3. Integrated Evaluation of Hydraulic Model Test

3-1 Purpose of integrated evaluation of hydraulic model test

The objective of the integrated evaluation was to provide the information and advice on the hydraulic model experiments that were entrusted by MWRI to the HRI in order to establish the consistency with the numerical simulation implemented in this project. At first, the hydraulic model test was limited to the 3D hydraulic model test that covered the surrounding area of the DGRs, but the 2D hydraulic model test of one of the new Bahr Yusef regulator, mainly for the bed protection work was added independently. The integrated evaluation was made based on these two tests.

3-2 Monitoring of 3D model test

(1) Provision of the results of survey on the natural conditions

A meeting with HRI was held together with RGBS to provide the results of the topographic survey and geological survey carried out in this Study as the basic data for the physical hydraulic model test.

As a result, it was confirmed that HRI had already completed the topographic survey for the physical hydraulic model test and that no further results of the survey were required in this Study.

As for the specifications and drawings for the new regulator design to be used in the hydraulic model tests, it was confirmed that for the model specifications of the new regulators for the hydraulic model tests, those used in the past F/S period were used because the work processes of the hydraulic model tests were scheduled to be completed in February 2016, earlier than the completion time of the basic design of the new regulators (July 2016).

The implementation process of the hydraulic model test at the start of this study and the new regulator design schedule in this Study are shown below (see Table 3-2.1 and Table 3-2.2.).

The additional hydraulic model test is currently on going and the final report has not been submitted yet. And additional hydraulic model test is not subject to integrated evaluation by D/D consultants.

Table 3-2.1 Work schedule of physical hydraulic model test

(Conducted for 10 months from May 2015 to February 2016)

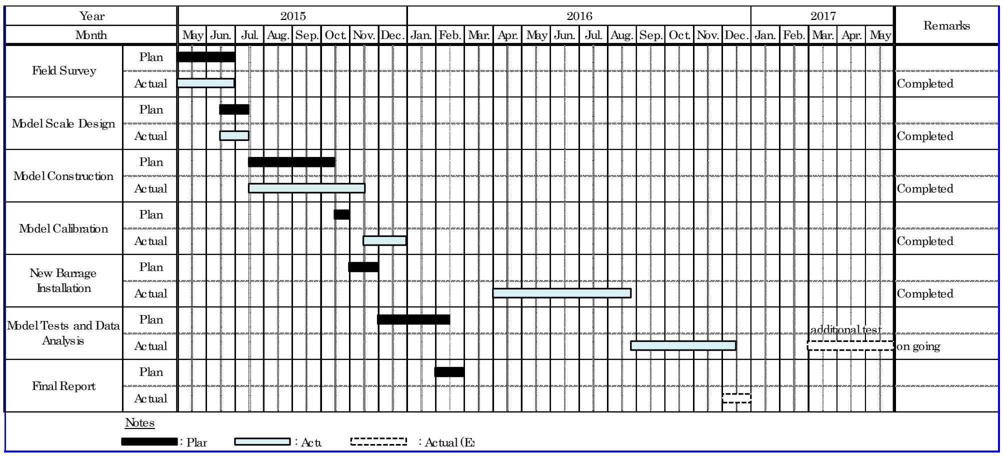
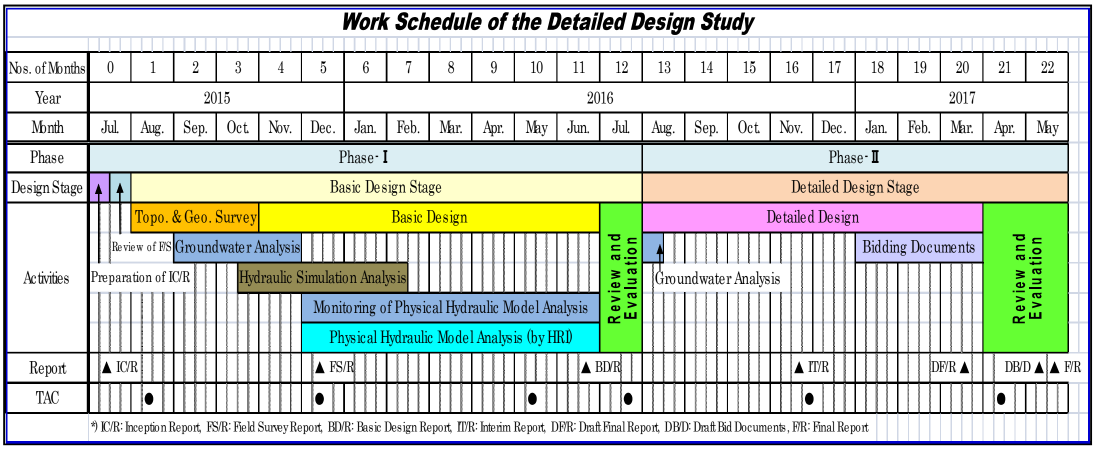


Table 3-2.2 Work schedule of this study

(The hydraulic model tests were conducted for 7 months from December 2015 to June 2016.)



(1) Monitoring and advice

In the respective stages of processes of the hydraulic model test schedule (test plan, model production, test measurements and phenomenon analysis), the details, method and conditions of each test were confirmed in Egypt.

The field survey for the hydraulic model tests had been carried out by HRI before the start of this Study (at the end of July 2015).

On monitoring the hydraulic model tests, the reports (drafts) were received at the following times:

August 2015............Field Investigation Report (Field Investigation at Dairut Group of Regulators for Physical Model Studies)

October 2015............Progress Report 2 (Physical Model Study of Dairut Group of Regulators Progress Report No.2 Model Design and Construction)

February 2016............Progress Report 3 (Physical Model Study of Dairut Group of Regulators Progress Report No.3 Model Set-up and Calibration)

December 2016............Draft Report (Physical Model Study of Dairut Group of Regulators Installation of the New Dirout Regulators and Flow Velocity Measurements)

The monitoring records on hydraulic model test are shown below.

Table 3-2.3 Monitoring records on hydraulic model test

No.	Date		Activity
1	4	2015 August	Monitoring the plan of installing the facility to perform hydraulic model test
2	19	October	Monitoring the construction status of the existing facility
3	27	October	Same as above
4	23	November	Monitoring the installation status of the existing facility
5	26	November	Same as above
6	29	November	Monitoring the flow pre-test for the existing facility
7	22	December	Monitoring the calibration test for the existing facility
8	1	2016 February	Same as above
9	25	February	Same as above
10	13	April	Same as above
11	29	June	Monitoring the construction status of the planned facility
12	31	July	Monitoring the installment conditions of the planned facility
13	2	August	Same as above
14	9	August	Same as above
15	23	August	Monitoring the flow pre-test for the planned facility
16	20	October	Monitoring the flow test for the planned facility and the installation status of the 2D hydraulic model test facility
17	22	2017 February	Monitoring the flow test for the planned facility and 2D hydraulic model test facility

a) Test plan

The D/D consultant visited HRI in August 2015 and had a meeting on the test plan of the hydraulic model test. Then, the site for installing the test laboratory and the field for physical hydraulic model construction were confirmed.

The scale of the hydraulic model test facility was determined to be 1/25 based on the size of the installation site and the supply capacity of flow discharge to be applied at the facility.

The purposes of hydraulic model test, the facility layout plan, the test conditions, the test cases and the similarity rules will be described below.

a-1) Purpose of test

The purpose of performing physical hydraulic model test is as follows:

> "The focal objective of the testing program is to adopt the best alignment and hydraulic design for the new barrages group components which fulfills the new emerged flow morphology regime through El-Ibrahimia canal after the construction of the new Assuit barrages. Flow capacity and velocity distribution upstream and downstream each of the new group components would be physically tested and investigated."

Source: Progress Report 3 (Physical Model Study of Dairut Group of Regulators Progress Report No.3 Model Set-up and Calibration)

a-2) Test device

Due to the restrictions of the HRI facility, the device for physical hydraulic model test was designed to be in the scale of 1/25 in both horizontal and vertical directions, and it was installed in the range of 46 m in the upstream and downstream directions and 24 m across. The actual scale of the site is approx. 1,150 m in the upstream and downstream directions and approx. 600 m across.

The test device has an underground reservoir weir and the discharge volume to the canal end is gathered in the underground reservoir tank, so that water is pumped up at the upstream end and discharged to the upstream end of the canal for cyclic use. The discharge from the upstream end of the canal is measured by the ultrasonic flow meter installed at the pipeline and the discharge to the downstream end of each canal is measured by the overflow depth in each regulator.

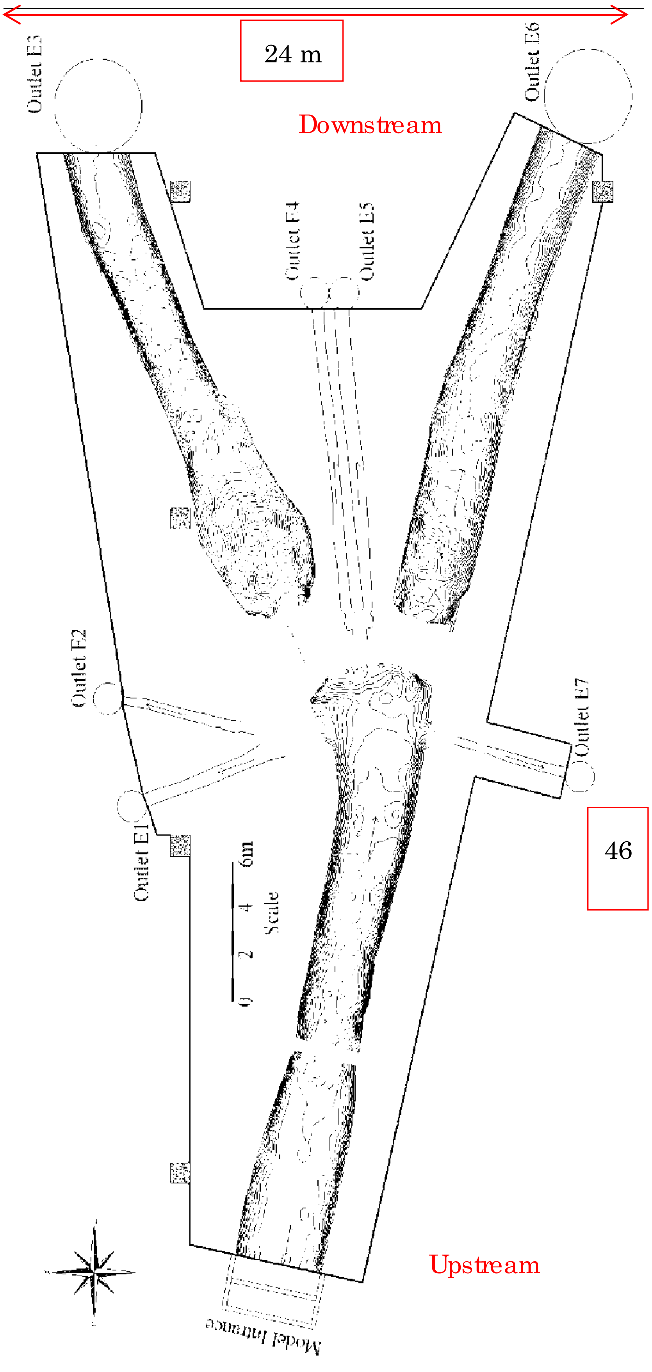


Figure (24): General Layout of the Modelled Reach

Figure 3-2.1 Plan for hydraulic model test

Source: Progress Report 2 (Physical Model Study of Dairut Group of Regulators Progress Report No.2 Model Design and Construction) a-3) Similarity rules

This physical hydraulic model test targets the flow in the canal with the free water surface; as such, the flow is dominated mainly by gravity and inertia. Therefore, Froude's similarity rules are applicable to the flow.

The hydraulic model facility is designed at the scale of 1/25 in all the directions. The similarity rules for each hydraulic quantity are shown in Table 3-2.4 below.

Table 3-2.4 Similarity rules

Hydraulic Quantity	Units	Scale	Model
Length/ Depth	m	$n_L = n_{model} / n_{prototype}$	1/25
Area	m^2	$n_A = n_L^2$	1/625
Flow velocity	m/s	$n_V = n_L^{1/2}$	1/5
Discharge	m^3/s	$n_Q = n_L^{5/2}$	1/3125

b) Measurement items in the test

The measurement items in the physical hydraulic model test are shown below.

b-1) Discharge

□) Inflow

The flow from the upstream reach of the physical hydraulic model test device is pumped up and supplied from the underground reservoir tank of the device into the pipeline. For this reason, the flow is measured by an ultrasonic flow meter installed in the pipeline.

Figure 3-2.2 Inflow measuring equipment (ultrasonic flow meter)

□) Outflow

The inflow at the downstream end of the physical hydraulic model test facility is measured by installing an overflow regulator sharp crested weir.

Figure 3-2.3 Discharge measuring device (regulator)

b-2) Water level

The water level is measured by the point gauge installed on the canal survey line as the criterion for the water level and flow measurements in the field survey. The accuracy is 0.1 mm for the model and 0.25 cm for the prototype.

Figure 3-2.4 Water level measuring device (point gauge)

b-3) Flow velocity

The flow velocity can be measured at an arbitrary water depth on an arbitrary survey line by the use of a micro current meter. The average flow velocity within a measuring time is calculated and indicated on the meter.

Figure 3-2.5 Flow velocity measuring equipment (micro current meter)

b-4) Test Case

The 3D physical hydraulic model test was carried out in two test cases as described below:

Calibration Stage: In this case, the existing water canal and facility were modelled to reproduce the flow by using the test device.

Planning Stage: In this case, the planned equipment was installed to monitor the upstream and downstream conditions of the new regulators at the maximum discharge, the dominant discharge and the minimum discharge.

Table 3-2.5 Physical hydraulic model test cases

Test Case	Upstream of Existing Regulators			Target Facility	Navigation Lock		Remarks
	Discharge (m^3/s)		Water level (EL. m)		Bahr-Yusef	Ibrahimia	
Calibration	Measured	355	46.02	Existing Regulator	Open	Closed	-
Planning	Maximum	455	46.30	New Regulators	Open	Closed*	-
	Dominant	306					-
	Minimum	22.67					-

Note*: The latest hydraulic model test will be carried out under conditions that opened the navigation lock.

c) Monitoring and advice

c-1) Calibration Stage

The calibration stage is described in the “Interim Report 3 at Calibration Stage” as follows:

Model calibration is the process for judging reliability and consistency between the constructed model and prototype condition. In order to ensure that, the model should fulfill the geometric, kinematic and dynamic similarity conditions. The geometric similarity was already applied during the model construction. The kinematic and dynamic similarity would be accomplished by measuring some flow velocity profiles in the prototype then compared it with that in the model. Therefore, the model calibration should include all the above mentioned conditions in addition the water surface slope which should be the same in the model as prototype value.
The three dimensions "DGR" model would be calibrated with bathymetric and hydraulic measurements and flow conditions that carried out during "HRI" field investigations which were conducted on June 2015. The model was calibrated against one cross section velocity profile along each of the seven branched canals downstream of the existing "DGR". The flow discharge in the model and accordingly through each branched canal were worked out according to the flow condition during field measurements. The water surface slope through the seven branched canals was also measured during the field measurements which ranged between 4.30 cm/km for Irad Delgaw canal and 8.9 cm/km for El-Dairutia canal. Applying the above mentioned procedure for operating the model, the calibration process was carried out through the following three phases:

- Inflow discharge calibration
- Establishing calibration condition
- Velocity measurement calibration

c-1-1) Water-level and discharge conditions

The observed values obtained in the measurements on June 30, 2015, are applied to the water-level discharge conditions in the calibration stage. The conditions for the upstream point of the existing DGRs were: the water level of EL. 46.02 m and the discharge of 355 m^3/s. The water level and discharge on the downstream side of each regulator were calibrated so that both values are equal to the measured water level and discharge.

Water level and discharge on the downstream side of each regulator are shown in Table 3-2.6.

Table 3-2.6 List of water level and discharge conditions in calibration stage

Item	US. of Regulators	DS. of Regulators							Remarks
	Existing DGRs	Bahr Yusef	Ibrahimia	Badraman	Diroutiah	Abo Gabal	Irad Delgaw	Sahelyia	
Water Level (m)	46.02	45.82	45.05	45.68	45.88	45.73	44.79	45.72	
Inflow (m^3/s)	355.0	–	–	–	–	–	–	–	
Outflow (m^3/s)	–	170.6	157.3	6.1	9.2	6.1	2.2	3.1	

c-1-2) Model manufacture

The D/D consultant visited the HRI site to inspect the model construction site for the existing regulators and confirmed that the model was being produced under the measured conditions. Also, the D/D consultant visited the installation site of the adjacent hydraulic model test facility and confirmed that respective channel forms for each survey section were installed according to the canal frames at a given altitudes, as well as the way canal construction is conducted with mortar.

The scenes of confirming the production of the existing regulators and canals are shown below.

Figure 3-2.6 Scenes of constructing of existing regulators (small scale regulator pier)

Figure 3-2.7 Scenes of constructing of existing regulators (large scale regulator pier)

Figure 3-2.8 Scenes of constructing existing canals (using mortar)

Figure 3-2.9 Scenes of manufacture of existing canals
(Existing canal construction and large-scale regulators)

c-1-3) Test measurements

The measurements in the physical hydraulic model test were performed at the calibration stage.

In the physical hydraulic model test, the water level was measured by a point gauge and the flow velocity by a micro current meter in the same position as in the cross section in the prototype.

The results in the calibration stage made clear that the model could reproduce the actual conditions of the prototype.

The achieved calibration results that illustrated in the above Tables and Figures revealed that the measured mid –depth velocity profiles in the model are following the same trend as that in the prototype. This in other words means that there are good agreement between the model and prototype and the model can be accurately simulate the prototype conditions.

Source: Progress Report 3 (Physical Model Study of Dairut Group of Regulators Progress Report No.3 Model Set-up and Calibration)

During the on-site confirmation at the calibration stage, RGBS requested advice on the physical hydraulic model test, and the D/D consultant recommended that the flow velocity measurements be made at the downstream points of 30 m, 50 m and 100 m from the new Bahr Yusef and Ibrahimia regulators for comparison with the results of hydraulic analysis.

Table 3-2.7 Conditions of calibration stage

Test Case	Upstream of Existing Regulators			Target Facility	Navigation Locks		Remarks
	Discharge (m3/s)		Water level (EL. m)		Bahr-Yusef	Ibrahimia	
Calibration Stage	Actual Discharge	355	46.02	Existing Regulators	Closed	Closed	

Table (28): Hydrological Condition during Calibration

No.	Canal name	Vel. No.	Discharge (mm^3/day)	Discharge (m^3/s)	Water level (m) U/S	Water level (m) D/S	Water level (m) At C.S.
1	Ibrahimia canal U/S "DGR"	[1]	30.672	355.00	(46.02)	--	(46.100)
2	Irad Delgaw canal	[9]	0.185	2.150		(44.80)	(44.794)
3	Abo Gabal canal	[2]	0.530	6.134		(45.75)	(45.725)
4	Bahr-Yusef canal (1)	[3]	14.738	170.578		(45.82)	(45.803)
5	Bahr-Yusef canal (2)	[4]	14.915	172.627		(45.82)	(45.786)
6	Badraman canal	[5]	0.528	6.111		(45.70)	(45.684)
7	Diroutiah canal	[6]	0.794	9.190		(45.90)	(45.879)
8	Ibrahimia canal D/S "DGR" (1)	[7]	13.591	157.303		(45.05)	(45.017)
9	Ibrahimia canal D/S "DGR" (2)	[8]	13.723	158.830		(45.05)	(44.998)
10	Saheleya canal	[10]	0.265	3.067		(45.80)	(45.718)

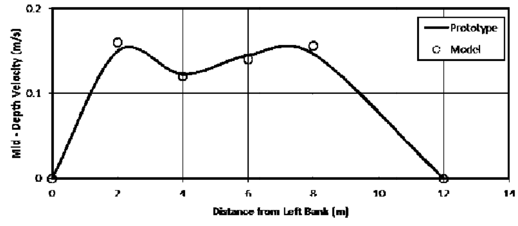


Figure (19): Velocity Distribution at Irad Delgaw Canal

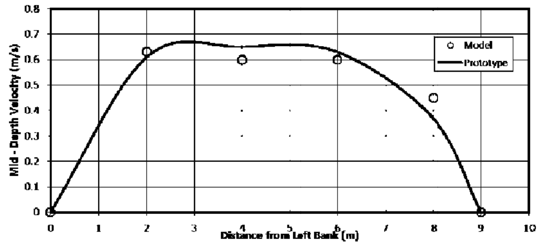


Figure (20): Velocity Distribution at Abou Gabal Canal

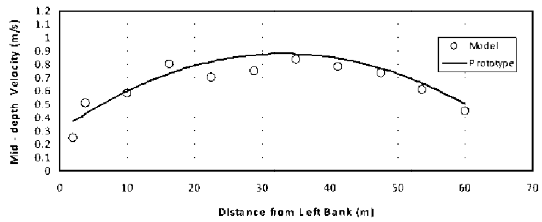


Figure (21): Velocity Distribution of Bahr Ussef Canal

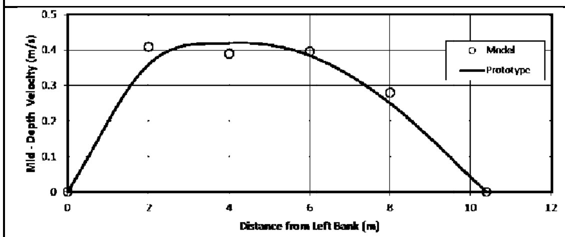


Figure (22): Velocity Distribution at Badraman Canal

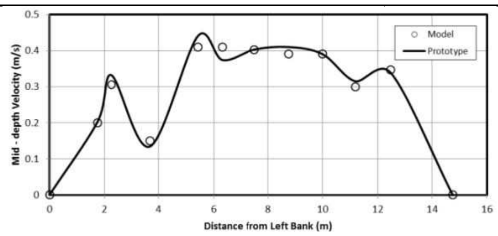


Figure (23): Velocity Distribution at El-Dairutia Canal

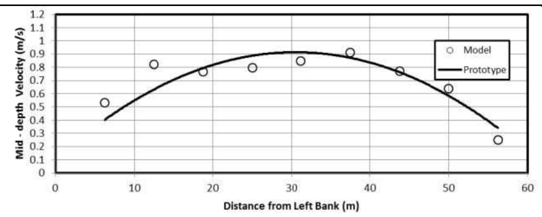


Figure (24): Velocity Distribution of El-Ibrahimia Canal

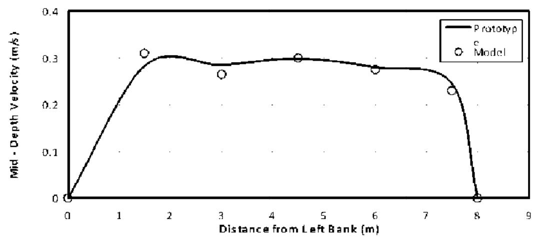


Figure (25): Velocity Distribution at El-Sahelia Canal

Figure 3-2.10 Results of cross-sectional flow velocity distribution

Source: Interim Report on Calibration Stage

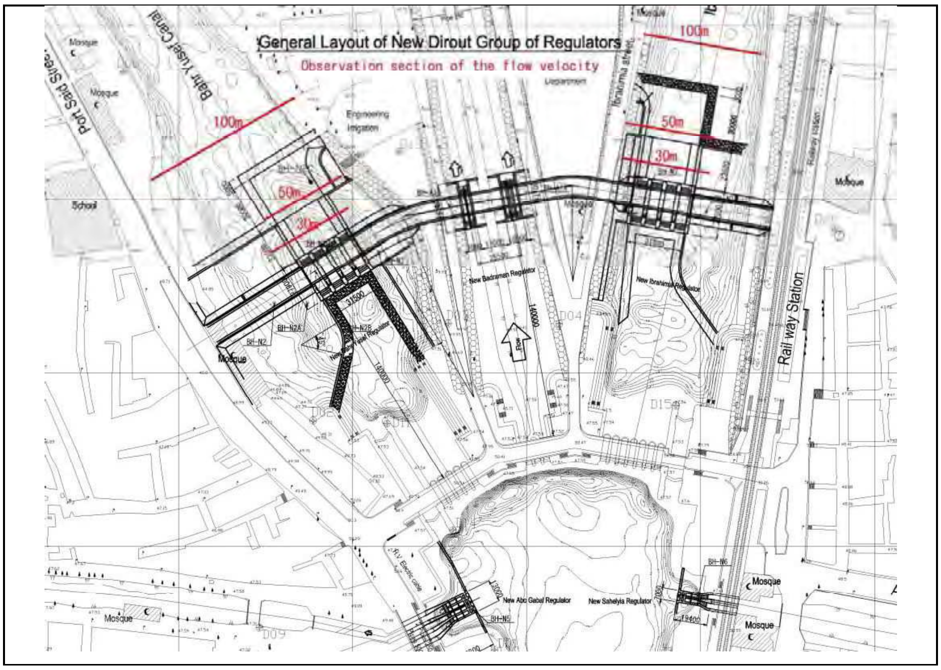


Figure 3-2.11 Observation section of the cross-sectional flow velocity on the downstream of the NDGRs

c-1-4) Analysis of phenomena

The D/D consultant observed and evaluated the flow conditions in the physical hydraulic model tests in the calibration stage for the phenomenon analysis.

In the calibration stage, it was confirmed that the flow in the upstream reach of the existing regulators was regulated in the physical hydraulic model test facility and was the same condition as in the field.

On the downstream side of the existing Bahr Yusef regulator and the Ibrahimia regulator, it was confirmed that some turbulence was generated in the flows in the same manner as in the field.

It was also confirmed that some vortexes were generated in the dead water region on the both downstream banks of the regulators. These were the phenomena that were confirmed in the field. Therefore, the physical hydraulic model test facility was evaluated as a facility that could reproduce those phenomena.

Upstream side of existing regulators	Upstream side of existing regulators

Figure 3-2.12 Flow situation on the upstream side of existing regulators in calibration stage (gentle flow)

Downstream side of existing Bahr Yusef regulators	Downstream side of existing Ibrahimia regulators

Figure 3-2.13 Flow situation on downstream side of existing regulators in calibration stage (turbulent flow)

Downstream side of existing Bahar Yusef regulators	Downstream side of existing Ibrahimia regulators

Figure 3-2.14 Flows on downstream side of existing regulators in calibration stage (dead water region)

It was confirmed that there were canals in which blocks were laid on the upper stream of the calibration survey line to increase their roughness. As the adjustment range for this calibration covered up to the downstream reach close to the planned point of installing the new regulators, DD consultant pointed out that in the planning stage it would be necessary to take the flow situation into consideration.

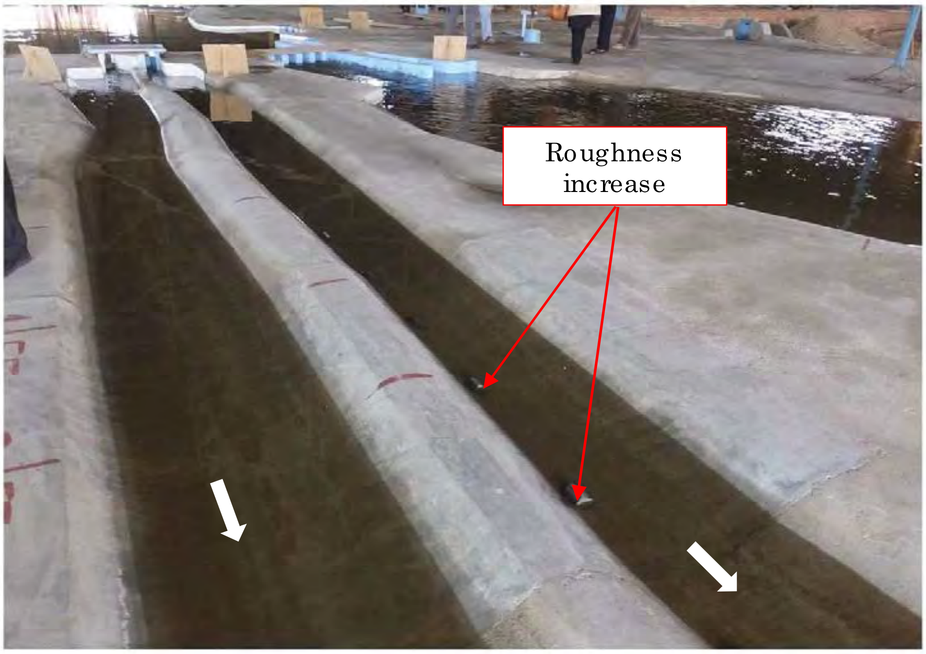


Figure 3-2.15 Increasing roughness on the downstream side of existing regulators (laying blocks)

c-2) Planning stage

c-2-1) Water-level discharge conditions

For the maximum discharge in the planning stage, the design discharge is 455 m^3/s, and the design control water level is EL. 46.30 m on the upstream side of the DGRs. The downstream water level and discharges of each regulator are those in the design conditions as shown in Table 3-2.8.

