



***Evaluation of  
Urban Pollution  
of Surficial and  
Groundwater  
Aquifers in Africa***





**Project DA/9999-00-01  
September 2002**

**Evaluation and Oversight Unit**

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## PREFACE

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The Urban Pollution of Surficial and Groundwater Aquifers in Africa project addresses the issue of aquifer vulnerability and the need to protect the quality of the continent's groundwater resources. The project is based on a uniform methodology of sample collection, analysis and reporting, while promoting measures for preventing and reducing aquifer pollution.

The project's objectives conform with the primary objectives of the main monitoring programmes of the United Nations Environment Programme (UNEP) and of the United Nations Educational, Scientific and Cultural Organization (UNESCO), including the environmental assessment and reporting element of the UNEP Environmental Assessment and Early Warning Programme. It also supports the Monitoring Strategies for Detecting Groundwater Quality Problems project of UNESCO's International Hydrological Programme (IHP) V 1996-2001 and VI 2002-2007, and is relevant to the Economic and Social Development in Africa programme of the United Nations medium-term plan, 1998-2001.

In this project UNEP and the UNESCO International Hydrological Programme (IHP) worked as facilitators and catalysts to establish and strengthen regional coordination, water management and monitoring systems, with encouragement and support from the United Nations Human Settlements Programme (UN-HABITAT), which has similar complementary activities, and political support from the United Nations Economic Commission for Africa (ECA). Remarkably, this is the first UNEP project to be funded through the United Nations Development Account in New York.

The evaluation of the project was carried out within the UNEP Evaluation and Oversight Unit, with financial support from the United Nations Development Account. An independent consultant and hydrogeologist, Prof. Dr. Lewis Clark, has prepared the current report.



## ABBREVIATIONS

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AMCEN	African Ministerial Conference on the Environment
AMCOW	African Ministerial Conference on Water
BGS	British Geological Survey
CIAPOL	Centre Ivoirien Anti-Pollution
CURAT	Centre Universitaire de Recherche Appliquée en Télédétection (Côte d'Ivoire)
DANIDA	Danish International Development Agency
DESA	Department of Economic and Social Affairs (of the United Nations)
DEWA	UNEP Division of Early Warning and Assessment
ECA	United Nations Economic Commission for Africa
ENRICA	DANIDA Enhancement of Research Capacity
GWSC	Ghana Water and Sewage Corporation
IAEA	International Atomic Energy Agency
IDA	Integrating Development Authority (Ghana)
IHP	UNESCO Division of International Hydrological Programme
INHP	Institut National d'Hygiène Publique (Côte d'Ivoire)
LNSP	Laboratoire de Santé Publique (Côte d'Ivoire)
NEPAD	New Partnership for Africa's Development
ROA	UNEP Regional Office for Africa
SIDA	Swedish International Development Cooperation Agency
SODECI	Société de Distribution d'Eau de Côte d'Ivoire
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-HABITAT	United Nations Human Settlements Programme
GIS	Geographic Information System
GRID	Global Resources Information Database



## EXECUTIVE SUMMARY

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### A. BENEFITS

1. An operating network of seven countries with a developing groundwater pollution monitoring and early warning system is in place. At a cost of \$20,000 a year from each country this has been an inexpensive project and the seven country networks can now be a springboard for future progress.
2. The distribution of Pollution Early Warning Bulletins by the various task forces has already had a clear, albeit local, impact on politicians and water industry managers in each country. One MSc thesis has been produced from the work done by the Abidjan team. A project web site has been established and will provide a window into the project for the international community.

### B. OBJECTIVES

3. The objectives of the Urban Pollution of Surficial and Groundwater Aquifers in Africa Project are set out in the UNEP project document as contributing to:
  - (a) Establishing a network on urban groundwater vulnerability;
  - (b) Developing methodologies for optimal monitoring of the contamination of surficial and groundwater aquifers in African urban areas. This will serve as an early warning and trend detection system for possible water supply pollution.
4. The objectives of the project have been attained and the planned outputs of the project have been largely achieved. The activities set out in the project document and more closely defined at subsequent progress meetings have been undertaken successfully and on schedule.

### C. REASONS

5. The main source of potable water in many cities in Africa is groundwater, commonly from shallow hand-dug wells but also from deeper water supply boreholes. The unplanned expansion of the cities leads, almost inevitably, to a serious pollution threat to the groundwater supplies. The project was organized to provide a robust system of monitoring to give early warning of such pollution and allow legislators and water managers to take action against it.

### D. SCOPE OF EVALUATION

6. This report presents the findings of a project evaluation following the guidelines of the terms of reference issued by UNEP on 16 July 2002. The scope of the evaluation included the following:
  - (a) The evaluation shall be conducted as an in-depth evaluation. The evaluation will review and evaluate the implementation of project activities against the actual results, outputs and activities of the project. Further, the evaluation will comprise proposals for a long-term strategy and action plan for the 2003-2004 biennium;



- (b) Field visits will be undertaken to one or two project countries in West Africa and interviews will be conducted with relevant UNEP and UNESCO staff, project personnel and consultants in project countries, including government and city officials and other stakeholders.

**E. CONCLUSIONS**

- 7. This evaluation deems the project successful and very cost-effective. The project covered seven countries and lasted two years, within a relatively small budget of \$280,000. The Evaluator recommends that a continuation of the project for a further two years is entirely justified and should be implemented immediately.
- 8. The success of the project implementation has been evaluated in terms of six aspects of the project following recommendations by UNEP in the terms of reference. The evaluation of the success of each of these aspects has been made on a scale of one to five, with one being the highest rating. The evaluation results are given in table 1 below. The overall rating for the whole project, based on the ratings in the table is assessed as 2.

**Table 1**

<b>Aspect of project evaluation</b>	<b>Score</b>
Attainment of outputs	2
Completion of activities	2
Project executed within budget	1
Cost effectiveness of project	1
Impact created by the project	3
Sustainability	2
Overall score	2

- 9. The project has encountered problems, but these have in the main been overcome and it is now operating well. The problems encountered have been treated as lessons learned and used to formulate a series of recommendations for the extension of the project.
- 10. The probability of the long-term sustainability of the project is considered very good if the second phase of the project is agreed, funded and implemented immediately following phase one. The project aims are consistent with the present international aid agenda for alleviating drought and water pollution problems in Africa that are being discussed at the World Summit on Sustainable Development in Johannesburg in September 2002. The raised awareness of the impact of the project will attract national and international notice and should encourage the national task forces to attract additional long-term funding from their own Governments, international aid donors and United Nations agencies.



