Partners for Water and Sanitation

Note on project reports

The following report has been prepared by Partners for Water and Sanitation
in response to a project Terms of Reference.

The content of the report is based on the opinion of the author(s) and does not
necessarily represent the opinions of the wider PfWS partnership,
or the project funders.

Any extracts from the report should only be used with prior permission
of the report author(s).

PAWS VISIT REPORT

Ethiopia

July 2006

**Water Works Design and Supervision Enterprise
Quality Management System**

PAWS VISIT REPORT

PROJECT NAME: Water Works Design and Supervision Enterprise
Quality Management System

PROJECT COUNTRY: Ethiopia

DATES OF VISIT: 17-21 July 2006

VISIT TEAM: David Rathmell BEng CEng MICE FCIWEM
Quality Manager
Earth Tech Engineering Ltd
Wentworth Business Park
Tankersley
South Yorkshire
S75 3DL

PLACES VISITED: Offices and Laboratory of WWDSE, Addis Ababa

MAJOR EVENTS: Monday 17th July – Opening Meeting with Management Team

Tuesday 18th – Thursday 20th July – Auditing all Departments

Thursday 20th July – Presentation of Findings and Discussion with Management Team

Friday 21st July – SIPOC Workshop to define investigation process

WWDSE Office

Management Team

Neme Sorie	**Negash Gemtessa**	**David Rathmell**
Kefeyalew Amare	**Tesfaye Kidane**	**Mekuria Yohanes**
Mohammed Ibrahim	**Amare Mamo**	**Tesfaye Zeleke**

CONTENTS

10.0   Appendices

    1.   Project Terms of Reference
    2.   SIPOC and VSM Examples
    3.   Support Service Visit Programme
    4.   WWDSE Company Structure
    5.   Technical Standards Reference Details
    6.   LRQA (Dubai) Training and Certification Proposals
    7.   ISO QAR Training and Certification Proposals
    8.   QSAE Training Courses
    9.   Earth Tech File Directory Structure
    10.   Earth Tech Revision History Sheet
    11.   ISO 9001: 2000 Implementation Plan
    12.   Flowchart Template and Standard Symbols

1.0 Visit Objectives

The initial purpose was a scoping visit to make an assessment of the Quality Assurance procedures and practices currently carried out by WWDSE. As a result of this visit firm recommendations were to be made advising what should be done to achieve certification to the international Quality Standard ISO 9001 : 2000 "Quality Management Systems – Requirements".

The Project Terms of Reference were prepared by Negash Gemtessa, General Manager, WWDSE and attached to an email to Mr Paul Turner, Manager, Partners for Water and Sanitation (PAWS) dated 6th July 2006 (Ref. Appendix 1).

2.0 Visit Outputs
Programme for Visit

An opening meeting was held at 2.0p.m. Monday 17th July between the WWDSE Management Team and David Rathmell at the offices of WWDSE. After initial introductions Negash Gemtessa explained the purpose and objectives of the visit and reiterated his vision for the company "to become a Reputed International Consulting firm".

David Rathmell then introduced himself and outlined the benefits to be realised by implementing an ISO Quality Management System (QMS). He described the model for a process-based quality management system and the concept of plan-do-check-act which underpins the successful implementation of QMS. He also described the analysis of a process using the SIPOC (Suppliers-Inputs-Process-Outputs-Customers) methodology and the concept of a Value Stream Map (VSM) to visualise core and support processes. Examples of a SIPOC and VSM are included in Appendix 2.

The opening meeting concluded with a discussion of an audit programme for all departments to be carried out by David Rathmell. The Management Team agreed to meet again at 2.0p.m. Thursday to review his findings and discuss the next steps for implementation of a QMS eventually leading to ISO 9001 : 2000 certification.

The detailed programme for auditing each department / service and the Department Heads to be interviewed is included in Appendix 3.

3.0 Summary Overview of WWDSE Capability

WWDSE is a public enterprise set up by the Ethiopian Government in October 1998 to operate as a consultant in the field of water resources. There are currently three technical departments:

- Design
- Water Resources Studies and investigation
- Supervision and Contract Administration

Each technical department is further sub-divided into specialist skills. Support functions are provided by:

- Administration and Finance Department
- Planning and Business Promotion Department
- Surveying and Drafting Service
- Laboratory Service
- Audit Service

An organogram showing the company departmental structure is included in Appendix 4.

It is understood that the current portfolio of 35 major projects are predominantly in the fields of Water Treatment and Distribution, Dam and Irrigation. Hydropower Divisions have been established but there are currently no live projects. I was also informed that ultimately the consultancy aspired to Roads and Building construction.

A core of 60 Qualified Engineers plus many other specialists and support staff win work either in competition or by direct works. A Technical Proposal is prepared comprising:

- Work Plan
- Contributions from assigned technical experts
- Identified work packages with budgets

The Technical Proposal is submitted to the client who evaluates and reviews the proposal. Upon receipt of an award the WWDSE establishes a project office with assigned staff. The Project Team lead by either a Project Manager or Team Leader would then:

- Collate and review all previous documentation
- Prepare interim reports for client review
- Undertake feasibility studies

If the WWDSE do not have the resource capacity or appropriate technical specialist skills they have two avenues for enlisting additional help:

i)   Outsourcing packages of work to sub-consultants
ii) Hiring freelance experts from a network of specialists at local universities or individuals previously employed on a contract basis.

In summary I formed the view that the level of engineering knowledge and practise is very high. This impression was obtained from the various technical discussions at all departments with specialists who clearly understood their chosen field. I was also impressed by the meticulous planning and attention to technical detail I witnessed in Technical Proposals and Inception Reports. The overall level of work flow planning and resource allocation is commendable.

The lack of infrastructure and standard systems however inhibits the development of efficient process performance management. I am persuaded that the implementation of a Quality Management System would provide a good foundation for:

- Consistent outputs
- Lean, value added processes
- The means by which continuous improvement would be driven

This should help WWDSE to realise their first goal of improved credibility and standing in the world markets.