The water-level and discharge conditions for the dominant discharge and the minimum discharge are shown in Table 3-2.8.

Table 3-2.8 List of water level and discharge conditions in planning stage

Case	Item	US. of Regulators	DS. of Regulators							Remarks
		Existing DGRs	Bahr Yusef	Ibrahimia	Badraman	Diroutiah	Abo Gabal	Irad Delgaw	Sahelyia	
Maximum Discharge	Water Level (m)	46.30	45.60 (45.82)	45.15 (45.13)	45.85 (45.90)	45.85 (45.90)	45.85 (45.90)	45.00 (45.90)	45.85 (45.90)	( ) Target WL
	Inflow (m^3/s)	455	–	–	–	–	–	–	–	
	Outflow (m^3/s)	–	227	186	9	12	7	9	5	
Dominant Discharge	Water Level (m)	46.30	45.30	44.50	45.60	45.60	45.60	44.60	45.65	
	Inflow (m^3/s)	306.644	–	–	–	–	–	–	–	
	Outflow (m^3/s)	–	162.523	115.984	5.938	8.380	4.444	6.470	3.021	
Minimum Discharge	Water Level (m)	46.30	52.55	41.55	–	–	–	–	–	
	Inflow (m^3/s)	22.67	–	–	–	–	–	–	–	
	Outflow (m^3/s)	–	18.52	2.08	0.44	0.63	0.32	0.46	0.22	

c-2-2) Model manufacture

Through the discussions with RGBS, it was decided to substantially change the scale of the new regulators in the F/S period. It was determined to provide the dimensions and drawings to RGBS as soon as the regulator design in the basic design stage is completed.

The drawings in the basic design stage were provided to RGBS at the end of April 2016. HRI produced the new regulator models based on those drawings provided by RGBS and installed them during the early part of August 2016.

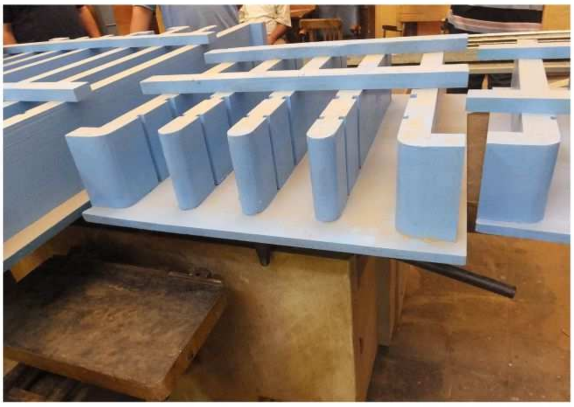


Figure 3-2.16 Scenes of construction of new regulators (large scale regulators)

Installation of new Bahr Yusef regulators

Upstream end of existing regulators

Figure 3-2.17 Installation of new regulators at test site

After completion of the basic design, in late August 2016, RGBS requested the D/D consultant to change the foundation height of 2 upstream small-scale regulators and the change of the foundation height was determined in September 2016. However, the models had been installed at the foundation height as designed in the basic design stage. Therefore, it was decided to perform the physical hydraulic model tests as specified before the change of foundation height.

c-2-3) Test measurements

The measurements in the physical hydraulic model test were conducted in the planning stage.

The flow velocity was measured by a micro current meter at the points of 30 m, 50 m and 100 m downstream from the regulator axes of the new Bahr Yusef regulator and the new Ibrahimia regulator.

Table (9): Absolute Values of the Flow Velocities at Sections downstream of the New Large Regulators for the Over flow and Underflow Conditions

Sec.	Canal	Over Flow									Under Flow		
		Maximum Discharge			Dominant Discharge			Minimum Discharge			Maximum Discharge		
		V_{max} (m/s)	V_{min} (m/s)	V_{ave} (m/s)	V_{max} (m/s)	V_{min} (m/s)	V_{ave} (m/s)	V_{max} (m/s)	V_{min} (m/s)	V_{ave} (m/s)	V_{max} (m/s)	V_{min} (m/s)	V_{ave} (m/s)
Sec. 1	Ibrahimia	2.60	0.50	1.55	1.80	0.28	1.05	0.28	0.01	0.14	2.80	0,60	1.70
	Bahr Yusef	1.20	0.20	0.70	0.57	0.02	0.30	0.28	0.02	0.15	2.52	0.89	1.70
Sec. 2	Ibrahimia	1.75	0.02	0.88	1.04	0.02	0.52	0.18	0.01	0.09	1.33	0.03	0.66
	Bahr Yusef	1.43	0.02	0.72	1.20	0.05	0.62	0.43	0.01	0.22	1.50	0.05	0.75
Sec. 3	Ibrahimia	1.05	0.07	0.53	0.82	0.04	0.43	0.27	0.07	0.14	0.90	0.03	0.46
	Bahr Yusef	1.12	0.02	0.56	0.96	0.16	0.56	0.266	0.07	0.16	1.08	0.06	0.57

Sec.1 30 m

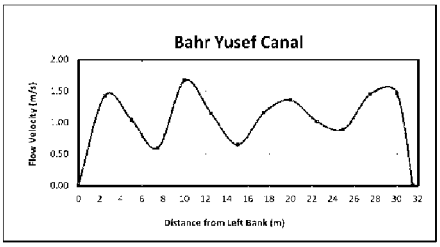


Figure (3): Flow Velocity Distribution at Mid Depth of Cross Section 1

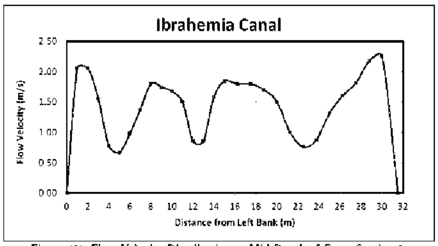


Figure (1): Flow Velocity Distribution at Mid Depth of Cross Section 1

Sec.2 50 m

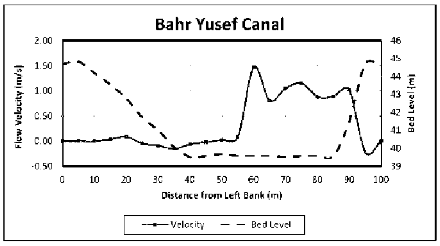


Figure (3): Flow Velocity Distribution at Mid Depth of Cross Section 2

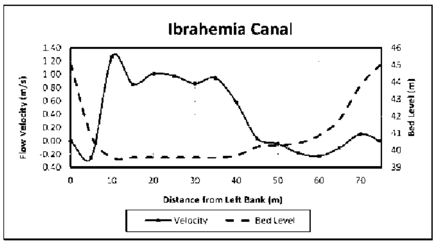


Figure (1): Flow Velocity Distribution at Mid Depth of Cross Section 2

Sec.3 100 m

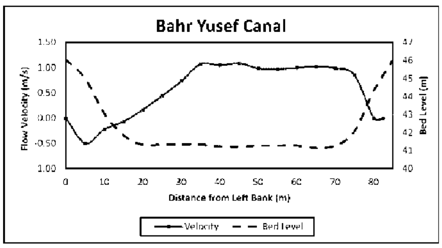


Figure (3): Flow Velocity Distribution at Mid Depth of Cross Section 3

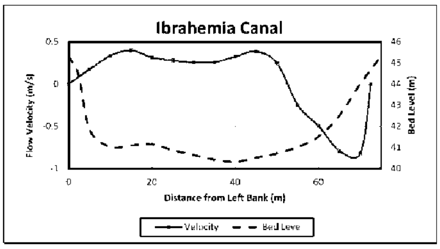


Figure (1): Flow Velocity Distribution at Mid Depth of Cross Section 3

Figure 3-2.18 Measured results of cross-sectional flow velocities

Source: Report (Draft) (3D Model)

c-2-4) Analysis of phenomena

In the planning stage, the new regulators were installed at 140 m downstream from the bridge end of the existing regulator group.

It was confirmed that the upstream flow of the DGRs in the physical hydraulic model test facility was smooth. (see Figure 3-2.19.)

It was confirmed that some turbulence in the discharge flow was generated on the downstream side of the new Bahr Yusef and the new Ibrahimia regulators. (see Figure 3-2.20.)

It was also confirmed that some vortexes were generated in the dead water region on the downstream side of the new regulators. (see Figure 3-2.21.)

	
Upstream side of existing regulators	Upstream side of existing regulators

Figure 3-2.19 Upstream flow situation of new regulators in planning stage (gentle flow)

	
Downstream side of new Bahr Yusef regulators	Downstream side of new Ibrahimia regulators

Figure 3-2.20 Downstream flow situation of existing regulators in planning stage (turbulent flow)

Downstream side of new Bahr Yusef regulator	Downstream side of new Ibrahimia regulator

Figure 3-2.21 Downstream flow situation of existing regulators in planning stage

3-3 Monitoring of 2D physical hydraulic model test

(1) Test Plan

The 2D physical hydraulic model test was carried out to reproduce the hydraulic jump phenomenon in the lower stream of the gates and to test the riverbed protection. Initially, this test was not planned.

The D/D consultant received the following report draft:

February 2017..................Report Draft (2D model of the new Bahr Yusef regulator)

a) Objectives of test

The objectives of the 2D physical hydraulic model test are as described below.

"The objectives of the 2D physical model can be summarized as follows: ・Study the flow characteristics along the stilling basin including formation of hydraulic jump. ・Optimize the stilling basin dimensions based on the typed intensity of hydraulic jump. ・Check the head losses due to the construction of new Bahr Yousef regulator with fully open gates. ・Investigate the stability of the rip-rap protection layer downstream the apron."

Source: Report Draft (2D Model)

b) Test device

The test device is described in the "Report Draft (2D Model)" as follows:

A 2D model with an undistorted scale 1:8.5 was designed to simulate one bay of Bahr Yousef regulator, the stilling basin, the rip- rap in both upstream and downstream reaches. The model structure is made from Plexiglas material in a steel-framed glass walled flume of 26.0 m long and 1.0 m wide, and 1.2 m high. The model bottom of the flume is shaped with sand overlaid by rip-rap in both upstream and downstream reaches. The glass panels allow visual observation and photographing of the flow patterns and other related phenomena in the vicinity of the tested structure.

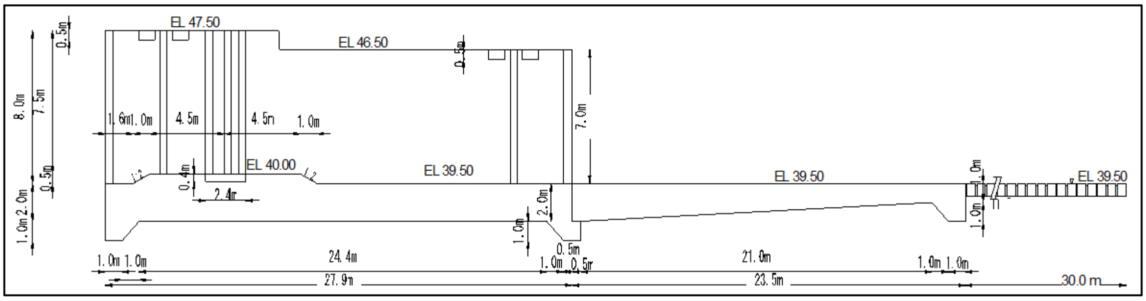


Figure 3-3.1 Layout plan in physical hydraulic model test

Source: Report Draft (2D Model)

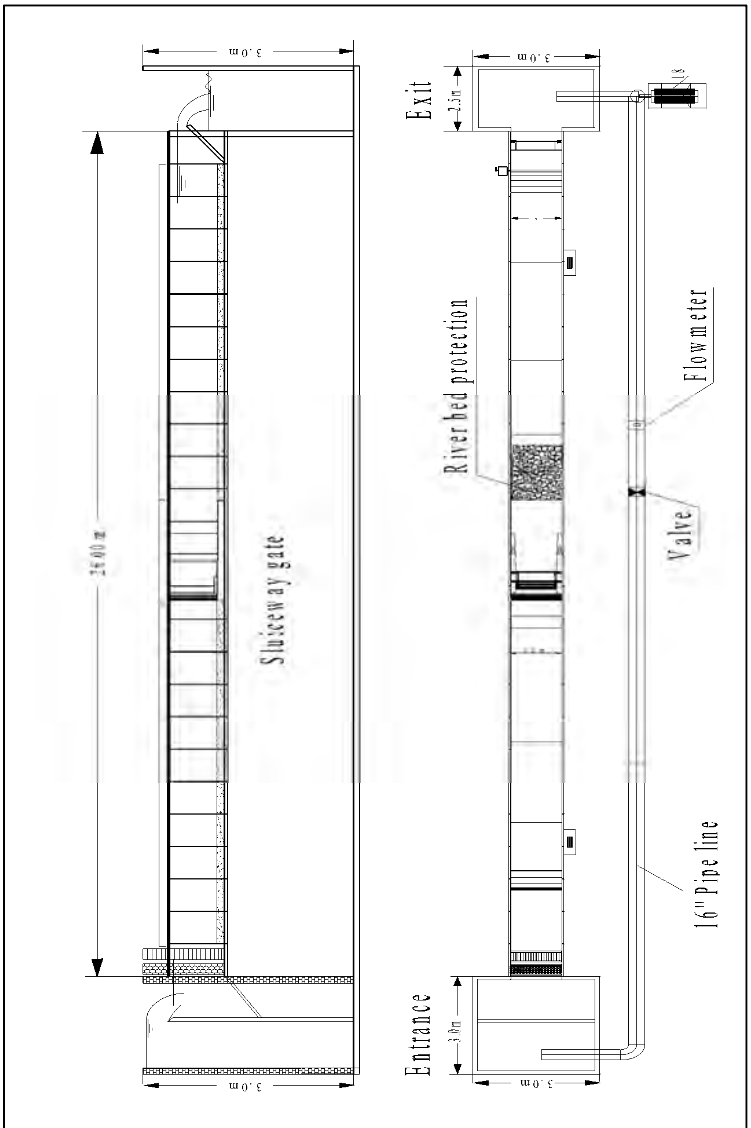


Figure (2-1) Model Layout in the Flume

Figure 3-3.2 Layout plan of flume in physical hydraulic model test

Source: Report Draft (2D Model)

c) Similarity rules

This physical hydraulic model test targets the flow of a canal with the free water surface, and the flow is mainly dominated by gravity and inertia. Therefore, Froude's similarity rules are applicable to the canal flow.

The scale of the physical hydraulic model test facility is 1/8.5 in all the directions. The similarity rules applicable to each hydraulic quantity item are shown below.

Table 3-3.1 Similarity rules

Hydraulic Quantity Item	Unit	Scale	Model Scale
Length/Depth	m	$n_L = n_{model} / n_{prototype}$	1/8.5
Area	m^2	$n_A = n_L^2$	1/72.25
Flow Velocity	m/s	$n_V = n_L^{1/2}$	1/2.92
Discharge	m^3/s	$n_Q = n_L^{5/2}$	1/210.64

(1) Test Measurement Items

The measurement items for the physical hydraulic model test will be described below.

a) Inflow

The inflow water from the upstream side of the physical hydraulic model test equipment is pumped up from the underground reservoir tank and supplied through the pipeline. Therefore, the inflow is measured by the ultrasonic flow meter installed on the water supply pipeline of 16-inch diameter.

Plate (5) Ultra-Sonic Flowmeter for Inflow Discharge to the Model

Figure 3-3.3 Inflow measuring equipment (ultrasonic flow meter)

Source: Report Draft (2D Model)

b) Water level

The water level is measured by the point gauge fixed at the upstream and downstream points at 60 m from the regulator crests of the scale used in the field.

Figure 3-3.4 Water level measuring equipment (point gauge)

c) Flow velocity

The flow velocity can be measured on an arbitrary survey line and at an arbitrary depth by the use of a micro current meter. The average flow velocity for the measuring time duration is calculated and indicated on the meter.

Figure 3-3.5 Flow velocity measuring equipment (micro current meter)

d) Water pressure

The water pressure is described in the "Report Draft (2D Model)" as follows:

In order to measure the pressure distribution on the horizontal apron, eight (8) cells 37.93 m apart (prototype scale) were fixed at the centerline of the apron surface. These cells are connected to eight (8) glass water manometers fixed on a vertical board to directly determine the pressure head above the inclined and horizontal apron.

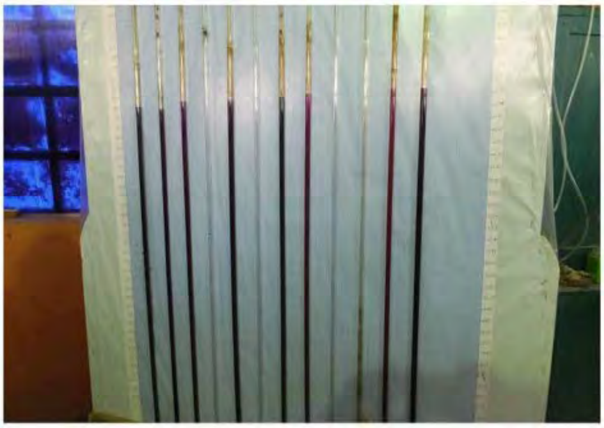


Figure 3-3.6 Water pressure measuring equipment (piezometer)

e) Test cases

The test of the detailed regulator models is conducted in three cases, each of which consists of a series of tests to attain its purpose.

Table 3-3.2 Test cases

Table 3.1: Test Program for the Proposed Cases

Case No.	Test No.	Discharge (Q) m^3/s	U.S.W.L (m) + MSL	D.S.W.L (m) + MSL	Condition
Case - 1	Test -1	18.52	46.3	42.55	Flow Over Gate
	Test -2	80.00	46.3	44.01	
	Test -3	120.00	46.3	44.76	
	Test -4	162.52	46.3	45.30	
	Test -5	195.00	46.3	45.73	
	Test -6	227.00	46.3	45.82	
Case - 2	Test -7	18.52	46.3	42.55	Flow Under Gate
	Test -8	80.00	46.3	44.01	
	Test -9	120.00	46.3	44.76	
	Test -10	162.52	46.3	45.30	
	Test -11	195.00	46.3	45.73	
	Test -12	227.00	46.3	45.82	
Case - 3	Test -13	18.52	46.3	42.55	Fully Open Gate
	Test -14	80.00	46.3	44.01	
	Test -15	120.00	46.3	44.76	
	Test -16	162.52	46.3	45.30	
	Test -17	195.00	46.3	45.73	
	Test -18	227.00	46.3	45.82	

* Source: Draft Report (2D Model)

(2) Test monitoring and advice

a) Model manufacture

Details of the model manufacturing are described in the "Draft Report (2D Model)" as follows:

> The model structure is made from Plexiglas material in a steel-framed glass walled flume of 26.0 m long, 1.0 m wide, and 1.2 m height.
>
> The glass panels allow visual observation and photographing of the results of the flow patterns and other related phenomena in the vicinity of the tested structure. The model was constructed inside the Northern flume of HRI.
>
> The modeled structure consists of one bay of the sluice way consists of two half piers of 1.25 m wide each (prototype scale) manufactured from Plexiglas. The upstream water level controlled by two gates made of Plexiglas each gate with 3.3m height. In the first test case the gates used as a weir.
>
> Under normal operations (case-2), the flow passes between the gate and the sill under gate which was made of wood in the model. The Stilling basin consists of 2 parts; Sill under gate followed by a horizontal apron. Both of them are made from special water tight wood.

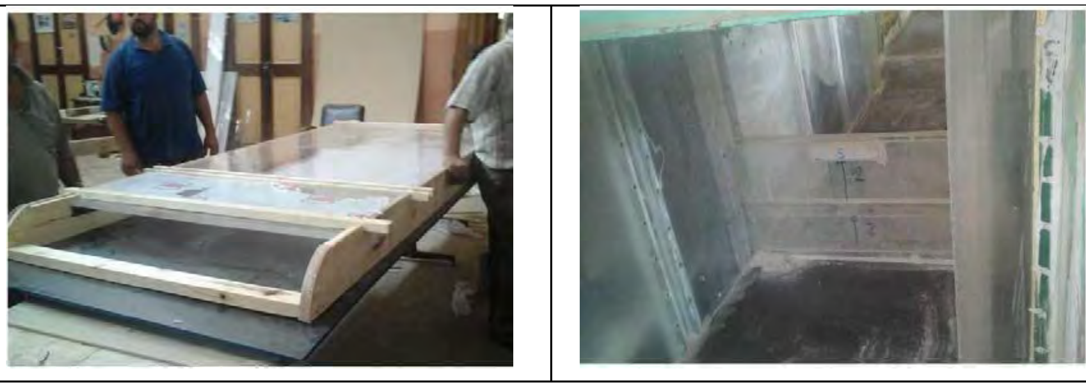


Figure 3-3.7 Gate manufacture

Figure 3-3.8 2D Model manufacture

Figure 3-3.9 Installation of regulator piers

b) Test measurements

In the 2D physical hydraulic model test, the water level is measured by a point gauge and the flow velocity by a micro current meter.

The flow velocity at each depth is measured in each of 6 cross sections in the center of the canal. The flow velocity distribution at the time of maximum discharge due to overflow is shown below.

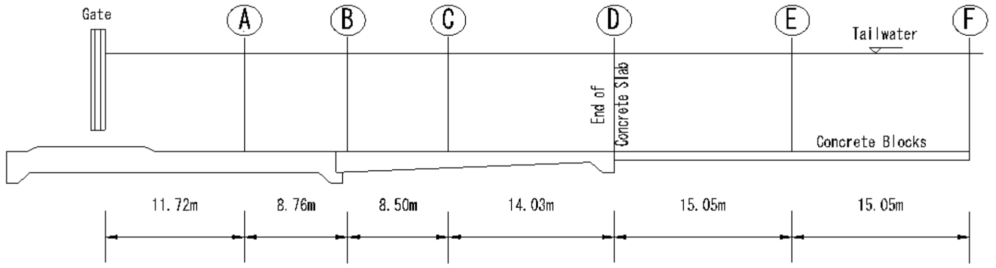


Figure 3.3 Locations of the Cross Section Velocity Measurements

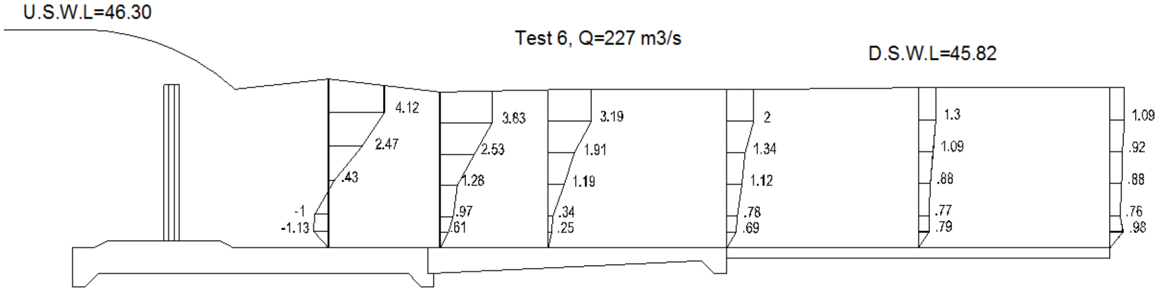


Figure 4.6 Velocity Distribution, Test-6, Case-1, Flow over Gate

Figure 3-3.10 Measuring positions and results of cross-sectional flow velocity measurements

Source: Draft Report (2D Model)

c) Analysis of phenomena

It was confirmed that the upstream flows of the new regulator in the 2D physical hydraulic model test facility were gentle and smooth. However, it was noticed that some turbulence was generated in the downstream flow of the new regulator.

	
Downstream flow	Upstream flow

Figure 3-3.11 Flow conditions in 2D model (1)

	
Upstream flow	Downstream flow of a gate

Figure 3-3.12 Flow conditions in 2D model (2)

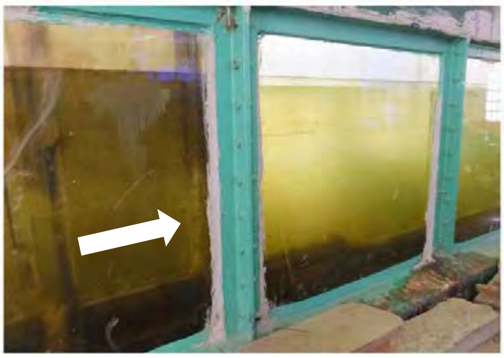
	
Side view of downstream flow	Downstream flow near the regulator's piers

Figure 3-3.13 Flow conditions in 2D model (3)

3-4 Integrated evaluation of physical hydraulic model tests

(1) Basic Policy of Integrated Evaluation

The integrated evaluation of the physical hydraulic model tests of the NDGRs was carried out by the HRI in accordance with the recommendation of two types of physical hydraulic model test as described in the report.

The report drafts on the two physical hydraulic model tests are as follows:

1) 3D Model (Received on November 29, 2016)
Report Draft on the Hydraulic Model Test of the DGRs, Installation of the New Regulators and Flow Velocity Measurement (November 2016)
Comments to RGBS submitted on: December 27, 2016)
Response from RGBS received on: February 2, 2017)

2) 2D Model (Received on February 9, 2017)
Final Report* on the 2 Dimensional Model for Bahr Yusef New Regulator (January 2017)
* The title of this report is "Final Report", but it is the Final Report Draft.

(2) Conclusion and Recommendations on Hydraulic Model Tests

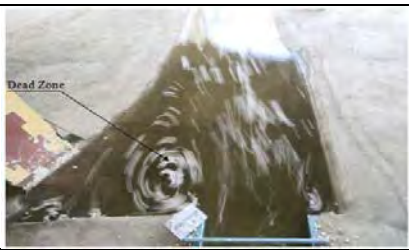
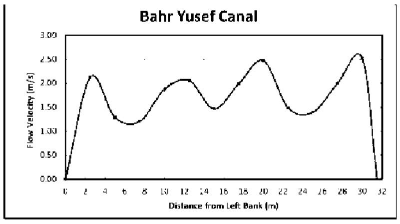
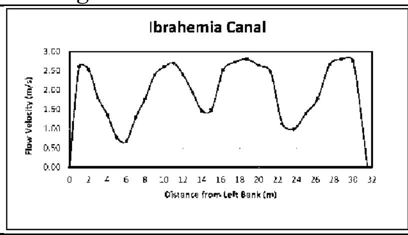
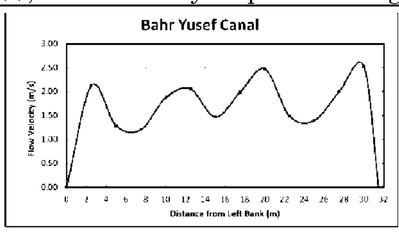
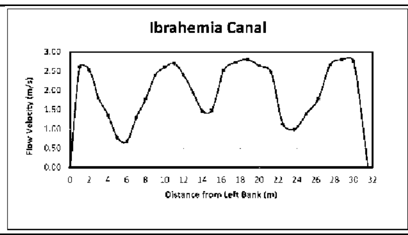
a) 3D hydraulic model test

Regarding the Draft Final Report on the Hydraulic Model Tests that were carried out by HRI, the D/D consultant accepted the response by RGBS as of February 2, 2017 to HRI's comments, because the flow distribution and flow velocity tendency were the same as the results of hydraulic analyses though the hydraulic conditions of the models were slightly different.

The D/D consultant submitted its comments to RGBS regarding portions of the Report Draft that could not be understood. Upon receiving the response from RGBS, the Study team verified its contents and everything that it could not understand was made clear. Thus, the D/D consultant has no objection to the response by RGBS.

The conclusions as described in the Final Report Draft on 3D Model are as described below. The study team accepted those conclusions including the response to the comments and reflected those on the design.

Table 3-4.1 Conclusion of 3D Model draft final report and its evaluation

Item	Conclusion	Evaluation
Dead zones	• Formation of dead zones downstream of the new regulators at Bahr Yusef and Ibrahimia Canal.  Bahr Yusef  Ibrahimia	Accepted
Influence on the new regulator	• The flow distribution amongst the gates of the new regulators is influenced by the upstream arrangements such as the lock situation and the arrangement of the existing regulator vents with respect to the new regulator vents.  Flow velocity at DS Bahr Yusef Reg.  Flow velocity at DS Ibrahimia Reg.	Accepted
Water level	• The water level in Ibrahimia Canal upstream of the existing regulator (DGRs) is influenced by the pool formed at water level of 46.30 m (MSL) between the existing and the new regulators. (Comment to HRI through RGBS) (4) It is serious contradiction that "water level of 46.30 m (MSL) between the existing and the new regulators" although the design water level, EL.46.30m, is at the upstream of the existing regulators. (Reply from HRI through RGBS) The upstream water level used in the model is 46.30 m and this is the level upstream the existing regulator. This statement will be modified in the updated report.	Accepted by reply (The water level of 46.30 m is the level upstream the existing regulator.)
Influence of the piers	• The flow distribution shape downstream the new regulator, especially at section (1), is influenced by the piers of the regulator.  Flow velocity at DS Bahr Yusef Reg.  Flow velocity at DS Ibrahimia Reg.	Accepted
Maximum flow	• The maximum flow velocity at downstream the new regulator of Ibrahimia Canal is 2.8 m/s, while it is 2.52 m/s for Bahr Yusef Canal.	Accepted by reply.

