SWISS DEVELOPMENT CORPORATION

FERGANA VALLEY
CANAL AUTOMATION PROJECT

REPORT OF THE FOURTH MISSION OF INTERNATIONAL EXPERTS

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EXECUTIVE SUMMARY

The team of international experts for the Fergana Valley Canal Automation project was invited by the Swiss Development Corporation (SDC) to travel to central Asia from May 12. to 22., 2009 to carry out the inspection of the SCADA works on the two canal automation pilot projects in Uzbekistan and Tajikistan (object of the present report), and to complete the Project Document for the Phase III of the SDC-supported Canal Automation Project. The mission was composed of Mr. Herve Plusquellec, Team Leader, Mr. Georges Favreau, SCADA system specialist and Mr. Jean-Francois Puigt, specialist in hydraulics and maintenance of automation systems.

The BWO-Syr Darya structures component and the Aravan-Akbura pilot project component under the SDC Fergana Canal Automation Project were successfully inspected during the third mission of the International Consultants in May 2008. No further inspection of these works to assess the adoption of the SCADA system by BWO and the AAB Canal Management Office was scheduled for the time being.

The original program of the mission provided that the team will spend about 6 days on the field to inspect the installation and test the functioning of the equipment under automation mode. The field visit was reduced to three days because the systems were not yet ready for full testing.

Khoji-Bakirgan Canal:

On May 15, the mission first inspected the three hydro-structures on the Khoji-Bakirgan canal system, which were found under reasonable conditions for the installation of the equipment during a short visit by the Team Leader in October 2008.

SIGMA has completed the installation of the sensors and control equipment (not including the control rooms). The mission could not perform any test for various reasons including lack of power supply and non availability of radio license. Moreover, it was expected that the quality of the works on gates and their motors by local contractor Gayur on the last three hydro-structures (points 3, 4 and 5) would be of the same standard as on the first three (points 1, 2 and 6). The team found little progress in the work, and on point 4 the situation is even worse than in 2008, with one gate severely damaged and leaking.

Since the work expected from the Tajik authorities is not complete (gate repair, motors, connection to grid), and that no reasonable completion date can be found, a solution was designed in co-ordination with SDC to ensure timely **availability of the SCADA system, currently planned for first half of October**:

1. SIGMA is asked to complete the installation of the SCADA system (including control) on points 1, 2 and 6 where their work is advanced and where no major problems on gates were detected (which will have to be confirmed by full range tests when electrical supply is available).

2. On points 3, 4 and 5, SIGMA is asked to install the SCADA system as initially designed, with the exception of:
    - connections to motors,
    - installation of gate position sensors and end switches,
    - computers in the local control centers.

This equipment can be installed at a later date when gate repair, motors and electrical supply from the grid is available. **The experts recommend that the gates on points 4 and 5 should be changed, and that gates on point 3 be reinforced so to avoid bending.** SIGMA promised they will finish installation of the SCADA system (part related to control) when these elements are available.

Installation of the SCADA system as described above will be made before end of August. A test procedure is asked from SIGMA.

Electrical supply being a problem in this area, it is envisaged to install power supply based on solar panels, using the solution developed for SFC. This will allow backup energy supply, and also will allow to perform SCADA system commissioning even if the grid connection is not installed. SIC must ask SIGMA to provide SDC for June 20. with a short note describing the installation of solar panel systems in points 1 to 6. Decision and order of the parts shall be made before end of June.

To ensure better follow up of the project, reinforced progress monitoring will be put in place. SIC is asked to send a monthly progress report to SDC and Expert team in English.

South Fergana Canal:

On May 16. and 17., 2009, the mission visited all the SCADA sites along the South Fergana canal, including two "water balancing" sites with no hydro-structures. The mission found that almost all SCADA equipment has been installed by SIGMA, except the communications equipment, the site delivery of which was delayed because of customs clearance. The team was only able to move some gates under local control and in a few cases from the control room of the site (distant control). The mission could not test any equipment under automation mode, either because of power outage or because of failure of the automation software.

The mission visited the SFC headquarters in Kuva and found that no equipment was installed. The mission decided to return to Tashkent on May 17. After the visit of the experts on site, SIGMA was able install the communication equipment at four sites: Kuva control centre, telecommunication tower near Andijan (center of the star-shaped network), Tolmazor structure and Karkidon reservoir, and provided screen hardcopies showing data transfer.

SIGMA still has to complete the installation of the communication equipment, carry out a systematic checking of the functioning of the gates under local and automatic control modes and the fine-tuning of the automation software. **These tasks should be complete by end of August**. The team is confident that SIGMA is able to complete this work successfully, given its past performance with the BWO-Syr Darya and AAB SCADA components.

To ensure better follow up of the project, reinforced progress monitoring will be put in place. SIC is asked to send a monthly progress report to SDC and Expert team in English.

The current objective is to perform hand over of the structures in the first half of October 2009.

OVERALL COMMENTS

The Team was disappointed not having been able to carry out all the automation tests of the hydro-structures as planned. In particular, problems and delays were announced when the team was already in Uzbekistan.

The need for improved progress monitoring is clearly felt, and a closer follow up of the project will have to be put in place. This includes reinforced reporting by the Engineer, SIC. A proposal of organization will be made to SDC by the expert team to ensure enhanced control of the work progress and also to get the most of the missions of the international experts.