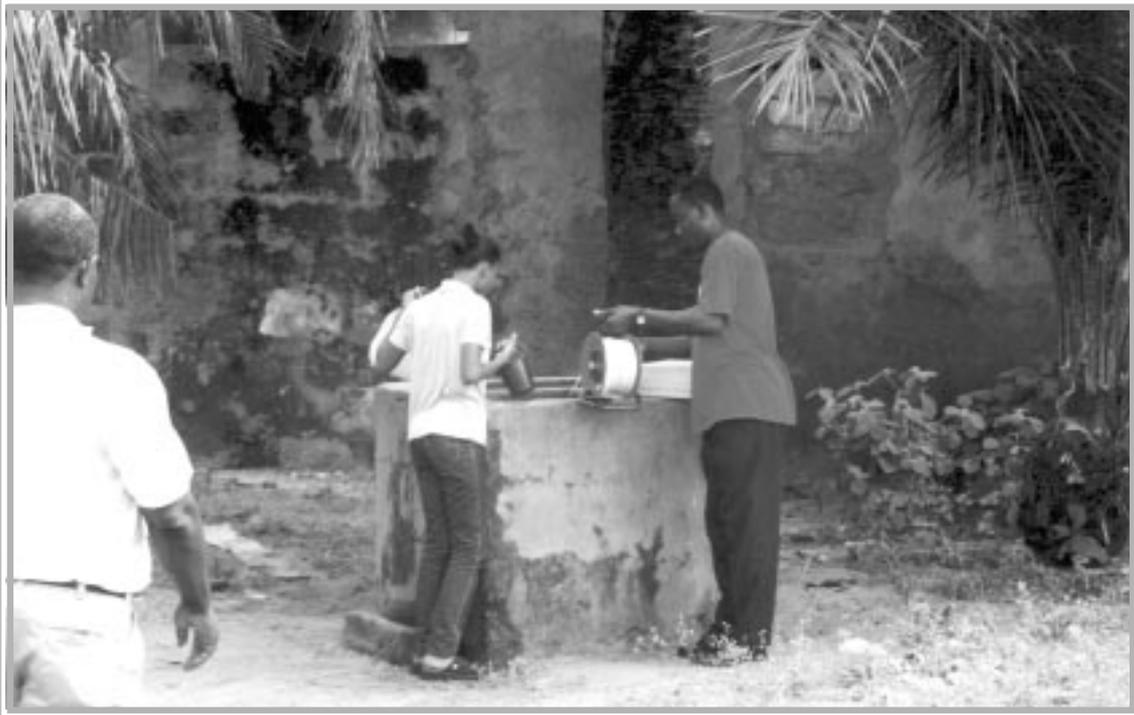
## INTRODUCTION

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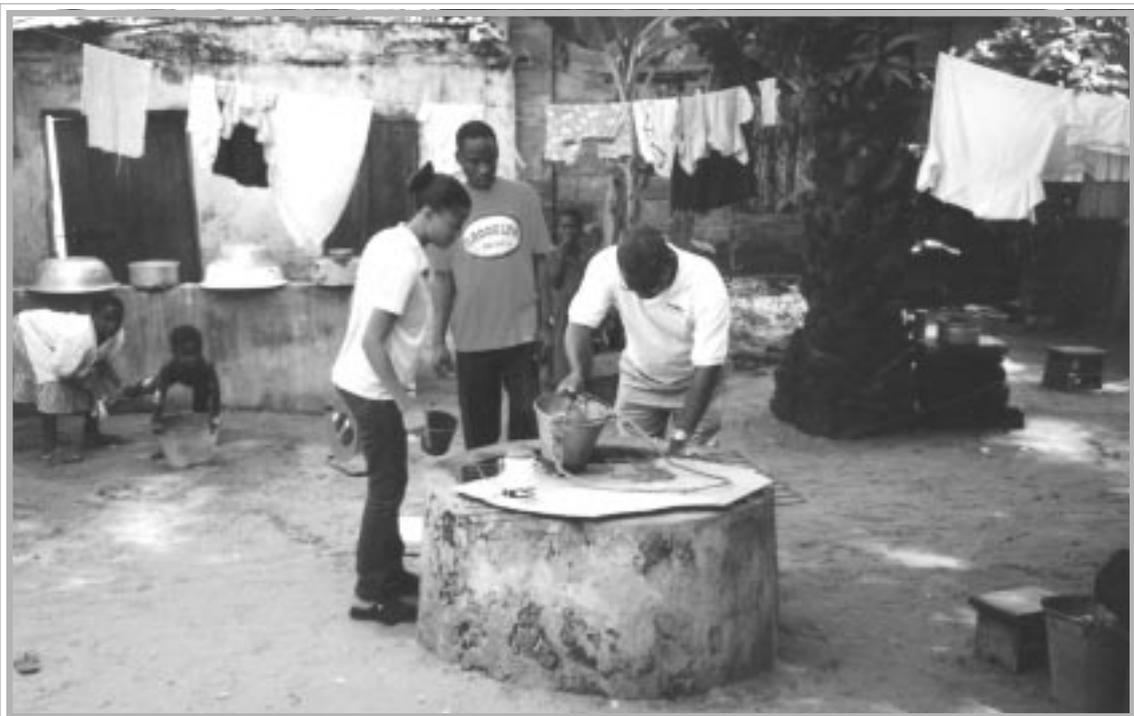
11. In recent decades, many African cities have undergone unprecedented growth in population through natural population growth and through migration from rural areas. In some countries this growth has been exacerbated by an influx of a large number of refugees. Population rise has led to the growth of cities into sprawling “mega-cities” with large areas of unplanned sub-standard housing with few services.
12. The main source of potable water in many of these cities is groundwater, commonly from shallow hand-dug wells but also from deeper water supply boreholes. The unplanned expansion of cities leads, almost inevitably, to a serious pollution threat to the groundwater supplies. Lack of basic sanitation leads to sewage effluent leakage from septic tanks and latrines. Lack of organized domestic waste disposal and uncontrolled industrial and commercial activity add to the pollution threat.
13. This threat to groundwater quality in vulnerable aquifers from urbanization has been recognized for some time. The Urban Pollution of Surficial and Groundwater Aquifers in Africa Project arose from the discussions at a UNESCO/IHP regional workshop held in Ouagadougou, Burkina Faso, in October 1998. This workshop, organized for arid and semi-arid countries in Africa, focused on the subject of mapping groundwater vulnerability and was attended by representatives from Benin, Burkina Faso, Côte d’Ivoire, Guinea, Mali, Niger and Senegal. Delegates recognized the importance of aquifer vulnerability and the need to protect the quality of groundwater resources, and agreed to take action. Delegates supported the scope and implementation of the present programme, with its emphasis on setting up a methodology for an early warning system for groundwater pollution beneath large African cities. Water treatment costs are high and the most effective way to keep the cost of clean water low is to take pre-emptive pollution prevention measures.
14. The objectives of the Urban Pollution of Surficial and Groundwater Aquifers in Africa Project are set out in the UNEP project document as contributing to:
  - (a) Establishing a network on urban groundwater vulnerability;
  - (b) Developing methodologies for optimal monitoring of the contamination of surficial (shallow) and (deep) groundwater aquifers in African urban areas. This will serve as an early warning and trend detection system for possible water supply pollution.
15. The specific tasks (objectives) of the project were listed as including:
  - (a) Assessment of groundwater vulnerability;
  - (b) Identification of hot spots and major threats of surficial and groundwater aquifers in African urban areas;
  - (c) Policy options for better safeguarding of surficial and groundwater aquifers in African urban areas, including pollution and health problem mitigation;
  - (d) Establishment of an early warning network for possible water supply contamination;



- (e) Hydrogeological modeling of groundwater vulnerability in African urban areas;
  - (f) Capacity-building development.
16. The Water Assessment Unit of the UNEP Division of Early Warning and Assessment (DEWA) has had the responsibility of implementing and managing the project in collaboration with the Division of the International Hydrological Programme (IHP), UNESCO Regional Office, Nairobi. The project was originally intended to start in April 2000 but was delayed until October 2000. The inaugural meeting of all participating countries was held in Bamako, Mali, from 11 to 14 December 2000. The work programme effectively started at the beginning of January 2001 and by August 2002 was approaching completion.
17. This report presents the findings of a project evaluation following guidelines in the terms of reference issued by UNEP on 16 July 2002. The scope and methodology of the evaluation were defined as follows:
- (a) The evaluation was to be conducted as an in-depth evaluation. The evaluation would review and evaluate the implementation of project activities against the actual results, outputs and activities of the project, covering the time span from project start, October 2000 to June 2002, 3 months short of project completion. Further, the evaluation would comprise proposals for a long-term strategy and action plan for the 2003-2004 biennium;
  - (b) Relevant documents would be reviewed at UNEP headquarters including project documents, financial reports, progress reports, review reports, guidelines, publications, bulletins, databases and web site;
  - (c) Field visits would be undertaken to one or two project countries in West Africa and interviews would be conducted with relevant UNEP and UNESCO staff, project personnel and consultants in project countries, including government and city officials and other stakeholders.
18. The guidelines were followed as closely as possible but, as the evaluation field visit took place in the last week of July 2002, the evaluation period was extended to the end of July. The countries visited were Ghana (Accra) and Côte d' Ivoire (Abidjan) (Photoplates 1 and 2). Those two countries were selected for the field visit, while the other countries in the network participated in the evaluation through telephone interviews and by e-mail. Questionnaires were prepared and forwarded by e-mail to national project coordinators. Additional questionnaires were prepared for the project management in UNEP/DEWA and UNESCO as well as for stakeholders. Throughout the project evaluation the Evaluator, Professor Lewis Clark, was accompanied and assisted by Ms. Susanne Bech of the UNEP Evaluation and Oversight Unit.



*Photo 1. Ghana task force sampling hand dug well in Keta Town,  
Note lack of hygienic protection and closeness to houses.*



*Photo 2. Sampling hand dug well in compound of house in Keta Town.  
Note poor state of repair and total lack of hygienic protection*

**Photoplate 1: Evaluation Visit to Keta Town near Accra, Ghana**





*Photo 3. Côte d'Ivoire task force and UNEP Evaluator at Public Supply Borehole at Abobo. Groundwater sampling point.*



*Photo 4. Dense unplanned slum development at the gates of SODICI's Adjame North public water supply borehole compound*

**Photoplate 2: Evaluation Visit to Abidjan Project, Côte d'Ivoire**

## I. OVERVIEW OF THE PROJECT

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### A. PROJECT IDENTIFICATION

Title of subprogramme:	1. Environmental Assessment and Early Warning
Title of subprogramme element:	1.2 Environmental Assessment and Reporting
Title of project:	Urban Pollution of Surficial and Groundwater Aquifers in Africa
Project number:	MT/1010-00-15
Geographic scope:	60 Africa
Implementation: Programme Assessment (DWIA)	UNESCO/IHP- Division of International Hydrological under leadership of UNEP Division of Early Warning and
Duration of the project:	24 months
Commencing:	October 2000
Completion:	September 2002

**Table 2**

Cost of project (expressed in US\$)

	Total	Percentage
External funds (United Nations Development Account funds)	250,000	89
Cost to Division of Early Warning and Assessment (DEWA) (in kind)	15,000	5.5
Cost to UNESCO/IHP (in kind)	15,000	5.5
Grand total	280,000	100

### B. PROJECT ACTIVITIES

19. A time table and work plan for the project were set out in the project document (October 2000), comprising five "activity clusters" (table 3), The activities in each cluster are defined in the project document and were meant to run in parallel throughout the project. The work plan of the project was designed to achieve the objectives set out in the project document and in the introduction to this report.
  
20. The realities and practical difficulties of implementing a project covering seven countries have led to changes in the details of the time table and work plan. The conceptual plan of the project, has been followed however and overall the original activities have been undertaken and largely completed.



21. The initial action of the activities cluster 4.2.1 was planned to be an inaugural meeting in Niamey, Niger in October 2000 to launch the field studies in seven African countries.

**Table 3**

Activity clusters in project document, October 2000

Cluster	Activity
4.2.1	Assessment of groundwater vulnerability
4.2.2	Identification of pollution hot spots and major threats to surficial and groundwater aquifers in African urban areas
4.2.3	Policy options for better safeguarding surficial and groundwater aquifers in urban areas
4.2.4	Establishment of an early warning network for possible water supply contamination
4.2.5	Hydrogeological modeling of groundwater vulnerability in African cities

22. The inaugural meeting was held in December in Bamako, Mali from 11 to 14 December 2000, two months later than planned. This Bamako meeting was very successful and set up the framework of the technical aspects of the programme under the guidance of the Senior Consultant. The UNEP/UNESCO officers responsible for the project management, in close consultation with the participating countries, selected a national coordinator for each participating country. The national coordinators in this project were selected from the academic community in each country, rather than from Government ministries because of the skill base already available in the universities. In each country a small team was assembled under the national coordinator. The selection of the coordinators and their colleagues was mostly based on the existing contacts of the UNESCO hydrology specialist at the UNESCO regional office. This was certainly the case with the selection of the Ghana national coordinator late in the project. The urban areas to be studied in each country were identified and agreed: Benin - Cotonou; Burkina Faso - Ouagadougou; Côte d'Ivoire - Abidjan; Guinea - Kamsar; Mali - Bamako; Niger - Niamey; Senegal - Dakar.
23. A time table was agreed for the year 2001, based on 10 tasks that would enable the activities identified in the original time table and work plan to be achieved. A memorandum of understanding was also agreed at the meeting between UNESCO, UNEP and the participating countries.
24. The 10 tasks for the project up to September 2001 are shown in a bar chart in annex II and are summarized in table 4. It was agreed that the progress of the project and the quality of outputs from each participating country would be supervised by the Senior Consultant, who would provide an interim progress report in September 2001.
25. The interim progress report of September 2001, together with the results of interviews during the evaluation mission, made it clear that difficulties had been met with during the start-up phase of the project, but in most countries the bulk of the planned work had been achieved. There were delays in setting up the project; the inaugural meeting, for example,



was delayed from October to December so that the project effectively started at the beginning of 2001. The length of time required for UNESCO procurement procedures also led to delays in starting work requiring computers, photographs or analytical tools. Almost all the countries had problems with the aerial photographs (Task 5), possibly because of procurement problems or the lack of scanning facilities. Despite these delays and difficulties, by the time of the interim report in September 2001, great strides had been made.

**Table 4**

Technical task programme up to September 2001

<b>Task</b>	<b>Action</b>
1	Topographic map digitization
2	Piezometry of identified areas
3	Collection of existing data tables (excel)
4	Keying in of geological data (fractures, structure)
5	Photo purchasing, scanning of aerial photos
6	Preliminary data collection
7	Analyses
8	Provisional thematic maps. Development of computers
9	Climatological data (rainfall) and internet system
10	Mapping of key pollution sources.

26. The activities in cluster 4.2.1, (Assessment of groundwater vulnerability) were either complete or under way as planned; a country task force had been set up in each country, focuses of the studies had been identified, a network of the task forces was established and the project programme was being actively pursued. A project web site had been designed and installed by the Senegal task force and the Senegalese consultants "E -business", and streamlined by the Web Tools Developments Unit in UNEP/DEWA. In September 2001 the web site was under design improvement.
  
27. The activities in cluster 4.2.2, (Identification of pollution hot spots and major threats to surficial and groundwater aquifers in African urban areas), were under way, with the main focus being the design and preparation of the vulnerability maps using geographic information system (GIS) technology. The need to improve the competence of some task forces in the use of GIS was recognized and suitable training was planned. The need to prepare summaries of the project activities in each city or country for dissemination to urban planners was also recognized. A standard format for an early warning bulletin giving details of the project, groundwater pollution and aquifer vulnerability was agreed and presented in the interim progress report. These early warning bulletins were considered important outputs from the project and would be distributed widely to stakeholders and posted on the web site. A summary bulletin of one page would be produced and could be expanded later to a fuller version. The Senior Consultant anticipated that the bulletins could be updated regularly for re-issue on the web site and to stakeholders in each country.