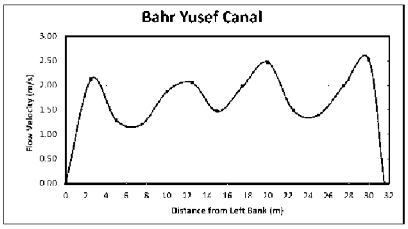
<table>
<tr><th>Item</th><th colspan="2">Conclusion</th><th>Evaluation</th></tr>
<tr><td rowspan="4">velocity</td><td>

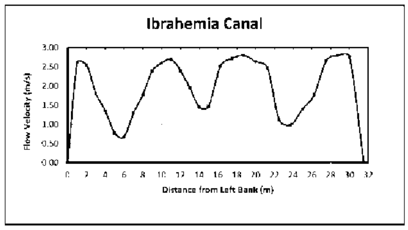
Figure (4): Bottom Flow Velocity Distribution at Cross Section 1</td><td>

Figure (2): Bottom Flow Velocity Distribution at Cross Section 1</td><td rowspan="4">Hydraulic conditions of model are slightly different at Bahr Yusef.</td></tr>
<tr><td>Flow velocity at DS Bahr Yusef Reg.</td><td>Flow velocity at DS Ibrahimia Reg.</td></tr>
<tr><td colspan="2">(Comment to HRI through RGBS)
(5) The description “It is not recommended to measure the flow velocity distribution in this vicinity because it gives ambiguous results” has an inconsistency with the description “The maximum flow velocity at downstream the new regulators of Ibrahimia Canal is 2.8m/s, while it is 2.52m/s for Bahr Yusef Canal.”</td></tr>
<tr><td colspan="2">(Reply from HRI through RGBS)
The statement will be changed in the updated report to be " measuring the flow velocity in the downstream of the new regulator should consider the turbulence that occur in this vicinity"</td></tr>
<tr><td>Remove the dead zones</td><td colspan="2">• It is recommended to remove the dead zones downstream the new regulators of Bahr Yusef and Ibrahimia Canals. This can be one by filling these zones with a filler material (e.g. sand, silt and clay mixture) and consider it as part of the bank of the canal.</td><td>Accepted
It reflected in the design.</td></tr>
<tr><td>Cross section (1)</td><td colspan="2">• Cross section (1) is located in highly turbulent and hydraulically unstable vicinity.</td><td>Accepted</td></tr>
<tr><td>Flow velocity at cross section (1)</td><td colspan="2">• It is not recommended to measure the flow velocity distribution in this vicinity because it gives ambiguous results.</td><td>Accepted</td></tr>
</table>

b) 2D hydraulic model test

The recommendations as described in the Final Report on “2D Model” are shown in the table below.

The D/D consultant accepted those recommendations and agreed to reflect them on the design.

Table 3-4.2 Recommendations and evaluations on 2D Model

Item	Recommendation	Evaluation
The type of bed protection	• No need for the area with concrete blocks downstream the apron and it can be replaced by riprap protection.	Accepted
The length of the riprap protection	• The length of the riprap protection D/S the apron can be taken as 20-30 m.	Accepted

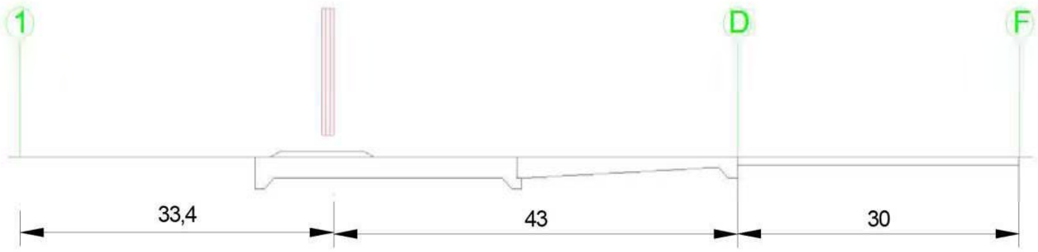


Figure 4.23 Location of Calculation of Stability of River Bed Protection

Table 4.10 shows the stability coefficient B' as calculated from modified formula with the measured standard deviation of the velocity fluctuations at the two cross sections **(D)** and **(F)** for tests from 1 to 12. Based on the measured near bed velocity fluctuation and the standard deviation the stability coefficient B' was found safe for all tested flow conditions of the Cases of flow over gate and flow under gate, see **Figures 4.24and 4.25**.

Table (4.10) Stability Coefficient for Rip-Rap Protection at Cross Sections D and F

(Case-1 and Case-2)

Test No.	Q m^3/s	Cross Section (D)				Cross Section (F)			
		$V_{0.9}$ (m/s)	SD.V	B'	Safety	$V_{0.9}$ (m/s)	SD.V	B'	Safety
Test - 1	18.52	0.109	0.018	0.063	Safe	0.180	0.021	0.105	Safe
Test - 2	80	0.372	0.135	0.288	Safe	0.338	0.062	0.221	Safe
Test - 3	120	0.545	0.269	0.542	Safe	0.496	0.101	0.355	Safe
Test - 4	162.52	0.429	0.328	0.468	Safe	0.766	0.161	0.625	Safe
Test - 5	195	0.846	0.300	0.885	Safe	0.868	0.107	0.631	Safe
Test - 6	227	0.685	0.516	0.961	Safe	0.979	0.135	0.757	Safe
Test - 7	18.52	0.075	0.024	0.044	Safe	0.153	0.034	0.093	Safe
Test - 8	80	0.385	0.106	0.279	Safe	0.397	0.070	0.265	Safe
Test - 9	120	0.542	0.224	0.499	Safe	0.526	0.057	0.339	Safe
Test - 10	162.52	0.818	0.331	0.898	Safe	0.535	0.082	0.366	Safe
Test - 11	195	0.584	0.298	0.609	Safe	0.613	0.110	0.449	Safe
Test - 12	227	0.937	0.398	1.132	Safe	0.947	0.100	0.677	Safe

Source: 2D Model (p40), Test 1-6: Overflow, Test 7-12: Underflow

< Considerations>

The D/D consultant confirmed the following points on the gate operation based on the results described in the Report, which will be specially described as follows:

The result of overflow gate operation at the time of maximum discharge (Test-6) indicates that the water level of the upstream of the regulators exceeds the target upstream water level of EL. 46.30 m.

This result suggests that the maximum discharge is not allowed by the overflow gate operation. Therefore, the maximum discharge should be made by the underflow gate operation on the condition that the gate opening is 2.5 m or more.

Table 4.1 shows that when the gate rested on sill under gate we didn't control the upstream water level so it reaches 46.33m+msl in test-5 and 46.59m+msl in test-6.

Table 4.1 Calculated Discharge Coeffiecient and Height of Gate for each Test

Test No.	Q m^3/s	U.S.W.L m+MSL	D.S.W.L m+MSL	Height of Gate (m)	Gate Crest Level m+MSL	H (m)	C_d (-)
Test-1	18.52	46.3	42.55	5.38	45.38	0.92	0.30
Test-2	80.00	46.3	44.01	4.97	44.97	1.33	0.74
Test-3	120.00	46.3	44.76	4.56	44.56	1.74	0.74
Test-4	162.52	46.3	45.3	3.87	43.87	2.43	0.60
Test-5	195.00	46.33	45.73	3.32	43.32	3.02	0.53
Test-6	227.00	46.59	45.82	3.32	43.32	3.28	0.54

Hydraulics Research Institute 25

Source: 2D Model (p. 25), Test 1-6: Overflow

(3) Integrated Evaluation of Hydraulic Model Tests

As a result of having examined the application of the recommendations on the two hydraulic model tests to the design, the consultant decided to reflect those recommendations on the design and wrapped up into the final design.

However, RGBS and HRI are planning to conduct the second stage of hydraulic model test aimed at the final confirmation on the design plan on which the form of revetment work and the scale of bed protection work are reflected based on the results of the 2 hydraulic model tests.

These results will be wrapped up after completion of this Study, and the length of bed protection may be changed in future.

a) Reflection of 3D hydraulic model test on the design

In the Draft Final Report on 3D Model, it is recommended to remove and fill the dead water regions on the downstream side of the new regulators in the Bahr Yusef canal and the Ibrahimia canal.

As the result of examination of this recommendation by the design group, the dead water regions on the downstream side of the new regulators were removed and their forms were corrected.

The change of the form in the latest design is shown below.

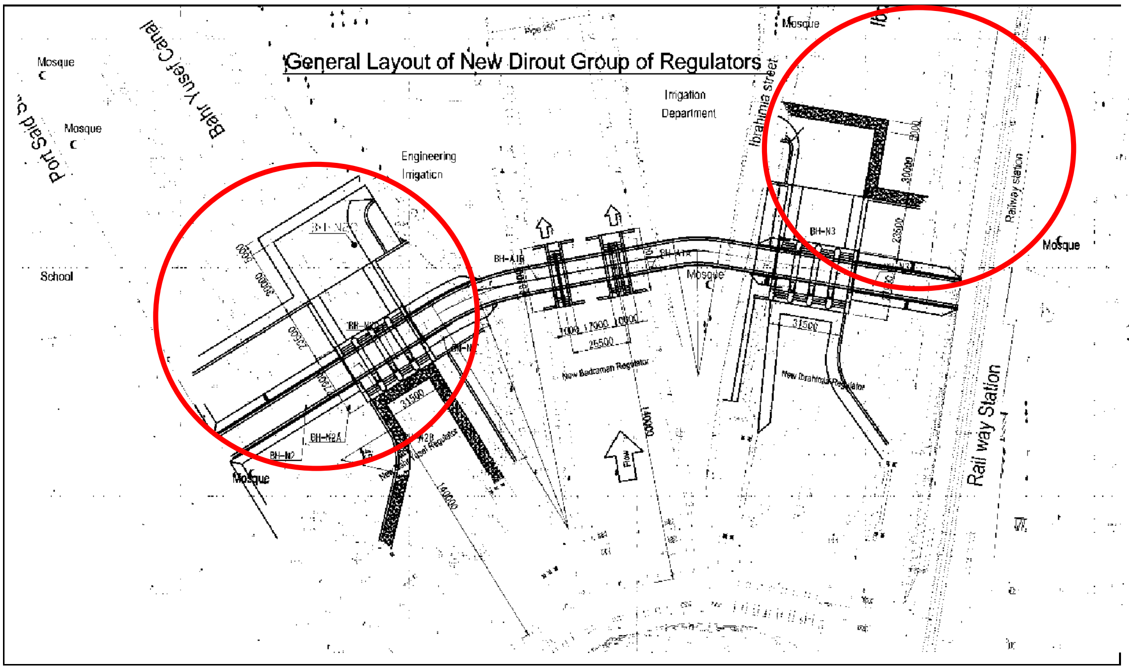


Figure 3-4.1 General layout of NDGRs (initial layout)

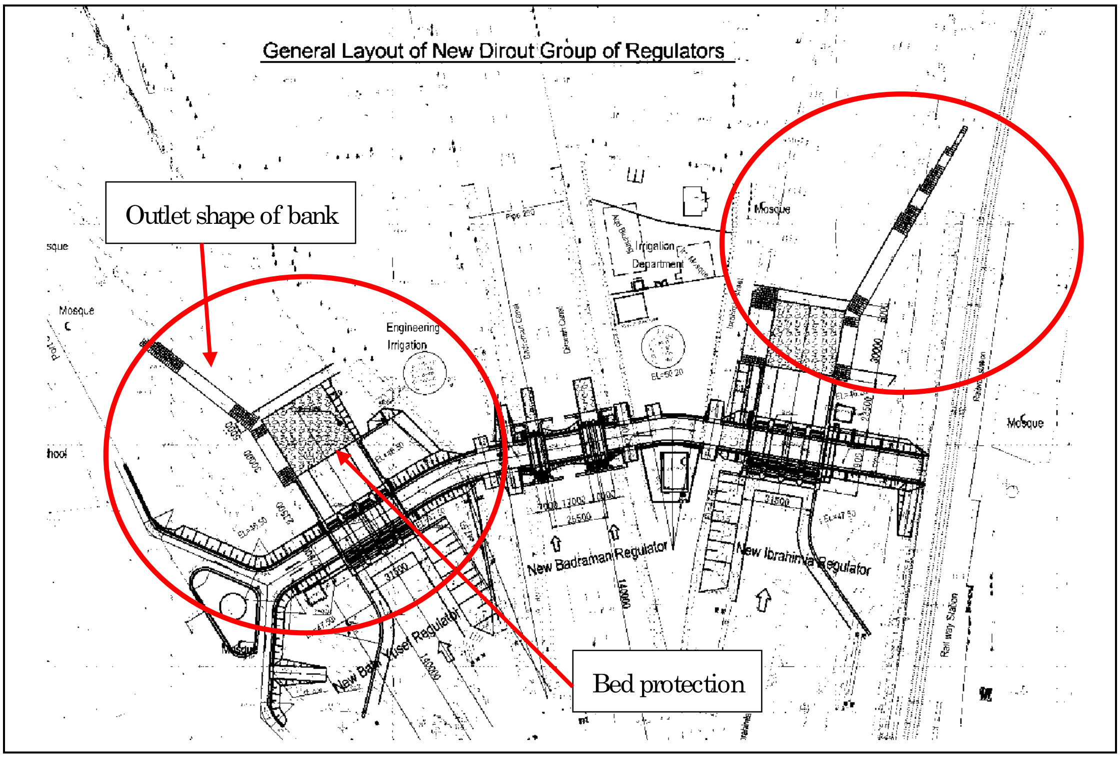


Figure 3-4.2 General layout of NDGRs (changed)

b) Reflection of 2D hydraulic model test on design

As described above, the range of streambed protection (20 to 30 m) and its type, which were determined in accordance with the Design Standard in Japan, are recommended in the Final Report Draft on 2D Model.

Based on the above recommendation, the design appropriateness of the range of streambed protection and its type has been confirmed as follows:

1) Length of bed protection work
   Large-scale regulators (Bahr Yusef and Ibrahimia): 30 m
   Small-scale regulators (Badraman and Diroutiah): 15 m
2) Type of bed protection work
   Riprap

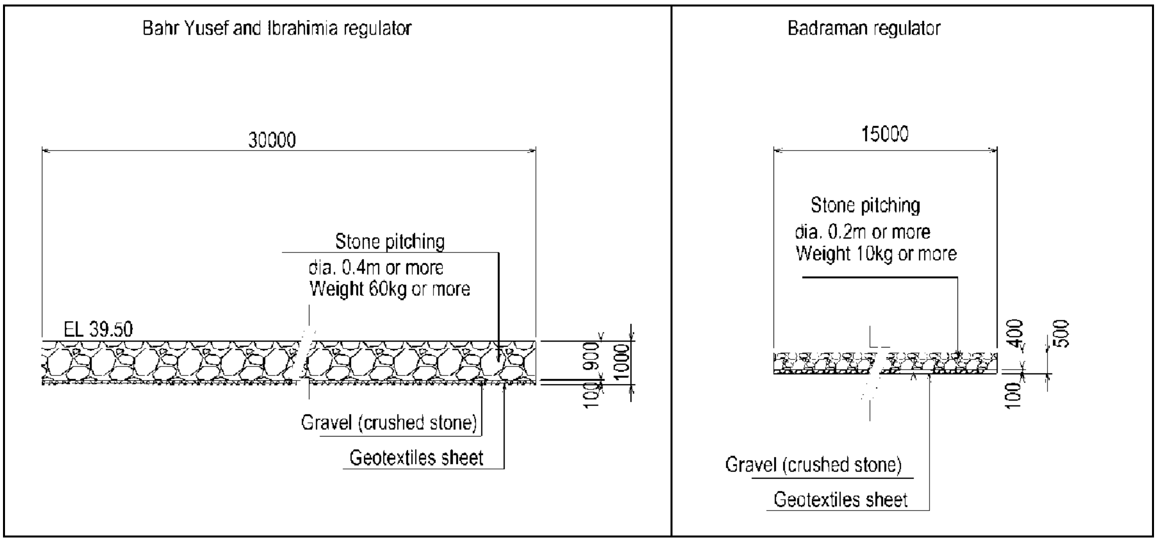


Figure 3-4.3 Sectional diagrams of bed protection works

Volume VII RECOMMENDATIONS

Volume VII RECOMMENDATIONS

Based on the result of the detailed design study, the following recommendations are provided.

1. Regulator Design

(1) The design water level at downstream of each regulators as the basic design conditions of the NDGRs are provided from the conditions of the canal sections rehabilitated completely. The implementation of the canal rehabilitation should be done immediately to realize the proper water distribution in accordance with design discharge from the each regulator.

(2) The H-Q curve at each canal should be prepared to realize the accurate water distribution from NDGRs. The periodical observation of the discharge at the location defined should be done.

(3) The plate bearing test at the site should be done for the ultimatum confirmation of the bearing capacity of the foundation after the completion of the excavation till the design foundation level on each regulators.

(4) The building works is necessary to conduct at least two borings in the control house and stoplogs house in order to confirm the bearing capacity

(5) The road alignment on the railway crossing to the national railway at right bank of Ibrahimia canal will be planned and designed by the national consultant who contracts with the Assiut Governorate. The implementation agency should confirm the ultimatum plan and design so as not to affect the NDGRs project.

(6) The construction works on the Abo Gabal and Sahelyia regulators located at upstream are necessary to partly demolish the existing ones and connect between the new and the existing ones as the one body structures. The discussion and organization with the Ministry of Antiquities and the other agency related should be done immediately.

(7) The sedimentation concerned in the vicinity of the NDGRs is necessary to remove for the proper operation of the NDGRs. The periodical dredging works as the maintenance works should be maintained as well as the existing works.

(8) The ground water level will be raised, which effect will be small and limited, after the construction works of NDGRs in the ground water analysis. Based on the result of the analysis, the monitoring and the analysis of the ground water should be maintained and studied.

2. Water Management System

(1) Water level sensors at the branch canal's intake will be installed two (2) years later after the commencement of the construction works of the NDGRs. Therefore, at the current situation of the D/D stage, the detailed location for water level sensor's installation has not been confirmed yet. It is recommended to finalize the installation location of the water level sensor by the executing agency and the S/V Consultant after the commencement of construction works.

(2) In order to realize the adequate water management from the main canal to branch canal, it is necessary to open and close the branch canal's gate appropriately. At the present situation, some of the intake gates along the branch canal could not open and close due to their deterioration, breakage of actuators for gates and etc. It is, therefore, recommended that the executing agency discusses the restoration works of intake gate with ID.

(3) In this project, it is planned that the operating status data of pump stations owned and managed by MED will be grasped and transferred to the telemetry system. In order for the remote monitoring of pump status, it is necessary to modify the control panel of pump stations. Therefore, it is desirable to clarify the demarcation of the expense and responsibility with MED for modifying the electrical devices from the early stage before the commencement of construction works. In this regard, it is recommended that the executing agency starts the discussion on modification works to monitor the operating condition of the pump status.

3. Construction Plan

(1) It was confirmed through the discussions with RGBS that the temporary yard for concrete batching plant and aggregate bin shall be secured at the site of the existing irrigation department office between Ibrahimia and Badraman canal. The building shall be relocated before commencement of the Project. On the other hand, the sites for other temporary facilities and stock yards which needs two years after the implementation of the construction will be selected among the adjacent candidate sites after D/D study. It is, therefore, recommended that the executing agency starts negotiation on lease agreement with land owners as soon as possible.

(2) It is recommended to discuss with the authorities of rail way about the position and method with considering the vibration for the sheet piles that is driven parallel with the railway on the right bank of Ibrahimia canal to protect the slope from collapse.

4. Project Cost Estimation

(1) The detailed project cost of the NDGRs was estimated assuming that the project will be commenced in February 2018. Since the commencement date of the project is an

important factor affecting the project cost, it is recommended to decide the commencement date as soon as possible to secure the accurate project cost.

(2) In the detailed design period, it was unstable in the Egyptian market because a fixed exchange rate system was shifted to a flexible exchange rate system. Because the project cost estimation had to be carried out such a period, an appropriate price escalation was required to be included in the project cost estimation as the price contingency. In order to set up a bidding price in high accuracy, it is recommended to review the exchange rate and price escalation rate.

5. Bidding Process and Construction Contract

(1) It is important that the procurement process for the construction contract shall be executed as originally planned, i.e. commencement of construction contract shall be made by February 2018. Since the procurement process shall be made in accordance with JICA Guideline as agreed on the Minutes of Discussions on the Loan Agreement for the NDGRs, and also the bidding documents shall be subject to JICA's concurrence before distribution, it is recommended to use the draft Bidding Documents attached to this report without major alteration on the process and contents.

(2) It is recommended that technical specifications will be finalized based on its draft version prepared by the D/D consultant, taking into consideration the results of review on the detailed design and construction plan of the NDGRs will be done by S/V consultant.

6. Environmental and Social Consideration

(1) Given that the letter informing of approval of the EIA Report as of 9th September 2010, which was issued by EEAA, recommends implementation of groundwater level monitoring and groundwater quality check, and it is necessary to monitor those environmental items before and during construction stage.

(2) Piezometers for groundwater level monitoring are mostly located on the center of Dirout city, and they can be easily degraded. It is, therefore, recommended to maintain them monthly from just after the completion of the D/D to commencement of construction works.

(3) Groundwater level seems to be influenced widely by the canal water level, and it is recommended to pay attention to the change in the groundwater head at BH-N10, N11 and N12 where the hydraulic connection may exist between the canal water and the aquifer; moreover, at BH-N13 which has shallow groundwater level.

(4) Due to the construction of the NDGRs, the existing three (3) mosques are to be relocated to other sites. The new relocation sites of two (2) mosques, which are under the Ministry of Awqaf, have been already fixed, and they will be transferred before the construction

works. On the other hand, the last one which is under the control of the MWRI, will be relocated to the area owned by MWRI during the construction works. It is recommended to implement the relocation plan most certainly.

(5) There is the Lawyer’s Club Café in the river bed which is operated illegally at just upstream of Abo Gabal Regulator. It is strongly recommended to take countermeasures against further expansion of the café to the construction site.

7. Mathematical Model Analysis

(1) Considering the smooth operation of the NDGRs in future, the sediments which are dredged every year around the existing DGRs should be examined from the view of river bed variation analysis. Based on the detailed bathymetric survey around the DGRs, it is significant for the reduction of the operation cost in future by predicting the future river bed variation and taking measures for less sedimentation. Therefore, it is recommended that;

1) to collect continuous measurement data of the sedimentation

2) to analyze the sedimentation tendency with the detailed river bed variation analysis, and

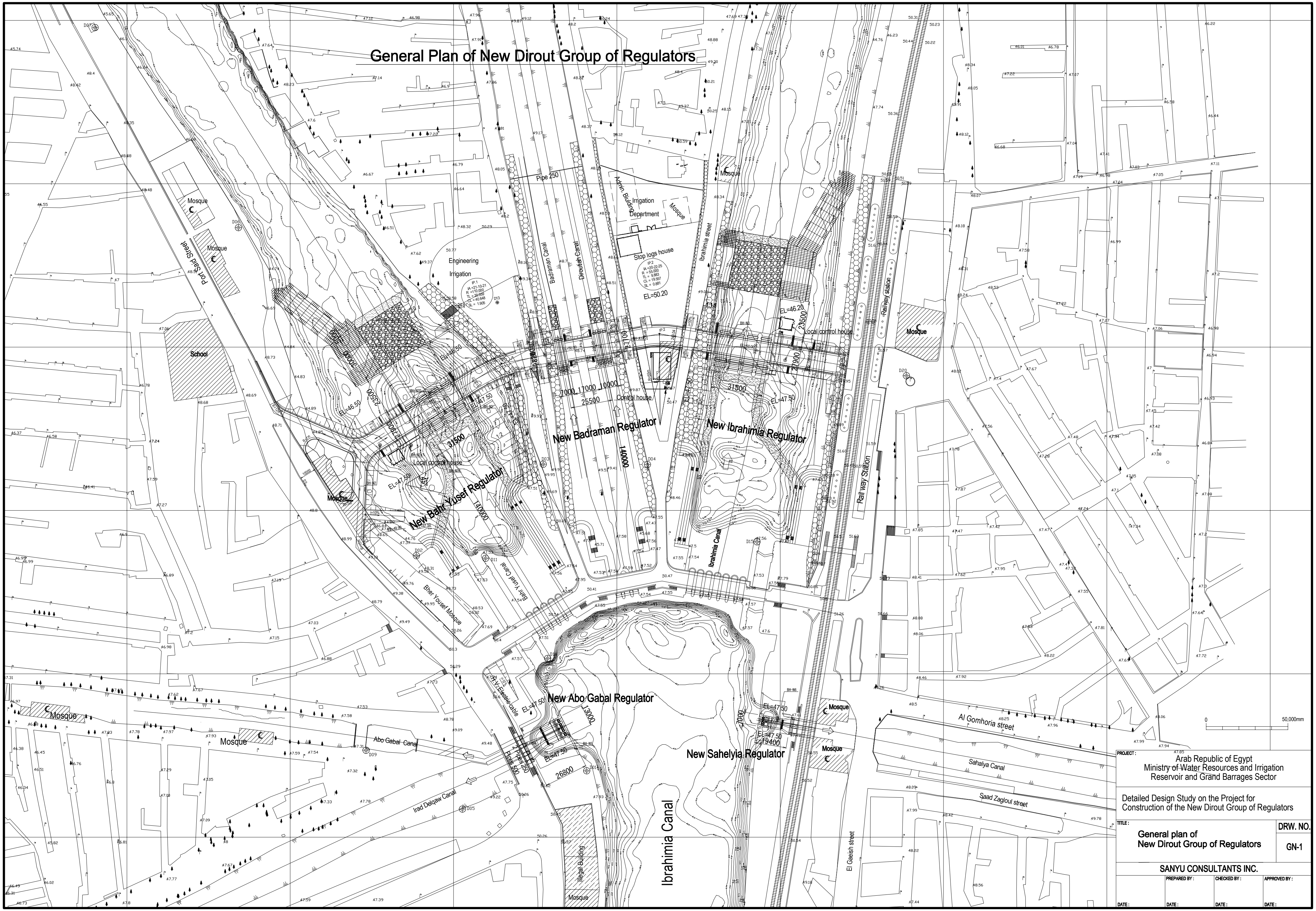
3) to take the countermeasures for less sedimentation.