On both pilot projects, test must be carefully planned. An appendix to the full report includes the functional list of the tests that SIGMA would have to carry out at all hydro-structures before the team of International experts came back to the field for a final test and acceptance of the works. SIGMA will have to prepare a complete test document on the basis of this list, and will also have to run successfully all the tests before acceptance tests can be envisaged.

Finally, the mission would like again to stress the importance of an operation and maintenance plan for the SCADA projects. The life of SCADA equipment is rather limited. Attention to preventive and curative maintenance is essential for the continuous operation of such systems.

PROGRAM OF THE MISSION

This is the report of the fourth mission of International Experts recruited by SDC to provide technical assistance for the Fergana Valley Canal Automation Project. The team of SDC International Experts was composed of:

- Mr. Hervé Plusquellec, team leader and expert in the field of automation,
- Mr. Georges Favreau, expert in control equipment and hydraulic control,
- Mr. Jean-François Puigt, expert in hydraulics and maintenance of control systems.

The team arrived in Tashkent on May 13., 2009. A preliminary meeting was held to present the current situation on the Khoji Bakirgan canal and on the South Fergana canal and elaborate a new program of visit. The SFC inspection was rescheduled to allow more time for SIGMA work of installation of the communication equipment.

The team traveled in the Fergana Valley from May 14. to 17., 2009. The first system which was visited was the Khoji Bakirgan Canal (KBC) in Tajikistan, to assess the progress of gate modernization and SCADA system installation. The mission moved then to Uzbekistan to visit the South Fergana Canal (SFC) and inspect the SCADA system.

In parallel to these activities linked to phase I of SDC project, the project document for phase III was deeply reworked, to adapt to the new scope of the phase. This report is presented separately.

A final meeting was held on May 21. in the offices of SDC in the presence of Mrs. Islamova, Mr. Maag, BWO and SIGMA staff.

The detailed itinerary is provided in Annex 1 and the list of persons met in Annex 2

PART I: KHOJI-BAKIRGAN CANAL

I. BACKGROUND

A short description of the project was provided after the first visit by the team to this canal in May 2008.

The main objective of the May 2009 SDC mission of experts was to assess the progress with the installation of the SCADA equipment by SIGMA contractor.

The original program of the mission provided two days to inspect and test the automation works on the Khoji Bakirgan canal, since it was expected that Gayur would have completed the installation of the equipment. When the mission was informed that the works were not finished, the program was revised to complete the visit of the six hydro-structures in one day, on May 15., 2009.

II. INSPECTION OF THE CONTROL STRUCTURES AND ASSESSMENT OF READINESS FOR INSTALLATION OF SCADA EQUIPMENT

Over the six structures to be automated, three had equipment installed by SIGMA. All six were visited by the team of experts and the staff of the Khoji Bakirgan Canal Administration (KBCA) on May 15., 2009 to assess the progress of work of SIGMA on the first three structures and to assess the readiness for SCADA installation on the last three.

The sites where SIGMA installed their equipment are the following (ordered from upstream to downstream):

- point 1: KBC head works on Khoji Bakirgan river,
- point 2 at DP 24.
- point 6 : Gorodskoy waterworks on Kostakoz canal.

The other sites foreseen in the SCADA project are (ordered from upstream to downstream):

- point 3 at DP 33,
- point 4 at DP 61.
- point 5 at DP 100,

Prior to site inspections, SIGMA showed the purchased equipment stored at the KBCA offices in Chkalovsk. This is the equipment still to be installed at all the sites by SIGMA, except the radio equipment still not purchased. Control boxes are assembled and ready for installation on site.

SIGMA did not install the computers, supervisory software and communication equipment because the radio operating license is still not available. SIGMA wants to perform all this installation in one step, in order to limit travel for their teams.

Since no supervisory computer was installed, the checking of all installed SCADA equipment was performed visually. In the absence of energy on most sites, the gates and their motors were not operated. In these conditions, proper alignment of end switches and proper positioning of position sensors could not be tested.

1. **Point 1: KBC head works on Khoji Bakirgan river**
    a) **Operating principle of the structure – hydraulic control**
    The head structure of the Gulyakandoz canal is located at the dam on the Khoji Bakirgan river. In normal operating conditions, the dam gates are closed and all discharge in the river is transferred to the Gulyakandoz canal (and a small outlet to the drinking water factory). In case of excess of water in the river, the gates of the dam can be opened to limit discharge in the Gulyakandoz canal.
    b) **Electrical supply**
    Electrical supply is available on the site.
    c) **Gates**
    The manual gate to drinking water factory was replaced. The automated gats did not need any repair.
    d) **Gate engines, reducers**
    Apparently the engines commanding the gates of the Gulyakandoz canal were just repainted and recabled. One reducer is still to be changed.
    e) **Level sensors**
    One ultrasonic sensor was installed upstream the structure, downstream in the Gulyakandoz canal and on the canal to drinking water factory.
    f) **Gate position sensors and end switches**
    The gate position sensors and end switches have been installed.
    g) **Communication equipment**
    No communication equipment was installed.
    h) **Operator workstations (computers, supervisory software)**
    No computer was installed. The computer room is ready.

