonization of data collection methods.

Country/Government Participation: As a United Nations, intergovernmental body, GEMS/Water

has a vested interest in strong country participation. There should be a strategy in place to recruit National Focal Points (NFPs), develop their active participation, ensure that they receive relevant benefits in return, and promote the programme to other stakeholders. For example, there should be a benefits page on the website. At the same time, experience shows that country participation is strengthened over time if NFPs have institutionalized commitment, a mandate and reporting relationship. One suggestion was to convene meetings for NFPs at regional or sub-regional levels. Such meetings could be coordinated with other ongoing events, since NFPs currently meet periodically for other reasons.

There is a potential need to have more than one NFP per country, which is the practice of Poland, for example. In this case, GEMS/Water should gain an understanding of the structure of country organizations, and which departments to target. The question arises as to the definition of NFP. Historically, NFPs were strictly government leads. Increasingly, universities and other non-governmental bodies are taking the role of NFP when appropriate. For example, the NFPs for the Convention on Biological Diversity include both governmental and non-governmental agencies.

Over the long term, there should be a plan to systematize the needs and responsibilities for country activity. It would be beneficial to work on standardization, or systematization at all levels, (political, capacity building, sub-regional) to become more efficient with tasks that are routine, and to improve uniform and consistent communications with stakeholders.

Increased contact with government representatives pays dividends in terms of response. The type of contact should be to acknowledge data transactions, report on data use, doing interlaboratory comparisons, and a twice-yearly newsletter. There is a need for feedback mechanisms and recognition. In addition to direct contact, reporting on country participation could be done within the UNEP Governing Council sessions, which would highlight country activity in UNEP. However, an outstanding question is how to serve low-technology countries.

Another method for strengthening links with countries is to build on existing networks or organizations and intergovernmental activities. For instance, linking with UNEP-UCC-Water laboratories could facilitate participation in active countries such as Burkina Faso, Cote d'Ivoire, and Denmark, including Greenland. Each TAG member's organization offers a wealth of networking opportunities in, for example, Germany, Asia-Pacific, UK, and others. GEMS/Water should ensure reciprocity to benefit our relationships. For example, Canada should be submitting hydrology data to GRDC/WMO.

A best practice example was raised: Eurowaternet, as a model for encouraging countries to participate. The European Water Framework forms the basis for countries in EU to conduct their monitoring activities.

Finally, complete global coverage is not just an issue for governments about their own domestic territories. One spatial gap concerns the continent of Antarctica. A related aspect is technological. Spatial coverage could be improved with remotely-sensed data on land use, which offers some water quality parameters. A second source of space-based data could be detecting turbidity and contents of surface water by its colour(s).

2.0 Global Water Quality Assessments - Challenges & Opportunities

There are at least three data sources for information related to the UN targets on water and sanitation, including WHO, UNICEF, USAID "Demographic and Health Surveys." It has been noted, however, that:

“There are definitional and data availability issues that tend to hamper our ability to measure progress towards the targets. Secondly, the available statistics often mask the situation on the ground. A mismatch between the statistics and results of spot checks gives the impression that there is something very wrong with the global statistics. And that something needs to be done to define and make them more realistic and useful. A major problem is still that governments probably doctor the data, and that there are perverse incentives for governments to provide poor data. (Moreover, data must be properly utilized in time for evaluation and continuous change of course and policies based on their feedback.)”-- Background paper of the UN Task Force on Water and Sanitation, 2002.

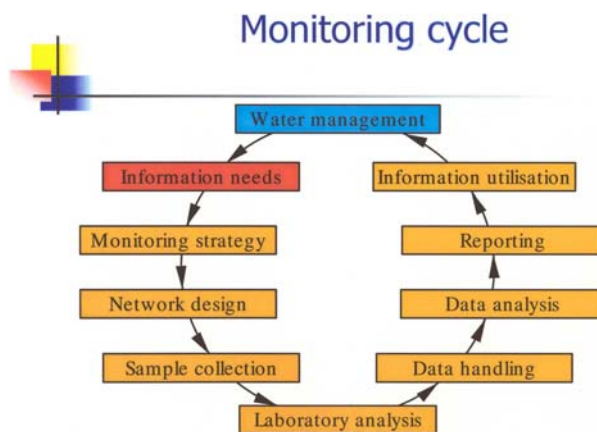
“Strategic and large scale field work at the sub-catchment scale to maintain or restore ecological processes is critical to demonstrating the benefits of investing in the health of rivers.” – World Wildlife Fund-International eco-region conservation approach

- What should GEMS/Water be doing to meet the needs of “user” agencies?
- How can GEMS/Water best contribute to global and regional assessment projects?

