SUSTAINABLE DEVELOPMENT OF DRY LANDS IN ASIA AND THE MIDDLE EAST: JORDAN COMPONENT

Jordan Visit Report
May 21 to May 25, 2006

Report Number
2006-001

Prepared

By

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I. Introduction

In an attempt to coordinate and facilitate the activities of the Sustainable Development of Dry Lands Project in Jordan, Dr. Tamimi traveled to Jordan to visit with the Badia Research and Development Center (BRDC), the main partner in the project to discuss the different activities. He also plans to visit Jordan University of Science and Technology (JUST) to coordinate and receive authorization from the university to offer the proposed video conferencing course, to visit with the University of Jordan's Water and Environmental Research and Studies Center (WERSC) to discuss the anaerobic wastewater treatment proposal, to visit with Royal Scientific Society's Environmental Research Center (RSS/ERC) to discuss and better define the biosolids activities, and to visit with Mr. Ross Hagen at the USAID Amman Mission to update him on the progress of the activities for this fiscal year.

The visit went well and the objectives of the trip were met. Another planned visit will be needed towards the end of June, 2006 to start the activities related to biosolids modeling, to have a test runt of the technical video conference capabilities at JUST, to present reports to USAID and to follow up on the other activities.

II. Objectives of the Visit

Dr. Akrum Tamimi traveled to Jordan on May 21, 2006 to work on the Sustainable Development of Dry Lands Project activities accomplishing the following objectives:

- Meet with BRDC staff members to discuss project activities.
- Visit Jordan University of Science and Technology (JUST) to get the authorization of offering the course at JUST and to discuss the timing, technology, audience and other logistics so as to finalize the course.
- Visit University of Jordan - Water and Environmental Research and Study Center (WERSC) to discuss the proposal submitted by Dr. Maha Halalsheh and to give feed back on approach.
- Meet with Royal Scientific Society – Environmental Research Center to discuss biosolids activities and proposals.
- Meet with Mr. Ross Hagan from USAID to brief him on the activities of the Sustainable Development of Dry Lands.

The itinerary of the visit is shown in appendix A of this report.

III. Badia Research and Development Center

On May 21, 2006 Dr. Tamimi visited with Engr. Mohammed Shahbaz, President of the Badia Research and Development Center (BRDC). Dr. Saad Al-Ayyash was not present during the meeting since he was traveling and was out of town until the first week of June.

Engr. Shahbaz talked about Wadi Mousa activities in general and asked Dr. Tamimi about the latest status of the activities there. Dr. Tamimi indicated that USAID approved the activities to be taken over by CDM and performed under a contract to be drawn directly between CDM and the architect Sahel Al-Hiyari and Dr. Erin Addison. The scope of work was reviewed and Engr. Shahbaz showed satisfaction of the progress.

In regard to the modeling of biosolids activity to be conducted by RSS/ERC with Dr. Tamimi leading the activity, Engr. Shahbaz indicated that the Karak wastewater treatment plant where the study was proposed originally is in a low area that does not represent the climate conditions of the surrounding area and he stressed on using the Madaba wastewater treatment plant for the modeling activity. Dr. Tamimi agreed and indicated that this is what is being proposed now in the proposal.

Dr. Tamimi reviewed with Engr. Shahbaz the objectives and the itinerary for his visit. Some modifications were made to the itinerary and Engr. Shahbaz requested that Dr. Tamimi makes all the visits to the different partners without his presence on the condition that Dr. Tamimi updates him through a report on what happens in the meetings. Engineer Shahbaz indicated that he is committed to attend meetings and to give presentations in workshops and seminars for the entire week and it would be difficult to skip any of his commitments.