ATTACHMENT

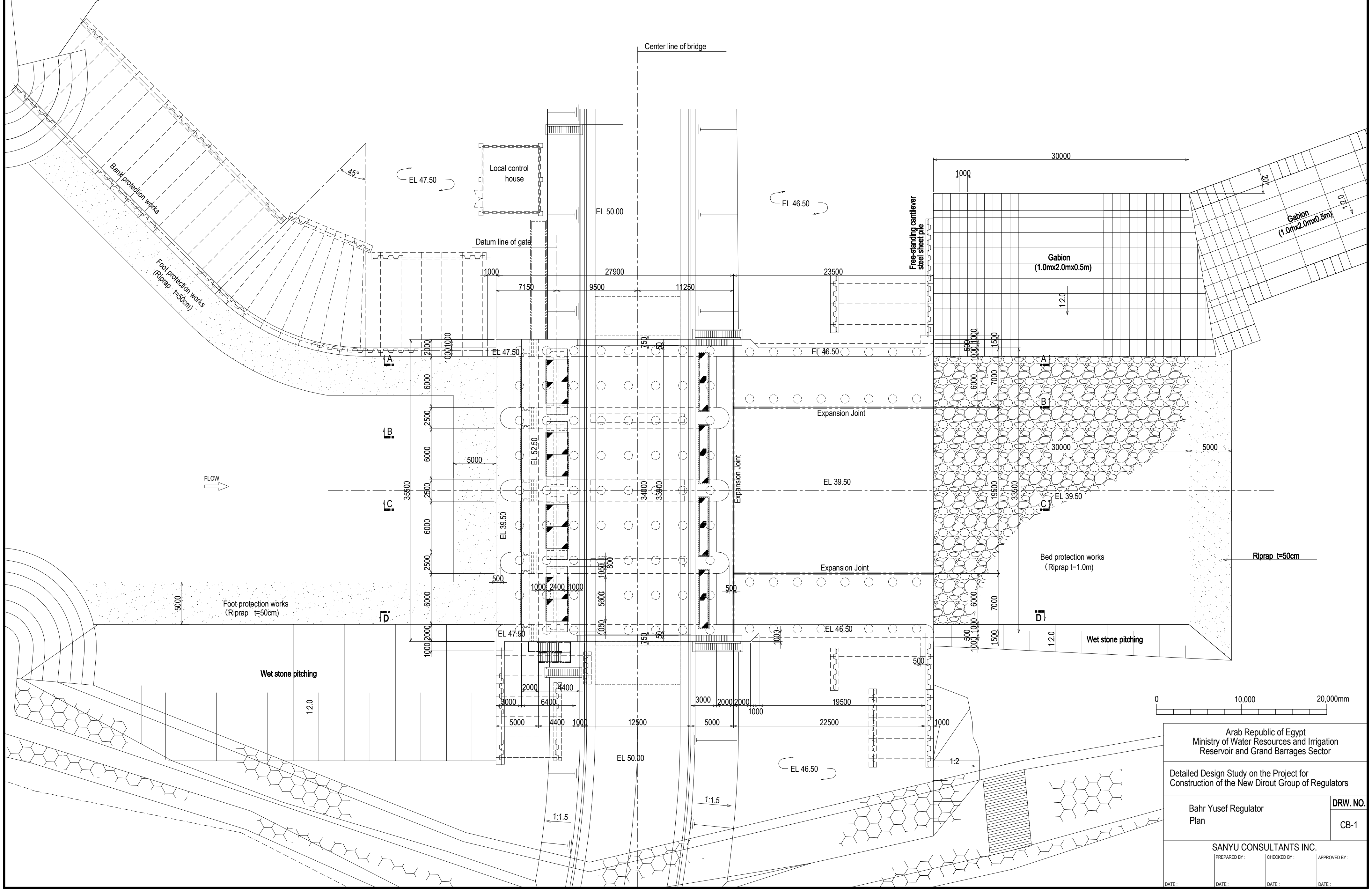
Drawings of NDGRs

AT-1. Civil Works Design of NDGRs

AT-2


General Plan of New Dirout Group of Regulators
New Badraman Regulator
New Ibrahimia Regulator
New Bahr Yusef Regulator
New Abo Gabal Regulator
New Sahelyia Regulator
Ibrahimia Canal
Badraman Canal
Diroutiah Canal
Ibrahimia street
Railway station
Rail way Station
Port Said Street
School
Mosque
Engineering
Irrigation
Irrigation Department
Admin Building
Stop logs house
Local control house
Control house
Pipe 250
EL=50.20
EL=46.20
EL=47.50
EL=46.50
Abo Gabal Canal
Irad Delgaw Canal
Al Gomhoria street
Sahalya Canal
Saad Zagloul street
El Gaeish street
Illegal Building
Bahr Yusef Canal
Bher Yousef Mosque
50,000mm
PROJECT :
Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector
Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators
TITLE :
General plan of
New Dirout Group of Regulators
DRW. NO.
GN-1
SANYU CONSULTANTS INC.
PREPARED BY :
CHECKED BY :
APPROVED BY :
DATE :

Plan of Bahr Yusef Regulator



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

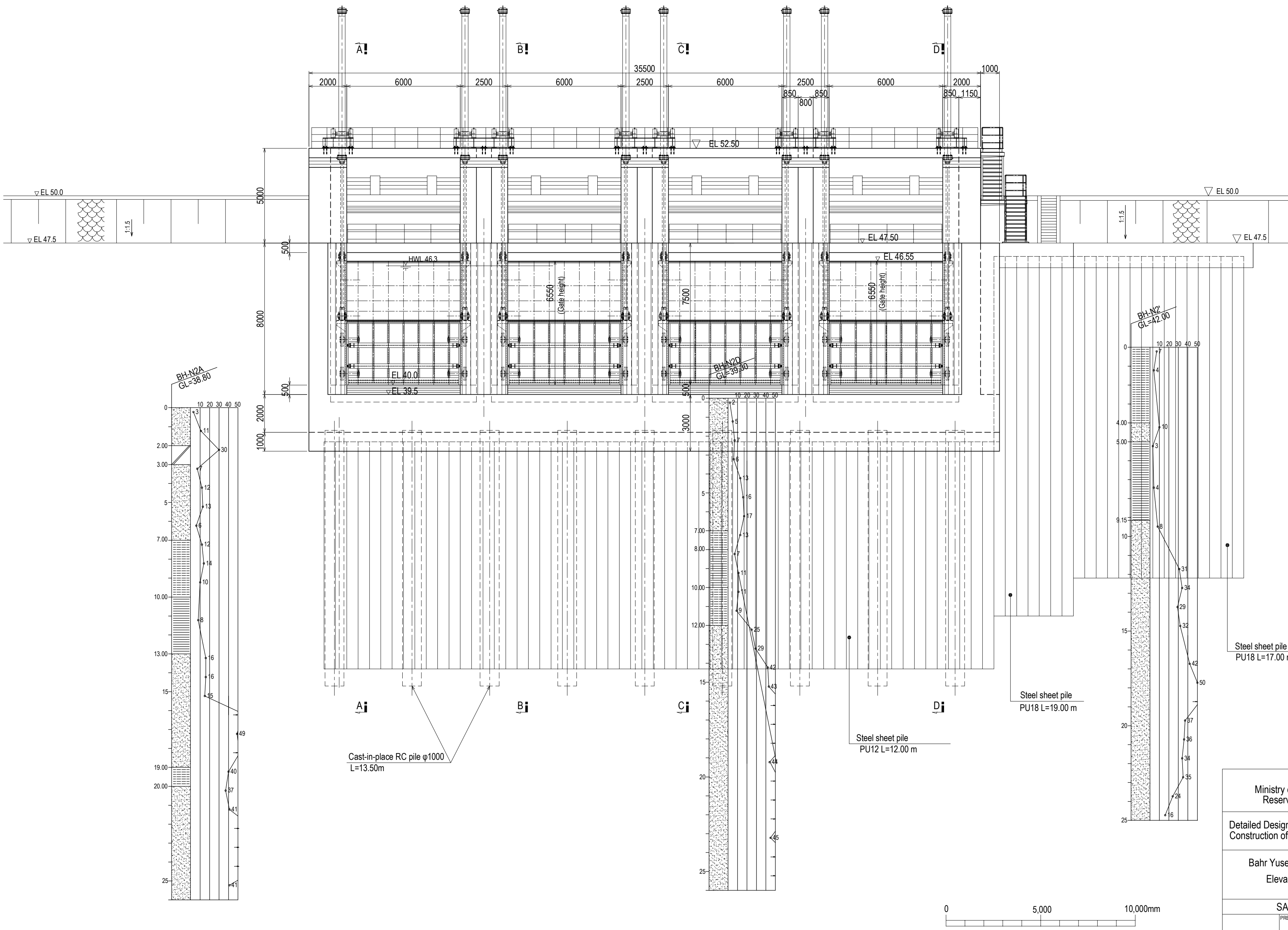
Bahr Yusef Regulator Plan	DRW. NO. CB-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-4

Elevation of Bahr Yusef Regulator



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

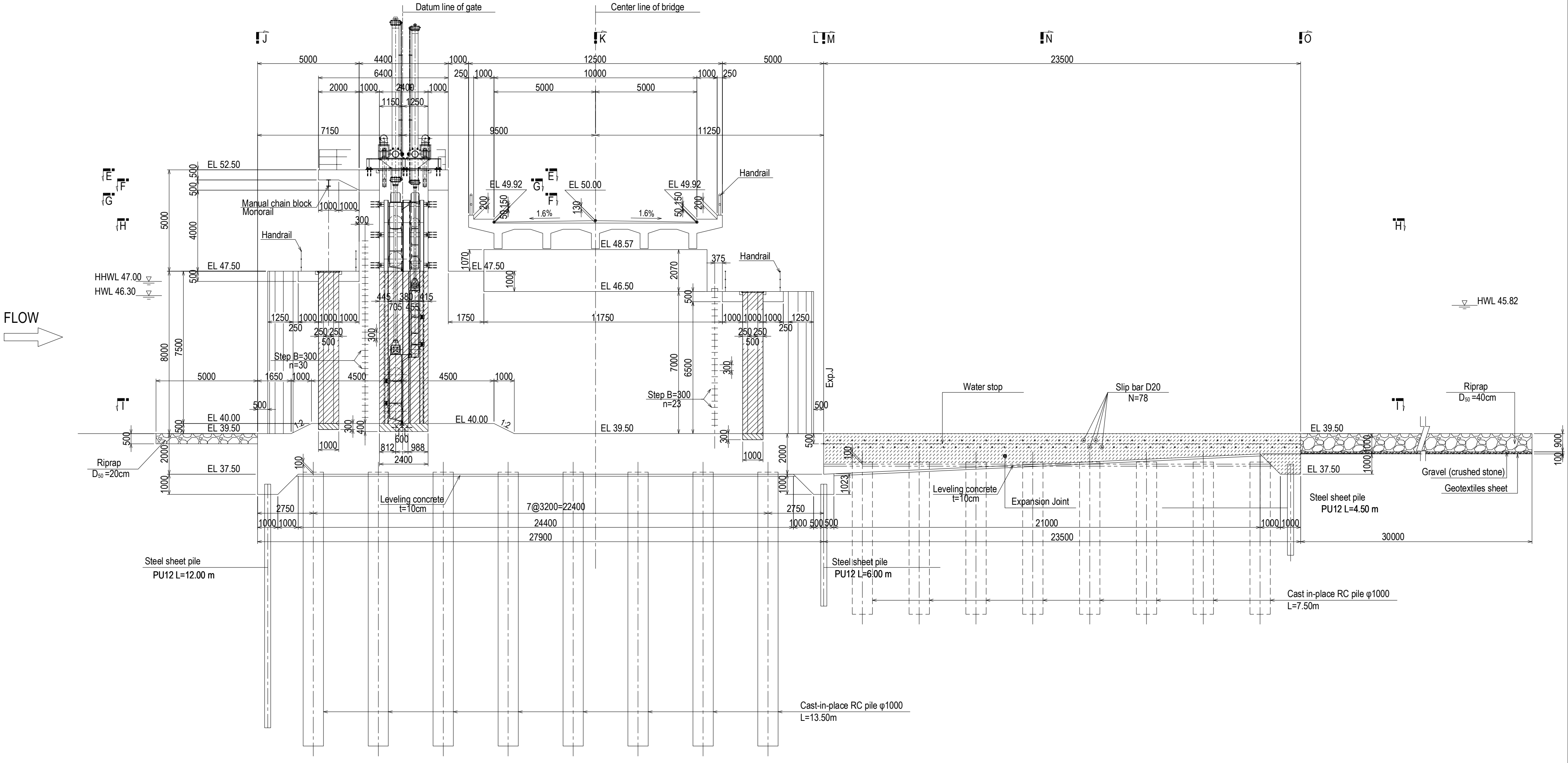
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Bahr Yusef Regulator Elevation	DRW. NO. CB-2

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

Longitudinal Section of Bahr Yusef Regulator（Section B－B）

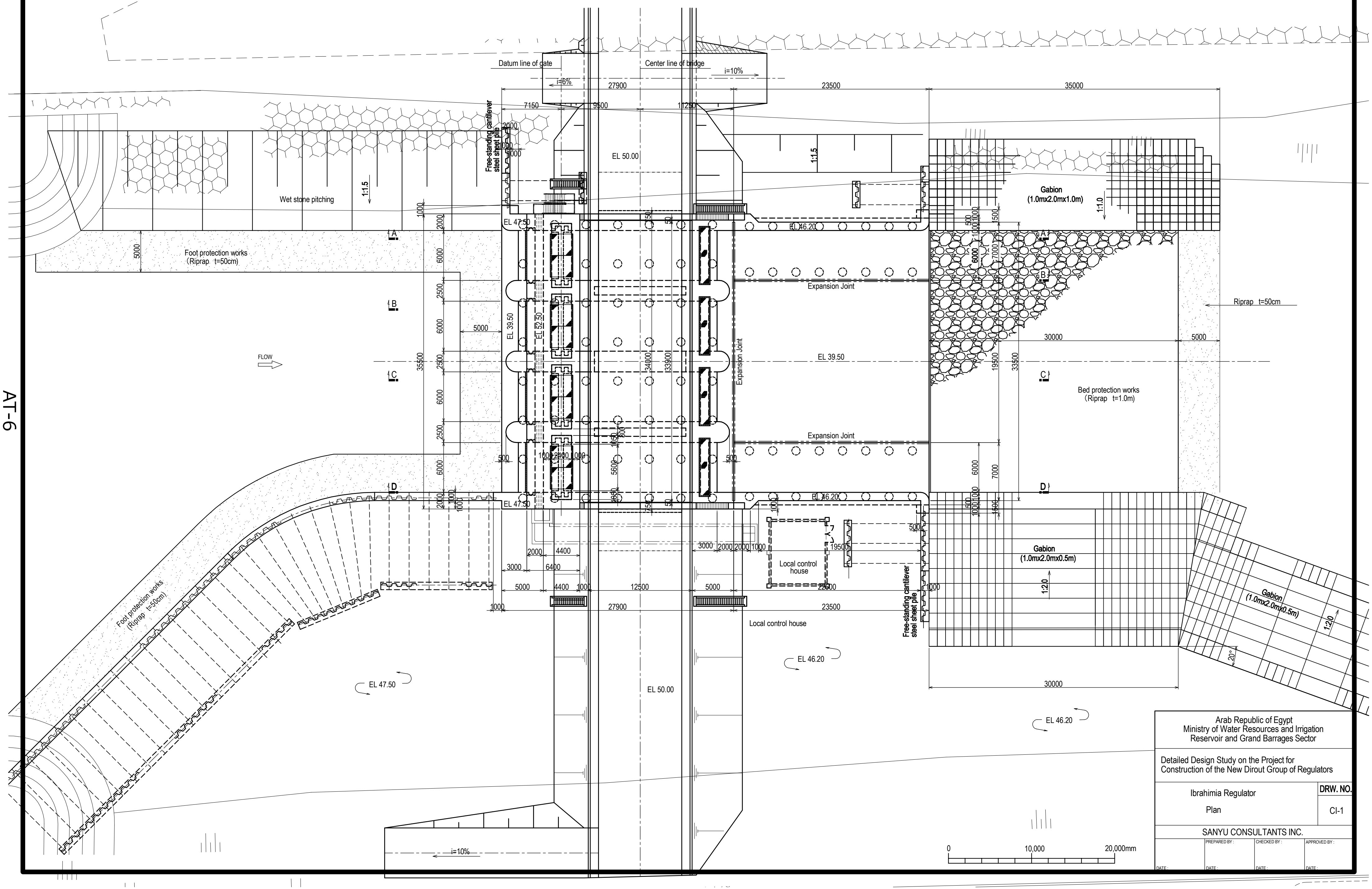


Note;

Shaded area indicates the range of second stage concrete to be placed with steel gate guide.

Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
Bahr Yusef Regulator Longitudinal section (2)	DRW. NO. CB-4
SANYU CONSULTANTS INC.	
DATE : / PREPARED BY : DATE : / CHECKED BY : DATE : / APPROVED BY : DATE :	

Plan of Ibrahimia Regulator



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

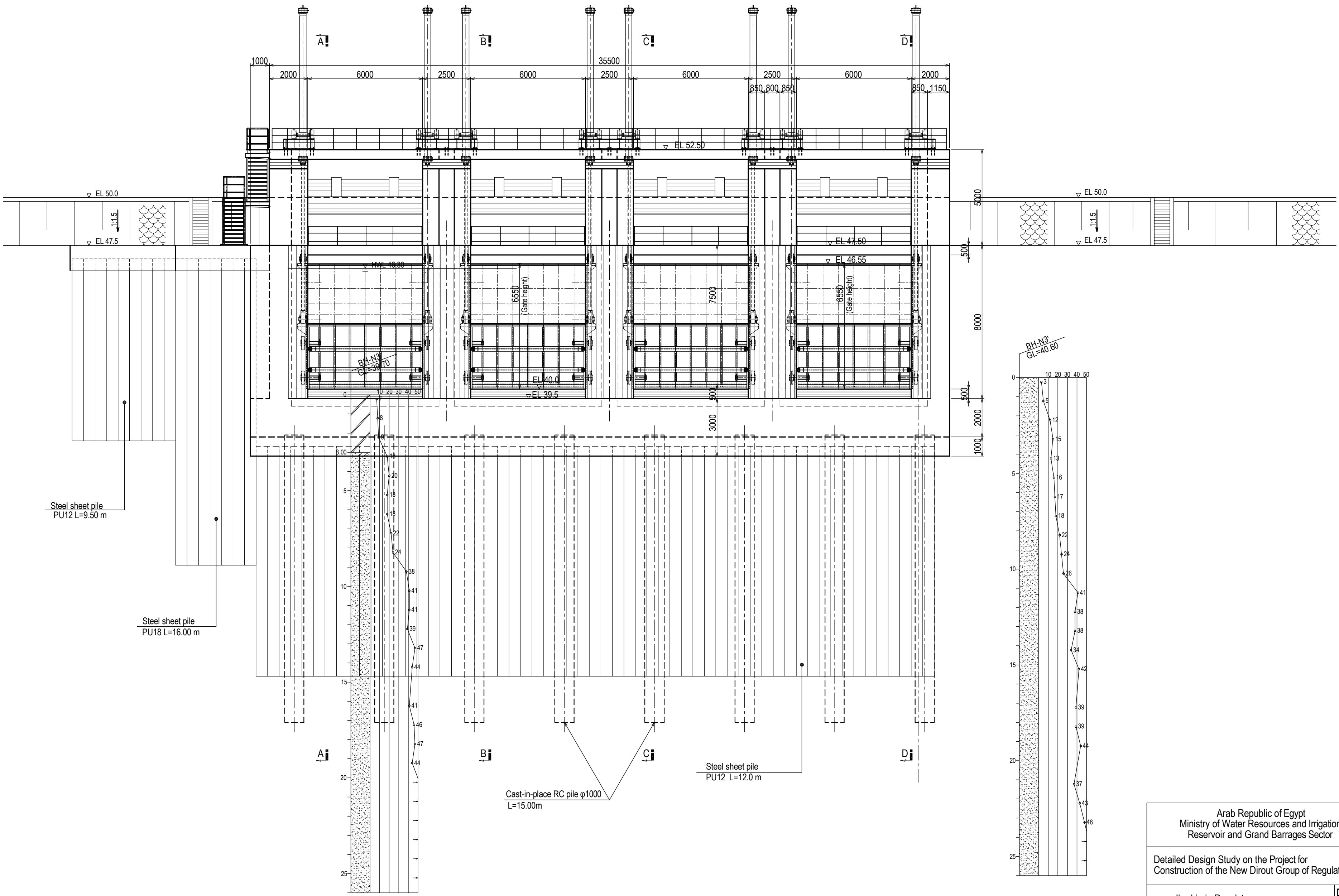
Ibrahimia Regulator
Plan

DRW. NO.
CI-1

SANYU CONSULTANTS INC.

PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :

Elevation of Ibrahimia Regulator



0 5,000 10,000mm

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

Ibrahimia Regulator
Elevation

DRW. NO.
CI-2

SANYU CONSULTANTS INC.

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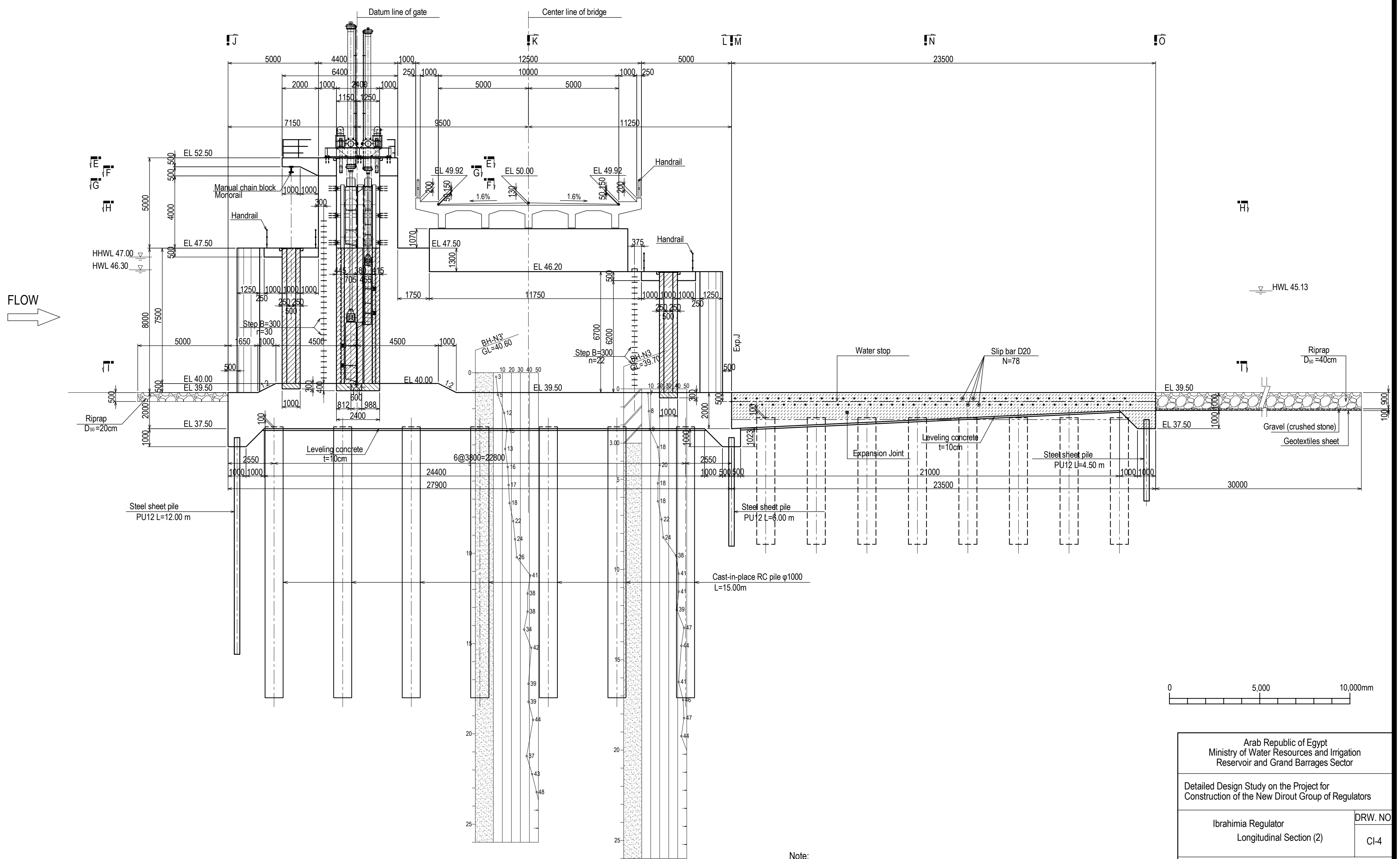
DATE :	DATE :	DATE :	DATE :

Longitudinal Section of Ibrahimia Regulator（Section B－B）



Note;

Shaded area indicates the range of second stage concrete to be placed with steel materials.

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

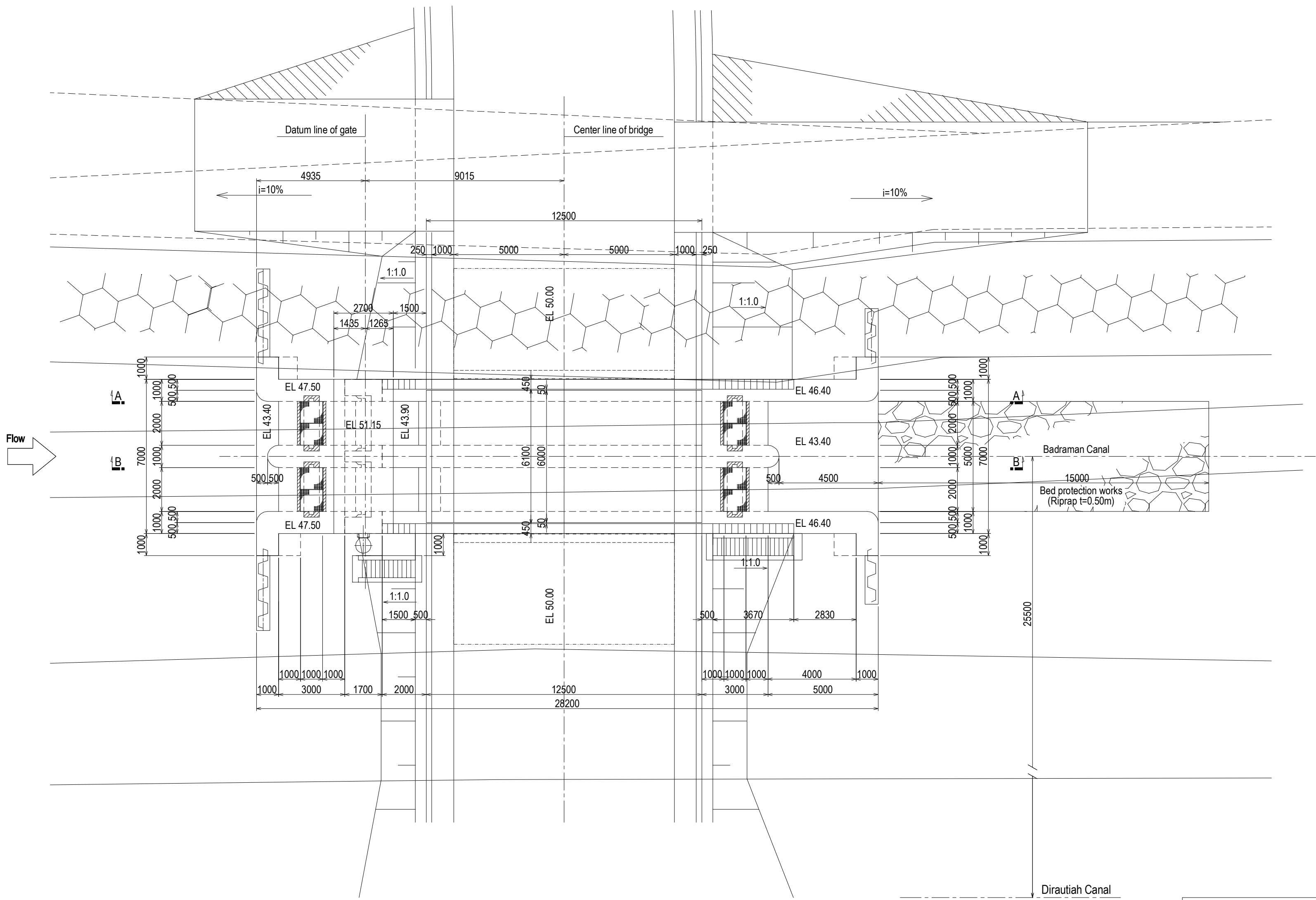
Ibrahimia Regulator
Longitudinal Section (2)

DRW. NO
CI-4

SANYU CONSULTANTS INC.

PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :

Plan of Badraman Regulator (Badraman)

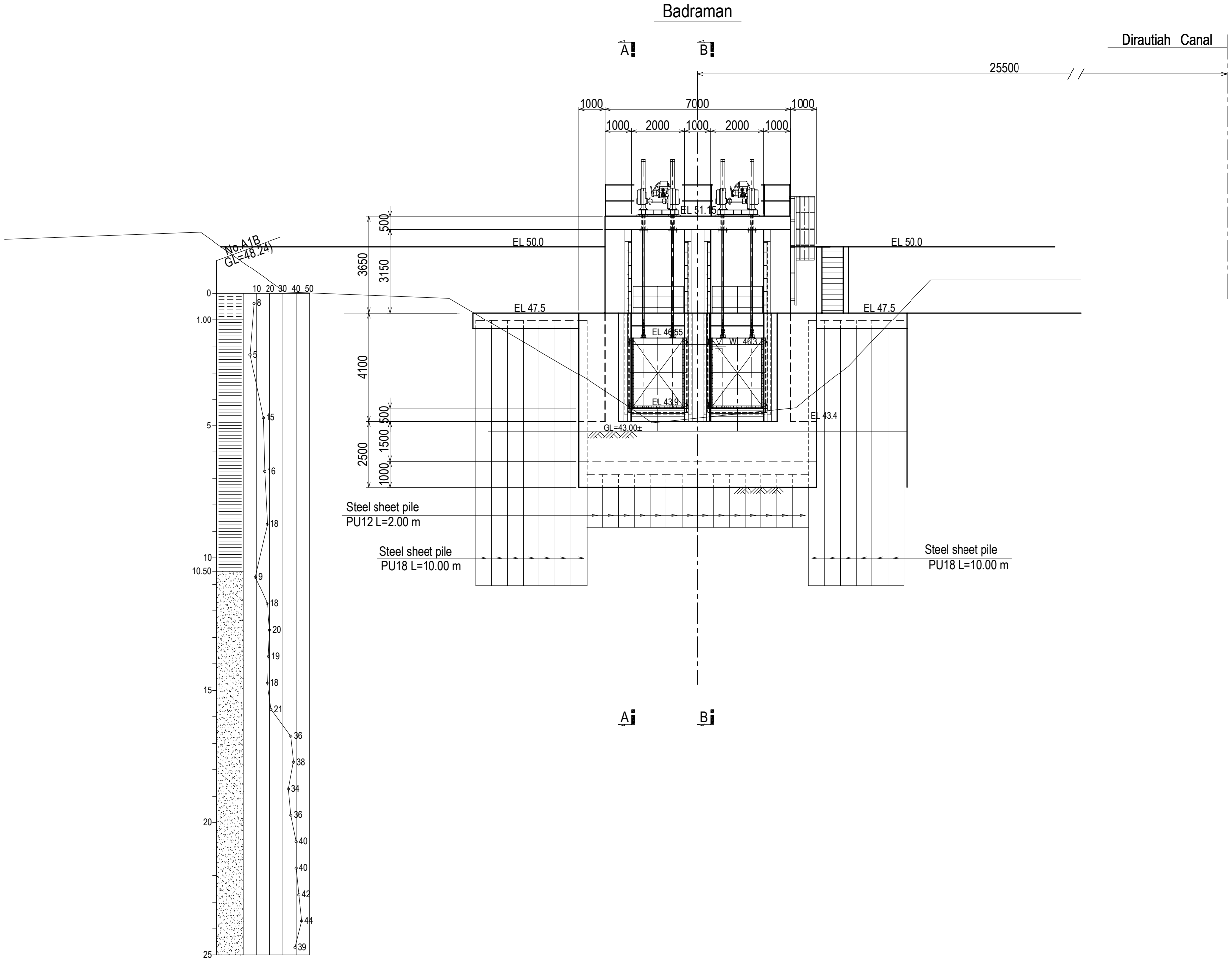


Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
Badraman Regulator (Badraman) Plan	DRW. NO. CN-1
SANYU CONSULTANTS INC.	