28. The technical activities in cluster 4.2.3, (Policy options for better safeguarding surficial and groundwater aquifers in urban areas), were also complete or under way by September 2001. The seminars planned to disseminate information on the project under the activity cluster 4.2.4, (Establishment of an early warning network for possible water supply contamination), were not scheduled until June or July 2002. Similarly, the activities in cluster 4.2.5, (Hydrogeological modeling of groundwater vulnerability in African cities), were mainly scheduled for the year 2002.
29. An important activity identified under cluster 4.2.5 is the testing and use of existing models and their adaptation, scheduled for April 2001 to June 2002. The models referred to in the project document (annex II) are clearly meant to be contaminant transport models such as Visual MODFLOW for Windows. In this annex to the project document the geographical information systems (GIS) are considered quite separately. The modeling activities have not been carried out and, although not spelled out in any document seen by the Evaluator, it is clear that, at an early stage in the project, an executive decision was made to concentrate the computer-based activities on the GIS aspects of the vulnerability mapping. This concentration of effort on GIS is considered prudent by the Evaluator considering the limited resources of the project and the need to set up a data-processing facility as early as possible. The issue is considered in more detail in chapter II, A. Outputs and Activities and chapter III, Lessons Learned.
30. The Senior Consultant reported that by September 2001 databases had been produced for each country and these had been combined in a single project database held at the Centre Universitaire de Recherche et d'Application en Télédétection (CURAT) by the Côte d'Ivoire task force. At that time it was recognized that the database needed some improvements to ensure uniformity in formatting, but it was in place and accessible. This was a remarkable achievement in just 10 months of work.
31. The GIS systems to be used were the subject of debate among the national project coordinators and a consensus favoured ARC VIEW. As the need for GIS training was recognized, a re-allocation of budgets was agreed to permit the purchase of ARC VIEW 3.2 and DESIGNER 10-2001 software and plan a training seminar in their use.
32. By September 2001 the Senior Consultant had identified a further 14 tasks to take the project from September 2001 to October 2002 (See Annex III). These tasks are summarized on the following page:

**Table 5**

Technical task programme up to October 2002

<b>Task</b>	<b>Action</b>
1	On-site chemical data collection for conductivity, pH, temperature and water levels
2	Databases of site chemistry and bacteriology
3	Databases transferred to web site as Excel tables
4	Setting up web site
5	Issue of first draft of early warning bulletin
6	CD-ROM. Data input standardization
7	Training in ARC VIEW at Abidjan
8	Vulnerability maps
9	Sampling and analysis (chemistry and bacteriology)
10	Finish web site
11	Issue final draft of early warning bulletin
12	Issue draft final report
13	Final version of web site
14	Final project report

33. At the September 2001 progress meeting, the national project coordinators from the participating countries presented the results of the work to date in their respective countries. The presentations by Guinea and Mali were deemed to be inadequate and the coordinators were given notice to improve their outputs by the end of September 2001 or leave the project. Mali met these requests by the deadline to the satisfaction of the Senior Consultant, but Guinea left the project in November 2001 (see section I. C). Ghana was chosen as the country to replace Guinea and joined the project at the beginning of June 2002 (see section I. D). Ghana was chosen because of its proximity to the French-speaking West African countries and because of the existing contacts of the UNESCO hydrology specialists in Accra and his knowledge of the capabilities of that country.
34. The period between September 2001 and the evaluation mission in July 2002 was used by the six active countries to consolidate the work plan shown in annexes II and III. A most important activity in 2002 was the four-day training seminar on ARC VIEW held at CURAT in Abidjan from 8 to 12 March. The representatives of each country were provided with the ARC VIEW software and training manual. They then underwent intensive training, using their own data, to produce the vulnerability maps of their country. The value of that training is shown by the reports, maps and data produced by this project (see chapter II, Project results). It was also evident in the familiarity with the system shown during the evaluation mission to Abidjan.
35. At periods throughout the hydrological year (to ensure that data was representative of both dry and wet seasons), field visits were made to the selected sampling points in each country. On-site geochemical data were collected, as well as groundwater samples for simple geochemical and microbiological analyses. These analytical data were put into the national project databases and incorporated in the vulnerability maps and reports to provide the early warning system.



36. The vulnerability maps for each country were produced under guidance from the Senior Consultant. Several reports (see chapter II) were also produced by each country including:
  - (a) A one-page early warning bulletin (draft and final);
  - (b) A summary report of the hydrogeological situation in the country;
  - (c) A project report giving a more detailed description of the chosen project area with the monitoring results to date (progress and final reports).
37. At the time of the evaluation mission all six countries had produced all the outputs planned for the project in the work plans agreed at the Bamako and Abidjan review meetings (annexes II and III).
38. The two tasks which were outstanding at the time of the evaluation mission were the finalization of the project web site and the project final report by the Senior Consultant (table 5, tasks 12-14 and annex III). There is no reason to believe that these outputs would not be forthcoming within the time frame of the project. Ghana has been part of the project for only two months and is still in the early data-collection phase of the work.

#### C. EXCLUSION OF GUINEA FROM THE PROJECT

39. A major problem for the project arose at the September 2001 progress meeting when it became evident that Guinea was not keeping to the terms of the project. The expected outputs were not produced and the Senior Consultant, supported by a British Geological Survey (BGS) consultant acting as an observer at the progress meeting, considered it unlikely that they could be produced. A deadline of the end of September 2001 was given for their production but this was not met and, regrettably, Guinea left the project under the terms of the UNESCO memorandum of understanding.
40. In a similar situation, Mali was slow in producing project outputs but, after encouragement from UNESCO/UNEP, the coordinator produced the final outputs in time for the evaluation mission.
41. The difficulties encountered by Guinea and Mali are discussed in chapter II (Problems encountered in the project), and prompted recommendations to reduce the risk of the same occurring in other countries joining the project in the future.

#### D. INCLUSION OF GHANA IN THE PROJECT

42. The inclusion of Ghana as a replacement for Guinea in the project was discussed at informal meetings at the University of Ghana in Accra in November 2001. Accra was discounted as a site because of its reliance on surface water for supply. The urban development of Keta, three hours drive east of Accra along the coast towards Togo, was accepted as a suitable location. The area was already the subject of studies by the University of Ghana and the Geology Department had sufficient equipment (donated by DANIDA) to begin work quickly.



43. Ghana joined the project at the beginning of June 2002, only two months before the evaluation mission's visit to Accra. The country could not be evaluated as part of the original project as it did not take part in any project activities and produced no outputs other than a project proposal supporting the choice of the Keta area.
44. Ghana's inclusion in the project is of great potential value, however, in that it may provide a case history for the extension of the project to other English-speaking countries. Recommendations regarding the incorporation of Ghana in a most expeditious manner are discussed in chapter VI (Recommendations).

#### E. RELATIONSHIPS WITH UNITED NATIONS PROGRAMMES AND OTHER INTERNATIONAL INITIATIVES

45. The present project supports the UNEP subprogramme1: Environmental Assessment and Early Warning programme element 1.1: Environmental Assessment and Reporting. It also supports the UNESCO International Hydrological Programme (IHP) VI 1996-2001 Project 3-2: Monitoring Strategies for Detecting Groundwater Quality Problems. The objectives of this project are in conformity with the objectives of these UNEP and UNESCO programmes. The project also is relevant to the overall vision of the United Nations 1998-2001 medium-term plan, programme 14: Economic and Social Development in Africa.
46. The project is part of UNEP water assessment activities in groundwater, which are implemented within the framework of the Global International Waters Assessment (GIWA) project. GIWA provides methodologies and analytical information to help in the identification of priorities and formulation of appropriate policy responses. Also of relevance is the Global Environment Monitoring System (GEMS) water programme, which assesses long-term water quality by establishing and strengthening national water monitoring systems, and recent publications such as the *Vital Water Graphics Publication* and *A Survey of Methods for Groundwater Recharge in Arid and Semi-arid Regions*.
47. In general UNESCO's IHP is set out to stimulate a stronger interrelation between scientific research, application and education. The emphasis is on environmentally sound integrated water resources planning and management supported by a scientifically proven methodology. The current IHP VI includes two major initiatives on groundwater:
  - (a) The project entitled "International Shared Aquifer Resources Management" (ISARM) in cooperation with the International Association of Hydrologists, the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Economic Commission for Europe (ECE); and
  - (b) The establishment of the "International Groundwater Resources Assessment Centre (IGRAC)" under the auspices of UNESCO and the World Meteorological Organization (WMO).
48. The Urban Pollution of Surficial and Groundwater Aquifers in Africa project is complementary to UNEP and UNESCO activities in groundwater in which UNEP and UNESCO work as facilitators and catalysts for establishing and strengthening regional coordination, water management and monitoring systems. The project is unique in its approach and is the only existing UNESCO and UNEP project set up to establish a network for systematic groundwater quality assessment in Africa.



49. Africa is now experiencing the fastest urbanization in the world. In view of acute problems of that urbanization and the drought over large parts of Africa, there is an international focus on groundwater issues on the continent. Aid organizations show a strong interest in alleviating the water problems of Africa. Significant new initiatives include the New Partnership for Africa's Development (NEPAD) and, national cooperation at ministerial level through the African Ministerial Conference on Water (AMCOW) and the African Ministerial Conference on the Environment (AMCEN). The problems of Africa are given global exposure through the World Water Assessment Problem (WWAP).
50. The project will provide data relevant to studies of other projects funded by the United Nations agencies, other international aid agencies and non-governmental organizations. The project in its continuation should be encouraged to learn from these other groundwater projects and profit from shared experience.
51. The ongoing Water for African Cities Programme (WACP) managed by UN-HABITAT is of immediate relevance to the present project. The two projects have different approaches but complement each other and the present project can learn much from the WACP experience. The latter has studied the water supplies of several large African cities, some of which were included in the present project, but has focused on the water management structure and the surface water supplies. The groundwater emphasis and, particularly, the early warning element of the present project are clearly complementary to the WACP outputs.
52. Established facilities such as the information dissemination channels of the Water for African Cities Programme should be utilized by the present project wherever possible, to avoid duplication of effort. The same applies to funding and materials from other sources or aid donors. The Ghana task force, for example, is using equipment supplied by DANIDA, as they have not received any through the UNEP/UNESCO project to date.
53. A service developed by the WACP project that could be invaluable to the present project is the provision of skills in information dissemination. The Evaluator was impressed by educational material produced for Water Education in African Cities and funded by the Swedish International Development Cooperation Agency (SIDA). Similar material such as Value-based Action Learning for Water Management in Kenyan Schools has been produced by UNEP.

## F. PROJECT BUDGET

54. The Urban Pollution of Surficial and Groundwater Aquifers in Africa project is the first UNEP project to be funded through the United Nations Development Account. This account is part of the regular budget and has been derived through administrative savings at the United Nations Secretariat. The Development Account can only be used for initiating projects with scope for long-term impact and for initiation projects in developing countries. It can be seen as development "seed money".
55. The present project has been very useful as a guide to conversion to the IMIS format and the detailed United Nations development account budgeting format for other United Nations development account projects implemented by UNEP. The authorized overall budget is fixed and there is no room for cost overruns. Internal items can be changed but substantive changes have to be agreed by the Office of Programme Planning Budget and Accounts



(OPPBA) in New York. The budget is controlled locally in Nairobi by the Project Coordination and Management Unit (PCMU) of UNEP. Financial reports are executed as follows: UNESCO (as co-implementer) reports their expenditure to UNEP on a quarterly basis; UNEP reports expenditure to OPPBA on a monthly basis. The narrative progress report (see table 7) submitted to the project manager for the Development Account in the Division of Economic and Social Affairs (at the United Nations Secretariat) on a six-monthly basis is completed by a financial report where the particular expenditures are related to the corresponding activities or outputs.