IV. Distance Learning Course U of A / JUST

On May 22, 2006 Dr. Tamimi left the hotel at 7:00am and drove to Irbid to meet with JUST officials to discuss the video conferencing course to be offered at JUST. He met first with Dr. Ziad Ghazawi and the following issues were discussed:

1. It will be difficult to offer this course in the summer 2006 session due to the need for a longer time to plan the course, work with officials at JUST to get the course offered from the Department of Civil Engineering, testing the video conferencing facility etc…etc…
2. It was agreed that the course would be offered in the fall of 2006 which starts the first week of October, 2006.
3. It was decided to meet with vice President Dr. Abdallha Malkawi and the dean of the College of Engineering at Just to discus the course and get the preliminary approval to offer the course at JUST.
4. Dr. Akrum and Dr. Ziad agreed to suggest offering the course as a special topic course. A special topic course at JUST can be offered as CE785 for master students at JUST and for other participants.

With the above information, Dr. Tamimi and Dr. Ghazawi met with:

Dr. Abdallah I. Husein Malkawi
Vice president and Professor of Geotechnical and Dam Engineering
Jordan University of Science and Technology
PO Box 3030
Irbid, 22110, Jordan
Tel: +962-2-720-1000, ext. 22717
Fax: +962-2-709-5148
Email: mhusein@just.edu.jo

The discussion accomplished the following:

1. Dr. Ghazawi and Dr. Tamimi introduced the idea of the course and Dr. Tamimi explained the long term relationship that existed between JUST and The University of Arizona.
2. Dr. Malkawi expressed that this would be an interesting opportunity for the students and for the faculty members at the College of Engineering to be involved with such a course.
3. Dr. Malkawi thought that offering the course as a special topic course will be the easiest route to formally get the course through the college and the university.
4. Dr. Malkawi suggested that both Dr. Tamimi and Dr. Ghazawi meet with the dean of the college of engineering to arrange and to facilitate the offering of the course and to meet with head of the IT department to determine what is needed technically to broadcast the course materials from The University of Arizona to JUST through video conferencing.

Dr. Tamimi and Dr. Ghazawi met with:

Professor Turki I. Obaidat, Dean of Faculty of Engineering
PO Box 3030
Irbid, 22110 Jordan

Tel: +962-2-720-1000, ext. 22525
Fax: +962-2-709-5018
Email: turk957@just.edu.jo

Dr. Turki stressed that:

1. The course has to be offered under the faculty of engineering – department of civil engineering for master students.
2. A coordinator from the college of engineering will be named as the coordinator for the course who will be responsible for the course and will take care of attendance, reviewing policy and regulations, approving grades and evaluation and corresponding with the faculty at The University of Arizona. In addition, the coordinator will be present during each lecture to facilitate technical problems and to clarify questions and issues related to communication, content or questions that rise from language difficulties, if any.
3. The course will be offered under the civil engineering graduate program as CE785: Special Topics.

Dr. Turki requested that The University of Arizona faculty member leading this activity send a course description and a course syllabus to him and he, acting as the Dean of the College of Engineering jointly with the head of the Civil Engineering Department, will determine who would be the best faculty member(s) to teach a few of the unassigned lectures available for JUST faculty members. Dr. Tamimi indicated that he will send an email to him with the minutes of the meeting and include the course syllabus as soon as that is finalized.

Dr. Turki and Dr. Ghazawi brought up the issue of the Memorandum of Understanding (MOU) that was initiated and probably signed a year and a half ago and requested that a copy of the MOU be sent to Dr. Turki to serve as an official document for cooperation between the two universities in this course and other courses in the future. Dr. Tamimi indicated that he will work on getting a copy to Dr. Turki if one was signed.

As recommended by JUST VP, Dr. Malkawi, Dr. Tamimi and Dr. Ghazawi visited the IT department at JUST and met with:

Dr. Omar Al-Jarrah, Assistant President
Director, Computer and Information Center
PO Box 3030
Irbid, 22110 Jordan

Tel: (office) +962-2-720-1010
Tel: (home) +962-2-704-0535
Fax: +962-2-709-5018
Email: aljarrah@just.edu.jo

And with:

Engr. Amer Olaiwi
Technical Engineer, Computer and Information Center
Mobile: +962-79-999-9188

Email: Amer@just.edu.jo

Dr. Tamimi explained that Sustainable Development of Dry Lands Project is planning to offer a course jointly with JUST using the video conferencing capabilities present at JUST. Dr. Tamimi requested the information required to make this possible.