Access to Data: A more visible and user-friendly means to access and disseminate data should be developed. This needs to be balanced with the wishes of data providers regarding use of their data. With these and other considerations in mind, GEMS/Water should develop a policy to distinguish categories of access: free, restricted or no access. This policy should be connected with UNEP and be similar to that of WMO Resolution 40. GEMS/Water could play an encouraging role in data sharing and use.

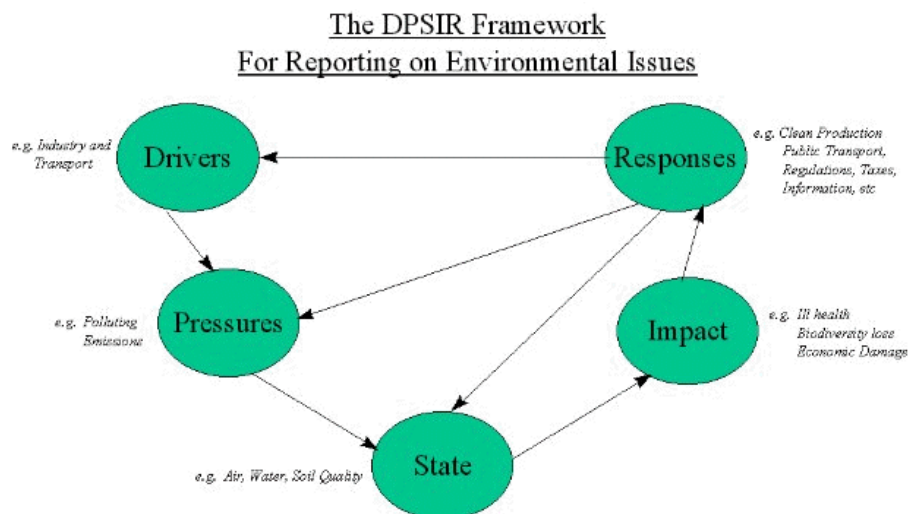
An important point concerns how to improve feedback mechanisms to data providers from users. One possibility would be to add a facility to let providers know how and by whom their data are used.

Appropriate, Strategic Role: In the Figure ‘Monitoring Cycle’ below, GEMS/Water operations are restricted to the bottom half of the loop. GEMS/Water would have to develop capacity in the top half to increase its relevance to assessment processes, and thereby better meet the needs of “users.”



As GEMS/Water develops the capacity to work to some degree at all stages of the monitoring cycle, the framework of DPSIR (Drivers-Pressures- State-Impact-Responses) should be used to guide state of the world’s water assessments. The figure ‘The DPSIR Framework’ describes UNEP’s state of

environment reporting framework, which was used in developing UNEP's *Global Environment Outlook*.



The question was raised as to what type of assessments can be done with the data which exist at present. The strength of the GEMS/Water database is that it is now 25 years old, which makes it like an historical treasure chest of information. Trend analyses or time-series data are needed for such pressure-impact analysis, and this requirement offers a niche role for GEMS/Water in the water quality field.

UN WWAP/World Water Development Report: GEMS/Water needs to target its efforts on the most important and strategic assessment activities, with the WWDR-2 as a priority. Within an overarching theme of “water and governance,” GEMS/Water should work to participate actively in the second edition of the WWDR. Activities should include:

- Producing a section on water quality for the report;
- UN-Water indicators initiative and workshops
 - as UNEP representative
 - peer-reviewer of results
 - as relevant to input of water quality statistics
 - test validity and reliability for indicators;
- Possible regional assessments;
- Producing baselines for trend analysis;
- Peer-review of emerging indicators work;
- Determining definitions for water quality, including aquatic ecosystems and human uses.

In light of Millennium Development Goals and World Summit on Sustainable Development implementation (including the Plan of Implementation and time-bound targets), governments are increasingly concerned about their ability to report achievements to intergovernmental fora, such as Commission on Sustainable Development-12. These processes require targeted water quality assessments, to which GEMS/Water should be anticipating and responding. Examples could include measuring impacts on drinking water as well as impacts on marine-coastal areas. Assessment activities should be linked to agreements and conventions, such as Ramsar, POPs, and other legal or binding intergovernmental mechanisms.

These activities must be selective and strategic; GEMS/Water should seek to avoid duplication and

wasting resources by being aware of UNECE-IWAC (International Water Assessment Centre in RIZA-Netherlands) and other institutions which work on indicators and emerging assessments.