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-9

Elevation of Badraman Regulator（Badraman）



Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
	DRW. NO.
Badraman Regulator（Badraman） Elevation	CN-2
SANYU CONSULTANTS INC.	

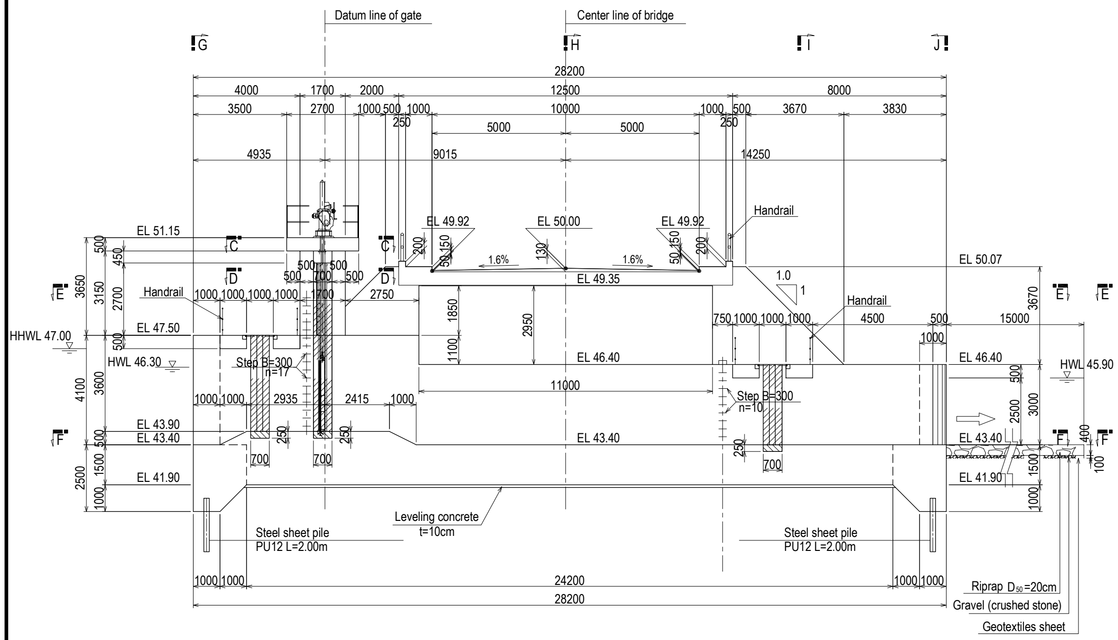
0 5,000 10,000mm

PREPARED BY : CHECKED BY : APPROVED BY :

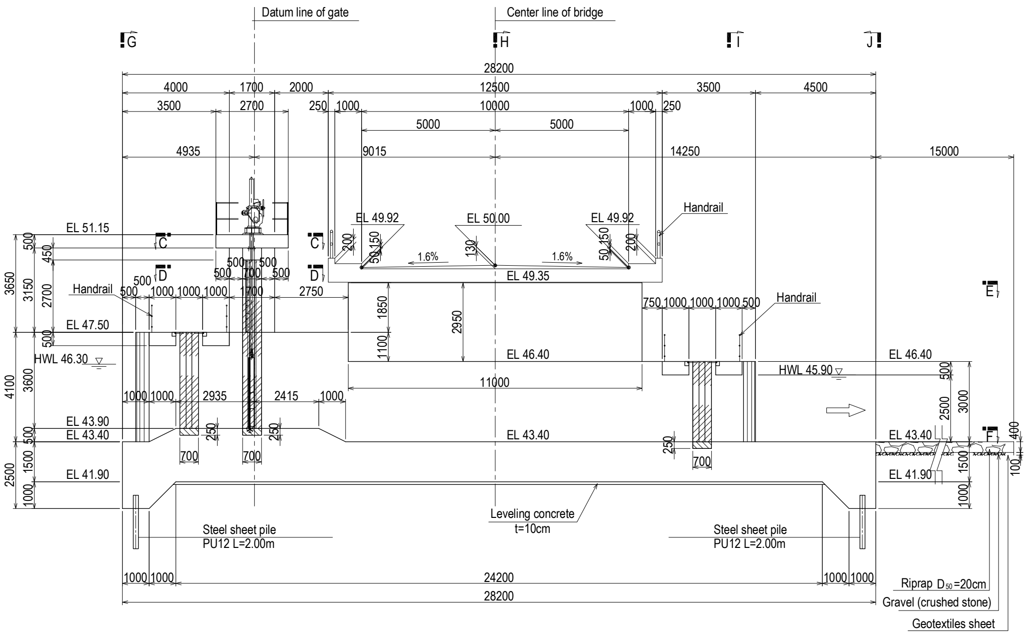
DATE : DATE : DATE : DATE :

Longitudinal Section of Badraman Regulator（Badraman）

Section A－A



Section B－B



0 5,000 10,000mm

Note;

Shaded area indicates the range of second stage concrete to be placed with steel materials.

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Badraman Regulator (Badraman)
Longitudinal section

DRW. NO. CN-3

SANYU CONSULTANTS INC.

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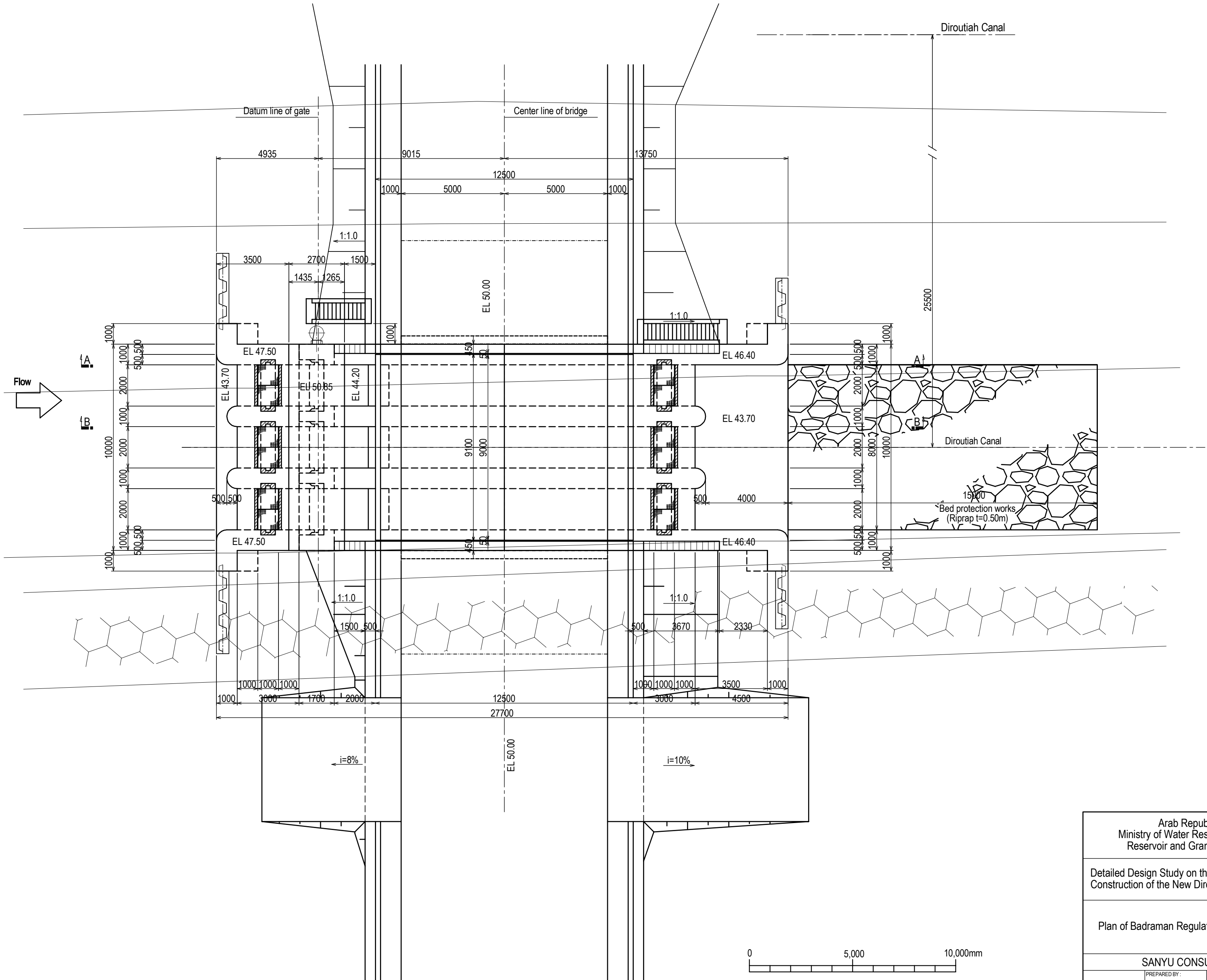
DATE :	DATE :	DATE :	DATE :

Plan of Badraman Regulator（Diroutiah）



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

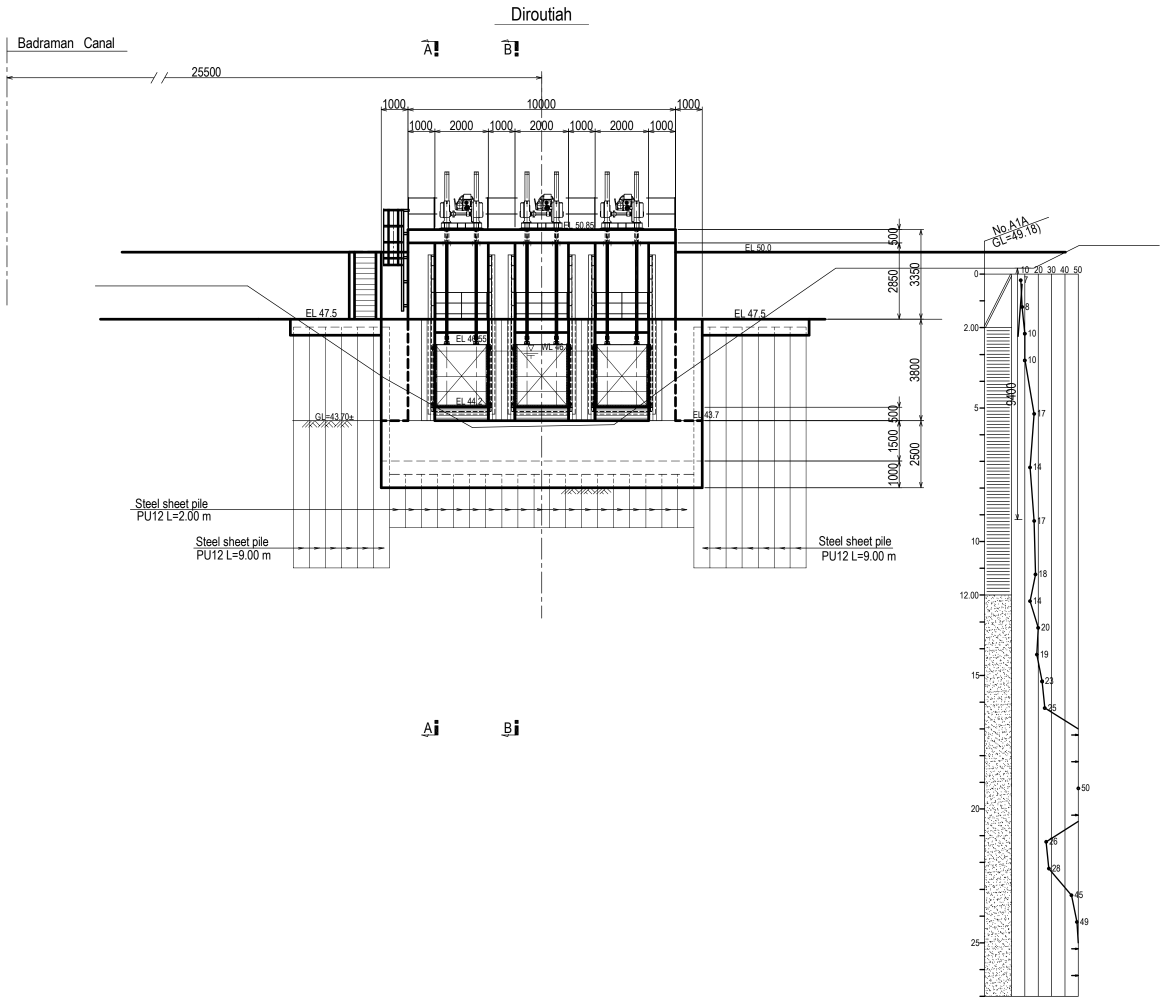
Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

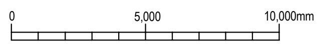
Plan of Badraman Regulator（Diroutiah）	DRW. NO. CD-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

Elevation of Badraman Regulator（Diroutiah）



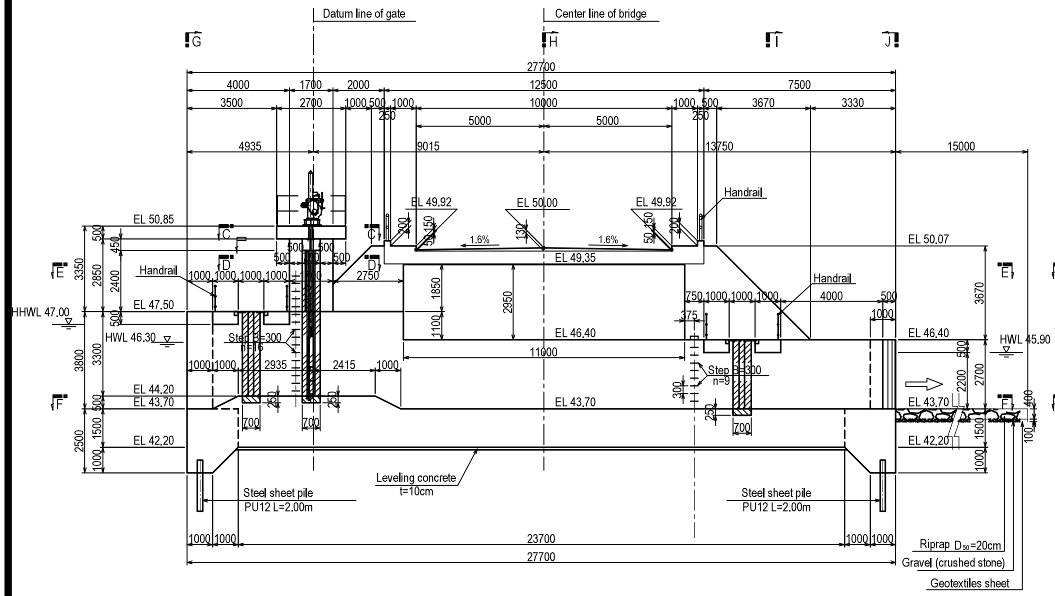


Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators
Badraman Regulator（Diroutiah） Elevation — DRW. NO. CD-2
SANYU CONSULTANTS INC.
PREPARED BY : / CHECKED BY : / APPROVED BY :
DATE : / DATE : / DATE : / DATE :

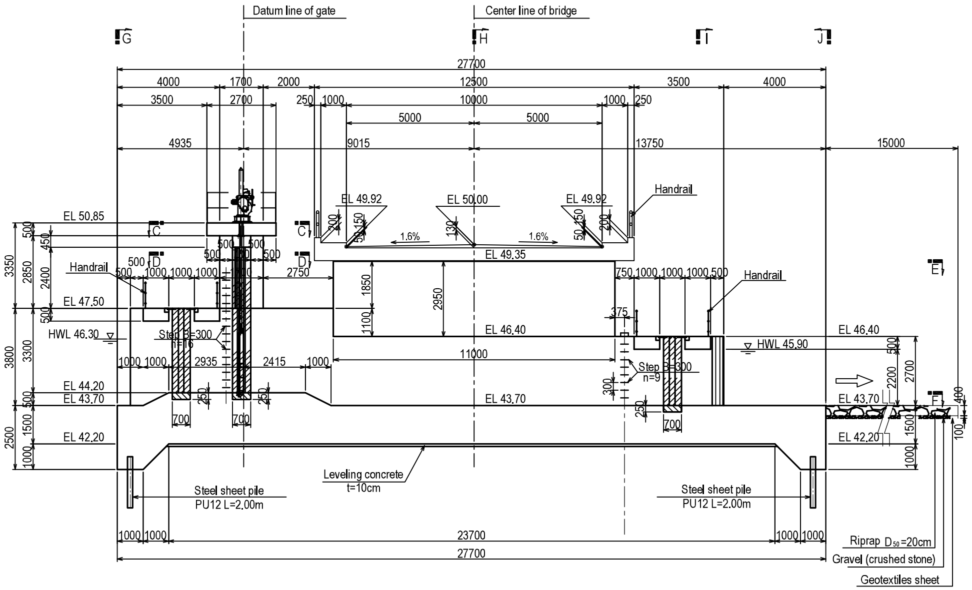
AT-13

Longitudinal Section of Badraman Regulator（Diroutiah）

Section A－A



Section B－B



0 5,000 10,000mm

Note;

Shaded area indicates the range of second stage concrete to be placed with steel materials.

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Badraman Regulator（Diroutiah） Longitudinal section	DRW. NO. CD-3

SANYU CONSULTANTS INC.

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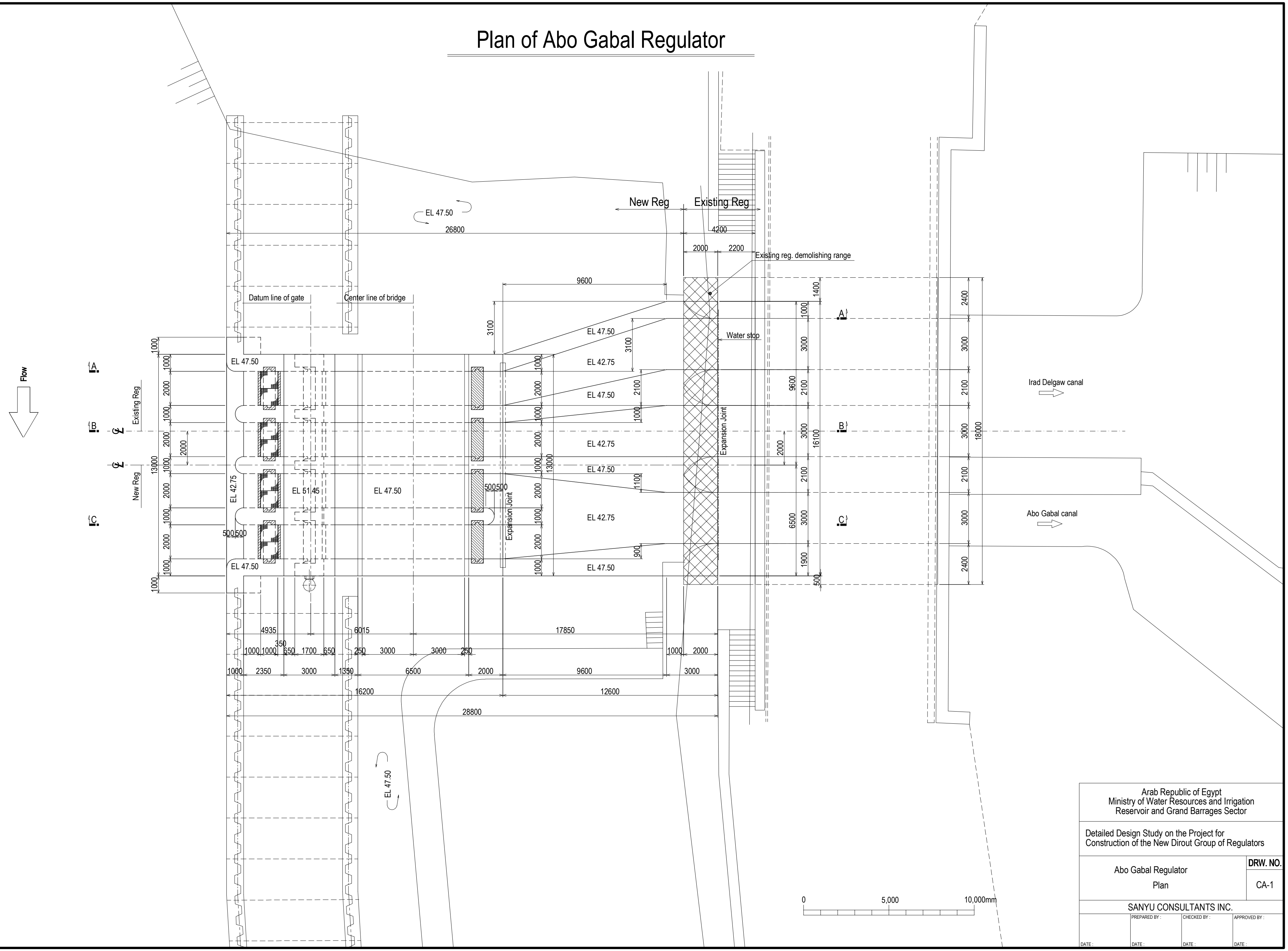
Plan of Abo Gabal Regulator



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

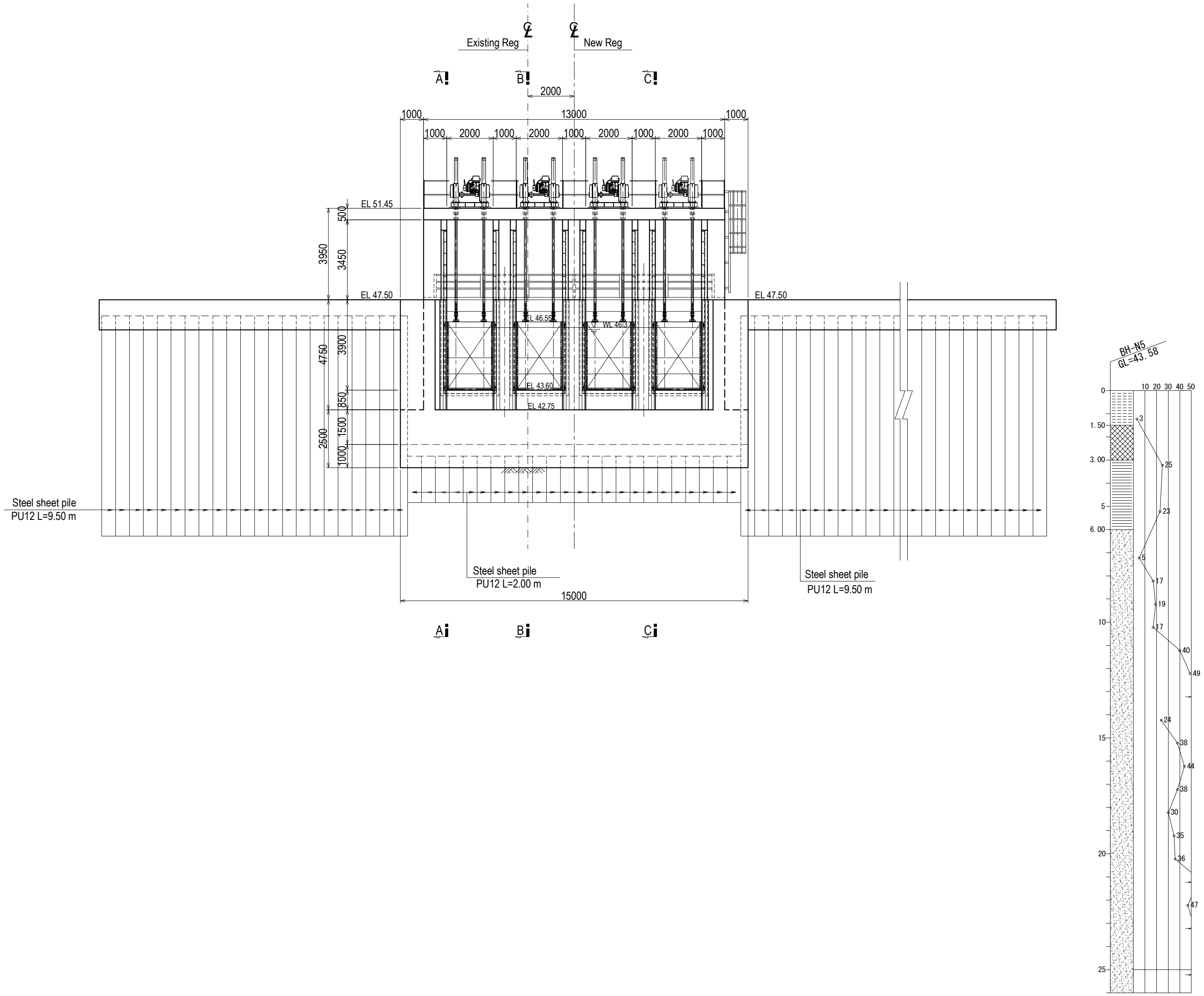
Abo Gabal Regulator
Plan

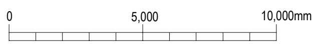
DRW. NO.
CA-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

Elevation of Abo Gabal Regulator





Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Abo Gabal Regulator Elevation	DRW. NO. CA-2

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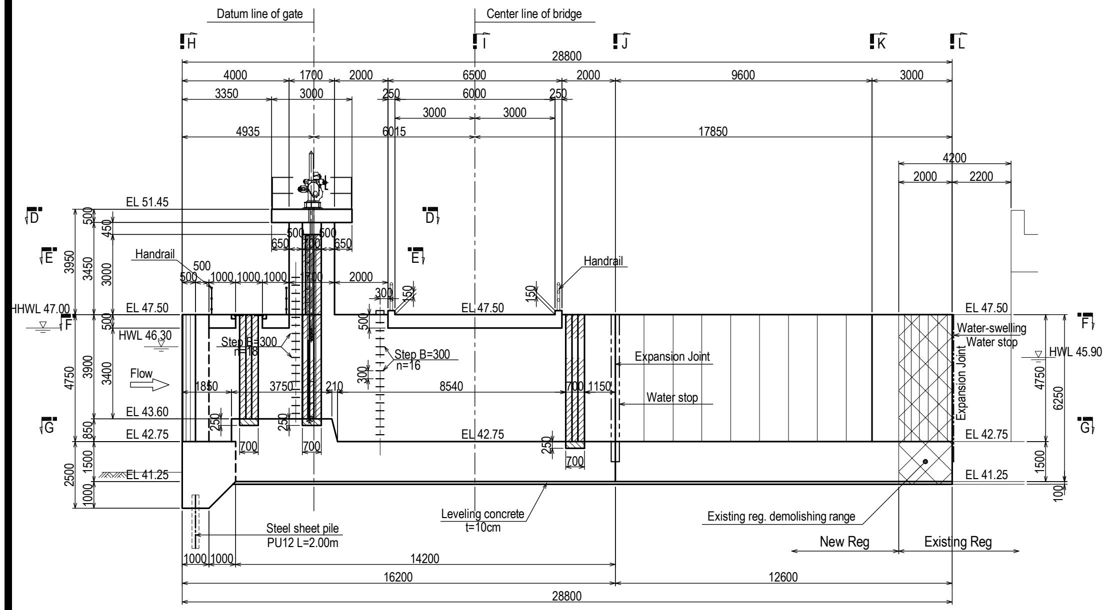
DATE :	DATE :	DATE :	DATE :

AT-16

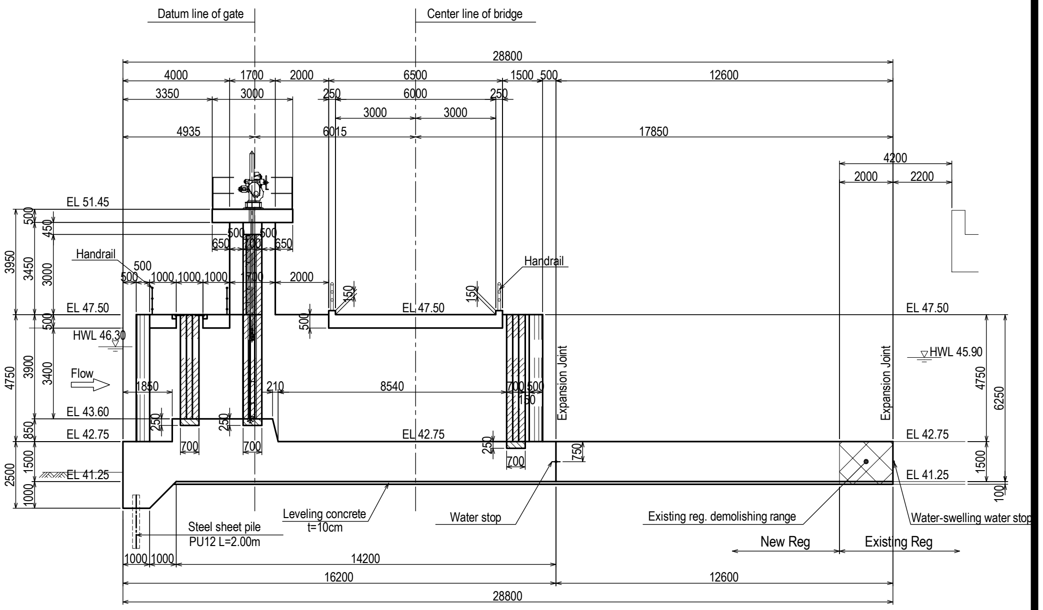
AT-17

Longitudinal Section of Abo Gabal Regulator

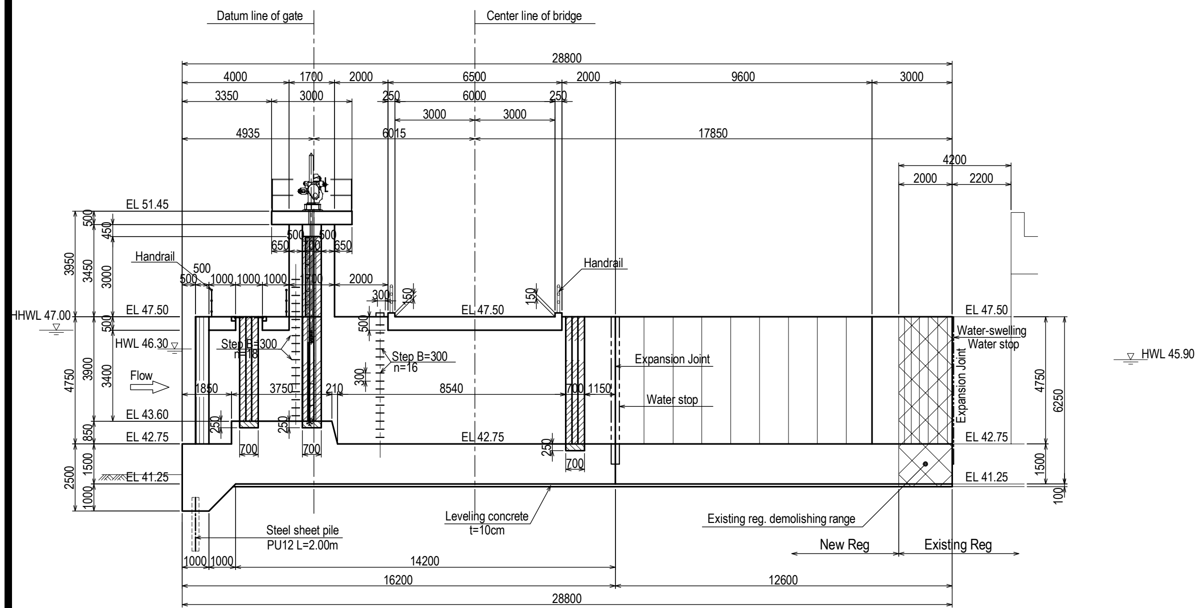
Section A－A



Section C－C



Section B－B



0 5,000 10,000mm

Note;

Shaded area indicates the range of second stage concrete to be placed with steel materials.