2. **Point 2 at DP 24**
    a) **Operating principle of the structure – hydraulic control**
    DP24 is a cross regulator structure between the Gulyakandoz canal and Kostakoz canal. Two minor outlets are also available on site: outlet to the Chkalovsk factory and outlet to release canal.
    b) **Electrical supply**
    Electrical supply is available on the site.
    c) **Gates**
    Some repairs were made by Gayur. Their quality is not excellent but acceptable.
    d) **Gate engines, reducers**

Three engines were installed on the Gulyakandoz gates, two on the Kostakoz gates and two on the release canal. As in point 6, these are not now engines.

e) **Level sensors**
Ultrasonic level sensors were installed on the Gulyakandoz canal upstream and downstream the structure, and also on the release outlet.

f) **Gate position sensors and end switches**
The gate position sensors and end switches have been installed.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
No computer was installed. The computer room is ready.

3. **Point 6 : Gorodskoy waterworks on Kostakoz canal**

a) **Operating principle of the structure – hydraulic control**
At this structure, the Kostakoz branch divides into three sub-branches. The first is the Gorodskoy new canal (4 m^3/s), the second sub-branch divides into the Gorodskoy old canal (1,65 m^3/s) and the Iskandarov canal (0,35 m^3/s), the third sub-branch divides also in two: the Kostakoz feeder and the Kostakoz New canal (1,2 m^3/s).

b) **Electrical supply**
No electrical supply is provided on the site.

c) **Gates**
The gates were repaired, but in the absence of vertical strengthening, it is possible to have some damage again in the future.

d) **Gate engines, reducers**
The engines are very old. This is not new equipment (at least 20 years old). The connectors are in very bad condition and the engines are not cabled.

e) **Level sensors**
The ultrasonic sensors were installed.

f) **Gate position sensors and end switches**
The gate position sensors and end switches are installed.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
No computer was installed. The computer room is ready.

4. **Point 3 at DP 33**

a) **Operating principle of the structure – hydraulic control**
DP33 is a cross regulator structure between the Gulyakandoz canal and Khitoyreza canal (4 m^3/s). A minor outlet to New Okaryk canal is also installed on site (0,05 m^3/s).

b) **Electrical supply**
Electrical supply is still not available. Transformer is installed on site.

c) **Gates**
Gates are still not repaired and still show some bending. Footbridges were installed by Gayur.

d) **Gate engines, reducers**
No gate engines were installed by Gayur. Electrical boxes were installed.

e) **Level sensors**
f) **Gate position sensors and end switches**
g) **Communication equipment**
h) **Operator workstations (computers, supervisory software)**

No equipment by SIGMA was installed on site.

5. **Point 4 at DP 61**

a) **Operating principle of the structure – hydraulic control**

At point 4, the following offtakes are found on the Gulyakandoz canal:

- the Navobod canal (4,5 m^3/s)
- the Kolkhozny canal (1 m^3/s)

b) **Electrical supply**

No electrical supply is provided on the site.

c) **Gates**

The left bank gate on the Gulyakandoz canal is broken and leaking. The status of the structure is worse than last year.

d) **Gate engines, reducers**

On the Gulyakandoz canal, one of the reducers is not installed. The support of the second one is completely torn off. The status of the structure is worse than last year.

The footbridge was repaired.

The electrical boxes were installed by Gayur on the Gulyakandoz canal and offtakes.

e) **Level sensors**
f) **Gate position sensors and end switches**
g) **Communication equipment**
h) **Operator workstations (computers, supervisory software)**

No equipment by SIGMA was installed on site.

6. **Point 5 at DP 100**

a) **Operating principle of the structure – hydraulic control**

At DP100, the Gulyakandoz canal is continued and the following offtakes are installed:

- B. Khamdamov canal (0,4 m^3/s)
- Chute (8 m^3/s)
- Release

b) **Electrical supply**

Electrical supply is still not available, although the power line and transformer were already installed before the last inspection in May 2008.

c) **Gates**

The gates were not repaired by Gayur, and in particular the two gates to the B. Khamdamov canal are much damaged.

Some minor work was made to prepare installation of the electrical cabinets.

d) **Gate engines, reducers**

No gate engine was installed by Gayur. Some reducers are still missing and the other ones were not repaired.

e) **Level sensors**
f) **Gate position sensors and end switches**

g) Communication equipment

h) Operator workstations (computers, supervisory software)

No equipment by SIGMA was installed on site.

III. CONCLUSIONS ON THE CONTINUATION OF WORK ON THE SCADA PROJECT

In May 2008, the conclusion of the inspection of structures by the team of experts was that the system was not ready for SCADA installation. In October 2008, further inspection showed some progress on three sites, and SCADA installation was recommended.

On points 1, 2 and 6, SIGMA work is well advanced but not finished. Energy has still to be provided on point 6. The radio license must be provided as soon as possible to enable end of installation. The experts were told that a letter was sent by KBC management to the Tajik authorities on month ago and that the license was expected in ten days. On these three sites, the work by Gayur is not excellent, but seems acceptable, which has to be confirmed by actual gate operation on their full range. A gate reducer has to be replaced at the head structure.

SIGMA is asked to complete the works on these three structures as initially planned. When installation and testing are finished by SIGMA, it will be necessary to organize detailed commissioning tests, as the team of experts could only do an inspection.