56. The project budget was planned very carefully at the beginning of the project to ensure that all foreseeable items were covered. The annual accounts closed at the end of January 2001 for review and re-allocation of funds to the second year.
57. No major problems have been identified within the budget during implementation. The modeling budget was re-allocated to the GIS purchasing and training under the same budget heads. The only item that required clearance from the Programme Fund Officer in New York was a transfer of funds from a final internal evaluation seminar to this external evaluation mission.
58. The evaluation finds that the project has run relatively trouble free from a budgetary point of view. No budgetary aberrations have been noted and the budget system has had the unexpected bonus of acting as a template for the use of IMIS for other projects. The overall budget of \$280,000 spread over the seven participating countries represents an expenditure of only \$40,000 per country over two years. In terms of the demonstrable activities and outputs completed by the project on time and within a tight budget, as well as the progress of implementation of the project, this project must be classified as outstandingly cost-effective.
59. The project management also has made cost-effective use of external consultants to improve the capabilities and outputs from the project. External to the present project and before its inauguration, a consultant from Zurich University was used by UNESCO to give a training seminar on the estimation of recharge and the use of basic MODFLOW for groundwater modeling to several of the national coordinators of the present project; a publication on this is currently in preparation by UNEP/DEWA and UNESCO/IHP. The training was an effective way of raising hydrogeological capabilities before the project started and encouraging networking. A BGS consultant attended the Abidjan progress meeting in September 2001 as an observer and to assist the Senior Consultant at the seminar. The cost of this consultant was paid for by BGS but the project benefited from his expertise and advice. The cost of the Senior Consultant was kept to a minimum, by avoiding overheads through a fixed-price contract to cover specified activities and outputs over the two-year lifetime of the project.



## II. PROJECT RESULTS

### A. PROJECT OUTPUTS AND ACTIVITIES

60. The outputs planned for the project as listed in the project document are listed in table 6 together with brief comments on their status of achievement. There is no indication from the six-monthly progress reports issued by UNEP that the original planned or described outputs had been changed. The records of the technical progress meetings, however, suggest that the actual outputs of the project were defined and put into place at the inaugural meeting at Bamako, Mali (11 to 14 December 2000).

**Table 6**

Project outputs and activities as planned in the project document, 12 October 2000

1	OUTPUTS AND ACTIVITIES PLANNED GENERAL OUTPUTS	COMMENTS
(a)	A technical report on regional groundwater quality as a tool for the optimal management of groundwater	Integrated in part in reports
(b)	Report on long-term trends in urban groundwater quality in West Africa and relate these observed trends to human activities	Partially fulfilled by summary of country reports (table 4)
(c)	Reports on regional urban variations in groundwater quality in West Africa to be used as the basis for studying natural processes and as a reference point for the study of long-term anthropogenic inputs	Integrated in part in reports
(d)	Technical reports on the groundwater quality in cities in selected West African countries with particular emphasis on drinking water or other non-potable uses	Partially fulfilled by the complete country bulletins
2	SPECIFIC OUTPUTS AND ACTIVITIES	
(a)	A set of country vulnerability maps and descriptive text showing nature and extent of pollution	Partially fulfilled for the selected cities in six countries
(b)	Standardized methodological guidelines for optimal monitoring of wells to serve as early warning and trend detection system for water supply contamination in seven West African countries	Guidelines for monitoring are planned for a later date. Guidelines for the early warning and trend detection completed for six cities
(c)	A report on the status of urban groundwater pollution in seven West African countries	Partially fulfilled for six cities
(d)	Regional training of technical staff on estimation of groundwater recharge and on the use of available software on groundwater flow and contaminant transport to be conducted	Software purchase and training transferred to GIS technology
(e)	A network established to monitor urban groundwater in West Africa	Established successfully in six countries



(f)	An Internet based information system/data base on urban groundwater quality in West Africa and a network provided of country task forces	Established and maintained successfully in six countries
(g)	Establishment of country task forces including all relevant experts in order to undertake the various tasks on surficial and groundwater aquifer vulnerability	Successfully established in seven countries
(h)	A technical cooperation memorandum of agreement signed among participating countries	Signed

61. The focus at the Bamako meeting was on the practicalities of establishing a project web site and on preparing standard vulnerability maps and databases of the chosen cities. The role of the Senior Consultant in focusing attention on these two crucial issues is clear from the record of the meeting. At that early stage (3 months into the project), the need for a uniform approach was being stressed and a programme of progress reports was being formulated. The original diffusely defined “outputs” were rather preliminary and had to be re-defined into more specific outputs that could be delivered by the project (table 7).

**Table 7**

Specific outputs as agreed at the Bamako Meeting 11 to 14 December and subsequent progress meetings

SPECIFIC OUTPUT	DATE DUE	ACTUAL OUTPUT
1. Report of inaugural meeting at Bamako, Mali. 11 to 14 December 2000	Jan. 2001	Delivered. On project web site *
2. Half yearly UNESCO progress report	July 2001	Delivered*
3. Data collection and collation. Prepare provisional maps and databases. Submit results at project progress meeting, Abidjan, 3 to 5 Sept. 2001	Sept. 2001	All countries except for Guinea and Mali delivered contributions judged satisfactory by Senior Consultant
4. National early warning bulletins first draft	Sept. 2001	All delivered except Guinea. Mali delivered very late.*
5. Report of project progress meeting, 3 to 5 September 2001 by Senior Consultant	Sept. 2001	Delivered*
6. National summary reports	Sept. 2001	Delivered for 5 countries. Not Mali or Guinea.*
Guinea excluded from the project		
7. National progress reports for the year 2001	Dec. 2001	Delivered for 5 countries*. Not Mali
8. Half yearly UNESCO progress report	Dec. 2001	Delivered*
9. Progress report by Senior Consultant. March 2002	March 2002	Delivered*



10. Training seminar. Introduction to ARC VIEW and Its Application to GIS. Manual by Côte d'Ivoire team	April 2002	Delivered*
11. Report of training seminar on GIS, Abidjan, 8 to 12 April 2002	April 2002	Delivered*
Ghana admitted to the project		
12. Half yearly UNESCO progress report	July 2002	Delivered*
13. National early warning bulletin. Final edition.	July 2002	Delivered for all countries* except Ghana
14. Final vulnerability maps	July 2002	Delivered for all countries* except Ghana
15. Final progress reports to July 2002	July 2002	Delivered for all countries* except Ghana
16. MSc thesis, University of Cocody, Abidjan	July 2002	To be defended Aug. 2002*
17. Project web site. Final version	July 2002	Final design yet to be agreed and implemented
18. Final project report by Senior Consultant	Sept. 2002	To be delivered
19. Half yearly UNESCO progress report	Oct. 2002	To be delivered
* Outputs seen by the project evaluation team		

62. The management approach of using several sets of planned activities and outputs (for example, those from the project document, the Bamako meeting and other progress meetings) gave the necessary flexibility to the project management. The approach, however, led to some confusion at times in the evaluation team. However, the data in tables 6 and 7 and the documents available to the evaluation team confirm that most of the tangible project commitments have been fulfilled.
63. The four main technical outputs from the project are:
- (a) The early warning bulletins;
  - (b) The complete country reports;
  - (c) Vulnerability maps;
  - (d) Summary of country reports.
64. The early warning bulletins are one-page summaries of the pollution situation in the project area of each country. The final bulletins have been produced by each country to a reasonably uniform format. They are informative, colourful and attractive and are suitable for mass distribution in either French or English. They could be used as leaflets, press releases or for publicity handouts to agencies such as television stations. We would recommend that they are updated annually and that a small box of text should be included, with a strong message of the pollution status and the need for groundwater resource protection.



65. The complete country reports are the summary documents of the project for each country. They contain all the data from the project and its analysis of aquifer vulnerability and groundwater pollution distribution. These bulletins give the national project coordinator an opportunity to present the findings of the project and send the message that the aquifers are under threat, that the economic consequences of pollution could be dire and that measures should be taken to protect groundwater by pollution prevention. It is our judgement that the policy link is not being made strongly enough in the present documents. The data collected for these reports, under the guidance of the project, is very limited in scope: about four sites, with only pH, conductivity and temperature being measured. Several countries measure and report more determinands, particularly nitrate and bacteriology. That effort should be encouraged and steps taken to cover a wider range of determinands and more sites, to raise the scientific quality of the reports. We would recommend that these complete country reports should be updated and issued annually to a limited number of influential stakeholders.
66. Each country now has a vulnerability map of its project area. These all appear to be of high quality and certainly make an impact on the early warning bulletins. The databases (pollution sources, etc.) on which they are based will need continuous updating; as more information is collected, the maps, will need updating. We suggest that the status of the vulnerability maps should be re-assessed formally on an annual basis.
67. The summary of country reports contains brief information documents describing the environment of the country concerned (the geology, hydrogeology, geology and climate, for example) and provide a national setting for each project area. These documents serve as a good introduction to each country. We would suggest that they could be reviewed now that the project is mature, possibly to make them a little more comprehensive. After that they will not need to be changed for some time.
68. The outputs stated to be objectives in the original project document are of such a wide-ranging nature that they are unattainable in a relatively small focused project such as the present one. Those "outputs" could be interpreted as aspirations towards which the tangible outputs of the project could contribute (see Recommendations, chapter VI).
69. Certain tangible "outputs" planned in the project document have not been produced, such as output 2(b) in table 6, (Standardized methodological guidelines for optimal monitoring of wells...) Specific guidelines for monitoring methods have not been produced, but such guidelines should not be needed in the present project as the project staff are hydrogeologists and should already be conversant with the techniques of groundwater monitoring. The required output might be better phrased as "Standardized guidelines for establishing a strategy for optimal monitoring of wells to serve as an early warning and trend detection system for water supply contamination in seven West African countries". That output, as stated, has been attained (see Recommendations, chapter V).
70. The second missed output was output 2 (d), in respect of groundwater modeling. The text of the project document makes it clear that this refers to the purchase and training with Visual MODFLOW for Windows software. This software was never purchased nor the training undertaken. The Evaluator has seen no document to explain the decision not to undertake the groundwater flow modeling but it is understood, from evaluation interviews, that it was an executive decision taken early in the project, possibly at the Bamako inaugural meeting. It was a practical decision that, within the constraints of project funding, aims and personnel, greater benefit would be obtained from ensuring the GIS technology and



training was established. This decision is considered by the Evaluator to have been a prudent one because both ARC VIEW and MODFLOW software and training almost certainly could not have been funded together in the present project (see Lessons learned chapter III). However, much better documentary records of management decisions involving such a change in project planning and budgeting should have been kept.

71. The project web site has been both a problem and success. At the time of the evaluation visit in July 2002 the web site could be accessed by anyone with access to the web (see Lessons learned chapter III), but it had not been updated for several months; Ghana was not included on the site and Guinea had not been removed. The home page needs to be redesigned to make it more attractive and the content pages, which are empty or contain only old material, removed or archived. Re-organization of the web site will be undertaken next month and suggestions are made in the sections of this report dealing with lessons learned and recommendations.