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Abo Gabal Regulator
Longitudinal section

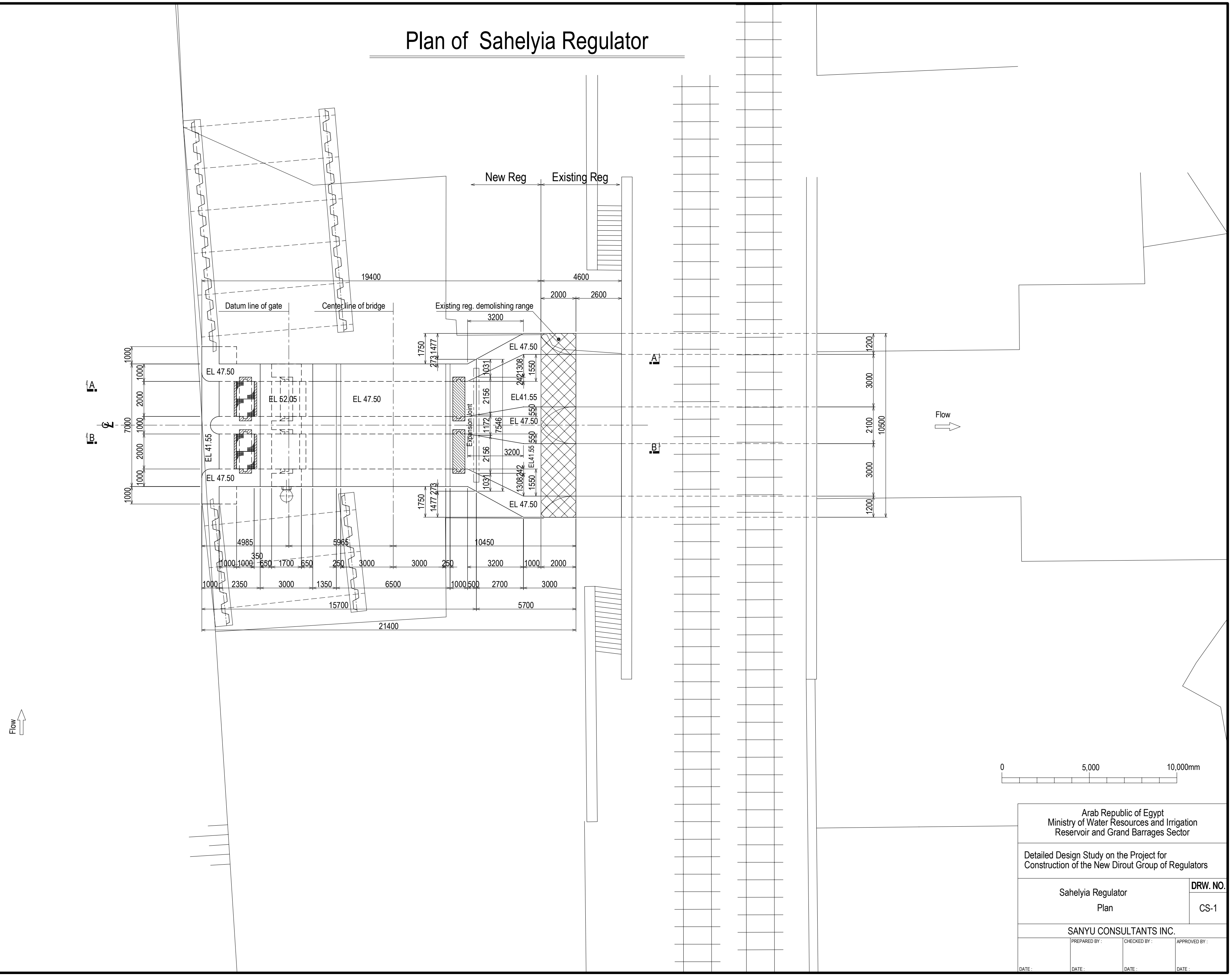
DRW. NO. CA-3

SANYU CONSULTANTS INC.

DATE:	PREPARED BY: DATE:	CHECKED BY: DATE:	APPROVED BY: DATE:

AT-18

Plan of Sahelyia Regulator



Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

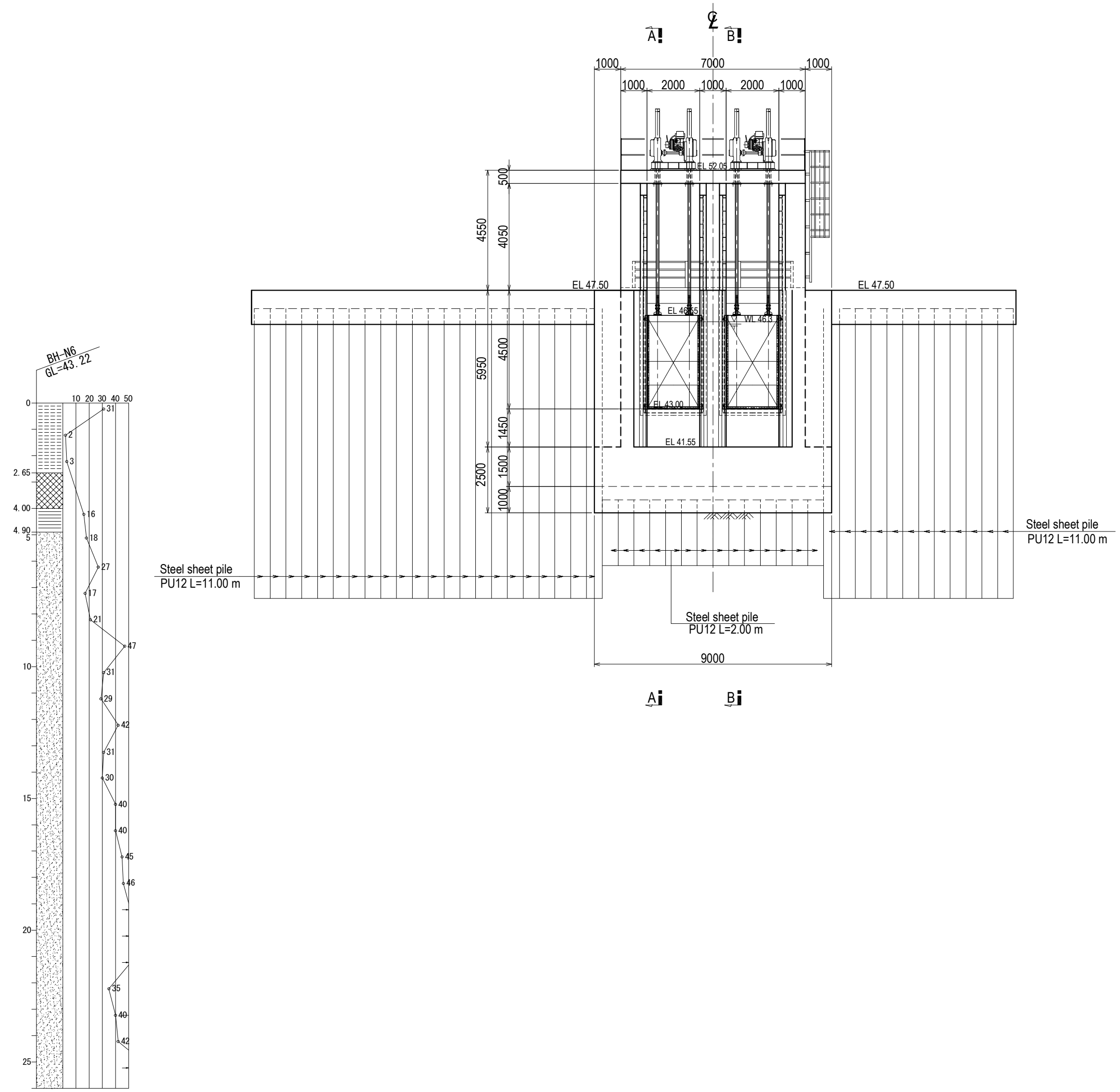
Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

Sahelyia Regulator Plan	DRW. NO. CS-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

Elevation of Sahelyia Regulator



AT-19

0 5,000 10,000mm

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

Sahelyia Regulator Elevation	DRW. NO. CS-2

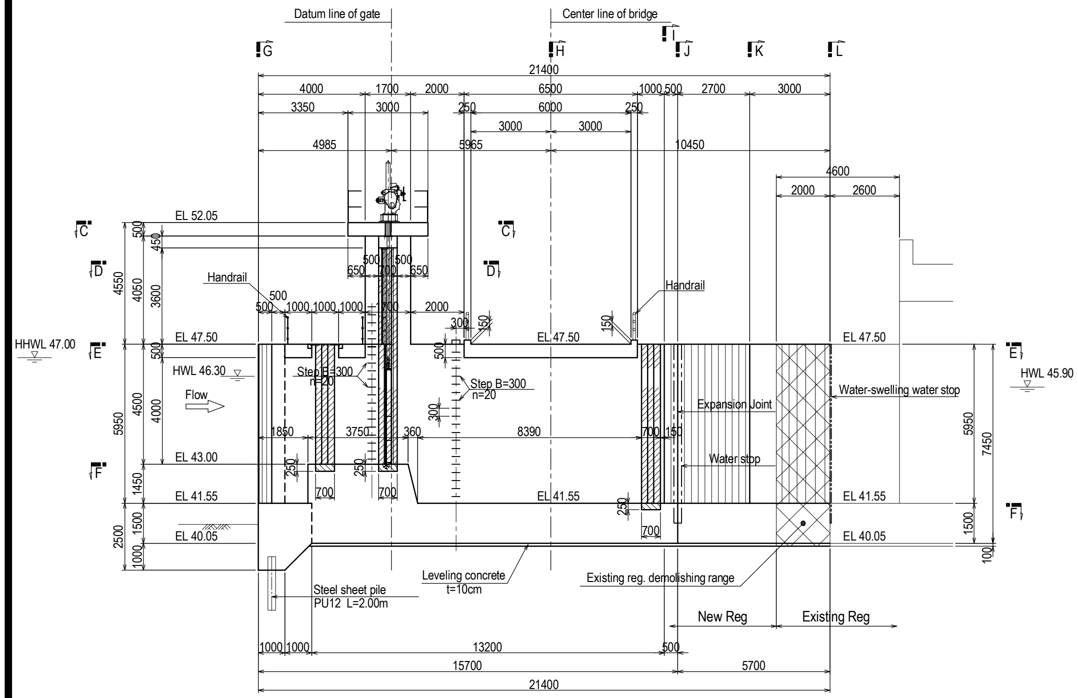
SANYU CONSULTANTS INC.

DATE :	PREPARED BY : DATE :	CHECKED BY : DATE :	APPROVED BY : DATE :

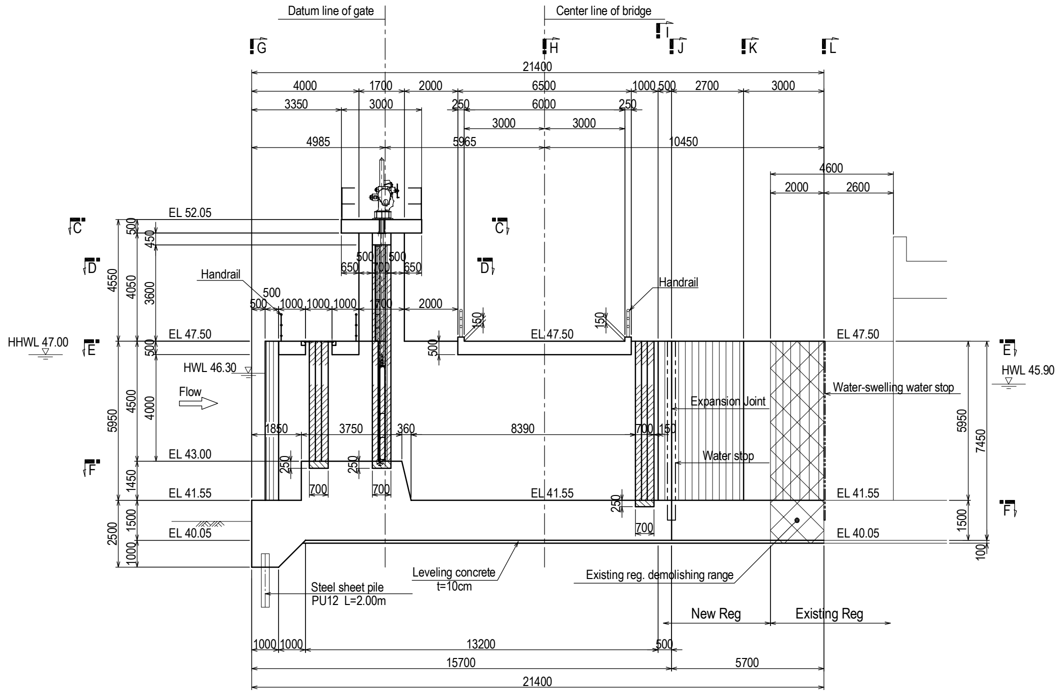
AT-20

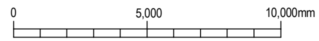
Longitudinal Section of Sahelyia Regulator

Section A－A



Section B－B





Note;

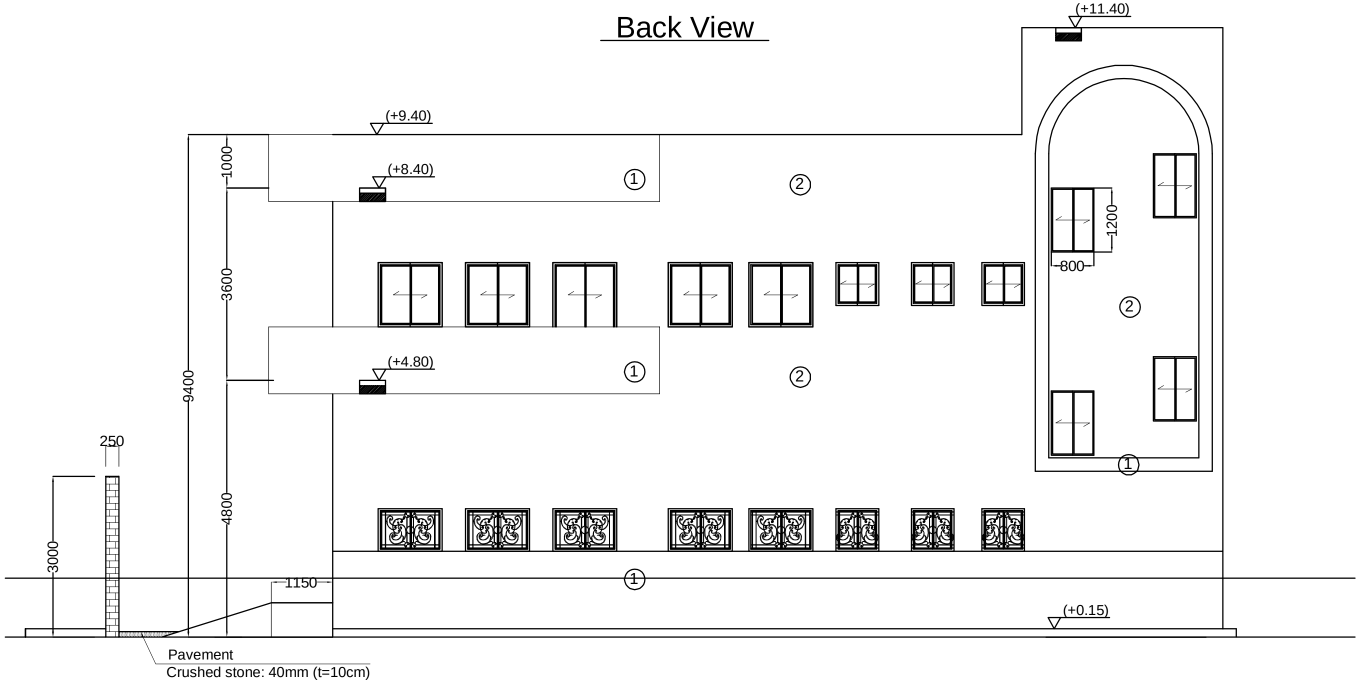
Shaded area indicates the range of second stage concrete to be placed with steel materials.

Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
Sahelyia Regulator Longitudinal section	DRW. NO. CS-3
SANYU CONSULTANTS INC.	
PREPARED BY : DATE :	CHECKED BY : DATE : APPROVED BY : DATE :

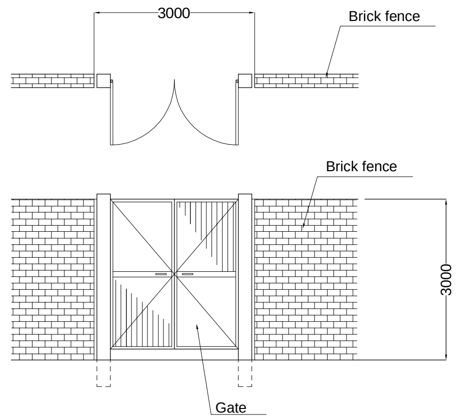
AT-2. Architecture Design of NDGRs

AT-22

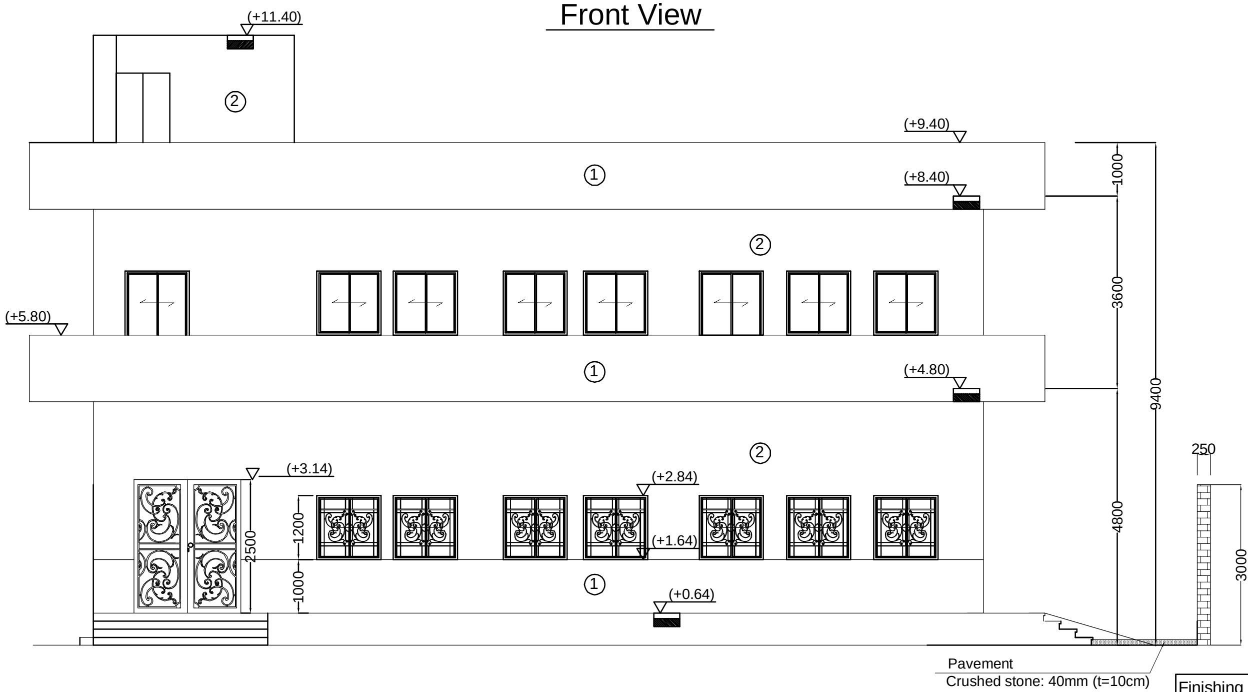
Back View



General drawing of Gate



Front View



Notes :

Design Ground Level (± 0.00) is = EL50.20

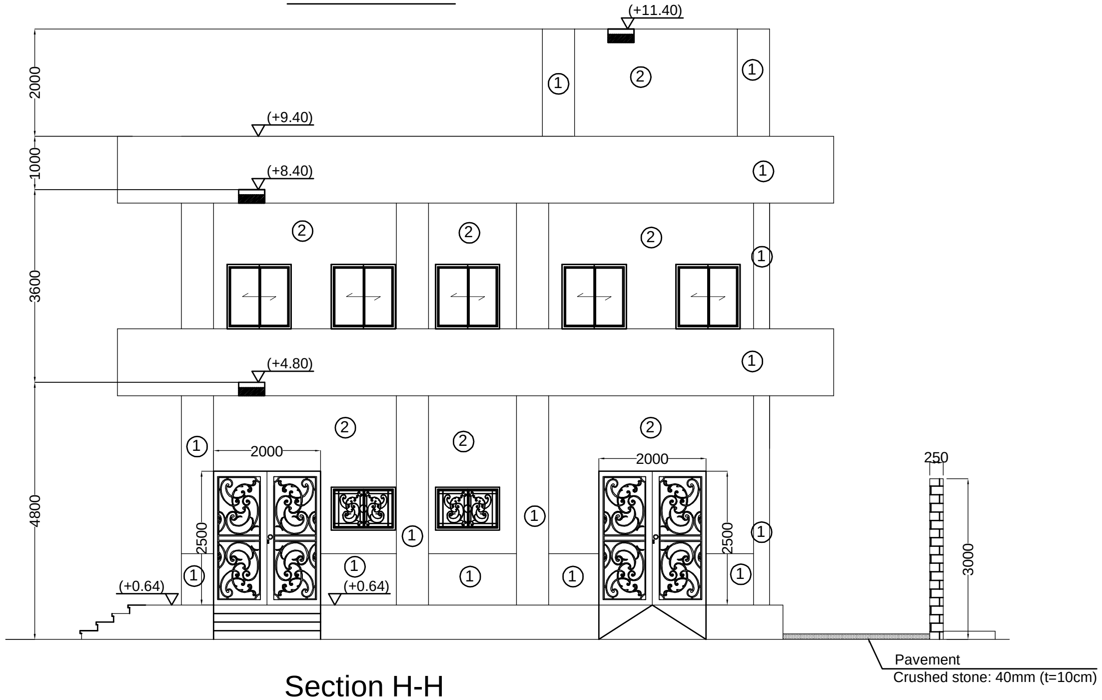
0 5,000 10,000mm

Table of Finishing

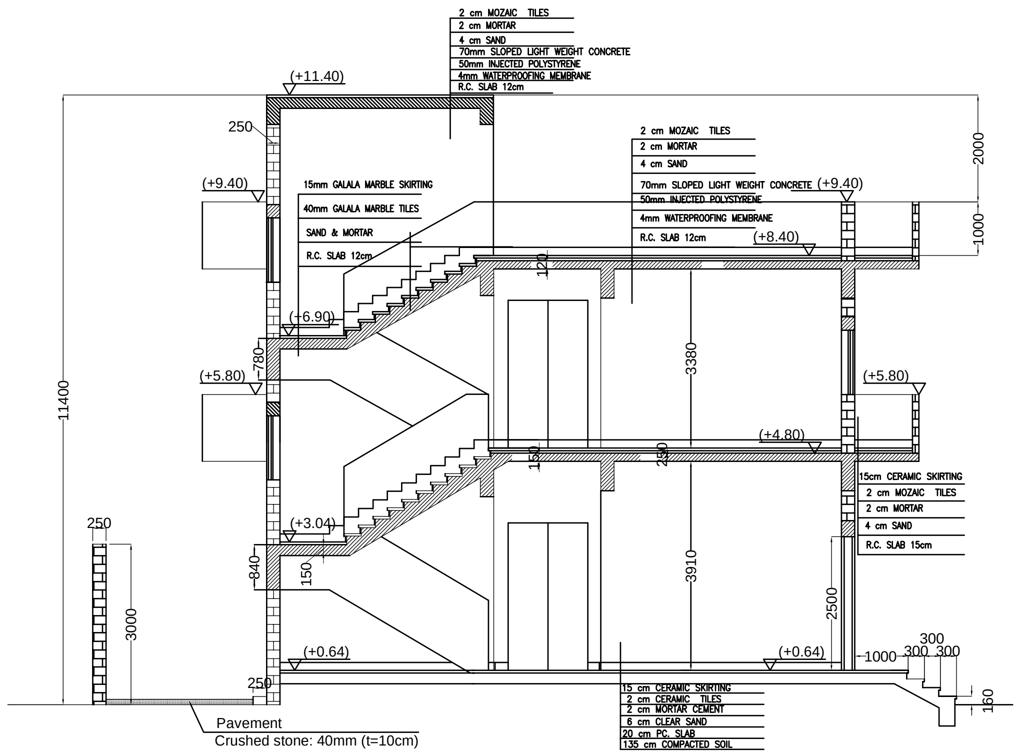
Finishing pattern	Finishing Type
①	Plastering : Kimstoon Painting With a requested color
②	Plastering : Kimstoon Painting With a different requested color

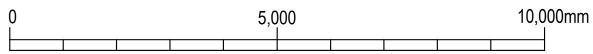
Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
Control house Views and cross sections(1/2)	DRW. NO. AC-3
SANYU CONSULTANTS INC.	
PREPARED BY :	CHECKED BY :
APPROVED BY :	
DATE :	DATE :
DATE :	DATE :

Side View



Section H-H





Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Control house
Views and cross sections (2/2)

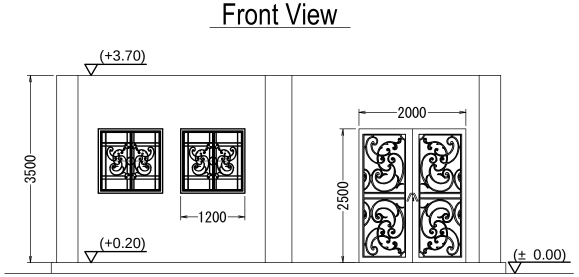
DRW. NO. AC-4

SANYU CONSULTANTS INC.