On the other three sites (points 3, 4 and 5), almost no progress was made by the Tajik authorities and their contractors regarding gate repair, installation of motors and electrical supply, although it was foreseen that Gayur's work should be completed by end of 2008. In these conditions, SIGMA cannot install the complete SCADA system. They have already prepared all the Gate Control Boxes and their programming.

Since the time required to complete the tasks to be performed by the Tajik authorities, and necessary for gate automation, is not known, a solution must be found to ensure timely availability of the SCADA system.

During a meeting between SDC, the expert team and SIGMA in Tashkent on May 20., it was decided that SIGMA will install a system for monitoring of water levels in the three structures, that can be completed in the future to a system also capable of gate control. The objective is to perform hand over of the system beginning of October 2009 (monitoring + control on points 1,2 and 6; monitoring only on points 3, 4 and 5).

On points 3, 4 and 5, SIGMA is therefore asked to install the SCADA system as initially designed, with the exception of:

- connections to motors,
- installation of gate position sensors and end switches,
- computers in the local control centers

This equipment can be installed at a later date when gate repair, motors and electrical supply from the grid is available. **The experts recommend that the gates on points 4 and 5 should be changed, and that gates on point 3 be reinforced so to avoid bending.** SIGMA promised they will finish installation when these elements are available.

SIGMA say that the installation of the monitoring system on points 3, 4 and 5 and end of installation of points 1, 2 and 6 is possible for end of August. At the end of this period, SIGMA shall provide a Global Test Document as described in Annex III.

In order to cope with the non availability of the grid at points 3, 4 and 5, and also to deal with frequent power shortages, it is envisaged to install power supply based on solar panels, using the solution of SFC (backup for 24 hours of computer, sensors and communications). SIC must ask SIGMA to provide SDC with a short note describing the installation of solar panel systems in points 1 to 6 including:

- computation of energy requirements of sites for monitoring only,
- technical specifications of equipment,
- conditions of installation,
- costs, site by site,
- time table.

This note is expected for June 20. at latest. Decision and order of the parts shall be made before end of June.

SIC will send every month a progress report to SDC and Expert team in English.

Decision for mission beginning of October has to be taken 2 months in advance (visas, logistics), i.e. beginning of August.

IV. OPERATIONAL STRATEGY UNDER SCADA

A proposal for improvement of the operational strategy was provided in the report of the mission of Experts in May 2008.

This strategy is still recommended, but the Experts would like to stress that prior to changes in the distribution of canals, it is necessary to have the gates of all small offtakes repaired.

PART II: SOUTH FERGANA CANAL

I. BACKGROUND

The goal of the mission of the experts was to test the complete SCADA system installed by SIGMA.

The original program of the mission provided three full days to inspect and test the automation works at the ten sites in the system, since it was expected that SIGMA would have completed their installation. When the mission was informed that the works were not finished, and in particular the communication components, the program was revised to reschedule the visit and allow more time for communication equipment installation.

The communications in the South Fergana SCADA system are based on Wi-fi equipment, which was not installed at the time of the visit. As a consequence, since no inter-site communication was possible, the checking of the SCADA system was performed locally, site by site. Some electrical power cuts were experienced, and tests of gates and their motors could not be totally performed.

SIGMA plans to calibrate the sensors (in particular end switches and position sensors for gates) when the communication equipment is installed. They must also check the operating mode based on discharge control (in particular the delays between commands and actions).

Since the installation was not terminated, the visit of the 10 hydro-structures was completed in two days on May 16. and 17.

The tests performed in the mission were made on a system not completely calibrated and validated by SIGMA. They must be considered as an inspection, and another mission will have to be foreseen to perform the commissioning tests.

The inspected sites are the following (presented from upstream to downstream):

1. Kampiravvat water works
2. Intake of SFC
3. Akbura water works at DP 36: crossing of Akbura River
4. Aravansai water works at DP 261: crossing of Aravan river
5. Khamza water works at DP 360: diversion of Karkidon Canal
6. Karkidon reservoir
7. Palvantash water works at DP 570
8. Tolmazor water works at DP 670
9. Beshalishai water works (DP 950)
10. Margilansai water works (DP 1034)

The following observations have been made during the inspection of the water works on the SFC.

II. INSPECTION OF THE CONTROL STRUCTURES AND ASSESSMENT OF PROGRESS OF INSTALLATION OF SCADA EQUIPMENT

1. Kampiravvat water works

a) Operating principle of the structure – hydraulic control

The Andijan power plant is operated on the basis of irrigation requirements on a continuous basis. i.e. there is no production of peak energy. From the Kampiravvat waterworks, the following canals are issued:

- the Savaisai canal
- the Shakhrikhansai canal, from which SFC will be issued
- the Andijansai canal

The purpose of automation is to control the discharges in the three irrigation canals through the SCADA system. The power plant management organization checks the releases to irrigation canals on a hydro-post located about one kilometer upstream from the dividing structure.

b) Electrical supply

Electrical supply is available on the site.

c) Gates

The gates are in good operating condition.

d) Gate engines, reducers

The gate engines and reducers seem to be in good condition, but were not all tested.

e) Level sensors

Four ultrasonic sensors were installed (one upstream the structure, one at the head of each canal). Their measurements are transferred to the control room.

f) Gate position sensors and end switches

Gate position sensors require calibration. Some sensors are still not installed on the Savaisai canal.

g) Communication equipment

No communication equipment was installed.

h) Operator workstations (computers, supervisory software)

The control room and its equipment is installed.