4.0   Summary of Departmental Audit Findings

4.1   Water Resources Study and Investigation Department (WRSID)

Seen: Tesfaye Kidane – Department Manager
        Engida Agegnehu – Head of Hydrogeology
        Arebo Sambi – Environmentalist

Tesfaye gave me a slide presentation of WWDSE's organisation and project profile.

We discussed Educational Qualifications for which records are held by Administration and Finance. Permanent staff are encouraged to seek Professional Registration.

Borehole drilling records are maintained on standard sheets.

Annual Plans are produced for each year from July to following June. Resource allocation schedules are prepared using MS Project.

The audit department only undertakes financial audits. There is no process performance auditing capability.

All laboratory testing is carried out in accordance with British and American Standards.

Geological mapping is carried out for regional ground water to assist in zoning aquifers and planning irrigation proposals.

The Project Manager would specify the requirements for a surveying task and assign the necessary staff. He would determine the following:

- Scope of work
- Specification
- Outputs
- Area to be surveyed
- Discuss and agree resourcing and timescales

All instruments are owned by the Surveying Department and vehicles are provided by WRSID. Any changes to the specified survey area are subject to approval by WRSID.

An Environmental Assessment is also carried out in accordance with National Guidelines comprising:

- Initial reconnaissance

- Meeting all stakeholders - Local Committees
  Regional bodes
  Environmental Protection Authority (EPA)
  Ministry

- Identifying key issues
  Detailed consideration of key issues
  Detailed surveys
  Data collection
  Consultation

I looked at the Feasibility Study and Inception Report, June 2006 for Humera Irrigation Project. There was no Approval Record or Document Revision History.

4.2 Contract Supervision and Contract Administration Department

Seen: Mohammed Ibrahim - Department Manager
      Seyoum Berhanu – Head of Water Supply and Sewerage Division
      Ibrahim Dinku – Head of Dams and Irrigation Division

Based upon the Technical Proposal outlining a methodology and manpower requirements a contract document is prepared as the basis of an Agreement with the client. FIDIC Contract Conditions are used for all projects.

The handover is carried out in collaboration with the client and the appropriate level of site supervision allocated:

- Resident Engineer
- Site Engineers
- Surveyors
- Laboratory Technicians

A schedule is prepared by the Contractor and used as a basis for monitoring progress on a daily, weekly and monthly basis. There is presently no standard report format although it is understood one is being prepared.

A weekly progress meeting is held with the contractor which is minuted. Monthly measurement against a Bill of Quantity forms the basis for payment. The Resident Engineer certifies payment and passes to Head Office for payment to be made. A standard format is used for Variation Orders.

The Specification used was a copy and appears to be the Civil Engineering Specification for the Water Industry (CESWI). It was unclear if this is the latest version (Sixth Edition – June 2004) as no originals are available to WWDSE. This is also true of FIDIC Contract Documents.

It is understood that the "Quality and Standard Authority of Ethiopia" (QSAE) have a library service, but it is not clear if they are able to sell standards. Relevant contract details for British Standards Institute (BSI) and Her Majesty's Stationary Office (HMSO) in the UK are provided in Appendix 5.

System failures are the lack of a standard filing system and identified Quality Records. Document numbering systems are in use for individual projects but there is no consistent document numbering across all projects.

Construction Completion Reports are prepared by Resident Engineers but there is no standard format or principle contents list. Typically they include:

- Scope changes
- Financial close out
- As built record drawings

A notable omission was the lack of Test and Inspection Records or reference to their being held elsewhere.

Mohammed told me that records and filing systems differ from site to site depending upon the individual.

4.3 Administration and Finance Department

Seen: Amare Mamo – Department Manager
Tesfaye Eluakber – Head of Personnel Division
Alemu Kassa – Head of Procurement, Property and General Service Division
Tesfaye Mexonnen – Head of General Accounts Division
Tsega Kebede – Head of Cost and Budget Division

Total staff numbers currently employed by WWDSE were reviewed.

199 Permanent staff
237 Contract staff
436 Total including management

The staff numbers employed in Administration and Finance are 74 Permanent / 59 Contract giving a total of 133.

Support staff including finance staff would be assigned to a new Project Team. This would include:

- Purchaser
- Project Accountant
- Financial Auditor
- Cashier / Storekeeper

General accounts assist in setting up a project budget. Cost codes are used for tracking project costs.

We reviewed the flowcharts developed for Resource Management. These comprised:

1)   How the budgeting process is performed
2)   External recruitment process
3)   Internal recruitment process
4)   Exit / termination process
5)   Provision of employee benefits
6)   Annual leave entitlement
7)   Sick leave
8)   Compassionate leave
9)   Performance related incentive process measuring key activities against output
10)   Promotion process

These have been developed by various Heads of Departments to enable value adding and non value adding activities to be identified.

A notable exception of the Personnel Division was responsibility for Human Resources Development. It was noted that the Training Officer is assigned to the Planning and Business Promotion Department.

Manpower planning forecasts are prepared by the respective departments. Work experience is offered to local university and college students for 2 or 3 months in the summer.

An induction process for new starters was reviewed. This starts with familiarisation of Administrative procedures. It was not clear if there was any formal technical skills, computer software or instrument training. This would normally be the responsibility of the technical departments.

General Accounts flowcharts cover:

1.   Monthly, quarterly and annual reporting to the Management Team and Ministry of Water Resources
2.   Cash and cheque payments
3.   Fuel coupons
4.   Annual bonus payment system
5.   Pensions, VAT and Income Tax
6.   Revenue realisation process
7.   Sub-consultant payments e.g. Mott Macdonald, Alexander Gibb

The Department has made an excellent start in flowcharting their processes to help them identify non critical or non value adding activities.

Purchasing flowcharts have been reviewed to drive lean, efficient processes. These cover:

1. Vehicle maintenance
2. Vehicle spare parts
3. Stationary
4. Office furniture and equipment
5. Accountancy supplies
6. Rig accessories
7. Surveying instruments – supply and maintenance
8. GPS
9. Chemicals

It was noted that there was no standard list of approved suppliers and no selection and approval process for new suppliers.