## B. INFORMATION DISSEMINATION

72. The major part of the work plan of the present project has been to set up the network of participating countries, agree a monitoring strategy and obtain both background and monitoring data on the groundwater of each country. Those aims have been successfully accomplished. Each country has produced a series of outputs such as bulletins and reports that can be disseminated widely to the general public, managers and legislators.
73. The dissemination of information from the project is seen as a vital function of the project in the long term. The aim is to raise public awareness regarding the issue of groundwater pollution and its impact on water resources and health. Managers and legislators need reliable information to back up the application and enforcement of environmental protection legislation. There is little point in providing early warning of groundwater pollution if there is no reaction or action to counteract its impact. The true cost of water pollution, which leads to increased health and water treatment costs, is not widely appreciated.
74. The project has produced its first information outputs and these should now be distributed widely in a coordinated awareness-raising publicity drive in each country. That work of providing information should continue at all levels with the assistance of UNEP and UNESCO facilities (see Recommendation chapter V). The distribution list for the first draft of the early warning bulletin from the Côte d'Ivoire team is shown below as an example for others to follow. This list has been extended for the final draft of the bulletin and should continue to be increased for subsequent editions. A publicity strategy for the second phase of the project should be agreed between UNEP, UNESCO and the participating countries.



**Table 8**

Distribution list for the first early warning bulletin, Côte d'Ivoire, 2001

Directeur de l'Hydraulique Humaine (Ministère de l'Infrastructure Economique)
Directeur de Cabinet du Ministère de l'Infrastructure Economique
Directeur de Cabinet du Ministère des Eaux et Forêts
Ministère de l'Environnement
Directeur Général de la SODECI
Directeur Technique de la SODECI
Directeur Technique Adjoint de la SODECI
S/D de la production de la SODECI
S/D de la maintenance de la SODECI
Chef du Labatoire d'analyse des eaux de la SODECI
Président de l'Université de Cocody
Doyen de l'UFR STRM
Les différents directeurs de l'UFR STRM
Directeur du CURAT

75. Interviews at the Ministries of Economic Infrastructure and of Health, SODICI and CURAT during the evaluation mission showed that these bulletins had been well received, their value recognized and more information was asked for and expected.
76. The web site for the project should be seen as the publicity and information forum for the international community, that is, scientists, administrators and managers in the water industry in countries and organizations worldwide with access to the web. This international community could include aid donor countries, agencies or individuals that could have an impact on the long-term sustainability of the project. The web site is at present inadequate, but with the improvements suggested it could provide a window for the world to see an early warning strategy being implemented in Africa.

### C. PROBLEMS ENCOUNTERED IN THE PROJECT

77. The project has been remarkably successful considering the short duration and meagre budget of the project, but recurring problems have been encountered, which were identified to the Evaluator by the coordinators and project management staff interviewed. The following should be treated as lessons learned and used to make improvements in phase 2 of the project:
- (a) Budget. It is not surprising that, with such a small overall budget, the coordinators complained of inadequate funding, but it should be noted that it did not prevent any country task force from meeting their target output. At the start of the project the release of funds was delayed, in some cases because of clearance delays in the banking system. The problems were overcome, but it was difficult to operate in the field with such delays;
  - (b) Equipment. Serious problems have been met with in the procurement and supply of equipment by UNESCO. The equipment allocated to Côte d'Ivoire has still not been delivered, more than 18 months after the start of the project. Ghana had not received any equipment after two months in the project. The UNEP and UNESCO/HP project



management in Nairobi was concerned about the cumbersome and difficult procurement procedures at UNESCO which led to frustration in the participating countries with delays or non-delivery of equipment. Côte d'Ivoire and Ghana managed to carry out their work using equipment donated by other agencies. Urgent steps should be taken to improve the situation. The GIS software and training, on the other hand, were delivered as planned. The software was delivered by hand to the training seminar;

- (c) Uniformity of approach. In the first half of the project, UNEP and the Senior Consultant had to deal with different approaches to the project by seven countries. Outputs were presented in different formats and to different timetables, depending on priorities and resources. The group of project countries operated as seven separate entities. The participating countries gradually agreed to follow a uniformity of approach and formatting of all outputs. The project is now working as a networked team. It is recommended (see chapter IV) that all new member countries, including Ghana, should be trained to adopt this unified approach. The training and the supply of equipment should be completed in the first weeks of the project extension;
- (d) Equality of opportunity. The project has tried to weld seven countries into a single team with no prior institutional arrangements on which to base it. The countries were in varying stages of hydrogeological development and affluence. The coordinators had different levels of skills, resources and local support to call on. Inevitably some countries performed better than others. Guinea failed to produce any acceptable outputs and had to be excluded in October 2001. Mali only produced the necessary outputs very late in the project (July 2002) and for a while in 2001 was in danger of being excluded. We believe that the problem in both Guinea and Mali was mainly a lack of local support and resources or staff. We recommend (see chapter V) that, in the extension to the project, the facilities in each country should be assessed and compared. UNEP/UNESCO then can focus on additional training and resources for the less equipped countries to raise all to a common standard. In order to ensure local and national support, the national project coordinators should be chosen with care, to ensure that they are capable and committed to the project;
- (e) Communications. The project is spread over the African continent with the management situated in Nairobi, the participating countries in West Africa and the Senior Consultant based in Mayotte in the Comoros. Communication has been largely by e-mail and at annual seminars. The management of the project has been mainly at a distance and this has given rise to three communication problems:
  - (i) Communication has been mainly from West Africa to Nairobi or Mayotte. More communication between participating countries should be encouraged (see chapter V);
  - (ii) Not all the coordinators have access to the Internet. Some have to rely on Internet cafés and pay for the service. This is inequitable (see paragraph (d) above). A free Internet service should be provided to all participating countries. Unhindered communication facilities are essential to the existence of the network;
  - (iii) Management at a distance has meant that project outputs have been slow to arrive in Nairobi. The management has had to wait for outputs instead of being able to interact directly with the providers (the coordinators). We recommend the appointment of a local liaison officer to overcome this problem (see chapter VI).



- (f) Web site. The web site is discussed in chapter II above. The major problem with the web site is the lack of updating. It appears to have been set up successfully and then remained dormant for some time. We suggest that priority be given to improving it by updating it with new information and that data should be dispatched to Nairobi regularly and one person given the responsibility for updating it on a regular basis.

#### D. SUCCESSES OF THE PROJECT

- 78. The most important successes of the Urban Pollution of Surficial and Groundwater Aquifers in Africa project are its intangible results including:
  - (a) A network of six West African countries (seven including Ghana) has been established successfully. There is clear cooperation between the countries and a sense of commitment in the national task forces. They are all working to a common agenda towards a common goal;
  - (b) A strategy has been agreed between UNEP, UNESCO and the participating countries for establishing an early warning monitoring system for the pollution of groundwater beneath large urban areas.
- 79. The success of establishing this degree of agreement and cooperation in such a short time, between so many partners and with such a small budget, is remarkable. The successes that reflect the tangible results from the project relate to the planned project outputs:
  - (a) The majority of planned outputs in terms of bulletins, reports and training have been achieved (table 6). Those still outstanding should be completed within the time frame of the present project;
  - (b) An additional success is the submission by a student of the University of Cocody, Abidjan, of the MSc thesis, " Apports d'un Système d'Information Geographique a la Realisation de la Carte de Vulnérabilité de la Nappe Souterraine du Continental Terminal au Niveau de l'Agglomeration d'Abidjan", based on the students work with the project;
  - (c) Through the distribution of early warning bulletins, the project has increased public awareness of the problem of groundwater contamination of water resources. This information dissemination is in its infancy and should be actively pursued in the second phase of the project. The experience of UNESCO in this field could be called upon and actively used in educating the public;
  - (d) The project web site has been set up and, subject to improvements, will be the window on the project for the world. It is however only accessible to those with access to the Internet and therefore cannot replace local information dissemination;
  - (e) The project has been the first UNEP project in Nairobi to be budgeted within the United Nations IMIS system according to the United Nations development account detailed budgeting format. The experience gained is being used to help with the budgeting of other United Nations development account projects implemented by UNEP.



### III. LESSONS LEARNED

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80. The Urban Pollution of Surficial and Groundwater Aquifers in Africa Project of UNEP/ UNESCO is the only UNEP groundwater assessment project of this kind in Africa therefore many lessons have been learned during the first two years. The major lessons are listed below and are derived from the organizational problems encountered during project implementation. These lessons learned have resulted in the recommendations given in chapter V.

#### A. PROJECT ORGANIZATION

81. The following lessons have been learned in this area:

- (a) Project implementation: this project has shown that the establishment of a technical programme encompassing a network of seven countries in West Africa on a limited budget can be done successfully. Improved documentation of management decisions should be kept of progress and changes in project planning and budgeting so that such changes can be monitored and evaluated;
- (b) Project definition: the definition of the project, particularly its objectives, results and outputs, should be as focused as possible, with each result tied to a verifiable output. The broad aspirations of the project and its position in the wider world can be stated as such, but should not be classified as results and tied to unachievable outputs. The project targets should be realistic;
- (c) Equipment procurement and supply: equipment procurement is too slow and cumbersome and should begin as early as possible in a project. The mobilization of equipment should begin well before the project activities start. It would also be better if the equipment was shipped to the regional UNDP office. The feasibility of local purchase of minor equipment items to avoid procurement delays could be examined. The possibility of the preferential supply of equipment to the poorer countries could also be examined;
- (d) Budget and finance: the IMIS budgeting procedure appears to work well, is sufficiently flexible, and can be applied to future projects. The transfer of funds under the budget should be through direct bank transfers to minimize long delays in processing payments. The budgets should be fixed and allocated as early as possible. People cannot work without funds. Different countries have different levels of affluence leading to inequalities in their ability to meet project targets. The project budget could be used to allocate extra funds to poorer countries to give them equal opportunities. Similarly a "mobility" budget item could be set up to allow travel inside countries or between countries to improve communication (chapter V). The inequalities between countries needing budgetary correction could be assessed by a local liaison officer (chapter V. D);
- (e) Project staffing: the present policy of setting up national task forces through academic institutions appears to be practical and cost-effective. These university institutions commonly are the centres of national expertise in hydrogeology and environmental impacts. The skill base in different countries varies, however, as do the staff and



time available to a coordinator. The skills, experience and general abilities of the national task force members could be noted and assessed by a local liaison officer. Any weaknesses in the skill base or resources then could be rectified by training or budget inputs. The need for a more positive hands-on support for the project coordinators is recognized and has led to a recommendation for the appointment of a local liaison officer. This person would support, not replace, the Senior Consultant. The Senior Consultant will be needed in the second phase to provide scientific and technical support to the national project coordinators;

- (f) Training: the training course for GIS ARC VIEW in this project was a great success but now needs reinforcing by further GIS training for newcomers to the project. There should also be a training course on groundwater flow and pollution transport modeling (Visual MODFLOW) to enable the project to progress. The sustainability of the project in the long term will depend on this training;
- (g) Laboratory facilities: the availability of analytical facilities to the task forces is fundamental to the success of the project. The facilities vary in quality from one country to another and assistance is needed in some countries. Such assistance from UNEP and UNESCO could be in the form of focused funding for analyses or of laboratory training to improve the facilities;
- (h) Project design: the strategy of providing seed money for the pilot phase of a project, as in this case, is more likely to have a successful outcome than setting up a full-scale project prematurely. The pilot phase is important to the long-term success of the project, as it can act as a trial and error period in which basic institutional structures and methods can be set up, giving a sense of ownership and commitment to the national project coordinators. A successful pilot project may encourage UNEP and UNESCO to mobilize resources for the second phase and for other projects in the area.