The discharge in each canal is computed from level upstream and downstream, and also using gate opening.

i) Performed tests

The automatic control of gates at the head of the three canals is not installed. Test of gate positioning was performed.

2. Intake of SFC

a) Operating principle of the structure – hydraulic control

The intake of the SFC consists of a weir without any control gate. The Shakhrikhansai intake is equipped of three gates to be used for flow control.

b) Electrical supply

Electrical supply is installed, and a small diesel generator is available for the operation of SCADA equipment (excluding gate motors).

c) Gates

The gates are in general good condition. The middle gate however is misaligned.

d) Gate engines, reducers

The gate engines and reducers were not tested, for want of electrical energy.

e) **Level sensors**
Three ultrasonic sensors were installed (one upstream the structure, one on the SFC, one on the Shakhrikhansai canal), and their measurements are transferred to the control room.

f) **Gate position sensors and end switches**
The gate opening sensors are shaft encoders.
No end switches are provided: gate operation stops on programmed gate positions.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
The control room and its equipment is installed.
The discharge in each canal is computed from level reading.

i) **Performed tests**
The structure was found without electrical energy. The diesel generator was started, which allowed monitoring of sensors, but the gates could not be operated.

3. **Akbura water works at DP 36: crossing of Akbura River**

a) **Operating principle of the structure – hydraulic control**
The two siphons under the river are not gated. The aqueduct over the river drains into a very short pool with two gates supplying a small irrigation canal (K1), controlled according to downstream water level, and two other gates connecting back with SFC, controlled on high level in the pool. One motorized gate is located upstream the aqueduct and used to interrupt discharge into the aqueduct.

b) **Electrical supply**
Electrical supply is installed.

c) **Gates**
No defect was observed on the gates, although their construction is not of excellent quality on K1 and return to SFC (screws).

d) **Gate engines, reducers**
One reducer was found missing on K1 gates, engine is also not available.

e) **Level sensors**
Three ultrasonic sensors were installed (one upstream the structure, one in the pool, one on the K1 canal), and their measurements are transferred to the control room.

f) **Gate position sensors and end switches**
Sensors were installed, but not all calibrated.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
The control room and its equipment is installed.
The discharge in the K1 canal is computed from level reading upstream and downstream the head gates, and also using gate opening.

i) **Performed tests**
The gates connecting the pool with SFC were tested using the SCADA system and performed correctly, including end switch for opening. A test of gate opening on the only motorized gate of K1 was made from the local controls of the motor. Opening was difficult and excessive heating of the motor occurred. This may be the result of bad condition of the reducer.

4. **Aravansai water works at DP 261: crossing of Aravan river**
    a) **Operating principle of the structure – hydraulic control**
    The three siphons under the river bed are not gated. One motorized radial gate is controlled by upstream water level and is used as release into the Aravansai river.
    b) **Electrical supply**
    Electrical supply is installed.
    c) **Gates**
    The radial gate could not be operated, but seems in good condition.
    d) **Gate engines, reducers**
    The gate engine and reducers could not be operated, but seem in good condition.
    e) **Level sensors**
    One ultrasonic sensor was installed and its measurements are transferred to the control room.
    f) **Gate position sensors and end switches**
    The gate opening sensor is a shaft encoder.
    No end switches are provided: gate operation stops on programmed gate positions.
    g) **Communication equipment**
    No communication equipment was installed.
    h) **Operator workstations (computers, supervisory software)**
    The control room and its equipment is installed.
    i) **Performed tests**
    No energy was available at the site during the visit.

5. **Khamza water works at DP 360: diversion of Karkidon Canal**
    a) **Operating principle of the structure – hydraulic control**
    That structure is the most important one of the SFC, as it controls the diversion of water to the Karkidon reservoir. The flow to the SFC canal will be adjusted to the target value and the gate at the head of Karkidon canal will provide automatic level control.
    b) **Electrical supply**
    Electrical supply is installed.
    c) **Gates**
    The gates were tested and are in good condition
    d) **Gate engines, reducers**
    The reducers on the gate to Karkidon feeder are noisy and oil is leaking from one of them.
    e) **Level sensors**
    Three ultrasonic sensors were installed (one upstream the structure, one downstream and one on the Karkidon feeder canal), and their measurements are transferred to the control room.
    f) **Gate position sensors and end switches**
    No end switch for closing, no position sensor on the Karkidon gate.
    g) **Communication equipment**
    No communication equipment was installed.
    h) **Operator workstations (computers, supervisory software)**
    The control room and its equipment is installed.
    i) **Performed tests**
    Two gates on the SFC were tested successfully from the operator workstation. The third gate had to be tested form the local controls.

The test of the Karkidon gate showed problems in the reducers.