4.4 **Planning and Business Promotion Department**

Seen: Neme Sorie - Department Manager
                    - Training Manager
                    - Computer Services Manager
                    - Marketing and Business Promotion Manager

Computer Services Manager is responsible for specifying requirements for new computer hardware. There is currently a programme in hand for linking all computers via a central server.

Issues for computing appear to be accessibility to the internet and obtaining software upgrades via the internet.

Training Manager is responsible for:

i) Identifying training needs by making annual requests for information to all departments.

ii) Developing a training programme linked to a budget.

iii) Implementation of training and issue of certificates which are held on personal files.

Issue to be resolved is the fragmented responsibility for total human resources development between this department and the Administration and Finance Department.

Corporate Planning – All departments submit an annual strategy plan to Corporate Planning. From this a comprehensive 5 year plan is prepared and updated each year. This is submitted to the Management Team and the Board of Directors for approval. Business Objectives are derived from the updated Business Plan and reviewed annually.

There is a process of performance reporting by monthly, quarterly and annual reports for review by the Management Team.

Marketing and Business Promotion Manager is responsible for identifying potential new opportunities by scanning the internet and local newspapers on a daily basis. He assesses the market potential and sends out questionnaires to existing customers. These are used to analyse the level of satisfaction and feedback any dissatisfaction to relevant departments.

Customers are:

i)   Government / Federal / MOWR / Regional bodies.
ii)   NGO – non government bodies working on water supplies.
iii)   Private investors.

Promotions are done through exhibitions. The Marketing Manager is also responsible for preparing financial proposals according to Project Terms of Reference. These are reviewed by the Head of Department and approved by the General Manager. Technical proposals are prepared by the relevant technical departments.

4.5   Design Department

Seen: Tesfaye Zeleke – Design Manager
        Russom G/Egziabher – Head of Dams and Irrigation

Design is split into three divisions:

i)   Dam and Irrigation Design Division
ii)   Water Supply and Sewerage Division
iii)   Hydropower Design Division

Resources comprise 11 permanent staff augmented by contract staff and freelancers. Packages of work are also sublet to local consultants.

Freelancers are required to:

i)   Submit their CV
ii)   Interviewed to discuss previous experience
iii)   References taken up

In reality there are a limited number of technically able professionals who know each other by reputation. Networking is achieved by asking permanent staff, private consultants or local universities for recommendations.

The Ministry of Water Resources (MOWR) has recently instigated a registration of dam/hydraulics design. The Ministry of Urban Development has had a licensing arrangement for a number of years for design engineers undertaking certain types of work.

The Department undertakes preliminary design during the tender stage by:

i)   Making a site visit
ii)   Reviewing previous documentation

iii)   Assigning relevant specialists to prepare the technical proposal.

Technical proposals are reviewed by the Division Head before submission.

Seen: Lake Ziway Irrigation Scheme
        Study and Detail Design Project
        Appendix A : Technical Proposal

Following award of a project a study team is established including all experts required for the project. A Team Leader is assigned and issued with the Terms of Reference and Proposals Document. Large projects are set up in an independent office with a Project Manager.

The design team then visit site, review the technical proposals and prepare an Inception Report. This includes a more detailed schedule of key design activities with milestone dates.

The Inception Report is submitted to the client. This report must demonstrate a clear understanding of the Terms of Reference and any previous work undertaken by other consultants as part of feasibility studies.

No evidence was seen of signing off design input on either individual documents or drawings. This is discussed fully in Section 5.12 of this report.

On large projects the Team Leader / Project Manager has a responsibility to arrange a meeting of experts to discuss, review and agree design parameters. These review meetings are minuted and would take place at:

•   Pre tender technical proposal
•   Inception report
•   Feasibility report
•   Detailed design

Also on large projects the Team Leader / Project Manager is required to arrange a workshop to present their proposals to the Management Team. Noted that members of Management Team are technical experts.

Checking and approval of outputs is not carried out at preliminary or interim stages. It is only done at final drawing stage. This issue is dealt with in Section 5.9 of this report.

A3 books of drawings are used at all stages up to final issue to the contractor. At contract issue drawings are issued as either A1 or A0 size, stamped with the WWDSE seal and signed.

No design change logs are maintained to control design changes. This issue is discussed fully in Section 5.13 of this report. Monthly progress reports are produced including the original schedule, revised schedule and a description of problems encountered.   These are issued to the Planning and Business Promotion Department for consolidation into the organisations monthly report for review by the Management Team. They are also issued to the Client for review.

Any changes having a significant impact must be discussed and resolved with the client before proceeding as the terms of payment or agreement may be affected.

4.6   Surveying and Drafting Service

Surveying

Approximately 55-60 surveys are undertaken each year. These vary from 15000 hectares (small) to 50000 hectares (large). Surveys are carried out using digital total electronic stations with data loggers downloading information to laptops.

Maintenance and calibration of these instruments is carried out by Joshannon in Addis Ababa. No calibration certificates or instrument logs are kept. This issue is dealt with in Clause 5.14 of this report.

The surveying manager would in addition carry out closed traverse checks in the field to confirm the instrument accuracy.

A briefing document is prepared for the survey team in the form of a detailed memo. Survey output is both digital and hard copy.

A standard methodology is used for both primary and secondary triangulations by always closing the traverse or obtaining a GPS fix. Before commencing a new survey, details are obtained from the National Grid of at least 2 or 3 benchmark co-ordinates.

Satellite imagery is useful for planning a survey to assess vehicle accessibility and local terrain. Maps produced in this way are accurate in position to within 4 or 5 metres but unreliable with respect to elevation.

Drafting

Drafting is undertaken using AutoCAD. Special software is required for topographical maps.

One apparent difficulty identified in other departments is checking for software upgrades. This issue is discussed in section 5.5 of this report.