## B. COMMUNICATIONS

82. The following lessons have been learned in this area:

- (a) E-mail access: not all countries have access to e-mail and this is seriously hampering communications between network members and with Nairobi and the Senior Consultant. Free and continuous access to the Internet and e-mail should be a priority for all participating national task forces;
- (b) Project web site: the project web site is operational but needs dedicated input to ensure it is kept up to date and can act as the focus for information on the project for the international community. It is not likely to be a successful communication interface without such dedicated support;
- (c) Networking: active networking between all members of the project would improve the project progress and outputs. Contacts and cooperation at all levels provides the basis for a successful project;
- (d) Extra funding: the funding available for any extension of the project is limited. Certain countries, Ghana and Côte d'Ivoire for example, are already using



resources provided from other sources. This should be encouraged through dissemination of results to, and dialogue with, other donor agencies and United Nations programmes. Extra funding will enable more detailed work to be done, increase the profile of the project and ensure its sustainability;

- (f) **Publicity:** the long-term success of the project will be measured by its impact on national groundwater protection strategies. This is why the raising of public awareness regarding the issues is a basic aim of the project. The dissemination of the project results as bulletins, reports or through the web site should be undertaken in an active and organized manner. That requires a publicity programme specifically designed for the target groups: local communities, water industry managers, administrators, legislators, the press and the media. The programme should be agreed between the participating countries and UNEP/UNESCO.

### C. DOCUMENTS AS PROJECT OUTPUTS

83. **Uniform outputs:** an important lesson learned early in the project was that each country has its own favoured format for the production of documents. It is essential that a common project format be agreed when and adopted at the beginning of the project. This should apply to all maps, bulletins and reports.

## IV. CONCLUSIONS

### A. SUCCESS OF THE PROJECT IMPLEMENTATION

84. The success of the project implementation has been evaluated for six aspects of the project, following recommendations by UNEP in the terms of reference. The evaluation of the success of each of these aspects has been made on a scale of one to five, with one being the highest rating. The evaluation results are given in table 8, but for each aspect of the project, success is discussed in more detail below. The overall rating for the whole project, based on the ratings in table 9 is assessed as 2.

**Table 9**

Project evaluation rating

Aspect of project evaluation	Score
Attainment of outputs	2
Completion of activities	2
Project executed within budget	1
Cost effectiveness of project	1
Impact created by the project	3
Sustainability	2
Overall score	2



## B. ATTAINMENT OF OUTPUTS

85. The tangible planned outputs of the project have been largely attained (table 7), although delivery was late in some cases. The only major output outstanding is the final project report from the Senior Consultant. A major problem occurred with respect to Guinea, from which no outputs were received and it had to be excluded from the project, to be replaced, at a later stage, by Ghana.
86. Other planned outputs that were not produced have been classified as General Outputs in table 6. These include wide ranging scientific reports, which really were not appropriate targets for the present limited project. The evaluation considers this problem to be caused by the wrong use of terminology and such "outputs" should rather be considered as "aspirations" for the project. The lack of their production is not considered a serious problem for the project. It is considered necessary, however, to recommend that planned outputs in the project document should be tied to tangible and attainable activities. Generalized aspirations or statements of intent should be clearly distinguished from specific results and outputs.

## C. COMPLETION OF ACTIVITIES

87. The activities defined in the project document and more closely detailed at subsequent progress meetings have on the whole been undertaken successfully and to schedule. The project managers and coordinators are to be congratulated on running a project on a limited budget over seven countries so successfully.
88. Two specific planned activities and outputs have not been undertaken:
  - (a) UNESCO seminars intended to disseminate information on the project in June/July 2002 were not undertaken. No budget was allocated for these seminars and, like the "general outputs" discussed above, they appear to have been good intentions rather than planned output or activity items. We stress that planned outputs should be tied to attainable activities. These seminars would, however, be useful and could be re-scheduled as outputs for any extension to the project;
  - (b) The purchase of groundwater modeling software and the provision of training in its use was planned and budgeted but was not undertaken. For practical reasons, the groundwater modeling was replaced by GIS modeling and training. We recommend that such decisions should be documented, which was not done in this case. The groundwater pollution transport modeling will be needed and a training seminar is recommended in the extension to the project.

## D. PROJECT EXECUTED WITHIN BUDGET

89. The project was completed within the overall budget of \$280,000. One change in internal budget items requiring authorization from New York was the replacement of an internal evaluation by the present external evaluation.
90. The change from groundwater pollution modeling to GIS modeling and training appears to have been made under the same modeling budget item.



## E. COST EFFECTIVENESS OF THE PROJECT

91. All the main aims of the project were achieved on schedule and within budget. An operating network of countries with an embryonic groundwater pollution monitoring and early warning system is in place. This network of seven countries can provide a platform for progress in the future.
92. At a cost of \$20,000 a year for each country, the project has been very cost-effective and an excellent investment by UNEP and UNESCO.

## F. IMPACT CREATED BY THE PROJECT

93. The present early warning groundwater pollution project is a completely new venture for UNEP and for the first year the project management was focused on setting up the network of countries and establishing a common methodology in seven countries. In the second year, outputs of a suitable standard for distribution to stakeholders and interested parties were produced. The distribution of early warning bulletins had a definite impact on politicians and water industry managers in each country (table 8).
94. The local impact achieved so far should be the basis of the second phase of the project, to ensure its sustainability. The intensive distribution of information to local organizations should be reinforced by press and other media releases. The project web site must be activated internationally and scientific publications encouraged to raise the profile of the project in the professional community.
95. The impact of the project is currently of local significance. A publicity campaign in the second phase should raise its profile and ensure an impact of continental significance.

## G. PROJECT SUSTAINABILITY

96. The short-term sustainability of the project over the next two years is ensured in some countries even if UNEP funding comes to an end. The enthusiasm of the coordinators and their teams is such that they will continue the groundwater monitoring if at all possible. If the funding stops, however, the effects of project will not last for very long.
97. In the case of an extension to the project with guaranteed funding, then short-term sustainability is assured and long-term sustainability is most likely secure. The extension of funding for a further two years would have other effects apart from sustainability. The training of local staff would continue to improve the national skill base. The databases of groundwater pollution would be more comprehensive and available to other agencies. Analytical services would improve. Publicity material would improve and become more comprehensive. The improvement in publicity material and its wide dissemination through the press, television and seminars would raise the profile of the project and highlight the importance of pollution early warning systems.
98. The probability of long-term sustainability is high if the second phase of the project is agreed and funded. The project aims are consistent with the present international aid agenda for alleviating drought and water pollution problems in Africa. The raised awareness of the impact of the project should attract national and international notice and this should



encourage the national task forces to obtain extra long-term funding from their own Governments, international aid donors and United Nations agencies.

#### H. CAPACITY-BUILDING

99. The project has already had an impact on building the scientific capacity of the participating countries. A relatively minor factor is the provision of equipment such as small computers and analytical meters. Of far greater importance are the three relationship factors:
- (a) Helping to build a professional team in each country capable and willing to do the work and understanding the importance of what they are doing;
  - (b) Helping to form a network of task forces in seven countries, working together and helping each other across national borders;
  - (c) Training staff in the technical aspects of the work, such as GIS or groundwater modeling. An M.Sc. to be defended this month in Abidjan is an excellent example of capacity-building in action.

### V. RECOMMENDATIONS

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100. The problems and successes encountered in this project led to valuable lessons being learned, which, in turn, prompted several recommendations to be proposed. The recommendations listed below apply to both French-speaking and English-speaking countries, and are intended to enhance the success of an extension to this project. Several of the recommendations could also be used to help with other similar projects.

#### A. EXTEND THE PRESENT PROJECT FOR A FURTHER TWO YEARS

101. The present project is judged to have been a success and will provide a good springboard for improving and extending the early warning system to other African countries (See - recommendations B and H and Annex V).

#### B. EXPEDITE THE INCORPORATION OF GHANA INTO THE EARLY WARNING NETWORK OF COUNTRIES

102. The following steps are suggested:
- (a) Provide the necessary software and equipment as a priority;
  - (b) Provide on-site GIS training and advice on the outputs and methodology demanded by the project. This will require a budget and can be done by the Senior Consultant or a person from the Abidjan team. The latter would encourage cooperation across the West African language barrier.



### C. CONTINUE THE CONTRACT WITH THE SENIOR CONSULTANT

103. The success of the project to date has been in a large part due to the professionalism and technical expertise of the Senior Consultant. The Senior Consultant has the experience needed to extend this project to other countries and ensure its success in the long term.

### D. APPOINT A LOCALLY BASED LIAISON OFFICER

104. Appoint one or two liaison officers to visit local task forces. The new appointments would be made from existing team members, those with the most successful results, appropriate skills and knowledge of project requirements. The person(s) appointed should, if possible, be bilingual (French and English).
105. The duties of this post should include:
- (a) Visiting each project country and providing support and assistance as requested;
  - (b) Acting as an agent for the dissemination of good practice among project teams;
  - (c) Liaising directly with Nairobi to expedite communication and resolution of potential and actual problems at the local level;
  - (d) Making recommendations for additional support and training needed by local teams to ensure that any deficiencies in skills, experience and equipment are quickly remedied;
  - (e) Identifying any problems arising from local management difficulties or inadequate local support and make recommendations to UNEP on how to remedy the problems.
106. The local liaison officer would require a budget to cover time and travel but it is felt that such an appointment would be most cost beneficial. The person would enable the present variation in facilities, experience and skills between the different countries to be ironed out over a relatively short time.

### E. PROVIDE FOCUSED BUDGETING

107. A common observation made during the evaluation was that facilities available to the task forces vary markedly from one country to another. Similarly, the skill base varies from one task force to another. We recommend that positive steps be taken to remove these variations. The needs would vary from country to country and would require UNEP to have the ability to vary material and training budgets as needs dictate, rather than providing equal aid to all countries. The aim is to raise all countries to the standard of the highest and ensure a uniformity of opportunity and sustainability across the whole project.

### F. IMPROVE COMMUNICATIONS

108. Ensure all member task forces have access to computer facilities and e-mail. The use of Hotmail through Internet cafés is not adequate. Also encourage all members of the network



to communicate directly among themselves by e-mail or telephone. Exchange of information on progress, problems and experience is important and is the only way to break down the French-speaking/English speaking language barrier.

#### G. IMPROVE THE UNESCO PROCUREMENT PROCEDURES

109. Almost every person interviewed identified equipment procurement as a fundamental problem of the project. The cumbersome procedure meant that the delivery of essential equipment was very slow at the beginning of the project in every case. In the case of Côte d'Ivoire the chemical analysis equipment never arrived and apparently it cannot be replaced. All through the project period this team has not had equipment essential for meeting the project targets. Ghana has been in the project for two months and has not been provided with any equipment; it may get the equipment sent to Guinea if that can be recovered. UNESCO and UNEP should explore ways or possibilities of giving the country teams funds to purchase or procure equipment such as computers, provided specifications are adhered to and the procured equipment is within the price estimated in the project budgets.