It was indicated earlier by Dr. Turki Obaidat, dean of faculty of engineering that the video conferencing unit was donated by USAID as part of a project to offer master and Ph.D. programs jointly with Washington State University, but due to high cost and other reasons USAID abandoned the program and the idea never materialized.

Dr. Al-Jarrah indicated that they have the video conferencing unit ready for use and encourage the faculties at JUST to use it. The IT center can have the output of the video conference be displayed at any lecture hall and it was suggested that Saladin Lecture Hall be used for this course.

It was indicated during the meeting by Engr. Amer that the video conference be carried out using a real IP address with an ISDN dedicated lease line with international calls. He indicated that they tried the video conferencing over regular IP address and it worked fine once but failed other times. When this was mentioned by Dr. Tamimi to Mr. Ross Hagen at USAID, he indicated that if The University of Arizona can use WWW2, it will work fine. It is believed that these questions can be answered by The University of Arizona technical staff who will be providing technical support on the other end. In addition, a test run will be performed using the technology available at The University of Arizona end during which the U of A faculty member will deliver a full lecture through the system. This will be scheduled and coordinated by Dr. Tamimi as soon as possible to determine the technical capabilities at both ends.

In addition, Dr. Tamimi will work with the U of A faculty members who will teach the course to develop a package of the course outline and description and all logistics necessary for the course and deliver that package to Dr. Turki cc'ing the Vice President and Dr. Ghazawi.

V. Anaerobic Low Energy & Low Cost Wastewater Treatment Activities

On May 23, 2006 Dr. Tamimi met with Dr. Manar Fayyad and Dr. Maha Halalsheh and discussed the WERSC submitted proposal entitled "Integrated anaerobic-aerobic treatment of concentrated sewage getting out of the dilemma". Dr. Tamimi pointed out that the proposal is different than what was expected and what was proposed in the Scope of Work submitted to USAID. He briefed both Dr. Fayyad and Dr. Halalsheh of the specific points he and Dr. Jim Field felt needed to be reexamined. These can be summarized in the following points:

1. The proposal was supposed to include septage characterization work as a first step to determine the properties of the concentrated influent usually generated in Jordan.
2. The maximum duration of the project can not exceed Sept 30, 2007, the end date of the current cooperative agreement with USAID.
3. The topic of the monitoring work that should be proposed should be in the theme of adapting the UASB technology to cold weather conditions in the higher areas of Jordan.
4. The proposal should refer to the RADAC grant awarded by IALC and should specify the unique aspects of both proposals and activities so as not to reflect an overlap of activities
5. The proposed activities should not be tied to other unsecured future funding.
6. The demonstration of UASB should be an output of the research and monitoring activity and should not be the main objective of the proposal.

Dr. Tamimi indicated that other remarks will come from Dr. Jim Field: The University of Arizona lead on the activity.

Dr. Tamimi also indicated that the proposal does not have to provide all the fine details of the project since these will be mentioned later in the quarterly progress reports. In addition, a detailed budget was requested to include in the proposal. Dr. Tamimi promised to send Dr. Halalsheh a template of a proposal and budget that he uses when writing scientific proposals.

Dr. Tamimi suggested to Dr. Halalsheh to start with an outline of the framework that she will be using, then discuss it with Dr. Field, and then add to the outline the needed details after Dr. Field comments on the outline. That will save time and ensures that everyone involved in this activity is on the same page.

It is believed that the development of the proposal for this activity will have a few iterations similar to what occurred when RSS/ERC submitted proposal for the characterization of biosolids before it is finalized. It took at least three trials to arrive at a final proposal that was approved by the peer review panel composed of members in the Technical Assistance Team at The University of Arizona. The next phase of proposals submitted by RSS/ERC was much better and the process of capacity building was noted.