The Global State of Water Quality Monitoring: GEMS/Water can report on the global state of monitoring, in addition to the state of water quality itself. Antarctica should be included in the participation map. The same map should also be refined to show state of global information country by country in terms of first, frequency of activity (ranking) and quality of data submitted (a second ranking.)

To help standardize database information, there should be typologies or metadata for station location (geospatial references), such as small narratives describing datasets.

3.0 Data Quality (QA/QC) --- Challenges and Opportunities

“Developing countries lack the ability to interpret data; the actual monitoring is less of a problem” (IFS Seminar participant)

“The United Nations should help member governments to strengthen their own scientific advisory capabilities... The United Nations will be better able to use scientific advice when all nations have the capability to participate fully in its scientific advisory processes... Scientific assessment mechanisms that have scientific credibility and transparency are especially important to the credibility of the United Nations system.”¹



- Should there be other tools or resources, for example, a rapid water assessment “toolkit?”
- Can remotely-sensed data be compiled and used to create baselines, and do trend analysis?
- Should GEMS/Water provide technical advice or training for laboratories or R&D facilities?
- How can these resources be better promoted and publicized?

New Tools and Resources: There should continue to be technical advice and resources, such as the forthcoming Analytical Methods Dictionary and Laboratory Performance Evaluation Studies. Because of varying capacities of countries to develop large monitoring programmes, a rapid water assessment “toolkit,” would be very useful as guidance to local water quality managers. This follows the step-wise approach described in section 1.0 above.

A technical report from Eurowaternet could be insightful as a ‘best practice’ case. The report² provides guidance to member countries on quality control procedures for Eurowaternet data which

¹ Recommendations from *Knowledge and Diplomacy: Science Advice in the United Nations System* (2002) <http://books.nap.edu/books/0309084903/html/61.html#pagetop>

² http://reports.eea.eu.int/technical_report_2003_98/en

need to be taken into account at national and regional levels. The advice focuses on quality control of sampling and analysis. It describes tests on the integrity of the data carried out by the European Topic Centre on Water before the data are uploaded to the Waterbase database. An attempt to develop a semi-quantifiable index of the quality of data held in the Waterbase is also described.

One suggestion is to make a form for data entry in both hardcopy and electronic formats. A questionnaire as a standardized method for data submission could include, data, mode of collection, method of analysis, difficulties encountered, accuracy rating, etc.

The technical tools that are developed and used can also play an added function of being resources for capacity building activities.

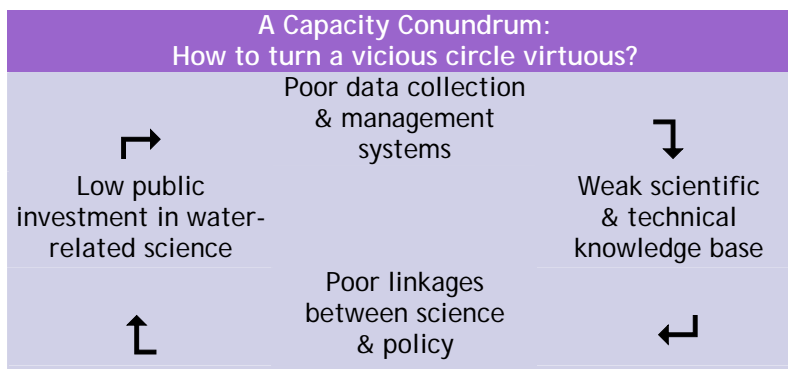
Maintain core focus: The function of research and development should be separate from the four core activities and should play a secondary role.

4.0 Building Water Quality Capacity – Challenges and Opportunities

“Our main problems are lack of equipment, lack of data, sampling, and control techniques.” – Researcher from Ethiopia

“We need lab equipment, documentation and training courses and aid for researchers on specific topics related to the quality of water resources.” -- Researcher from Benin

“We have lots of equipment, but it is going unused because no one is trained on how to use it.” – Researcher from Burkina Faso



- Which funding sources and partners should be sought?
- Who could be potential teaching partners? Should GEMS/Water courses be certified?

The ability of countries to participate in supranational monitoring activities is a separate development requirement from internal GEMS/Water operational resources. In this respect, linking to existing monitoring projects would strengthen GEMS/Water by association. Shared resources are a key, particularly for African countries, which constitute a priority for increasing local monitoring capacity. Examples of linkages could include Global Resource Information Database-Nairobi, IW-Learn, and UNDP CAPNet for ‘Integrated Water Resource Management and Capacity Building’ activities.