#### H. INCLUDE ENGLISH-SPEAKING AFRICAN COUNTRIES

110. Preliminary planning has been undertaken by UNEP/UNESCO for the possible extension of this project to other countries in Africa, on the basis that those new countries should be from English-speaking parts of Africa. We would make the following recommendations concerning such a possible project extension:
- (a) The criterion for the choice of urban areas for the extension should, if possible, be that those urban areas should each constitute a mega-city;
  - (b) A site in Ghana and no more than three other sites (preferably two) should be chosen, otherwise the individual site budgets would be below an effective level;
  - (c) Every site (urban area) chosen should have certain basic features:
    - (i) It should have an organization in place (preferably a university department) with hydrogeological expertise and access to some basic hydrogeological survey facilities;
    - (ii) The chosen organization should be of good standing in the country and have good relations with local government departments;
    - (iii) It should be close enough to the headquarters of the country's project team to be reached by road without straining the available travel budget;
    - (iv) It should be dependant on groundwater for most of its potable water supply;
    - (v) It should be a large densely populated urban area with some unplanned (slum) development;



- (vi) It should have in place boreholes or hand-dug wells used for potable supply, which can be used for water quality monitoring;
- (vii) It should have at least a basic water quality analytical laboratory within reach;
- (d) When staffing the project extension, every effort should be made to ensure a good gender balance on the team.

#### I. BOLSTER DISSEMINATION OF INFORMATION

111. A major aim of this project is to raise the awareness of the general public and of local and national government officials regarding the problems of groundwater pollution and aquifer vulnerability. The dissemination of the project aims, programmes and results is considered vital to raise this awareness at all levels. In the next stage of the project, now that output material is available, more emphasis should be placed on providing information to the people.
112. We recommend that :
- (a) The early warning bulletins for each country should be distributed widely in hard copy, as press releases to newspapers and to local television stations. They should be updated regularly to keep the project fresh in peoples' minds;
  - (b) The country summary reports and the annual summary reports giving project results should be distributed to libraries, local government departments and government ministries;
  - (c) Local seminars to provide information to the public and other stakeholders could be arranged through the UNESCO educational facilities. Particular attention should be paid to women's organizations in order to raise awareness of the significance of groundwater pollution in everyday life at a local level.

#### J. REDESIGN AND UPDATE PROJECT WEB SITE

113. The web site has been established successfully but most people interviewed agreed that it should be improved. The following steps are suggested:
- (a) Define the major target group for the web site and customize the web site design to meet the needs of that group. Is the web site just for the use of the participating countries, for academic institutions, for other African countries interested in the project or for the international community? We suggest it should be aimed at the last two groups. The international community would include countries and agencies which, through aid, could have an impact on the long-term sustainability of the project (see chapter III. B, Information dissemination);
  - (b) Update the web site regularly, at least once a month;
  - (c) Make the home page more pictorial and attractive. People should want to enter the site;



- (d) Make sure the contents actually reflect the contents listed on the home page. At present they do not;
- (e) Limit the contents to items of interest, possibly only the early warning bulletins, illustrative photographs, the country summaries and the latest country progress reports.;
- (f) Put in links to the member countries and their data bases for more detailed information.

#### K. ENFORCE METHODS AND METHODOLOGY OF PROJECT OUTPUTS

- 114. The objectives, results and outputs stated in the project document should be attainable and tied to defined project outputs and activities. Wide ranging aspirations of a project can be stated but should be distinguished from objectives and not tied to any expected outputs. A planned output from the project should be identifiable in the project document as the result of a budgeted activity.
- 115. The outputs from the project to date have been based on a limited data-collection exercise involving a few data collection points and analyses of groundwater for a limited number of determinands. The resulting country progress reports could be considered, scientifically, to be rather incomplete. Several countries already measure and report more determinands, particularly nitrate levels and bacteriology. It is recommended that this trend should be encouraged and steps taken to cover a wider range of determinands and more sites to raise the scientific quality of the reports from all countries.
- 116. The number of sites to be monitored and the number of determinants analysed will be determined by the resources and facilities provided. It is recommended that the number of sites monitored should be sufficient for the measured quality of groundwater to be related to the vulnerability classes on the vulnerability maps and to the main known sources of pollution. At present this cannot be done with any certainty. We would suggest that about ten sites would be needed in each project area before the relationship could be demonstrated. Groundwater analyses are expensive but they provide the data on which an early warning system is based. The pollution to be measured is man-made, so the determinants to be measured should be indicative of human habitation. It is recommended that all analyses should include:
  - (a) On-site analyses: pH, electrical conductivity and temperature;
  - (b) Laboratory analyses: nutrients - nitrate as a minimum  
microbiology - E. coli, total coliforms, faecal streptococci.
- 117. Desirable extra determinants in laboratory analyses, provided as budgets permitted, would include: nutrients (nitrite, ammonium, phosphate), chlorinated solvents and mineral oils and petroleum hydrocarbons. Other determinants might be included as known contaminants of local significance, such as aluminium in the low-pH water of Abidjan.
- 118. More stress could be placed in all project areas on understanding and explaining the underlying groundwater flow regime of the aquifers being monitored. Without this understanding the forecasting of the environmental impact of the groundwater pollution will be difficult. The recommended training in visual MODFLOW for Windows will reinforce the necessary basic hydrogeological understanding of the various national project teams.



119. A better quality of data collected and its analysis would provide material, not only for the project bulletins, country progress reports but also for peer-reviewed scientific publications. The production of a M.Sc. thesis in Abidjan is a demonstration that this is possible. The preparation of such scientific publications is an integral part of the mandate of UNEP and UNESCO. The publication of good quality papers in the scientific press would raise the profile and reputation of the project in the eyes of the international community and could be instrumental in ensuring the project's long-term sustainability.

#### L. SECURE POLICY DEVELOPMENT IN GROUNDWATER MANAGEMENT AT UNEP PROGRAMME LEVEL

120. This project has increased public awareness regarding the problem of groundwater contamination and, has the potential to serve as an effective early warning system in the project countries. In order to translate this initial success into a useful UNEP programme for the protection of usable aquifers, the programme should be institutionalized through the development of policies, legislation and capacity within relevant government agencies to manage groundwater pollution. We therefore recommend that future UNEP projects and extensions to existing ones should explicitly include components which will facilitate the ability of the participating countries to institutionalize groundwater protection policies and programmes in national development plans.



## ANNEX I

### People interviewed for the evaluation

#### United Nations Gigiri complex, Nairobi, Kenya

Emmanuel Naah, Specialist in Hydrology, UNESCO Regional Office, Nairobi Office

E. Salif Diop, Senior Environmental Affairs Officer, DEWA, UNEP

Patrick Mmayi, Consultant, Water, DEWA, UNEP

Ivar Baste, Chief, Environmental Assessment Branch, DEWA, UNEP

Dr Sékou Touré, Director and Regional Representative, ROA, UNEP

Alex Alusa, Deputy Director and Deputy Regional Representative, ROA, UNEP

Kalyan Ray, Chief Infrastructure Section, Shelter Branch, UN HABITAT

Brygida Kubiak, Fund Management Officer, Project Coordination and Monitoring Unit. UNEP

Paul Akiwumi, Programme Officer, Policy Support and UNFIP, Programme Co-ordination and Management Unit, UNEP

Segbedzi Norgbey, Officer in Charge, Evaluation and Oversight Unit, UNEP

Susanne Bech, Junior Professional Officer, Evaluation and Oversight Unit, UNEP.

#### Ghana

Dr Bruce Banoeng-Yakubo, Project Coordinator for Ghana, Geology Department University of Ghana, Legon, Accra

#### **Team:**

Jacob Tumbulto, Research Officer, Water Research Institute, CSIR (Not met on Visit)

Prof. S. K. Danso, Director, Ecological Laboratory, University of Ghana, Legon, Accra (Not met on Visit)

Assoc. Prof. Christopher Gordon Acting Director, Centre for African Wetlands, University of Ghana, Legon, Accra. (Not met on Visit)

#### **Assistants:**

Vincent Hotor, M. Phil Hydrogeology student

Emmanuel Teye-Mensah, M. Phil Hydrogeology student

Yvonne Anku, Final year Geology student

Contact in Keta Fiels Area: Mr Edward Ahiabor (M.Phil. Soil Science)



## **Côte d'Ivoire**

Dr Jean Patrice R. Jourda, Project Coordinator for the Côte d' Ivoire, Director of the Laboratory of Science et Techniques for Water and the Environment, Geoscience and Mineral Resources Training Unit, University of Cocody, Abidjan.

### **Team members not met during visit:**

Nagnin Soro, University of Cocody, Abidjan

Mamadou Sako, University of Cocody, Abidjan

Germain Miessan Adja, University of Cocody, Abidjan

Gnanzou Bile, University of Cocody, Abidjan

### **Team members met during visit:**

Dr Fernand Koffi Kouame, University of Cocody, Abidjan

Kan Jean Kouame, University of Cocody, Abidjan

Ernest Ahoussi Kouassi, University of Cocody, Abidjan

Bachir Mahaman Saley, University of Cocody, Abidjan

Dr Adama Ouattare (Soil Scientist), University of Cocody, Abidjan

### **Members of other organizations:**

M. Kopoin, Sous Directeur de la Production, SODECI, Abidjan.

Mamadou A. Sako, Directeur de Cabinet, Ministère des Infrastructures Economiques, Abidjan, Côte d'Ivoire

Professeur Oupoh Bruno Gnaoule, Directeur de Cabinet, Ministère de la Santé Publique, Abidjan, Côte d'Ivoire.

### **By telephone and/or e-mail questionnaire:**

Loic Giorgi, Senior Consultant

Dr Brian Morris, Consultant, BGS, England

Alain Nindaoua Savadogo, Project Coordinator for Birkinia Faso

Abdoul Aziz Tandia, Project Coordinator for Senegal

Amadou Zanga Traore, Project Coordinator for Mali

Felix Azonzi, Project Coordinator for Benin







## ANNEX IV

### Plan of action for the biennium 2003-2004

The plan of action recommended for the 2003-2004 biennium is to establish and fund the extension of the present project for a further two years. A draft project document for this extension based on projected funding by the Belgian Government has been prepared by UNEP. The draft project summary from this document is given below:

#### PROJECT EXTENSION SUMMARY

Title of subprogramme:	1. Environmental Assessment and Early Warning
Title of subprogramme element:	1.2 Environmental Assessment and Reporting
Title of project:	Assessment of Pollution Status and Vulnerability of Water Supply aquifers in African Cities
Project number:	
Geographic scope:	60 Africa
Implementation:	UNESCO/IHP- Division of International Hydrological Programme under leadership of UNEP Division of Environmental Assessment and Early Warning (DEWA)
Duration of the project:	24 months
Commencing:	October 2002
Completion:	September 2004

Cost of project (expressed in US\$)

	<b>Total</b>	<b>Percentage</b>
External funds (contribution by the Belgian Government)	400,000	80
Cost to DEWA (in kind)	15,000	3
Cost to UNESCO/IHP (in kind)	15,000	3
Cost to 10 Countries (in kind)	70,000	14
Grand total	500,000	100

We would recommend that this document be used as the basis of the plan of action for the next two years. The document requires some redrafting in the light of the recommendations (chapter VI) of this evaluation. We would recommend also that a hydrogeologist be used on the drafting team to ensure that the targets set out in the project document are pertinent to the aims of the project, attainable within the project and tied to outputs demanded by the project.