Dr. Tamimi sent Dr. Halalsheh the templates he uses and these are attached to this report in appendix B.

VI. Biosolids Related Activities

On May 23, 2006, Dr. Tamimi met with Engr. Wael Suleiman from RSS/ERC to discuss the biosolids related activities. The activities that were discussed are as follows:

1) Modeling Biosolids Treatment in Jordan

Engr. Wael Suleiman indicated that the modifications of the proposal made by Dr. Tamimi and the modified budget are fine with RSS. Engr. Suleiman will have the Cooperative Monitoring Center at RSS (CMC/RSS) assist in the mounting of the weather station at the Madaba Wastewater Treatment Plant. The information for the person who is handling these issues is:

Engr. Iyad Aldasouqi, System Manager
CMC @ Amman – RSS
Tel: +962-6-534-4701 ext. 200
Fax: +962-6-533-2810
Cell: +962-77-748-8955
Email: iyad@cmc-amman.gov.jo

Dr. Tamimi requested that RSS/ERC send the modified copy of the proposal to BRDC to start the contracting arrangement and the transferring of funds. The actual installation of the weather station will take place at the end of June 2006 and the first summer experiment will be conducted during July, 2006. Dr. Tamimi requested that RSS/ERC make the necessary communication to obtain an authorization from Water Authority of Jordan (WAJ) to use the Madaba wastewater plant for the experiment and to have one of the drying beds available for the experiment around the end of June. Engr. Wael indicated that he will take care of that issue.

On his next scheduled visit to Jordan around June 25, Dr. Tamimi will have one of his objectives of the visit to work with RSS on installing the weather station and the calibration of the station.

2) Biosolids Reuse Application Study Phase III

Engr. Wael Suleiman facilitated a visit for Dr. Tamimi on May 22, 2006 to A-Ramtha experimental station where the application study is being conducted. During the visit Dr. Tamimi met with RSS and NCARTT engineers and technicians who were harvesting the barley and taking samples for lab analysis. It was observed that the height of the barely is half what it was in the previous season due to the lack of rain during the current season. The experimental station received approximately 167 mm of rain during this season while it received around 250 mm during the last rainy season according to the NCARTT specialist at the station.

3) *Ad Hoc* committee meeting

On May 11, 2006 an ad hoc committee meeting was held at RSS/ERC and Dr. Tamimi was suppose to attend that meeting presenting the activities that were supported by the Sustainable Development of Dry Lands Project but did not attend due to personal reasons.

Engr. Wael Suleiman filled Dr. Tamimi on what was discusses at that meeting and can be summarize by the following:

1. The meeting was No. 9 in a series of meetings started during the first year of the project (December 2003).
2. Engr. Asma Shareedeh from RSS/ERC presented the 2nd technical report on the application of biosolids for growing barley at the NCARTT experimental station and she presented the soil and crop tests that were performed in the first 7 months of the study.
3. Engr. Saleh Malkawi presented the status of the biosolids reuse standards that was developed during the biosolids risk assessment and standard development workshop held in December 2005 at RSS/ERC. He indicated that the standards were prepared and approved by the standards sub-committee of the ad hoc committee and was passed along to the WAJ reuse of treated effluent unit headed by WAJ's Secretary General. The standard was then approved and passed along to Jordan Institute of Standards and Metrology (JISM) to be approved and passed on to the governmental cabinet to become a law.
4. Engr. Wael presented future plans to develop an operational manual that will consist of 2 volumes: one to tackle the operational and managerial aspects of handling biosolids and the 2nd to deal with characterization methods and procedures of biosolids. The *ad hoc* committee revised his idea and requested a third volume that deals with beneficial reuse and disposal issues.
5. The *ad hoc* committee requested that the application study at Ar-Amtha NCARTT station be continued for at least another season with a small budget to be requested from IALC through BRDC. A letter was sent from RSS/ERC to BRDC requesting the activity to be continued for another season with a smaller budget ranging from $30K to $35K.
6. Representatives from Ministry of Environment and from WAJ stressed the need to work on capacity building and training of their technical staff to be able to test and enforce the biosolids standards.