6. **Karkidon reservoir**
   a) **Operating principle of the structure – hydraulic control**
   The 70 m high Karkidon dam creating a 212 million m^3 reservoir plays an important role for the operation of the 120-km long SFC canal as a compensation reservoir. The target flow in the downstream section of SFC is controlled both at Khamza structure and at Karkidon reservoir.
   The SCADA system provides monitoring of the reservoir level and monitoring of positions of the hollow jet gates and bulk gates.
   b) **Electrical supply**
   Electrical supply is installed.
   c) **Gates**
   The gates could not be tested (monitoring only)
   d) **Gate engines, reducers**
   The engines and reducers could not be tested (monitoring only)
   e) **Level sensors**
   Three ultrasonic sensors were installed in the reservoir at different heights, and their measurements are transferred to the control room. A fourth one is located in the discharge canal to SFC, but almost all the water released was pumped by users before reaching the sensor, resulting in erroneous reading.
   f) **Gate position sensors and end switches**
   The gate position sensors are connected to the control room, but could not be tested.
   g) **Communication equipment**
   No communication equipment was installed.
   h) **Operator workstations (computers, supervisory software)**
   The control room and its equipment is installed.
   i) **Performed tests**
   At the time of the visit, the level in the Karkidon reservoir was very low (only 61 million m3) and no test of release of water could be made.

7. **Palvantash water works at DP 570**
   a) **Operating principle of the structure – hydraulic control**
   That structure is located at a point where the SFC is divided into two branch canals which drop about 20 m before joining again into a single canal. The water level is controlled in the SFC by three gates on the right branch, and discharge is controlled in the Mayarik branch by three gates.
   b) **Electrical supply**
   Electrical supply is provided on the site (motors are supplied from the pumping station, other SCADA equipment from the control room upstream).
   c) **Gates**
   The gates seem in good condition but could not be tested.
   d) **Gate engines, reducers**
   Electric motors have been installed on the three gates of the SFC as well as at the head of the Mayarik branch canal.
   e) **Level sensors**
   Three ultrasonic sensors were installed: one in SFC near the control room, one in SFC upstream the three gates, one in the Mayarik branch canal. Their reading is transferred to the control room.
   f) **Gate position sensors and end switches**

The equipment was installed, but could not be tested.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
The control room and its equipment is installed. The discharge in the Mayarik branch is computed from level sensor reading and gate position.

i) **Performed tests**
The remote tests of the gates could not be performed. The gates are in local mode.

8. **Tolmazor water works at DP 670**

a) **Operating principle of the structure – hydraulic control**
This structure diverts water to the Kuvasai canal through a radial gate. The regulator on the SFC consists of two bays, with only one equipped of a radial gate. This gate is used to control the level upstream the Kuvasai gate.

b) **Electrical supply**
Electrical supply is installed.

c) **Gates**
The gates are in general good condition. The Kuvasai gate is slightly bent.

d) **Gate engines, reducers**
The gate engine and reducers were tested, but in some cases, blocking was observed (e.g. closing of Kuvasai gate).

e) **Level sensors**
One ultrasonic sensor is installed in SFC upstream the structure, another one in the Kuvasai branch downstream the radial gate.

f) **Gate position sensors and end switches**
The sensors could not be tested (no authorization to work in automatic mode).

g) **Communication equipment**
Two Wi-fi antennas were installed on the tower between canal and control centre;

h) **Operator workstations (computers, supervisory software)**
The control room and its equipment is installed. The discharge in the Kuvasai branch is computed from level sensor reading and gate position.

i) **Performed tests**
The Kuvasai gate was tested using automatic discharge control. The system is slow and the adjusted discharge is not stable (value much over the setpoint).
The level control in SFC was tested but did not operate.

9. Beshalishai water works (DP 950)

a) **Operating principle of the structure – hydraulic control**
That structure located at the crossing of the SFC with the Beshalishai River is the most complicated one on the SFC. It makes possible to transfer water between SFC and the river and the opposite. A diversion structure of oval shape located on the river about 200 m consisting of 8 flat gates is located just downstream of the crossing with SFC to supply water to canals on both sides (Akhshak on left bank, Kora Tepa on right bank), and discharge excess water when needed to escape). All the 18 gates of this complex have been motorized. Not all of the 8 gates of the diversion structure are in good conditions. These gates will not be automated, but equipped only for local control.

Two gates on the SFC will automatically control the level upstream of the diversion structure in the river section. Two other gates will control the upstream level of SFC.

b) Electrical supply

Electrical supply is installed.

c) Gates

Some gate screws are not completely vertical (offtake to Beshalish river) and some supports of reducers are bent (siphon under Beshalish river).

d) Gate engines, reducers

Motor on right bank bay is not properly cabled.

e) Level sensors

Seven level sensors were installed and their reading is transmitted to the control centre.

f) Gate position sensors and end switches

The opening end switches of the gates are installed in a position which is the limit of operation using the motors, and does not correspond to complete opening. In case of manual operation, which is often the case, the gate may be opened more and the ring attached to the gate screw may change position.

Several end switches sensors were found not aligned or even broken.

The closing end switches are installed in a position that does not correspond to total closing of the gate (e.g. 5 cm on the siphon of SFC). According to SIGMA, they were asked to do this for security, to avoid damage to the gates. This feature, variable among gates, is not documented, and SIGMA has been asked to include it in the Operation Manual.

g) Communication equipment

No communication equipment was installed.

h) Operator workstations (computers, supervisory software)

The control room and its equipment is installed. The discharge in the Akhshak and Kora Tepa branches is computed from level sensor reading upstream and downstream the diversion structure and gate position. Discharge in the SFC is computed using the level reading downstream the Beshalish structure.

i) Performed tests

A few gates were tested in local mode, but not to the end switches.