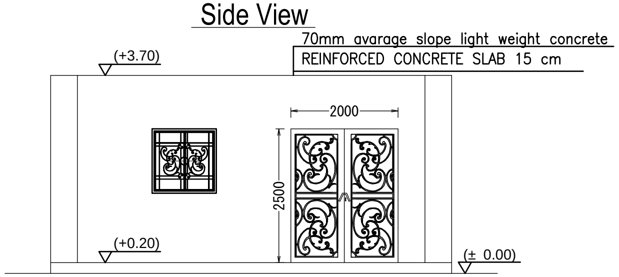
PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :

AT-24

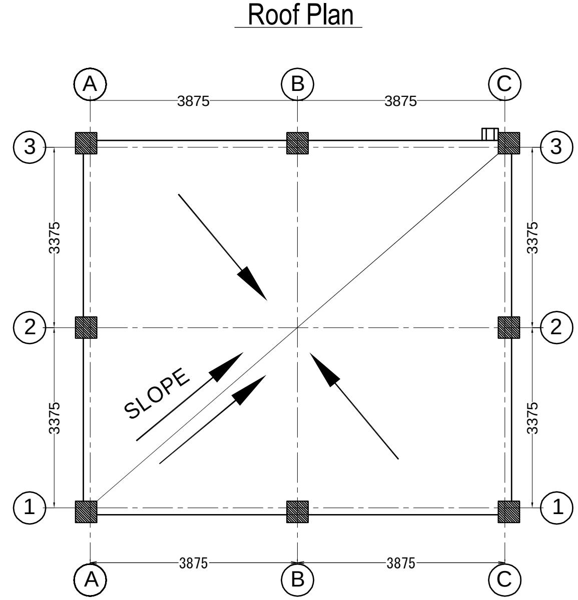
Front View



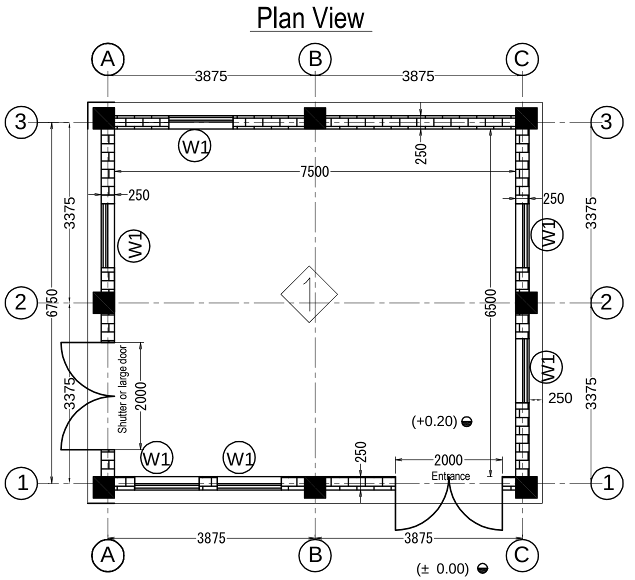
Side View



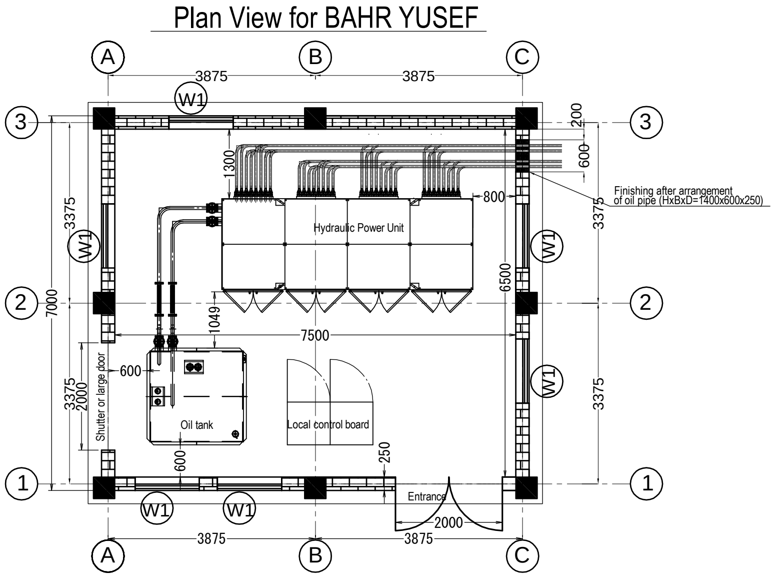
Roof Plan

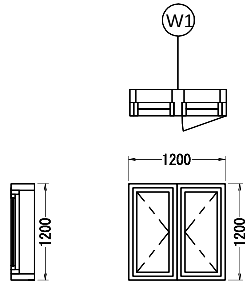


Plan View

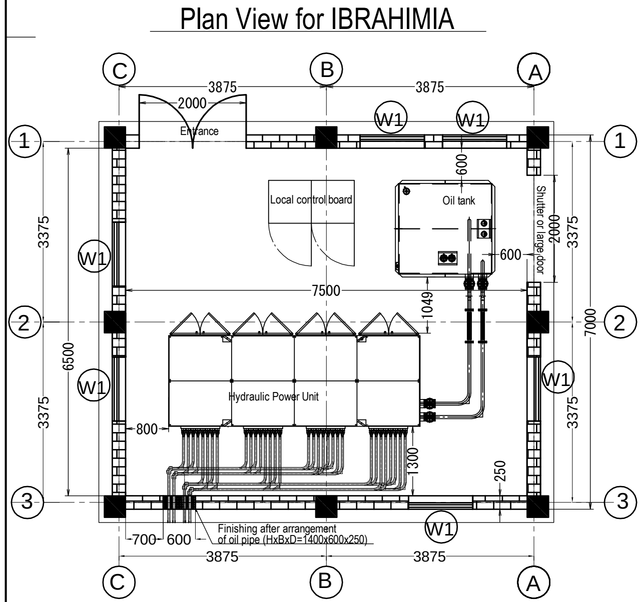


Plan View for BAHR YUSEF





Plan View for IBRAHIMIA



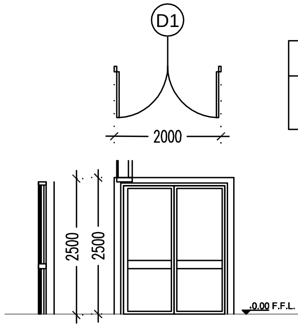
ROOM NO	WINDOW TYPE	NO OF LEAFS	WINDOWS		FRAMES	
			DIMENSIONS (MM)	MATERIAL	TYPE	MATERIAL
1	W1	2	1200*1200	AL	–	ST

Notes :

Design Ground Level (± 0.00)of Ibrahimia is EL46.20

Design Ground Level (± 0.00)of Bahr Yusef is EL47.50

Thickness of wall is 250mm, unless otherwise specified



Room No.	Room Name	Walls	Floor	Ceiling	Skirting
1	Local control room	Plastering and Painting	Helicopter finished Exposed P. concrete 20 cm Thk.	Plastering and Painting	---------

Legend

Brick wall

Reinforce concrete column

ROOM NO	DOOR TYPE	NO OF LEAFS	DOORS		FRAMES	
			DIMENSIONS (MM)	MATERIAL	TYPE	MATERIAL
1	D1	-	2000*2500	ST	–	ST

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Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Local control house
General layout

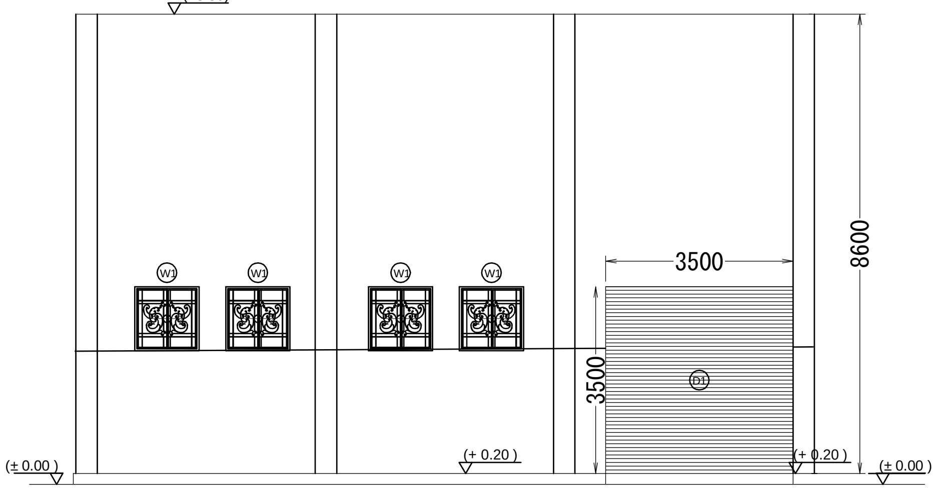
DRW. NO. AL-1

SANYU CONSULTANTS INC.

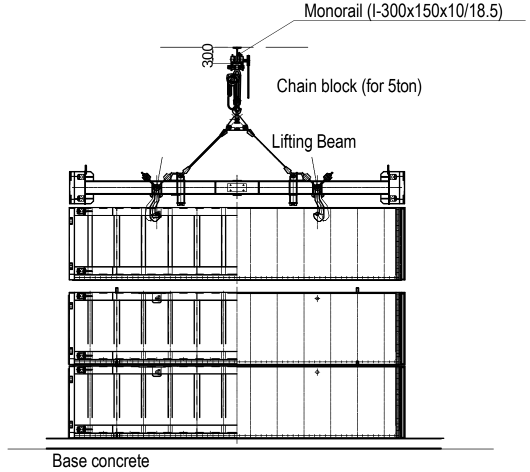
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

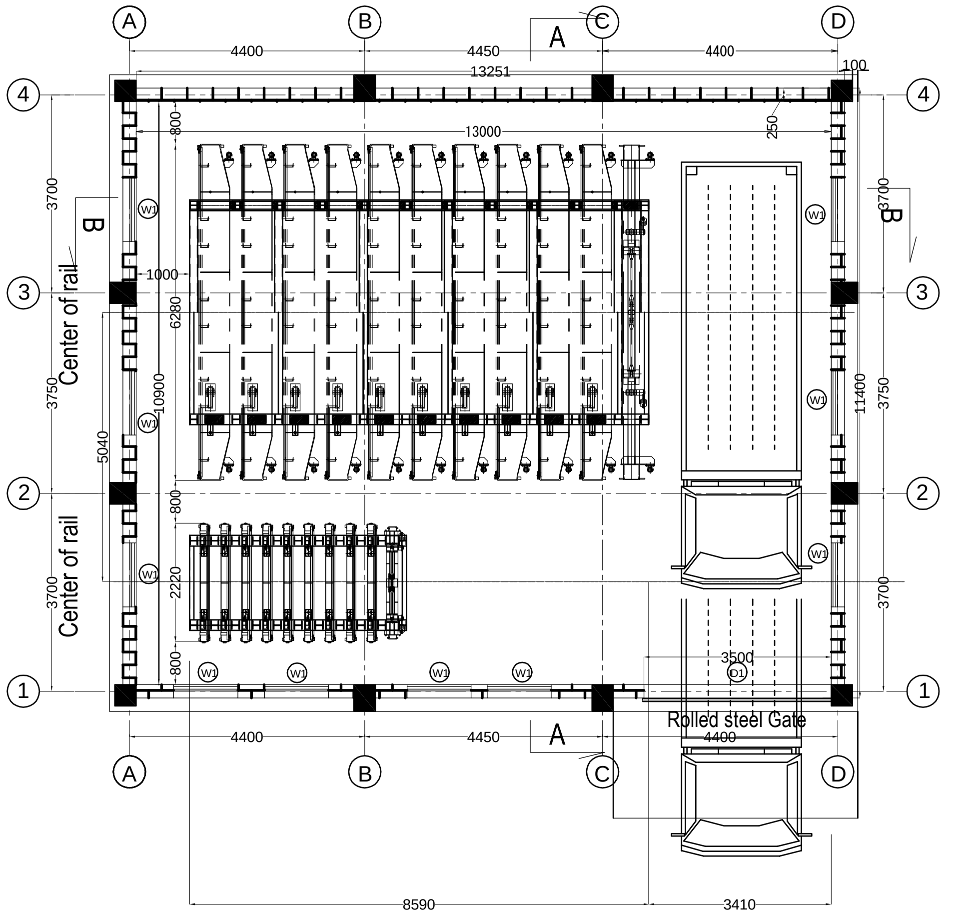
AT-25

Front View

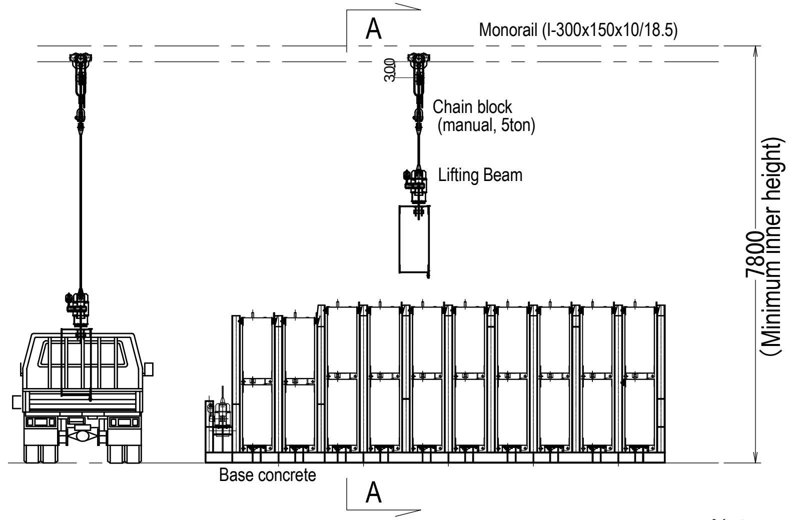


Section A-A





Section B-B



Notes :

Design Ground Level (± 0.00) is = EL50.20

Legend

- Brick wall
- Reinforce concrete column

0 5,000mm

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Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

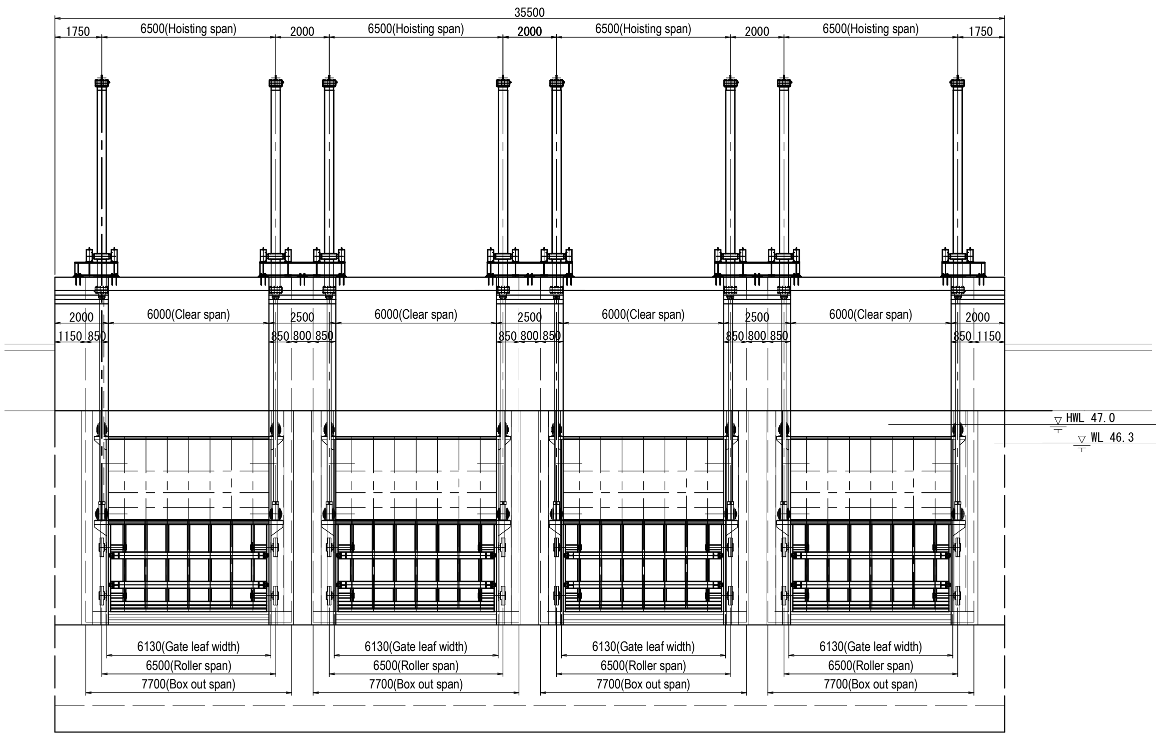
Stop log house Views and cross sections	DRW. NO. AS-1

SANYU CONSULTANTS INC.

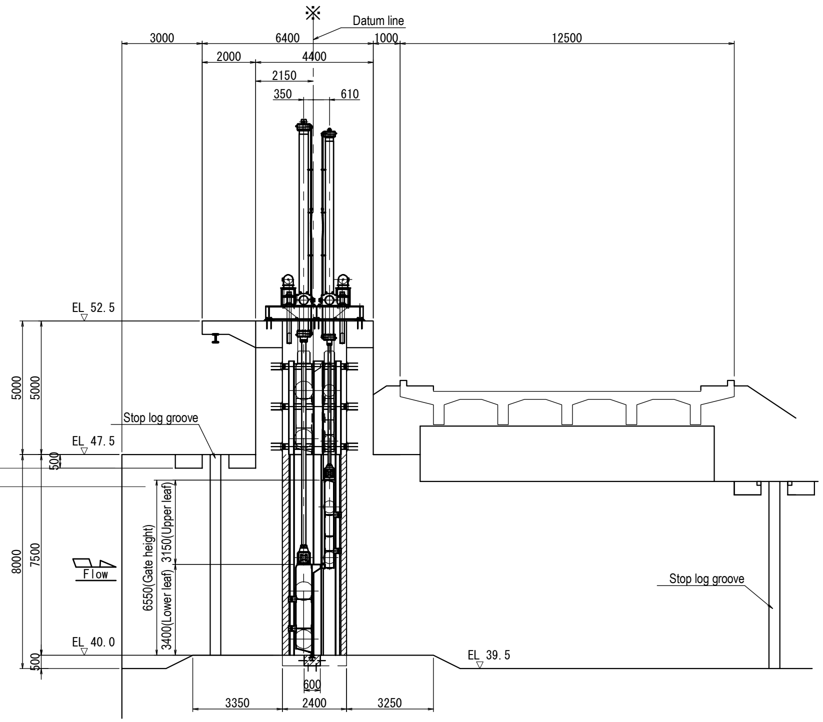
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

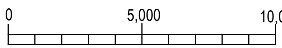
AT-3. Mechanical and Electric Works for Gate

Front elevation



Side view





Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

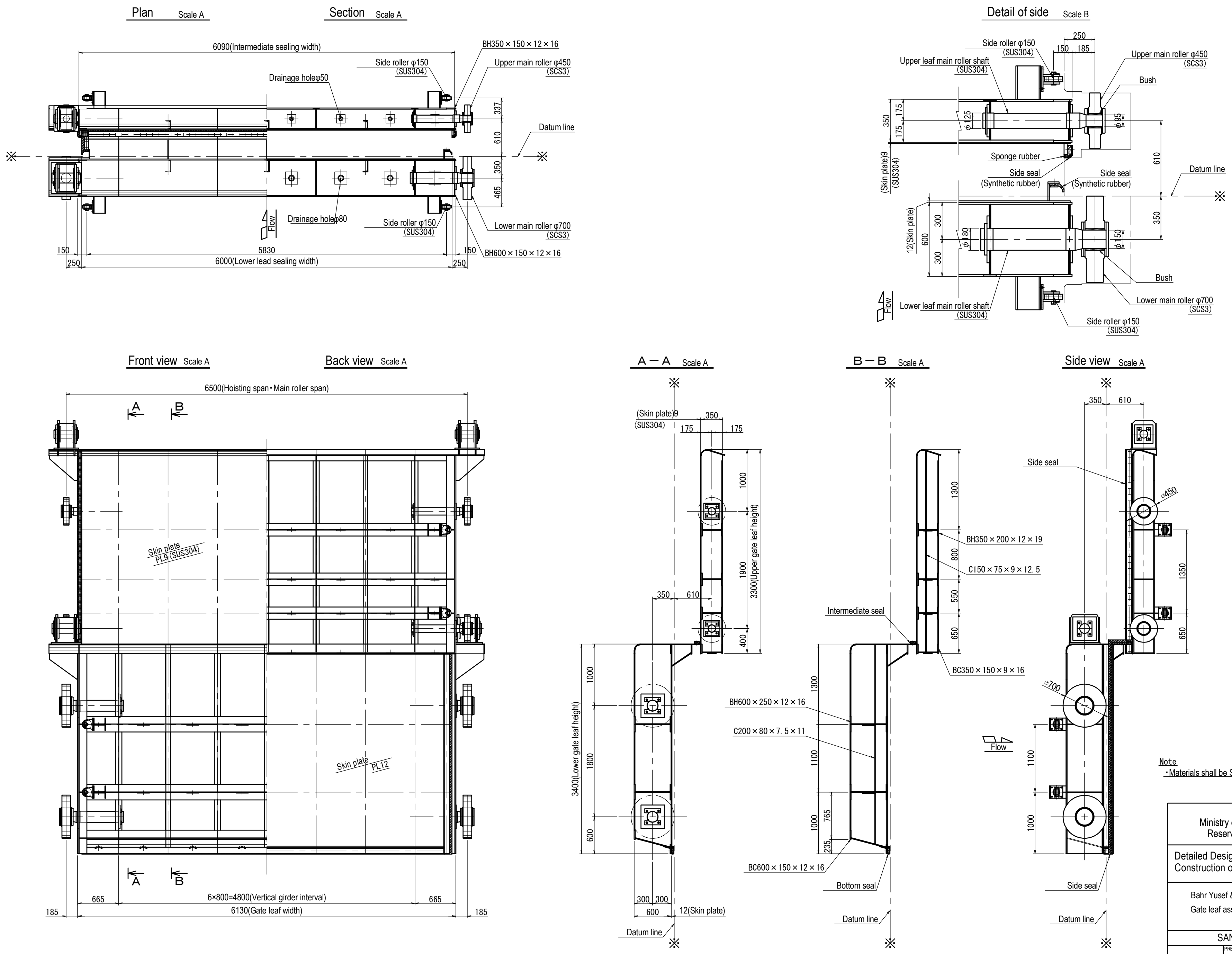
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Bahr Yusef & Ibrahimia Regulator General drawing	DRW. NO MBI-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-28



Note
・Materials shall be SS400 unless otherwise specified.

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Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

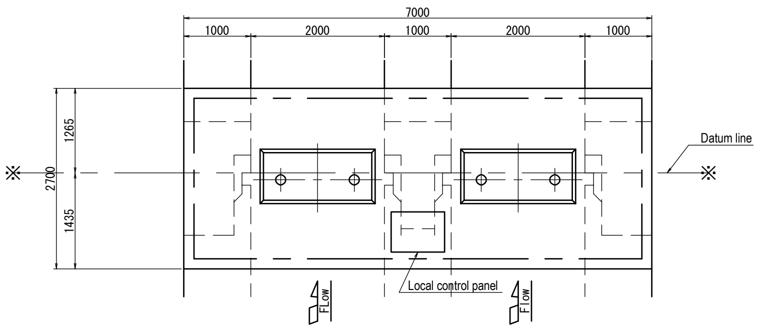
Bahr Yusef & Ibrahimia Regulator Gate leaf assembling	DRW. NO. MBI-2

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-29

Plan

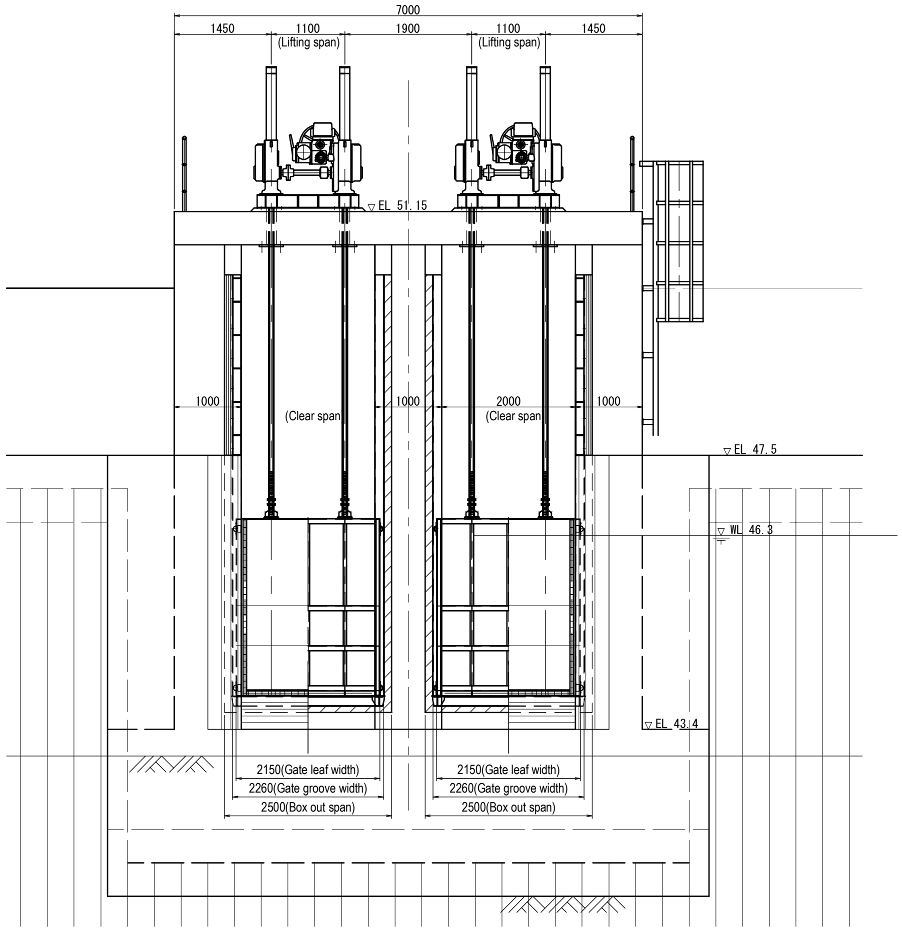


Design Condition

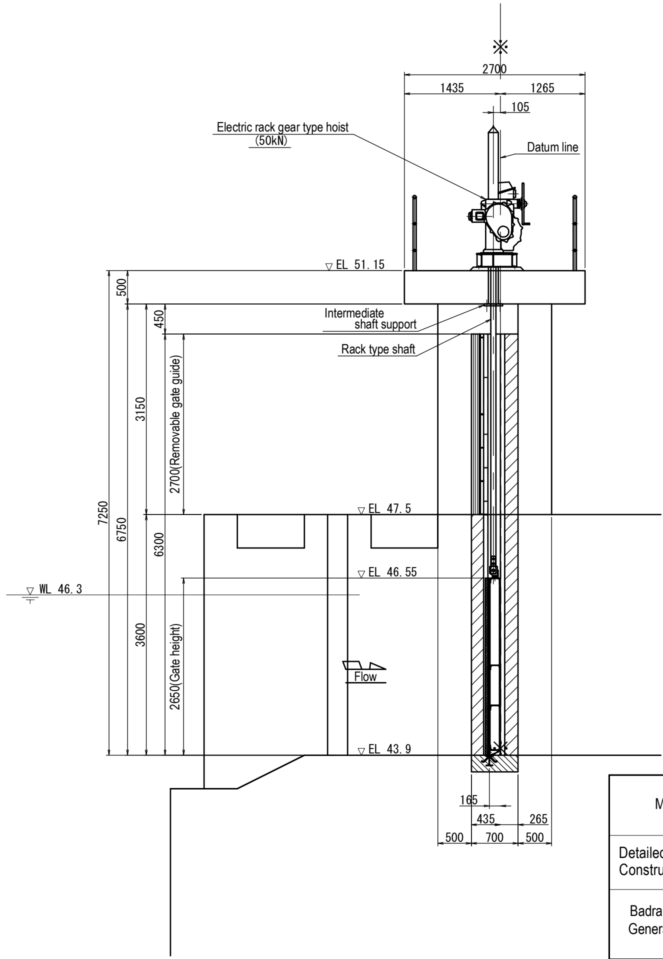
Type	Slide gate	
Number of gate	2	
Clear span	2.000 m	
Gate height	2.650 m	
Design water depth	2.650 m	
Operation depth	Open	2.650 m
	Close	2.650 m
Sediment height	0.300 m	
Seal type	Upstream 3-side sealing	
Hoist type	Electric rack gear type	
Operating speed	0.3 m/min	
Lifting height	3.600 m	
Operation type	Local and remote control	