We would suggest that careful attention should be paid to the following features identified in this evaluation:

- (a) The employment of a local liaison officer or equivalent for West Africa. We believe this to be a most important recommendation that would improve considerably the management of the project in this region;



- (b) GIS reinforcement training. Training will be needed for the staff of new countries entering the project, but on-going training is also considered important to maintain the skills in existing participating countries;
- (c) Groundwater pollution transport modeling. The purchase of visual MODFLOW for Windows and training in its use should be a priority for the first year of the project extension;
- (d) Information seminars. We recommend that information seminars be held to disseminate the information coming from the project to local people (as envisaged in the existing project but not undertaken). These would be extra to the technical seminars and would be part of the overall awareness-raising activities of the project;
- (e) New countries. The number of new countries should be severely restricted and, for logistical reasons, their geographic spread also should be limited. The introduction of Ghana to the existing network of countries should be prioritized so that this can act as a template for the introduction of other countries. The new countries or cities should be chosen from practical viewpoints; the chosen cities must be dependent on groundwater for their potable water supplies so that they have an incentive to join. In addition, there should be sufficiently advanced institutional and analytical facilities in place sufficiently advanced to allow the project to succeed;
- (e) Groundwater policy development at UNEP programme level. The initial success of this project should provide the impetus for a UNEP programme for the protection of useable aquifers, in which monitoring and early warning systems are tied to the development of policies, legislation and capacity in groundwater management. Future UNEP projects and extensions to existing ones should explicitly include components which will facilitate the ability of project countries to institutionalize groundwater protection policies and programmes in national development plans.

## ANNEX V

### Long-term strategy

The purpose of the plan of action for the next biennium is to consolidate the excellent progress made in the present project. The long-term strategy is to carry this consolidated programme of groundwater pollution monitoring and early warning through the next decade.

The fundamental bases of the proposed long term strategy will be two-fold:

- (a) To increase the skill base of the participating countries ; and
- (b) To increase the impact and profile of the project to ensure an increase in awareness of the importance of groundwater pollution to water resources and public health.

These two bases will be used to make the public aware of the need for pollution prevention action and to give politicians supporting evidence to enact and enforce pollution prevention legislation. The long-term goal of the project must be to empower a population to enforce pollution prevention measures, otherwise the provision of monitoring and early warning systems will remain an academic exercise. Such monitoring and early warning systems must, therefore, be tied to project components, which facilitate the institutionalization of groundwater policies and programmes in national development plans.

In order to fulfill this long-term aim the strategy action plan would cover three main sectors:

- (a) Improving facilities. The strategy should ensure that all countries have access to the necessary facilities to undertake the work. These could include computing facilities, scanners, digitizers or software packages. They must include access to the internet and e-mail. Emphasis also should be placed on improving access to analytical facilities. At present these are limited in some countries but, as the project expands, the analytical facilities will need to improve. Access to a wider range of determinants including nutrients, organic compounds and microbiology will be needed at reasonable costs. New laboratories may be required to meet this need;
- (b) Training. The cost-effective way of improving the skill base in a country is through training. In the long term this could be provided in many ways:
  - (i) Training seminars aimed at specific skills such as computer skills (word processing, data processing, graphics);
  - (ii) Training seminars aimed at specific software (ARCVIEW or MODFLOW);
  - (iii) Training in hydrogeology, groundwater contamination or water resource management;
  - (iv) Training in management skills;
  - (v) Training in techniques for water sampling and laboratory analyses.

This focused training could be given in single seminars by a central training agency but would be more useful as part of an overall training strategy involving a mix of centralized and local, internal



training, new training and reinforcement training. The national skill base also would be improved if the members of the task forces were able to use the experience and data from the project as material for post graduate work. This academic aspect could be enhanced by granting bursaries to selected members of staff;

- (c) **Publicity.** The long-term sustainability of the programme will depend on the ability to attract long-term funding. This will to a large extent depend on the ability to raise the profile of the project so as to make an impact on the international aid scene. This, in turn, will depend on the generation of high quality publicity for the project. The project outputs or publicity must not be seen as unimportant parts of the programme; they are critical to the long-term survival of the work. The long-term programme of publicity is of sufficient importance for us to suggest it be planned by professional publicists. The series of project outputs (i.e., bulletins or reports), press releases, television appearances or academic papers should be planned. Their quality should be high and designed to make an impact on the audience.



## ANNEX VI

### Terms of reference

#### TERMS OF REFERENCE FOR EVALUATION OF Urban Pollution of Surficial and Groundwater Aquifers in Africa Project DA/9999-00-01

Under the guidance of the Officer-in-charge of the Evaluation and Oversight Unit (EOU) and in close collaboration with the Water Unit in UNEP's Division of Early Warning and Assessment (DEWA) and the UNESCO Division of International Hydrological Programme (IHP), UNESCO Regional Office, Nairobi, the Evaluator(s) shall undertake a detailed review and evaluation of the Urban Pollution of Surficial and Groundwater Aquifers in Africa Project DA/9999-00-01. The evaluation shall be conducted by a consultant and the Evaluation and Oversight Unit (EOU) during the period of July-September 2002.

#### BACKGROUND

The Urban Pollution of Surficial and Groundwater Aquifers in Africa project was developed and jointly implemented by the Water Unit, DEWA (as the lead agency) and IHP, UNESCO Regional Office, Nairobi.

The project was funded by United Nations Development Account Funds with in kind contributions from DEWA, UNEP and IHP, UNESCO.

The overall expected result of the project is to develop a variety of approaches to groundwater protection such as enactment of protective legislation at the national level and protection of public supply wells at the local level mainly by targeting the development and strengthening of national government capacity.

The project addresses the need to develop appropriate monitoring strategies and data and define cost-effective management alternatives, new technology and education programme in the area of protecting groundwater quality in African mega-cities through clusters of inter-linked activities of:

- Assessment of groundwater vulnerability
- Identification of hot spots and major threats on surficial and groundwater aquifers in African urban areas
- Policy options for better safeguarding surficial and groundwater aquifers in urban areas
- Establishment of an early warning network for possible water supply contamination
- Hydrogeological modeling on groundwater vulnerability in Africa Urban areas

For the implementation of the project seven cities and countries of West Africa were selected: Dakar, Senegal; Kamsar, Guinea; Abidjan, Côte d'Ivoire; Cotonou, Benin; Bamako, Mali; Ouagadougou, Burkina Faso; Niamey, Niger. As of October 2001, Guinea left the project and Accra/Ghana joined in May 2002.

#### LEGISLATIVE MANDATE

The project supports UNEP subprogramme 1: Environmental Assessment and Early Warning and in particular programme element 1.1: Environmental Assessment and Reporting and programme component 1.3.3: Freshwater assessment activities of the UNEP Programme of work for the 2000-2001 biennium.



The project also supports UNESCO's International Hydrological Programme (IHV-P: 1996-2001), project 3.2: Monitoring strategies for detecting groundwater quality problems.

Furthermore, the project is complementary to the scope and priorities of the United Nations medium-term plan 1998-2001, programme 14: Economic and Social Development in Africa and programme 11: Human Settlements.

## **SCOPE OF THE EVALUATION**

The evaluation shall be conducted as an in-depth evaluation. The evaluation will review and evaluate the implementation of project activities against the actual results, outputs and activities of the project, covering the time span from project start October 2000 to June 2002, three months short of project completion. Further, the evaluation will comprise proposals for a long-term strategy and action plan for the biennium 2003-2004.

Relevant documents will be reviewed at UNEP headquarters including project documents, financial reports, progress reports, review reports, guidelines, publications, bulletins, databases and web site.

Field visits will be undertaken to one or two project countries in West Africa and interviews will be conducted with relevant UNEP and UNESCO staff, project personnel and consultants in project countries, including government and city officials and other stakeholders.

## **TERMS OF REFERENCE**

The Evaluator(s) shall:

- (a) Assess the overall appropriateness of the objectives of the project to the pertinent UNEP mission, mandate and subprogrammes objectives, UNESCO programme and United Nations medium-term plan;
- (b) Assess the extent to which the project has been successful in fulfilling its immediate objectives and obtaining the expected results and whether it has been a cost-effective way of obtaining these results;
- (c) Compare the planned outputs of the project to the actual outputs and assess the result to determine the impact of the project both in term of positive and negative effects. In particular the Evaluator(s):
  - (i) Assess the technical/scientific quality and relevance of the vulnerability maps and data files produced and identify strengths and weaknesses in the data collection and processing;
  - (ii) Determine the effectiveness, level and soundness of the training provided to national project members and technical/scientific training approach;
  - (iii) Determine how effective the dissemination of information and related activities have been in addressing city management and decision-makers;
  - (iv) Establish the usefulness of the project web site ([www.unep.org/groundwater](http://www.unep.org/groundwater));



- (d) Determine the effectiveness and efficiency of project design, outputs and results in relation to funding and their contribution to the objectives of the project;
- (e) Assess the effectiveness of the institutional arrangements made between the implementing agencies and country teams;
- (f) Determine how the project has contributed to increased public involvement and awareness of urban water pollution in project countries;
- (g) Review the monitoring and management system developed to implement activities, and assess the effectiveness of the assistance provided by UNEP;
- (h) Identify problems encountered in the process of implementing project activities in the institutional arrangement employed, fund-raising, dissemination and internalization of project outputs and result;
  - (i) Identify lessons learned and provide recommendations on how to improve future project delivery;
  - (j) Determine the viability for demonstration and replicability of the project to other countries and of linking activities in assessment with policy regulation.

## EVALUATION REPORT FORMAT AND PROCEDURES

The evaluation report shall be a detailed report, written in English, of no more than 35 pages and include:

- A concise summary (no more than 2 pages);
- Separate chapter on lessons learned;
- Separate chapter on findings and recommendations;
- Separate annex on long-term strategy;
- Separate annex on plan of action for the biennium 2003-2004;
- All annexes should be typed.

The success of project implementation will be rated on a scale of 1 to 5 with 1 being the highest rating and 5 being the lowest. The following items should be considered for rating purposes:

- Attainment of outputs
- Completion of activities
- Project executed within budget
- Impact created by the project
- Sustainability

Each of the items should be rated separately and then an overall rating given. The following rating system is to be applied:

- |                    |                          |
|--------------------|--------------------------|
| 1 = Excellent      | (90% - 100% achievement) |
| 2 = Very good      | (75% - 89%)              |
| 3 = Good           | (60% - 74%)              |
| 4 = Satisfactory   | (50% - 59%)              |
| 5 = Unsatisfactory | (49% and below)          |



The contract will begin on 22 July 2002 and end on 6 September 2002 (four weeks spread over seven weeks). The terms of reference will be developed collaboratively by DEWA, UNESCO and EOU staff. The consultant will submit a first draft to the Evaluation and Oversight Unit (EOU) on 19 August. A draft version will be forwarded to the Water Unit (DEWA), UNEP and IHP, UNESCO for initial comment. Hereafter a draft version of the evaluation report will be shared with other partners for comment. Comments to the final draft report will be sent to the consultant after a maximum of two weeks after which the consultant will submit the final report.

The consultant will travel to UNEP headquarters, Nairobi and travel together with an Evaluation and Oversight Unit (EOU) staff to visit projects in Accra, Ghana and Abidjan, Cote d'Ivoire.

The final report shall be submitted in electronic form in MS Word format by 6 September 2002 to the Director of DEWA and Officer-in-charge, Evaluation and Oversight Unit, and printed in hard copy.

Consultants will be penalized if they do not meet the dates of submission of draft reports and final report, unless they request for an extension of the contract showing that the delays are beyond their control and giving valid reasons.