10. Margilansai water works (DP 1034)

a) Operating principle of the structure – hydraulic control

That simple structure consists of a 3-bay regulator of which only two are equipped of motorized gates, and one bay is ungated at the head of the Margilansai canal. The two gates of the cross regulator are not in good operating conditions and apparently rarely operated**.**

b) Electrical supply

Electrical supply is installed.

c) Gates

The gates seem in good condition but could not be tested.

d) Gate engines, reducers

The equipment seems in good condition but could not be tested.

e) Level sensors

One ultrasonic sensor in installed in the SFC upstream the structure, one in the Margilansai canal.

f) Gate position sensors and end switches

The equipment was installed but could not be tested.

g) **Communication equipment**
No communication equipment was installed.

h) **Operator workstations (computers, supervisory software)**
The control room and its equipment is installed.

i) **Performed tests**
No test was possible, because of a power cut which lasted more than the duration of the visit.

11. Other sites in SFC

Kuva
This site will be the general control centre of the SCADA system. No communication equipment and no SCADA equipment is installed yet. The communication tower is already available.

Faizabad
This site is a balancing site, with no SCADA equipment foreseen. A new communication tower was installed, but no communication equipment is available. The control room is still under construction.

Akbarabad
This site is a balancing site, with no SCADA equipment foreseen. No communication equipment and tower are available. The control room works are not started.

Repeater station at Andijan communication tower
At the time of the visit, the communication equipment was not installed at the station. It is not possible to visit this site without special authorization, and this site was not visited during the mission.

III. VOICE AND DATA COMMUNICATION SYSTEM

1. Data communication system

The data communication system is based on the Wi-fi standard.
All the equipment was purchased by SDC. The license for operating the equipment was granted by the Uzbek authorities to the canal management for this project.

A technical description of the system was sent to SIC. SIC will prepare a translation into English for the Expert team.

After the visit of the experts on site, SIGMA was able install the communication equipment in four sites: Kuva control centre, telecommunication tower near Andijan (acting as the hub of the system), Tolmazor structure and Karkidon reservoir.

Solar panel systems are foreseen in the communication system at 7 sites:

- hub of the system (backup of grid),
- three local re-translators (relays) (backup of grid),
- three remote hydroposts with no access to grid.

These systems allow operation during 24 hours. They have been ordered by SIGMA, but not received yet.

2. Voice communication system

The voice communication system is a standard radio system (ICOM equipment operating in the 170 MHz range). This equipment is currently in the Uzbek customs.

SIC will prepare a translation of the technical description of the system into English for the Expert team.

IV. CONCLUSIONS ON THE SOUTH FERGANA SCADA SYSTEM

The installation of the SCADA system is well advanced, but testing was not possible. An inspection of all sites was performed by the team of Experts.

Final tuning is required on all sites (position of end switches, minor adjustments, missing equipment, response time of automation).

The communication equipment was partly installed after the visit of the Expert team, and has to be completed on 8 sites on SFC within 3 weeks, according to SIGMA (except 3 hydroposts which require still unavailable solar panel systems).

No solar panel was observed on SFC.

SIGMA plans to have all work finished on SFC by end of August.

By that time, and in order to allow the Expert team to prepare the commissioning tests, SIGMA shall provide:

- a completed Global Test Document as described in Annex III.
- a detailed Operation and Maintenance manual. This document shall also include all the specific features (e.g. position of the end switches at Beshalish).

The objective is to perform hand over of the system beginning of October 2009. SFC management considers it is possible to have enough water for the tests at this period.

A progress report shall be sent by SIC every month to SDC and Expert team in English.

Decision for mission beginning of October has to be taken 2 months in advance (visas, logistics), i.e. beginning of August.

ANNEX 1: MISSION SCHEDULE

May 12:	**Departure of the team from Paris**
May 13:	**Meeting with SDC, SIC and SIGMA at SDC offices**
May 14:	**Meeting with BWO and SIC at BWO offices**
	Meeting with SDC, SIC and BWO at SIC offices
	Departure to Tajikistan
May 15	**Meeting with KBCA in Chkalovsk town and joint visit of structures on the Koji Bakirgan canal**
	Travel to Fergana
May 16:	**Travel to Kampiravvat, visit of the structure**
	Visit of the South Fergana canal down to Palvantash
May 17:	**Visit of the SFC downstream of Palvantash, including Karkidon reservoir**
May 18:	**Travel to Tashkent**
	Writing of mission report
May 19:	**Visit of the Dustlik canal (Uzbek and Kazakh parts)**
May 20:	**Meeting with SDC, BWO and SIGMA**
	Writing of mission report and project document for phase III
May 21:	**Debriefing meeting at SDC with BWO and SIC**
	Work on mission report and project document for phase III
May 22:	**Flight to Paris.**

ANNEX II: PERSONS MET DURING THE MISSION:

SDC:

Hanspeter Maag:	Country Director for Kyrgyzstan and Uzbekistan
Omina Islamova:	Regional Water Sector Program Manager
Olivier Magnin:	Water Resources Management Advisor