The other major issue is the lack of centralised electronic storage for the very large files produced by topographical surveying. The drafting department are required to download surveys onto CD's. A master is kept by the Surveying Manager and copies send to the design teams.

I was advised that Computer Services provide hardware and maintain anti-virus definitions but the lack of networked computers is a major difficulty. It is understood that a fully networked system is planned for coming online in the year July 06 – June 07.

Training on new instruments is provided by the company selling the instrument.

The total surveying resource capability numbers about 40 senior surveyors. It is company policy to always send one senior surveyor and one junior surveyor together.

4.7 Auditing Service

Seen: Kefyalew Amore – Audit Service Manager

The auditing service is a direct report to the Management Team. The audit department currently comprises a Manager, 2 Senior Auditors and a Secretary.

The role of the Audit Service is primarily to undertake financial transaction audits. All proposed payments are submitted by the finance department for auditing before payment is authorised.

There is no audit resource capable of undertaking performance auditing at present within WWDSE. Furthermore the Audit Service Manager knew of no institution in Ethiopia which was able to provide quality auditor training. Options for providing suitable training are discussed fully in Section 5.3 of this report.

4.8 Project Office for Humera Irrigation Project Feasibility Study

Seen: Taye Duresa – Project Manager
       Leulseged Abayneh
       Esayas W/Mariam

Feasibility studies are undertaken in two phases:

Phase 1:   i)   Review of previous reports
         ii)   Reconnaissance
         iii)   Preparation of an Inception Report
         iv)   Submission of Inception Report to client for comment and discussion

Phase 2:   Field investigations comprising:

               Topographical
               Soil Survey
               Geotechnical
               Hydrogeology

This produces a lot of data collection which would be classified as design input (Section 5.12 of this report refers).

A feasibility study produced General Arrangement drawings, profiles and typical sections. A Bill of Quantities is prepared for sample areas of the project based upon detailed drawings and rates used to prepare a cost estimate. The estimate is then pro rata to ascertain the whole project cost. A project economist will analyse the cost estimate for social, environmental and engineering elements.

Consideration is given to minimising the impact of environmental and social impact by introducing mitigation measures.

The use of Risk Management techniques in preparing project cost estimates was not understood and is addressed further in Section 5.15 of this report.

Guidelines and recommendations for watershed management and catchment development are derived from these feasibility studies. These include:

- Conservation measures
- Biological measures
- Forestation measures recommended special plants for conserving and enriching soil.
- Cropping measures

All of the above confirm the need to embrace the Environmental Standard ISO 14001 : 1996 as discussed in Section 5.17 of this report.

WWDSE as the leading Ethiopian Consultancy in water management will sublet work by either tender or directly to sub-consultants or freelancers. Selection is made based upon relevant experience and qualifications. An MSc is a preferred technical qualification.

Project reports are reviewed internally by WWDSE before submitting them to the client. In the case of the MOWR these reports would be reviewed by a National Steering Committee comprising experts from other consultants, universities and government bodies.

The drawing numbering system was discussed for the Humera project. It was also noted that the drawing title block is standard although it requires a revision status block. These issues are discussed in Sections 5.7 and 5.8 of this report.

The issue of standard engineering designs was discussed. It was felt that a high degree of standardisation was possible on Water Supply projects but was not possible on irrigation except for possibly structures and culverts.

Calculations are produced on both hard copy and electronically. The latter are backed up on CD's.

4.9   **Laboratory Services**

Seen: Dawit Nerie – Head of Laboratory Services

There are three testing laboratories:

- Water Quality
- Soil Mechanics and Concrete
- Soil Fertility

Customers include both Government and private clients.

The issues discussed with the Head of Laboratory Services before inspecting the testing laboratories were:

- Staff competency and training
- Independent laboratory certification
- Calibration of equipment
- Testing standards
- Record keeping

Staff

Laboratory staff are either:

- Degree qualified chemists
- Diploma qualified water quality technicians
- Fertility technicians
- Soils technicians

They are rated as either Senior, Junior or Assistants according to experience.

Water Quality Technicians normally graduate from the Arba Minch Water Technology with a diploma. Most of the WQ Technicians employed have 10 years experience.

On the job training for new recruits is provided by Senior people in each laboratory.

Personnel files are held at the laboratory for recruitment and salary increments of each person. Qualifications and CV's are held by Administration at WWDSE.

Equipment Calibration

Annual testing of laboratory equipment is carried out by the Ethiopian Quality and Standard Authority:

> PO Box 2310
> Addis Ababa
> Tel: 251 11 6460111
> Website: http://www.qsae.org

Certificate number P980067 Issued 6 June 2006 was inspected.

Testing Standards

Water Quality tests are generally carried out in accordance with Ethiopian Drinking Water Quality Guidelines produced by MOWR December 2001. These are generally based on World Health Organisation (WHO) guidelines and typically cover:

- pH
- Electrical conductivity
- Calcium

- Magnesium
- Potassium
- Fluoride etc

Soil testing is carried out in accordance with British Standards (BS) primarily and sometimes American Standards (ASTM).

Soil fertility testing is carried out in accordance with procedures specified by the Food and Agricultural Organisation of United Nations.

A common problem for WWDSE is having no internet access to check for latest editions of test standards.

Quality Training

It was interesting to note that the Head of Laboratory Services and all Diploma Technicians have recently received training in ISO 9001 QMS requirements from the Ethiopian Quality and Standards Authority (Ref. Appendix 8). Noted however that QSAE are not accredited for the certification of organisations to ISO 9001 : 2000.

The three laboratories were then inspected and sample testing equipment explained. Testing standards and manuals are held by the technician. Records of samples tested were also inspected – notably the order and registration form for Humera Irrigation project.

Noted with interest that the Senior Soils Fertility Chemist has begun drafting flowcharts for fertility testing procedures.

4.10 **Service Delivery Improvements**

Seen: Mekuria Yohanes: Head of Service Delivery

This is a new department currently waiting for approval from the Board of Directors.