Engr. Wael Suleiman discussed the outcome of the meeting with Dr. Tamimi and requested for the operational manual to have 3 volumes. He gave Dr. Tamimi an electronic copy of the proposed manual to be discussed with Mr. Bob Freitas and The University of Arizona Technical Assistance Team. The draft proposal submitted by Engr. Wael is attached to this report in appendix C.

In regard to item 6 of the *ad hoc* committee meeting concerning the capacity building of the technical staff at the Ministry of Environment and WAJ, Engr. Wael Suleiman requested that a training workshop involving The University of Arizona technical assistance team be sponsored by the Sustainable Development of Dry Lands Project. The workshop topics will include training on the characterization of biosolids with the parameters present in the standards of biosolids reuse and would be conducted at RSS/ERC in the next fiscal year. The workshop would be presented as lectures and as hands-on training at the RSS laboratories. The RSS/ERC staff would lecture and do the lab training jointly with The University of Arizona team.

If the training workshop receives approval from IALC / The University of Arizona then a proposal will be developed by RSS/ERC and presented to The University of Arizona to prepare a schedule and topics for this workshop.

VII. United States Agency for International Development, USAID

On May 24, 2006, Dr. Tamimi met with Mr. Ross Hagen at USAID headquarters in Amman. Dr. Tamimi presented a brief update about the Sustainable Development of Dry Lands Project activities. Since Mr. Hagen had only 1:15 hours for the meeting Dr. Tamimi promised to come back during June and give a full blown presentation about the status of the project activities. Mr. Hagen indicated that he will be out of his office on June 14 and 15 so as to avoid scheduling these 2 days for the visit.

Mr. Hagen indicated that he accepts the Wadi Mousa activities financial proposal as submitted by Mr. Bob Freitas and CDM will be in control of developing the designs and the tender documents for the Wadi Mousa Awareness Center. He indicated also that CDM might find another architect since Engr. Sahel Al-Hiyari requested starting the design of the awareness center in three months since he is so busy with other commitments. Mr. Hagen also indicated that CDM might look for another landscape designer since Dr. Erin Addison requested a high fee for her services. Mr. Hagen indicated that The University of Arizona was paying her a high fee and this is why she is requesting the above than normal fee for her services. Dr. Tamimi indicated that she was getting paid as a graduate student at The University of Arizona and that probably she is raising her fee since she filled a bio-data sheet with a US contractor for the Water Demand Management proposal submitted to USAID by that contractor. Dr. Tamimi indicated that that company requested her to raise her fee from $18,000K per year to $50,000 per year.

Dr. Tamimi promised to have the final copy of the FY 2004-2005 reports CD along with the final report and the CD for the Biosolids risk assessment workshop held in December 2005. He said he would have the final report and the CD for the anaerobic wastewater treatment workshop held in Egypt between March 13 and 15, 2006.

With regard to the Rusaifah remediation activity present in the FY2005-2006 Scope of Work as item number I, Mr. Hagen indicated that a representative from US EPA is finishing up a report on what can be done to the site. The report will be presented to USAID and to the ministry of environment so as to get funding for the implementation stage from donors other than USAID. Dr. Tamimi stressed that the technical assistance team at The University of Arizona expressed interest in providing technical assistance to the rehabilitation efforts. Dr. Tamimi is suggesting to have a meeting with the ministry of environment and present the work and capabilities the TAT has and to express their interest in providing technical assistance to the ministry for that project.

In regard to the video conferencing course proposed with JUST, Mr. Hagen indicated that "Internet 2" can be used if available at The University of Arizona since it gives better results. This needs to be discussed with the technical group at The University of Arizona.