One suggestion was to establish an MoU with the Global Environment Facility (GEF), for projects in Africa with monitoring components. A format for reporting could be developed so that relevant

water quality monitoring information could be archived at GEMS/Water, the GEF credited as the source.

GEMS/Water publications are useful as capacity building resources. The Operations Guide, the forthcoming revised Robens Water Quality Monitoring book, and even the database can be used as teaching aids.

Historically, GEMS/Water has strived towards operating and producing materials in the six UN official languages. Currently, GEMS/Water's daily operations can take place in English, French or Spanish. The first edition of the Operations Guide was published in English, French, Spanish, Arabic and Chinese. Multilingualism facilitates worldwide communications and promotes participation. GEMS/Water's flagship publication is the Operations Guide, which will be re-released within the year. It would be beneficial to produce a multi-lingual publication, notwithstanding high costs of translation. GEMS/Water-Japan could provide the Japanese translation of publications, as appropriate.

Mekong River Training Centre proposal: GEMS/Water-Japan envisions establishing a capacity building programme for the Mekong riparian states, in collaboration with local NGOs, including the Mekong Monitoring Institute. This initiative is designed to meet GEMS/Water objectives, while increasing a regional presence in the area.

It may also be useful to add a course on data analysis and QA to the existing course series.

PART III: Cross-cutting Issues

5.0 Institutional Linkages and the International Water Agenda

"The problem with integration is a lack of natural incentives to work together... we need to create rewards for institutions to work together..." – Stockholm Water Symposium participant

GEMS/Water could contribute either directly or indirectly to two Millennium Development Goals and two World Summit targets,

1. Water-borne disease MDG
 2. Ensuring environmental sustainability MDG
 3. Access to water and sanitation target
 4. National IWRM plans by 2005 target.
- How can relationships with others in the UN water and science families become active and productive? (DEWA-regional offices, etc.)

It is important for GEMS/Water to play a role in both the development and implementation of intergovernmental commitments in appropriate UN processes. Key points of engagement include the UN targets numbered above, and linking to agencies with assessment priorities identified for GEMS/Water assessment activities. (These include UNEP GEO, WWDR, CSD-12, etc.)

Diverse data types are needed for UN target related to countries' need for having IWRM plans in place by 2005.

The 'water, sanitation and human settlements' theme connects directly to ongoing Water and Cities initiatives with UN-Habitat. The focus on water use for irrigation and agriculture shows the need for better involvement in GEMS/Water from other UN agencies, such as FAO.

GEMS/Water should make ties with NGOs on specific issues, for example, with International Council for Local Environmental Initiatives (ICLEI) and its Melbourne principles and drinking water database.

6.0 Policy... IWRM and Governance

*The World Bank's Poverty Reduction Strategy Papers include sections on establishing environmental information systems.*³

Integrated Water Resource Management plans include monitoring components.

- How can GEMS/Water become “mainstreamed” in the United Nations system?
- How can GEMS/Water gain access to data generated by IWRM projects in developing countries? (such as UNDP and the development aid industry)
- How can GEMS/Water best position itself with respect to the UNEP Governing Council?
- How can GEMS/Water help improve the scientific base of UNEP?

This issue serves to strengthen the mandate of GEMS/Water to work towards meeting information needs for decision-making, in both management and governance processes. For management (IWRM) related activities, GEMS/Water should be linked to the Global Water Partnership (GWP), targeting assessment and capacity development activities. GEMS/Water should look into becoming a GWP associate programme on water quality monitoring.

Water and Governance is the guiding theme of the WWDR-2. This theme can be drawn on to inform how GEMS/Water can become better engaged in important UN processes. At the regional level, GEMS/Water must play a role in the UNECE Pan-Africa Conference and other activities linked with the African Ministerial Conference on Water (AMCOW) and NePAD.

From a UNEP policy perspective the UNEP Water Policy and Strategy⁴ serves to guide GEMS/Water, as do Governing Council decisions. GEMS/Water should remain actively engaged with UNEP's Division of Policy, and activities and engagement can be linked with UCC-Water, as one of the policy's implementing agencies. A status report to Eighth Special Session on country participation could be a contribution to the Governing Council preparations.