SIC-ICWC

Victor. Dukhovny:	Director
Ismail Begimov:	Automation Expert

SIGMA

Michael Tolstunov:	Technical Director for Uzbekistan
Sergey Vasilenko:	Director, Kyrgyzstan, Tajikistan and Uzbekistan

BWO/Syr Darya

Alexander Laktionov:	Chief of Technical Division
Narkabul Rakhmatov	Head of Territorial Management of Hunger Steppe and Dustlik Canal
Atkham Suleymanov	Head of Water Management Division

South Fergana Canal Organization

Mirkhamid Maksudov:	Deputy head of Fergana Valley water management
Abduvakhob Elmurodov	Head of South Fergana canal

Khoji-Bakirgan Canal Organization

Zafar Maksudov:	Head of KBC Administration

ANNEX III: GUIDELINES FOR WRITING OF THE GLOBAL TEST DOCUMENT OF ONE SCADA SYSTEM

Prior to commissioning of each system (KBC, SFC), the Contractor shall prepare a Global Test Document, containing:

- a description of all the tests to be performed to demonstrate that the installed system meets the contract requirements
- a recording of the fact that the Contractor has performed successfully all of these tests.

This Global Test Document shall be approved by the Engineer (SIC) and transmitted in English to the Expert team.

A possible outline of this document is given here below (the Tolmazor site is given as an example):

N° (1)	Site (2)	Test Description (3)	Date of test (4)	Comments on test (5)
…				
45	Tolmazor DP670	Kuvasai discharge control (increase/decrease): - from operator workstation, increase setpoint for Kuvasai discharge by 2 m^3/s - check gate movement, - after 10 minutes, observe discharge measurement on operator workstation and also level in SFC, which must be kept constant, - restore initial value of setpoint - check gate movement, - after 10 minutes, observe discharge measurement on operator workstation and also level in SFC, which must be kept constant.	15/06/2009	OK
46	Tolmazor DP670	Upstream level control (increase/decrease): - from operator workstation, increase setpoint for upstream level by 10 cm - check gate movement,	15/06/2009	OK

		- after 10 minutes, observe level measurement on operator workstation and also discharge in Kuvasai canal which must be kept constant, - restore initial value of setpoint - check gate movement, - after 10 minutes, observe level measurement on operator workstation and also discharge in Kuvasai canal which must be kept constant.		
…				

(1): unique number of test

(2): name of structure + DP

(3): short description of test: operations to be made, waiting time between operations, expected result, etc.
The tests shall include:

- For each gate:
  - test of complete opening and closing from operator workstation and locally, and check that movement is stopped by end switches and that gate position is smoothly measured,
- For each level sensor:
  - test of reading at several heights and comparison with manual measurement (ruler),
- For each controlled variable (level, discharge):
  - test of increase and decrease from operator workstation, including response time,
  - in case of several controlled variables, test of interaction of change of one variable on others
- For electrical supply:
  - Test of capacity of UPS
  - Test of operation of generators
- For communications:
  - Test that the general control center can get the information from all the structures. Simulation of communication problem on all structures.

(4) : date when the test was performed by Contractor

(5): comments: can be “OK” if successful, or can contain explanations why the test is not successful (e.g. : no enough water in canal, etc.).

ANNEX IV: PLANNING OF ACTIVITIES TO COMPLETE INSTALLATION AND TESTING OF SCADA ON KBC AND SFC

The following tables summarize the pending actions and necessary documents to complete installation of the SCADA systems on the Khoji Bakirgan canal and on the South Fergana canal

SOUTH FERGANA CANAL

Activity	Performed by	End date
Terminate installation and test of the SCADA system	SIGMA	31/08/2009
Provide Global Test Document	SIGMA	31/08/2009
Provide Operation and Maintenance Document	SIGMA	31/08/2009
Translate Global Test Document and transmit it to team of Experts	SIC	15/09/2009
Translate Operation and Maintenance Document and transmit it to team of Experts	SIC	15/09/2009
Decide on visit of the team of Experts for system commissioning on first half of October	SDC	01/08/2009
Acceptance tests of the SCADA system	Team of Experts	15/10/2009
Provide to SDC progress report in English	SIC	monthly

KHOJI BAKIRGAN CANAL

Activity	Performed by	End date
Write note on solar system power supply	SIGMA	20/06/2009
Write letter to Tajik Ministry of Water Resources to present situation and ask for completion of their obligations	SDC	30/06/2009
Terminate installation and test of the SCADA system	SIGMA	31/08/2009
Provide Global Test Document	SIGMA	31/08/2009
Provide Operation and Maintenance Document	SIGMA	31/08/2009
Translate Global Test Document and transmit it to team of Experts	SIC	15/09/2009
Translate Operation and Maintenance Document and transmit it to team of Experts	SIC	15/09/2009
Decide on visit of the team of Experts for system commissioning on first half of October	SDC	01/08/2009
Provide to SDC progress report in English	SIC	monthly

ANNEX V : INSPECTED SITES AT KHOJI BAKIRGAN CANAL

ANNEX VI : SUPERVISION ON THE SOUTH FERGANA CANAL

ANNEX VII : INSPECTED SITES ON THE SOUTH FERGANA CANAL