In regard to the training workshop proposed by RSS/ERC and presented above, Mr. Hagen suggested to have the lab training at the WAJ laboratories since their labs are being evaluated and being certified to conduct laboratory test for monitoring water, wastewater and effluent. USAID is working closely with JISM to certify it as the certification body that decides on what labs should be recognized as certified labs.

Finally Dr. Tamimi indicated that Mr. Bob Freitas, the project director, will be in Jordan between August 12 and 25, 2006 to present along with Dr. Tamimi the proposed Scope of Work (SOW) for FY 2006-2007 along with the budget. Dr. Tamimi inquired about the level of funding that will be available from the mission and Mr. Hagen indicated it will be at the same level as the current FY 2005-2006. Mr. Hagen indicated that there will be a cut from Washington to his office for next year and he knows what is available and is committed to provide the same level of funding as this year. He indicated that the money was split between two offices within his department last year (Current Fiscal Year) but this year he is in control of all the money and he will be allocating it throughout his department.

VIII. Conclusion

It is believed that Dr. Tamimi met the objective of his visit and it is proposed that another well planned visit for Dr. Tamimi to Jordan take place around the 24 or the 25th of June, 2006 to follow up on the activities and the promised actions presented in this report.

Appendix B

Research Proposal Template
And
Proposal Budget Templates

IX. Summary information

1) Title

2) Brief Abstract

(50-100 words)

X. Detailed Information

1) Description

a. Subject

b. Background

c. Objectives

d. Research question(s)

e. Methodology

f. The significance of the proposed research

(Scientific, scholarly or other)

g. Capacity building

h. Work plan and timetable

(Use time frames, not dates)

i. Personnel

(Staff to be involved in the research project, including the disciplinary backgrounds of all researchers)

2) Relevant literature

XI. Overall budget (USD)

(The budget should be filled out on the separate Excel spreadsheet. All budget justifications should be written here)

XII. Resumes

(Attach brief résumés (CVs) of principal investigators and researchers, including positions held, fields of specialization, and recent publications)

	Year 1			Year 2			Year 3			Total		
	WERSC	Requested from IALC	Total	WERSC	Requested from IALC	Total	WERSC	Requested from IALC	Total	WERSC	Requested from IALC	Grand Total
1. Human Resources												
1.1 Principal Investigators			0			0			0	0	0	0
1.2 Researchers			0			0			0	0	0	0
1.3 Post-doctoral researchers			0			0			0	0	0	0
1.4 PhD students			0			0			0	0	0	0
1.5 Research assistants			0			0			0	0	0	0
1.6			0			0			0	0	0	0
1.7			0			0			0	0	0	0
Subtotal Human Resources	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2. Equipment												
2.1			0			0			0	0	0	0
2.2			0			0			0	0	0	0
Subtotal Equipment	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3. Consumables												
3.1			0			0			0	0	0	0
3.2			0			0			0	0	0	0
3.3			0			0			0	0	0	0
Subtotal Consumables	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4. Travel												
4.1			0			0			0	0	0	0
4.2			0			0			0	0	0	0
Subtotal Travel	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5. Other												
5.1			0			0			0	0	0	0
5.2			0			0			0	0	0	0
5.3			0			0			0	0	0	0
5.4			0			0			0	0	0	0
Subtotal Other	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6. Subtotal direct project costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
7. Indirect Costs (up to 10%)	0	0	0	0	0	0	0	0	0	0	0	0
8. Grand Total (6+7)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix C

Biosolids Operational Manual Draft Proposal
Developed by RSS/ERC

Operational Manual for Best Management Practices of Sludge/Bio-solids in Jordan

The recent changes in regulations concerning municipal wastewater treatment in Jordan have resulted in a significant increase in reclaimed water as well as bio-solids quantities. The majority of municipal wastewater treatment plants in the country are of secondary type, utilizing conventional and modified activated sludge processes that generate relatively huge amounts of Class B bio-solids. Handling, reuse and/or disposal of bio-solids represent an increasing challenge worldwide as the presence of pollutants and micro-organisms is a potential health risk to such practices.