GEMS/Water activities can strengthen UNEP's scientific basis by:

- Being engaged in the process of refining the future direction of DEWA;
- Ensuring that publications should meet the criteria of the scientific and university communities;
- Strengthen the regional component – i.e., through GRID centres, UNEP regional offices, and DEWA regions;
- UNEP must incorporate the human and social component in their assessments. This must be done through partnering with other UN agencies with a human and social mandate. For example, assessments of water need to be coordinated throughout the UN system;
- Focusing on emerging issues is an important mandate for UNEP;

³ For example, http://poverty.worldbank.org/files/Chad_PRSP.pdf

⁴ <http://www.waterday2003.org/unep-water-strategy.htm>

- The SCOPE contract has been designed to identify emerging environmental issues. The final goal is empowerment. DEWA should have a major facilitating role in capacity building; and
- Ensuring that gender issues are incorporated in all assessments.

UNEP.Net activities will focus on data with further focus on quality assurance. DEWA needs to streamline and focus activities. A major task will be the evaluation of legacy activities, such as the global GRID centres, Infoterra, country profiles and points-of-contact. DEWA needs to focus on assessments and emerging issues. Assessments need to be more integrated and address environmental change and peace.

7.0 Communication and Networks

*“What we really need to do is build links with international science organizations.”
– Researcher from Swaziland*

- What are the best communication vehicles for reaching constituencies and stakeholders?
- Are there specific international organizations or processes that GEMS/Water should be networking within?
- How can participant countries in GEMS/Water benefit from being part of a global network?

The single most important communications factor is to improve and maintain strong visibility within the international water community, based on a solid reputation as a credible, science-driven body. The message currently being conveyed is that since the revitalization in 2002, GEMS/Water is a going concern. This message should evolve over time.

Suggestions for improving visibility included writing articles on revitalization for international journals, such as that of the IGBP.

GEMS/Water’s information tools, such as the newsletter, should take international events into consideration, so that for example, the November issue could be on Africa and be distributed at the Pan-African conference in December.

The corporate website is a key communications vehicle, and should include a page on new revitalization aspects of the programme, as well as a tour of site.

ANNEX: AGENDA 21 - Calls to Action in GEMS/Water

Chapter 18 - Freshwater

18.39. All States, according to their capacity and available resources, through bilateral or multilateral cooperation, including the United Nations and other relevant organizations as appropriate, could set the following targets:

(d) To participate, as far as appropriate, in international water-quality monitoring and management programmes such as the Global Water Quality Monitoring Programme (GEMS/WATER), the UNEP Environmentally Sound Management of Inland Waters (EMINWA), the FAO regional inland fishery bodies, and the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention);

18.43. Monitoring and assessment of complex aquatic systems often require multidisciplinary studies involving several institutions and scientists in a joint programme. International water-quality programmes, such as GEMS/WATER, should be oriented towards the water-quality of developing countries. User-friendly software and Geographical Information Systems (GIS) and Global Resource Information Database (GRID) methods should be developed for the handling, analysis and interpretation of monitoring data and for the preparation of management strategies.

Chapter 40 - Information for Decision-Making

40.13. Institutional capacity to integrate environment and development and to develop relevant indicators is lacking at both the national and international levels. Existing institutions and programmes such as the Global Environmental Monitoring System (GEMS) and the Global Resource Information Database (GRID) within UNEP and different entities within the system wide Earthwatch will need to be considerably strengthened. Earthwatch has been an essential element for environment-related data. While programmes related to development data exist in a number of agencies, there is insufficient coordination between them. The activities related to development data of agencies and institutions of the United Nations system should be more effectively coordinated, perhaps through an equivalent and complementary "Development Watch", which with the existing Earthwatch should be coordinated through an appropriate office within the United Nations to ensure the full integration of environment and development concerns.

The UNEP GEMS/Water Programme is a multi-faceted water science centre oriented towards knowledge development on inland water quality issues throughout the world. Major activities include monitoring, QA/QC, assessment and capacity building. Organizational goals are to improve water quality monitoring and assessment capabilities in participating countries, and to determine the status and trends of regional and global water quality.

GEMS/Water was created in 1978. Its role is highlighted in *Agenda 21*, Chapters 18 — *Freshwater*, and 40 — *Information for Decision Making*. While the programme belongs to the whole UN system, it functionally fits into the Division of Early Warning and Assessment (DEWA), UNEP.

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UN GEMS/Water Programme Office
c/o National Water Research Institute
867 Lakeshore Rd. Burlington Ontario
L7R 4A6 Canada
Tel: 1 306 975 6047
Fax: 1 306 975 5663
Email: gems@ec.gc.ca
Website: www.gemswater.org



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