It is proposed to have three divisions:

- Performance improvement
- Organisation and methods
- Information technology inc. computer services

Two officers would be transferred from other departments:

- Training officer responsible for Human Resource Development
- Service Delivery and Complaint Handling

Intended activities of the Department would require potentially 7 or 8 staff and would include:

i)   Establishment of measurement systems at all levels.
ii)   Introduction of new technologies and software.
iii)   Storing raw data with central management.
iv)   Human resource development.
v)   Reviewing strengths and weaknesses of the organisation and practice.
vi)   Feedback from clients and other consultants including complaints.

The role of Quality Manager and integration into the proposed Service Delivery Improvement Department is discussed in Section 5.2 of this report.

5.0   Summary of Key Recommendations

My considered opinion after the audits undertaken during the scoping visit is that certification to ISO 9001 : 2000 by WWDSE is certainly possible. Indeed the company is already complying with many requirements of the standard. In order to commence the process of establishing, implementing and maintaining a QMS for the purpose of obtaining ISO 9001 : 2000 certification the following actions are recommended.

5.1   Management Team Training

The commitment shown during my scoping visit by the General Manager and Management Team was highly commendable. It is a pre-requisite for ensuring the success of a QMS. To aid their understanding I recommend an in-house awareness training course of the requirements of ISO 9001 : 2000. This would be more cost effective for 5 delegates or more than going off site. Options for consideration are:

i)   An appreciation of the ISO 9001 : 2000 Requirements. One day course provided by Lloyds Register Quality Assurance (LRQA – Dubai). (Ref. Appendix 6 for 1 Day Appreciation Course profile).

ii)   ISO QAR offer a three day course to provide delegates with a good understanding of the requirements of a QMS. It also combines the ISO 9001 : 2000 Internal Auditing Course and would be useful for raising management awareness at the same time as training internal auditors (Ref. Appendix 7).

iii)   The Quality and Standards Authority of Ethiopia provide a number of courses relating to QMS requirements (Ref. Appendix 8 for complete list).

5.2   Quality Manager Appointment

A key person in establishing and implementing a QMS is the Quality Manager role. This person is defined as the Management Representative in Clause 5.5.2 of the ISO standard.

I recommend that a suitable person from the existing staff is identified and appointed as soon as possible. This person should be an integral part of the Service Delivery Improvement Department to ensure that all continuous improvement initiatives are co-ordinated. This would also align very well with the proposed transfer of the Training and Computer Services Officers to Service Delivery Improvement ensuring that all systems were integrated.

Suggested attributes of the Quality Manager should be:

- Engineering background so he/she understands the processes
- A person of integrity and reliability
- Good people skills
- Comfortable with higher management
- Good listener
- Logical thought and rational thinker
- Motivated – does not easily give up
- Believes passionately in the benefits of standard systems and process improvement

The appointed Quality Manager would require Lead Auditor training. This is a 5 day course which may be provided by either LRQA or ISO QAR (See Appendices 6 and 7 for Lead Auditor Course Details).

5.3 Internal Quality Auditors

In order to maintain a successful internal audit programme of performance auditing it is necessary to select and train up suitable persons.

These may be volunteers from existing permanent staff. They should be selected across all departments to ensure the Quality Manager has auditing capability across all processes. Suggested attributes of internal auditors are:

- Relatively senior staff who command respect
- Good people skills
- Good listeners
- Rational thinkers
- Pay attention to detail
- Dependable
- Trustworthy
- Committed

Clause 8.2.2 of the ISO standard defines the requirements for internal auditing. It should be noted that auditors may not audit their own work.

A 2 day Internal Auditor course (max. 12 delegates) may be provided in-house by either LRQA or ISO QAR (See Appendices 6 and 7). To save cost this could be provided back to back with the 1 Day Appreciation course for the Management Team.

5.4 Process Mapping

All core and support processes should be mapped to simply define "What we do". This process should begin with the Management Team agreeing what are the core/support processes and capturing these on a Value Stream Map (See Appendix 2 for VSM example).

Every process should have a Process Champion who will determine all the separate activities which require mapping for a particular area of the business e.g. the flowcharts listed in Section 4.3 for Resource Management are a good example. The use of the SIPOC (See Appendix 2) in a workshop environment will assist in drawing up a list of key activities to be mapped. The process champion plus 3 or 4 persons maximum should undertake this task.

The process champion should then advise the Quality Manager of a detailed list of activities to be mapped. The Quality Manager will compile an Excel spreadsheet and monitor progress as mapping proceeds.

Process mapping should be done using standard international symbols. This is best done using Microsoft Visio 2003 professional as the flowchart templates are set up ready for use and symbols are readily dragged and dropped. (ref. Appendix 12)

In summary process mapping steps are:

1. Management Team identify core/support processes.

2. Core/support processes captured on VSM by Quality Manager.

3. Management Team identify all Process Champions.

4. Process Champions draw up lists of activities to be mapped using SIPOC analysis.

5. Quality Manager maintains list of all activities to be mapped for each process / department and monitors progress.

6. Process Champion nominates individuals to draft process/activity maps using standard input/process/output symbols.

7. Draft process maps are reviewed by Process Champion and approved.

8. Approved process maps are forwarded to Quality Manager for inclusion in QMS.

It should be noted that there are six mandatory requirements by ISO 9001 : 2000. These are recognised by the words "A documented procedure shall be established …..". The relevant clauses are:

4.2.3 Control of Documents
4.2.4 Control of Records
8.2.2 Internal Audit
8.3   Control of Non-conforming Product

8.5.2 Corrective Action

8.5.3 Preventive Action

5.5 Computerised Network

From my experience as a Quality Manager for the last 7 years it is essential to have a computerised network across the entire company. This ensures that all data is held on a central server which aids the standard identification, storage, protection, retrieval, retention and disposition of records". (Clause 4.2.4 of ISO standard).

It facilitates the implementation of standard systems, standard document templates and enables back up and retrieval if part of the system should fail.