The Royal Scientific Society RSS of Jordan has been involved in conducting studies in fields of bio-solids characterization, treatment and application for agricultural lands since 2003. In addition, RSS carried out a field survey in 2005 to investigate and assess current management practices of sludge/bio-solids including treatment, handling, testing and disposal. These activities have been financially supported by the Sustainable Development of Dry Lands Project that is funded by the United States Agency for International Development USAID (Washington and Jordan/ the office of Water Resources and Environment Office-Jordan) under a cooperative agreement with the International Arid Lands Consortium IALC / University of Arizona, and is run through the Jordan Badia Research & Development Center BRDC.

The activities, particularly the field surveys, revealed that there are almost no available systematic data for generated bio-solids quality as bio-solids is not usually analyzed for at the laboratories of the Water Authority of Jordan WAJ; that sludge treatment units are not being operated based on typical design criteria; that almost all generated quantities are disposed of at dumping sites with paying very little attention to health and environmental aspects; and that there are no definite strategies or even an operational manual for treatment plants operators as well as for land appliers and users.

This proposal is a continuing activity to the current cooperation between IALC and RSS in fields relevant to sludge and bio-solids, and aims at developing of an operational manual for best management practices of sludge/bio-solids in Jordan. The manual will help improving current bio-solids management practices at the treatment plant level and at dumping sites where sludge/bio-solids is being dumped. It will also act as a guide for laboratories technicians as well as for bio-solids land appliers, particularly in view of the adoption of a new Jordanian regulations for the reuse of bio-solids in agriculture (this is expected to be issued during 2006).

METHODOLOGY

1. The main findings of previous activities, particularly those of the field surveys, will be reviewed and assessed. A literature survey on best sludge/bio-solids operational, technical and managerial practices worldwide will be carried out to try to cover various aspects. A proposed table of content of the manual is shown below that is divided into three main volumes; the operational/managerial one; a volume for beneficial reuse/disposal aspects; and a third volume that describes physical, chemical and microbial testing procedures and methods in details.

   - **Introduction.**
   - **Scope.**
   - **Definitions.**
   - **Volume (I): Operational/Managerial Aspects.**
     - **Treatment Techniques**: This section will focus on operational considerations of treatment processes mostly used in Jordan such as gravity thickeners (e.g. solids loading, required detention time, polymer addition and others), filter press (mixing and chemical feeding, odor control and others), drying beds (solids loading, detention time, weather effects and others), digesters with different systems, and different composting techniques.
     - **Storage and Transportation**: Including storage process requirements and control, storage locations or devices and their operational considerations, transportation techniques, odor control during storage and transportation.
     - **Health and Safety Practices**: Health and safety measures, workers protection, personal protective equipments and immunization.

   - **Volume (II): Beneficial Reuse/Disposal Aspects.**
     - **Agricultural Utilization of Bio-solids**: Including site restrictions, application rate determination, application techniques, site management and public information strategy.
     - **Sludge Disposal**: This section will discuss the regulations for sludge disposal and the operational considerations of the land filling process.
     - **Licensing**: For agricultural utilization and for disposal.

   - **Volume (III): Sludge Characterization.** This volume identifies the sampling points along different sludge treatment processes; sampling procedures; and chemical, physical and biological analytical standard procedures and methods.

2. An operational manual will be developed based on the information mentioned above. RSS will work in close cooperation with the *ad hoc* committee during this process.
3. The manual will be reviewed and adopted by the *ad hoc* committee and WAJ representatives.

PROPOSED DURATION

The manual will be developed and finalized within eight months of the commencement date.

ESTIMATED BUDGET

The total estimated budget is (43,000 USD) as shown below.

Category	Budget (USD)
Volume (I)	12,500
Volume (II)	12,500
Volume (III)	18,000
Total	**43,000**

It is herein understood that at this stage RSS is applying for the financial support for preparing volume (I) only (12,500 USD), and will apply for the required support for volumes (II and III) at later stage.