Means should be found to connect remote construction sites to the central system either by Broadband / Satellite links etc. Two major benefits to WWDSE of investment in centralised servers should be:

i)   Centralised data storage of huge files created by GIS and surveying topographical mapping – these files would then be accessible to all departments.

ii)   Ensuring the latest software upgrades are accessible to all staff as these would be held on a central server and individual PC's updated as required.

5.6 Central Filing System

No evidence was found during my audits of any filing system for project documents. A computer network allows centralised document management and the adoption of a company wide filing system. This is easily done using a standard file directory structure in Windows Explorer for each project. An example is shown in the Project Directory Structure (Appendix 9), adopted by my company Earth Tech. The basic principle is that every document type should have a folder. A new set of folders is set up by Computer Services for each new project.

A standard filing system ensures:

*   Consistency
*   Ease of finding documents
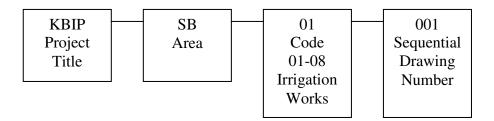*   Should be used with a file naming convention so that documents are easily found in large folders

Quality Records can be easily identified on a central filing system. These are records which must be kept for defined periods of time to satisfy legislative and contract requirements. Typical examples are:

*   Company Accounts
*   Personnel Records
*   Site Records (12 years for contracts signed under seal)

5.7 Document Numbering System

The identification of documents required by Clause 4.2.4 of the ISO Standard demands a standard document numbering system. This should apply to all documents and drawings. Documents would include all project reports, and any stand alone documents e.g. programmes and activity schedules.

It was noted on the Humera Irrigation Project that the following numbering system was being used on drawings:

KBIP Project Title	SB Area	01 Code 01-08 Irrigation Works	001 Sequential Drawing Number

It is not clear if this standard numbering system is in force on all projects. It could easily be adopted with different codes across the three technical divisions:

- Water Supply and Sewerage Division
- Dam and Irrigation Division
- Hydropower Division

5.8 Revision History

As part of a standard document numbering system there must be a revision status. This may simply be A-B-C which indicates the latest version. Above the title block of each drawing should be a revision history note explaining why the document or drawing has changed. Each time the document or drawing is re-issued to a customer for review/approval purposes the revision letter must be changed. This makes it clear as to which is the latest version of the document.

My company, Earth Tech, uses a different system based upon:

P – signifies a preliminary document / drawing
P1
P2   are later versions of preliminary documents
P3 etc

A – signifies an approved document / drawing
A1
A2   are later versions of an approved document
A3 etc

C – signifies a construction document / drawing
C1
C2   are later versions of construction documents
C3 etc

5.9 Document Checking and Approval

The control of documents is fundamental to an ISO certified QMS. The over-riding requirements are stated in Clause 4.2.3 Control of Documents e.g.

a) To approve documents for adequacy prior to issue.
b) To review and update as necessary and re-approve documents.
c) To ensure that changes and the current revision status of documents are identified.
d) To ensure that relevant versions of applicable documents are available at points of use etc.

There are additional requirements with respect to design for verifying that design and development outputs have met the design and development input requirements. This is clearly stated in Clause 7.3.5.

All project documents must therefore have a record of checking and approval. This must be maintained each time the document is issued.

For reports it is customary to include a joint checking / approval revision history sheet after the front cover (see Earth Tech example in Appendix 10).

For drawings the checking and approval signatures are seen in the title block. It is good practice to compile an A3 book of project drawings with original signatures always ensuring that the latest version is included. Superseded versions are held behind the latest version in plastic sleeves.

To satisfy the requirement to verify output in accordance with "planned arrangements" it is customary to develop a generic checking and approval matrix stipulating the minimum level of technical person authorised to undertake checking and approval roles.

5.10 Supplier Evaluation and Selection

It is necessary to develop a Supplier Evaluation and Selection process as required by Clause 7.4.1 of the ISO standard. This is usually a set of standard enquiry forms which can be sent to the prospective supplier. It should cover all areas relevant to scope of supply, quality and financial worthiness.

This process should be used for the purchase of equipment, vehicles and bought out services such as sub-consultant design. It would normally be used for potential new suppliers but may also be used to re-evaluate existing suppliers to update your records.

5.11 Approved Supplier List

It is also a requirement of Clause 7.4.1 to maintain records of the evaluation and selection process. This is most easily done by setting up and maintaining an Approved Supplier List. No purchases would be made from non approved suppliers. In the event that a supplier performs poorly, then action should be taken and either a warning noted on the approved list as to additional precautions or limits or they are removed from the list.

5.12 Review of Design Input

I noted that collection of previous raw data and information from various sources is a large part of the initial investigation process. The ISO standard requires in clause 7.3.2 that all design input shall be "reviewed for adequacy" and a record maintained.

It is good practice therefore to have a 'Design Input' stamp to be signed and dated by the relevant technical expert when they have satisfied themselves that the data or information is from a genuine source, is the latest version available and may be used for design purposes.

If that data, information or drawing is subsequently used as the basis of a design proposal then it must be regarded as design output. A good example was a topographical map over which a dam axis had been drawn and boreholes indicated. The original was design input from a previous consultant and required a design input stamp. The new drawing should have been copied into the standard WWDSE drawing template, given a document number, revision status, checked and approved.

5.13 Design Change Control

It is important to define the point at which a design is frozen for the purpose of logging change. It is customary to assume this is at contract award when the cost of the service to be provided has been accepted by the client.

Thereafter a design change log is maintained as required by Clause 7.3.7. This will register all significant changes to the design concept, give reasons why and apportion recovery of cost. It is important to note that minor changes arising from the development of detailed design would not normally be logged unless they fundamentally alter the original design.

5.14 Instrument Calibration Records

Any equipment used by the company which affects the service provided must be routinely tested, calibrated and records maintained ref. Clause 7.6. In the case of WWDSE this would apply to all surveying equipment and laboratory testing equipment.

I did see some evidence of calibration records at the laboratory. It would be good practice however to set up a register of all equipment used with serial numbers, date last tested, and date test due. This provides a history of testing and a useful aide memoire.

5.15 Risk Management

Whilst auditing the Project Team responsible for the Humera Irrigation project I asked if a risk log was maintained. This would normally be associated with buildability issues including technical and commercial considerations. I was advised that the risk of dam failure had been considered but none other.

As designers and advisers to the client I believe that you should develop skills in Risk Management to give greater confidence when preparing cost estimates for large projects. In addition some certification bodies interpret clause 8.5.3 Preventive Action as pro active Risk Management. This helps to mitigate the occurrence of hazards and make financial provision. Clients do not like unforeseen events with large financial implications and the consultant has a key role to play in anticipating such events.

5.16 Management Objectives

It is a requirement of the ISO standard that senior management establish quality or business objectives at all relevant levels within the company. Ref. Clause 5.4.1 Objectives are reflected in the Quality Policy and must be measurable.

Objectives should therefore be established at company, departmental and individual levels. It is advisable to start at the top with a balanced score card based upon the company's key strategic goals. These could be around growth of the business, customer satisfaction, new markets, attracting and retaining highly motivated staff etc.

Departmental objectives should then be developed to help achieve company objectives and similarly individual goals should feed into departmental objectives,

Measures or Key Performance Indicators (KPI's) should be developed for each goal. These must be SMART (simple, measurable, achievable, realistic and timely). Try to avoid creating new measures. It is much better to use existing data as the basis for a measure wherever possible.

Individual goals or targets are set at an Employee's annual appraisal with their line manager or supervisor. Ideally these should reflect behavioural attitude and technical ability. It is good to review an individual's goals at say quarterly or half yearly intervals to provide fresh impetus and motivation.

Quality or business objectives are reviewed by the Management Team as part of the formal annual Management Review process but ideally would be reviewed more frequently to assess trends.

5.17 ISO 14001 Environmental Standard

Whilst undertaking the departmental audits, it became increasingly apparent to myself that environmental considerations play a major part in project feasibility and implementation proposals. The Management Team may wish to consider certification to ISO 14001 : 2004 "Environmental Management Systems – Specification with guidance for use" as one of their key objectives.

The Environmental and Quality standards have many common requirements and are designed to be complimentary. Most of the internationally recognised consultants would wish to achieve certification to both standards.

6.0 **Implementation Timetable for ISO Certification**

6.1 The following steps are recommended to implement and achieve certification to the ISO standard.

1. Establish a steering committee of selected senior management.

2. Assign a Quality Manager as the Management Representative.

3. Management team participate in QMS awareness training.

4. Train up Quality Manager as Lead Auditor (Note: ISO QAR have provisionally arranged for Lead Auditor Training in Addis Ababa from 13- 17 Nov 06 – ref. Appendix 7 – further details can be provided)

5. Management team formulate Quality Policy, Objectives and communicate intentions to all staff.

6. Management Team identify all core and support processes and assign process owners/champions.

7. Process owners identify process activities using SIPOC and inform Quality Manager of full list of Process maps required.

8. Quality Manager maintains a comprehensive list of all proposed process maps and monitors progress.

9. Process owners map all process activities using international process mapping tools and symbols.

10. Undertake a Stage 1 : Documentation Review and Audit Planning Visit (Gap Analysis) of management systems and QMS procedures to ascertain the state of readiness for a certification visit.

11. Implement actions and address deficiencies arising from Stage 1 visit.

12. Finalise QMS documentation.

13. Launch QMS and train all staff in its requirements.

14. Conduct internal audits to demonstrate compliance to new QMS.

15. Undertake Management Review.

16. Stage 2 : Assessment visit by certification body and approval of QMS.

17. Certification body issue certificate.

18. Certification body commence routine surveillance visits.

Additional Notes

6.2   **Implementation Plan**

The above steps are shown diagrammatically on the Implementation Plan indicating approximate timescales (Ref. Appendix 11). It should be noted that this entire process is likely to take from 18 months to 2 years depending on how quickly QMS is implemented. The longest time required is for process mapping as this is done by process owners who have busy day jobs. Nevertheless it is vital that processes are mapped by the people who really understand what they do. Typically from my experience it takes 3 months to map a department but it is difficult to co-ordinate all mapping activities at the same time. Allow 6-9 months for mapping a number of departments.

6.3   **Stage 1 : Documentation Review and Audit Planning Visit**

This is step 10 of the Implementation Plan and full details of the process are set out by Lloyds (Appendix 6) or ISO QAR (Appendix 7).

I personally have first hand experience of Lloyds ability and impartiality over a number of years and can vouch for their professional approach. The proposals set out in Appendix 6 are from their Dubai office and assume the services of an assessor based in Egypt.

It has come to my notice however that ISO QAR based in Manchester, England have been working with Ethiopian companies over a 2 year period. These companies include:

•   Metahara Sugar Factory, Addis Ababa
•   Daschen Breweries Share
•   Ethiopian Steel
•   Elico (Ethiopian Leather)

They are also training up staff at the Ethiopian Quality and Standards Authority to enable them to provide quality training courses (contact at QSAE is Tadele Kumie).

ISO QAR are regulated by the United Kingdom Accreditation Service (UKAS) and would therefore offer the same standard of service as Lloyds Register Quality Assurance (LRQA).

Full training proposals and certification visit details with costs for ISO QAR are quoted in Appendix 7. It may be possible by arranging audit visits at the same time with other organisations in Ethiopia that the cost to WWDSE of their flight and accommodation costs could be shared.

The Stage 1 visit is effectively a Gap Analysis but in my opinion it may be more effective if there is a monitoring programme by PAWS before inviting Lloyds or ISO QAR to carry out this Stage 1 visit. The number and frequency of visits by PAWS would depend upon how quickly WWDSE begin to action the steps outlined. A further visit in 3-4 months time would greatly assist in firming up this tentative programme.

6.4 **Stage 2 : Assessment Visit**

Ref: Appendix 6 – Lloyds Stage 2 – Initial Assessment Visit

Appendix 7 – ISO QAR – On Site Audit Planning and Assessment

The assessor may recommend approval immediately to the ISO 9001 : 2000 Quality Standard if he has not reported any Major Nonconformities. However, if any Major Nonconformities have been reported, approval will be delayed and a follow-up assessment will be required to review corrective actions.

7.0 **Degree of Success at Achieving Objectives**

From the Project Terms of Reference compiled by the WWDSE General Manager there were two key objectives.

1. Assessment of their QA procedures and processes.
2. Recommendations for Project Management best practise

The first objective of assessing QA procedures has been achieved due to a number of key factors:

- Detailed Audit programme allowing a good understanding of WWDSE practise
- Commitment from the Management Team to improve their business performance.
- Full co-operation from all departments.
- A ready acceptance that QMS will help them to achieve their number one goal of an international reputation.

Arising from the visit I have gained a good overall impression of the capability of WWDSE and its management practices. It my view a more detailed assessment would benefit the process of implementing QMS and this is discussed under the next section "Continuation of Monitoring".

The second objective of looking at Project Management best practise should also be left to another visit

8.0 **Continuation of Monitoring and Reporting**

Method: a) Monthly progress reports
b) Follow up visits @ 3-4 monthly intervals

8.1 WWDSE have a culture of monthly progress reporting. It would seem natural for the newly appointed Quality Manager to prepare a regular monthly report on progress made and submit that to the Management Steering Committee. A copy of that report should be forwarded to myself to assess progress and perhaps comment, answer queries or make suggestions for next steps.

8.2 Follow-up visits each of say 1 week duration would give invaluable support and guidance to a new Quality Manager and Management Team with little previous experience or understanding of Quality Systems.

These visits should be planned in advance based on monthly progress reports and areas of concern in order to get the greatest benefit from each visit.

At present I suggest 3-4 month frequency at least up to the Stage 1 visit by the external assessment body. Provisionally that would require 2 or 3 visits.

8.3   I believe that having developed an initial relationship and level of trust with the Management Team together with an understanding of their modus operandii I am the best person suited to continue with this programme.

9.0   **Issues**

There are a number of potential issues which could hinder the successful implementation of QMS.

• Lack of Infrastructure

This was discussed in Section 5.5. Computerised Network clearly requires further investment. Whilst QMS can be implemented by hard copy it is clearly of much greater benefit to facilitate document storage centrally by electronic means.

• Cost of External Assessment Bodies

These are not insignificant.

• Pressure of Project Order Book

There are currently 35 major projects ongoing and clearly all staff are very busy. I know from my own experience how difficult it is to find time for non project type work. The SIPOC and process mapping tasks will certainly test the commitment of the Management Team.

• Communication to Staff

Implementing a QMS is really about changing the culture of the company. There will be resistance to some of these new ideas and requirements. It is important that the Management Team communicate their aims and progress achieved to all staff. Department Heads can do this very successfully by regular team talks or All Staff e-mails from the Quality Manager.

APPENDIX 1

PROJECT TERMS OF REFERENCE

APPENDIX 2

SIPOC AND VSM EXAMPLES

APPENDIX 3

SUPPORT SERVICE VISIT PROGRAMME

APPENDIX 4

WWDSE COMPANY STRUCTURE

APPENDIX 5

TECHNICAL STANDARDS REFERENCE DETAILS

1. **British Standards Institute**
2. **WRC plc**
3. **Thomas Telford Ltd**
4. **FIDIC MDB Harmonised Construction Contract**

Technical Standards

British Standards available from:
BSI Group Headquarters
389 Chiswick High Road
London
W4 4AL

BSI Membership
Tel: 0044 20 8996 7069

Customer Services – to order publications
Tel: 0044 20 8996 9001

Civil Engineering Specification
Sixth Edition
June 2004

Published by WRC Limited
Frankland Road
Blagrove
Swindon
Wiltshire
SN5 8YF

On behalf of UK Water Industry Research Limited
1 Queen Anne's Gate
London
SW1H 9BT

FIDIC Conditions of Contract for Construction
ISBN 2884320229
Published 31 December 1999
Price £30.00

FIDIC User's Guide: A Practical Guide to the 1999 Red and Yellow Books
ISBN 0727734415
Format: Hardbound
Published Date: 09 June 2006
Price: £50.00

Available from:
Thomas Telford Limited
Thomas Telford House
1 Heron Quay
London
E14 4JD

Tel: 0044 207 987 6999
Email: info@thomastelford.com

APPENDIX 6

LRQA (DUBAI) TRAINING AND CERTIFICATION PROPOSALS

1. **ISO 9001 : 2000 Appreciation and Interpretation – 1 Day**
2. **ISO 9000 : 2000 Series Auditor / Lead Auditor – 5 Days**
3. **Internal QMS Auditor – 2 Days**
4. **Stage 1 – Document Review and Planning Visit**
5. **Stage 2 – Initial Assessments**
6. **Surveillance Visits**
7. **Enquiry Form**
8. **Quotation Dated 30 July 2006**

APPENDIX 7

ISO QAR TRAINING AND CERTIFICATION PROPOSALS

1.   **Letter from ISO QAR Dated 1 August 2006**
2.   **ISO QAR – A Company Overview**
3.   **Letter Dated 1 August 2006 Outlining Cost of 3 Day Training Course**
4.   **Quality Management Systems – The Quality Manager Course**
5.   **Certification Application Form**
6.   **The Audit Procedure**

APPENDIX 8

QSAE TRAINING COURSES

APPENDIX 9

EARTH TECH FILE DIRECTORY STRUCTURE

APPENDIX 10

EARTH TECH REVISION HISTORY SHEET

APPENDIX 11

ISO 9001 : 2000 IMPLEMENTATION PLAN

APPENDIX 12

FLOWCHART TEMPLATE and STANDARD SYMBOLS