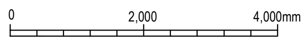
Front elevation

Badraman



Side view





Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

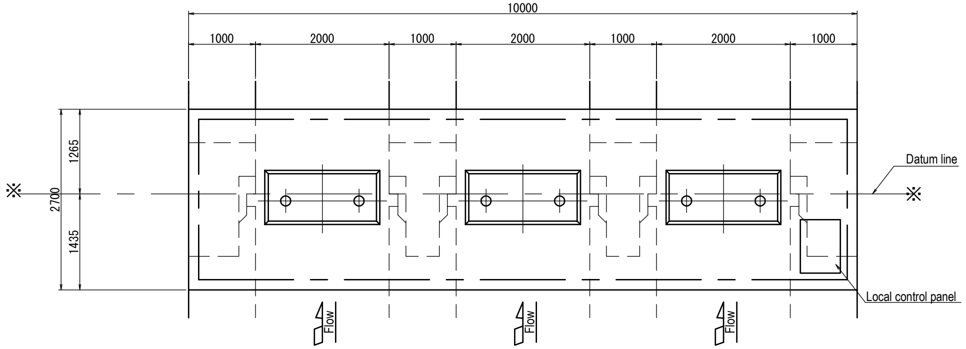
Badraman Regulator (Badraman) General drawing	DRW. NO MN-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-30

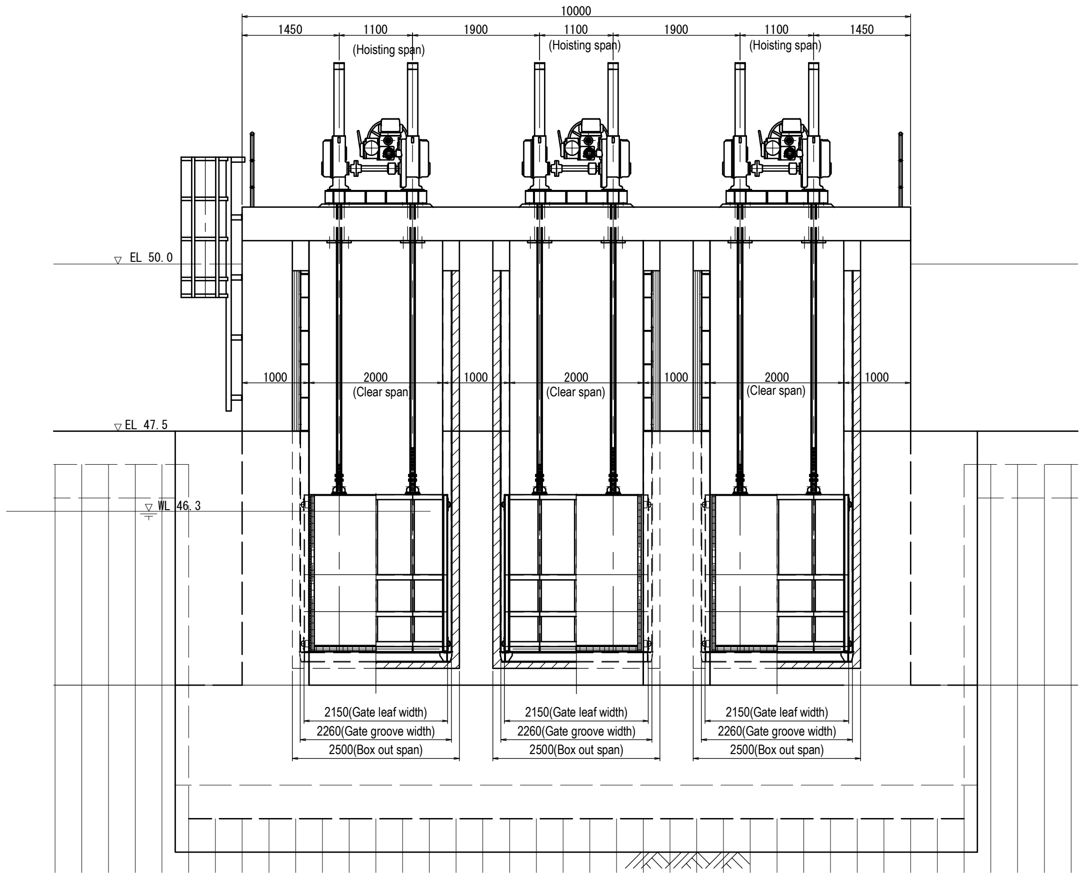
Plan



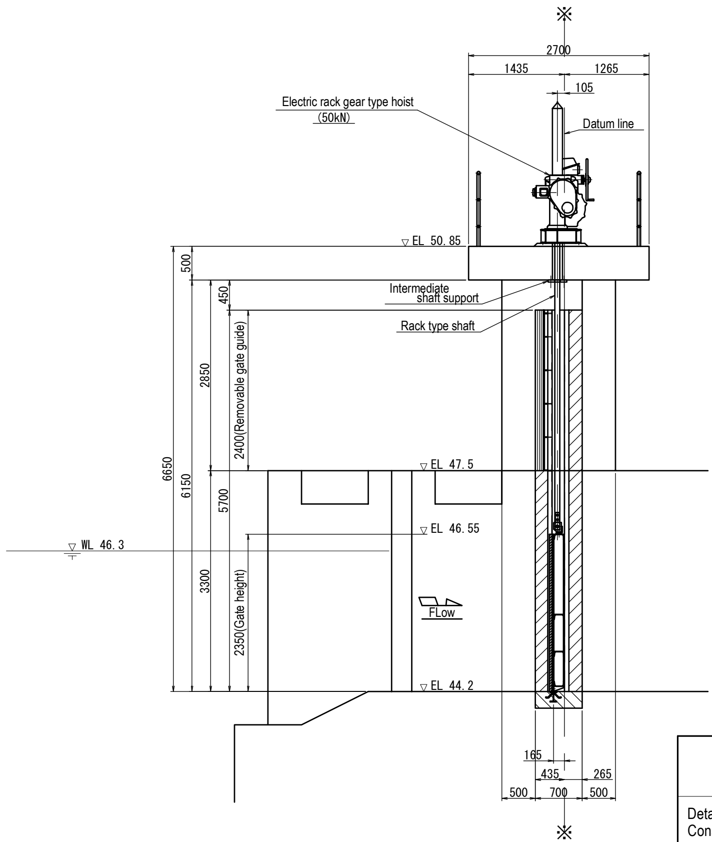
Design Condition		
Type		Slide gate
Number of gate		3
Clear span		2.000 m
Gate height		2.350 m
Design water depth		2.350 m
Operation depth	Open	2.350 m
	Close	2.350 m
Sediment height		0.300 m
Seal type		Upstream 3-side sealing
Hoist type		Electric rack gear type
Operating speed		0.3 m/min
Lifting height		3.300 m
Operation type		Local and remote control

Front view

Dirautiah



Side view



0 2,000 4,000mm

Arab Republic of Egypt
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Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

Badraman Regulator (Diroutiah)
General drawing

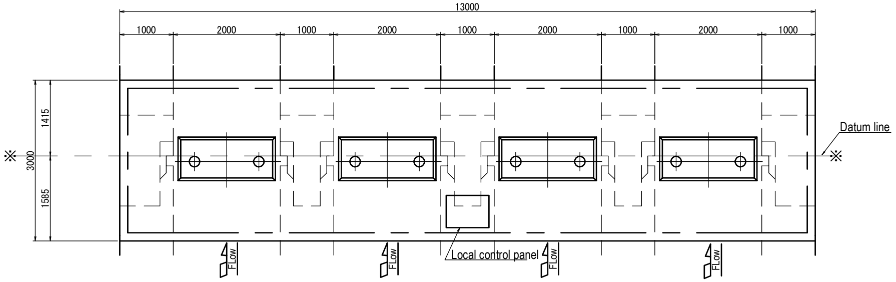
DRW. NO
MD-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

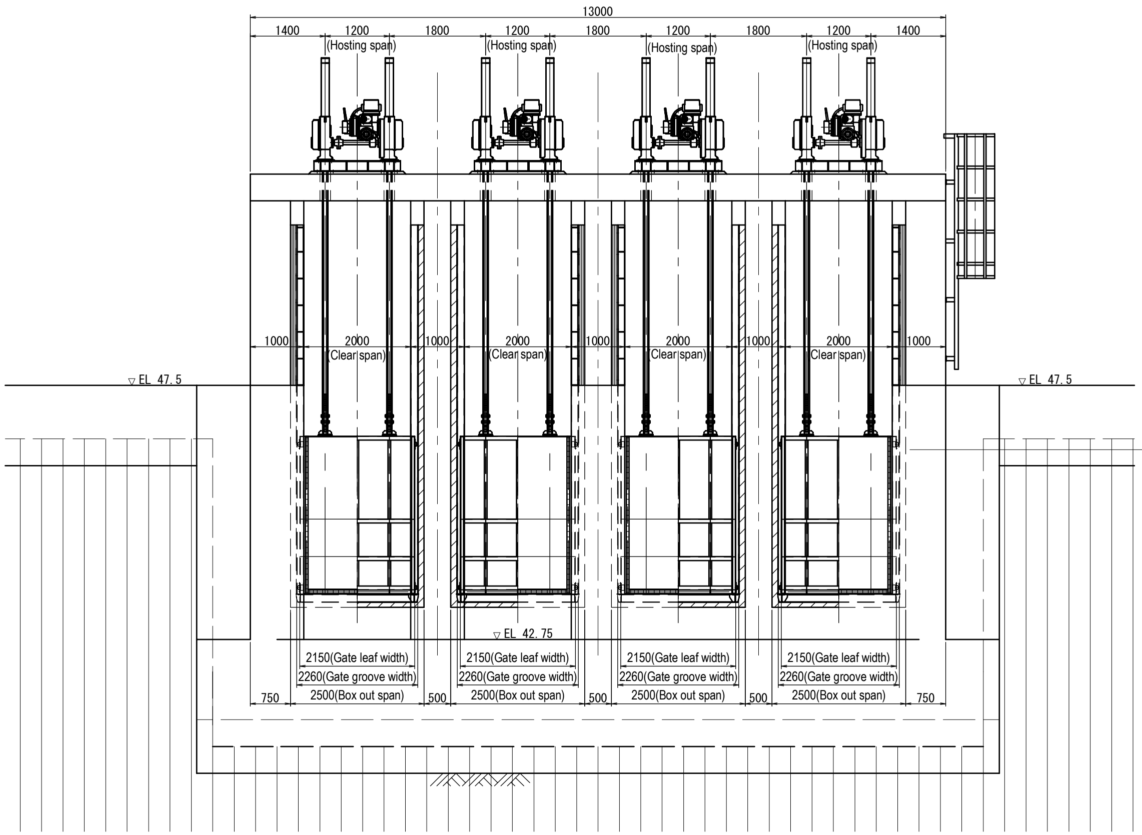
AT-31

Plan

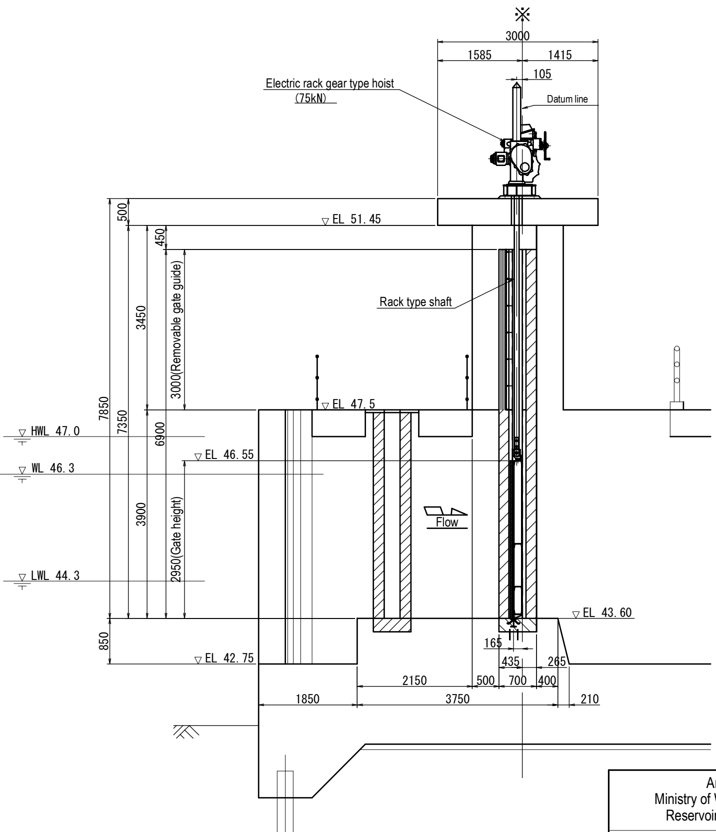


Design Condition		
Type	Slide gate	
Number of gate	4	
Clear span	2.000 m	
Gate height	2.950 m	
Design water depth	2.950 m	
Operation depth	Open	2.950 m
	Close	2.950 m
Sediment height	0.300 m	
Seal type	Upstream 3-side sealing	
Hoist type	Electric rack gear type	
Operating speed	0.3 m/min	
Lifting height	3.900 m	
Operation type	Local and remote control	

Front elevation



Side view

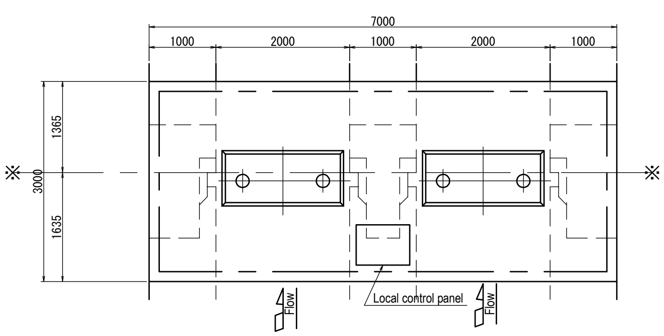


0 2,000 4,000mm

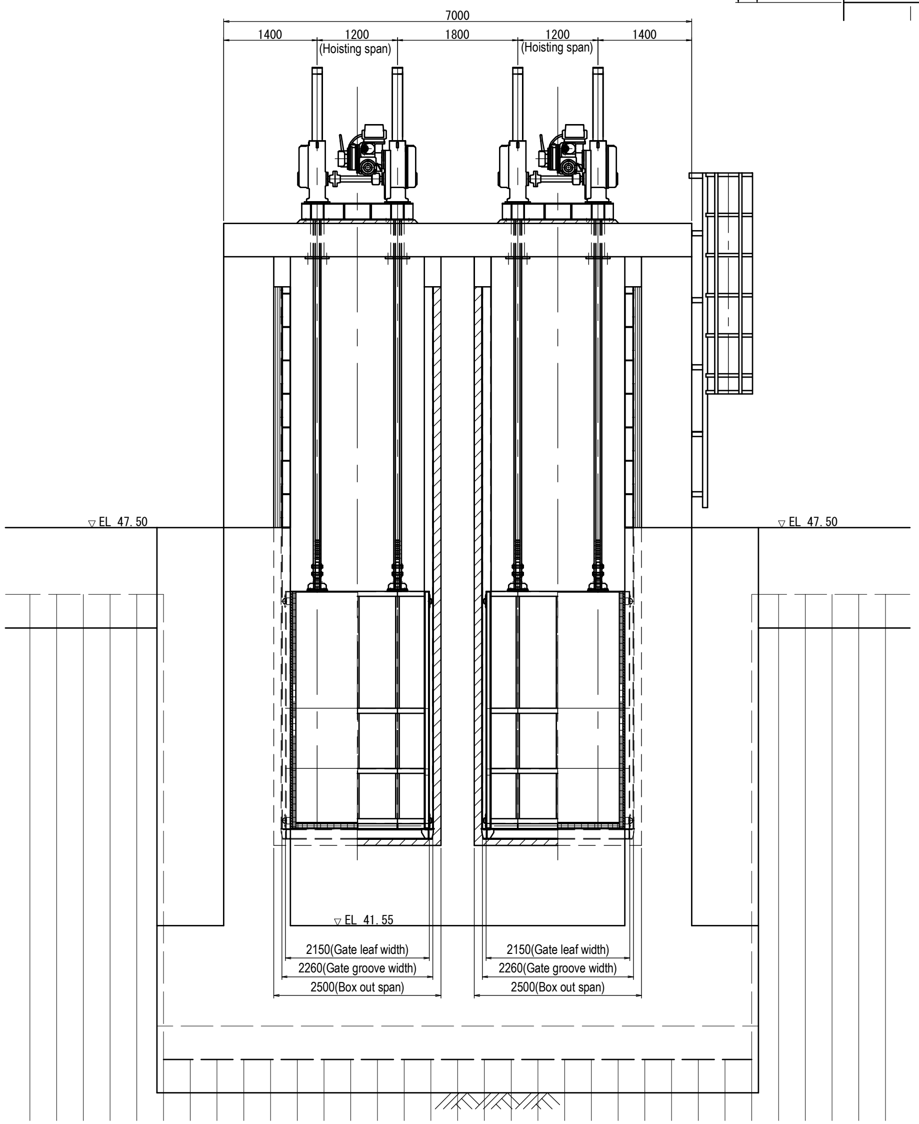
Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
Abo Gabal Regulator General drawing	DRW. NO MA-1
SANYU CONSULTANTS INC.	
PREPARED BY : / CHECKED BY : / APPROVED BY :	
DATE : / DATE : / DATE : / DATE :	

AT-32

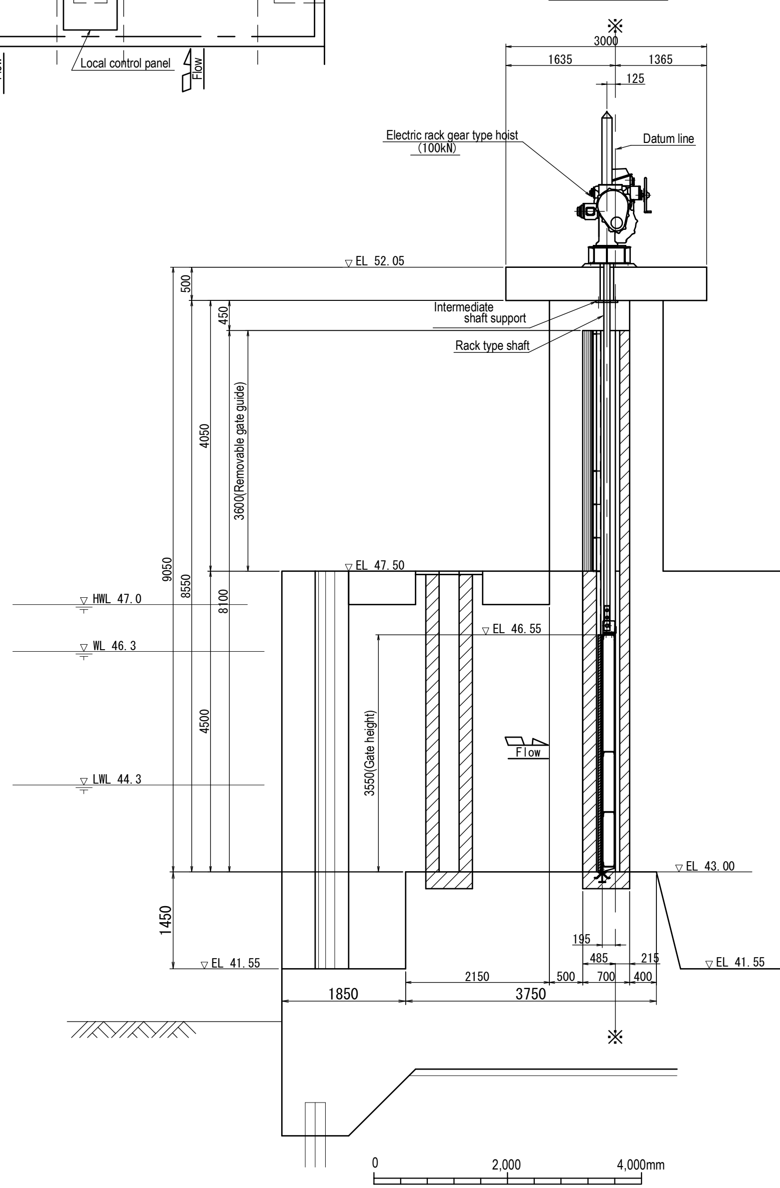
Plan



Front view



Side view



Design Condition		
Type	Slide gate	
Number of gate	2	
Clear span	2.000 m	
Gate height	3.550 m	
Design water depth	3.550 m	
Operation depth	Open	3.550 m
	Close	3.550 m
Sediment height	0.300 m	
Seal type	Upstream 3-side sealing	
Hoist type	Electric rack gear type	
Operating speed	0.3 m/min	
Lifting height	4.500 m	
Operation type	Local and remote control	

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

Sahelyia Regulator
General drawing

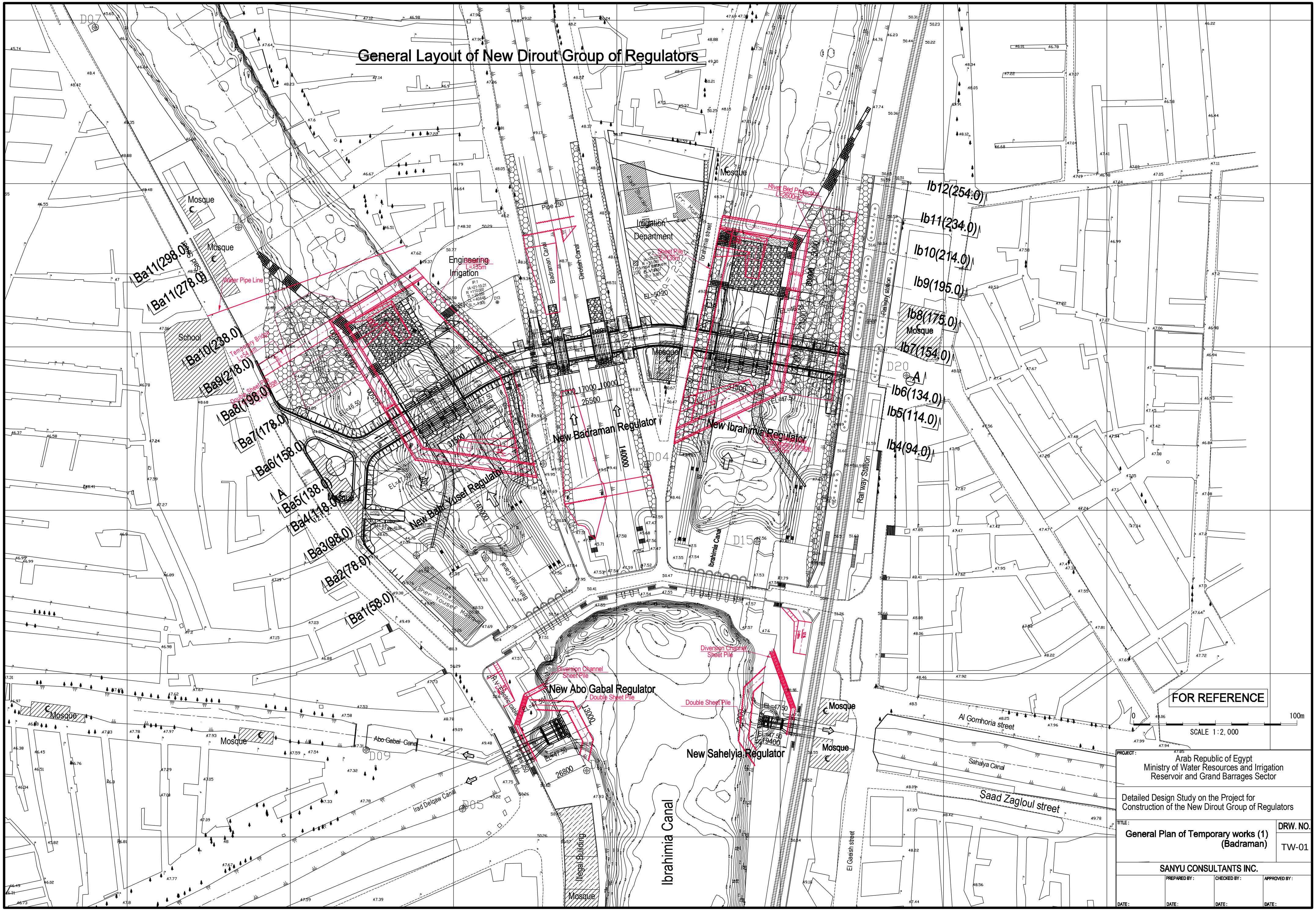
DRW. NO
MS-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

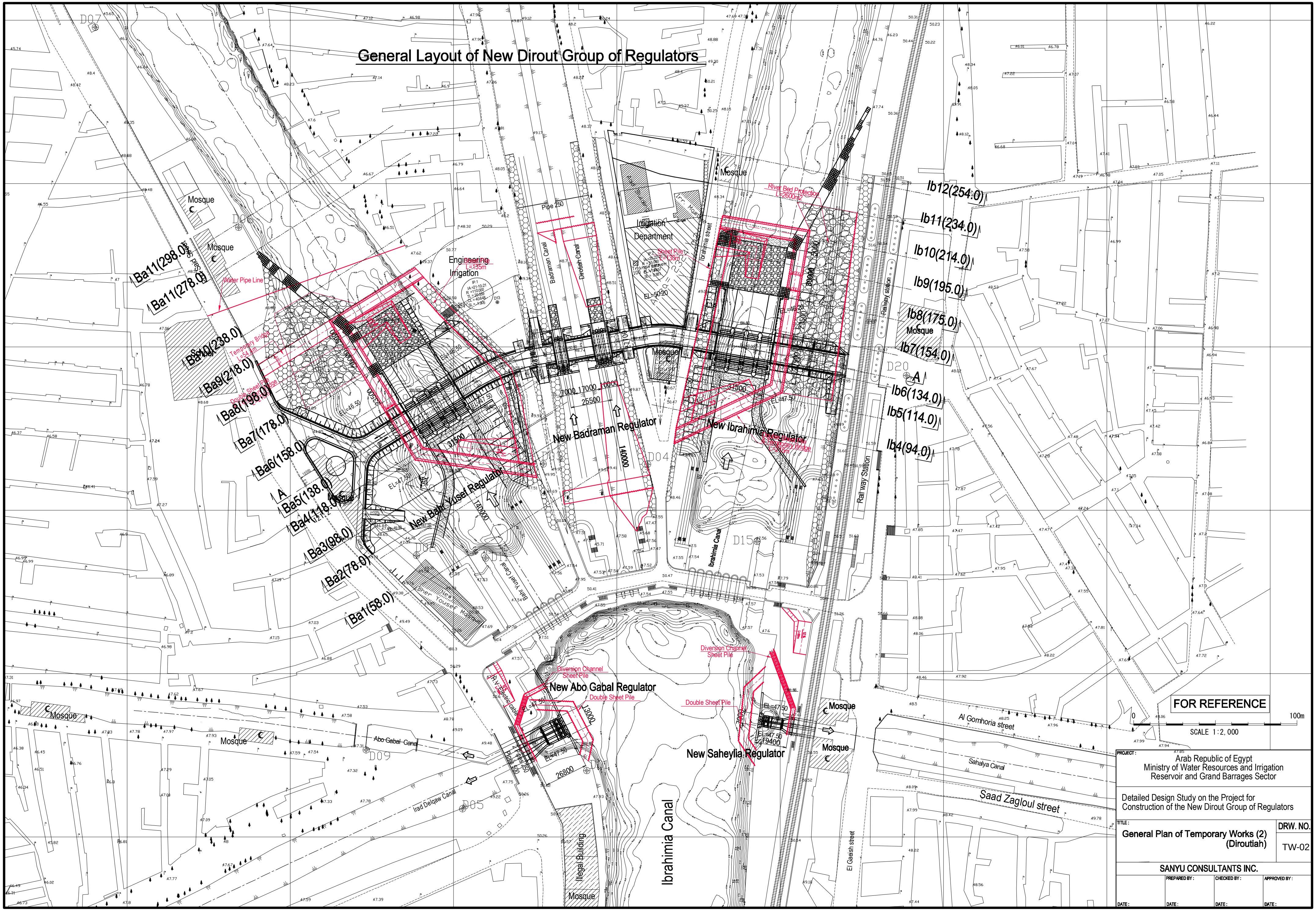
AT-4. Temporary Works

AT-34


General Layout of New Dirout Group of Regulators
New Badraman Regulator
New Ibrahimia Regulator
New Bahr Yusef Regulator
New Abo Gabal Regulator
New Sahelyia Regulator
Ba11(298.0)
Ba11(278.0)
Ba10(238.0)
Ba9(218.0)
Ba8(198.0)
Ba7(178.0)
Ba6(158.0)
Ba5(138.0)
Ba4(118.0)
Ba3(98.0)
Ba2(78.0)
Ba1(58.0)
Ib12(254.0)
Ib11(234.0)
Ib10(214.0)
Ib9(195.0)
Ib8(175.0)
Ib7(154.0)
Ib6(134.0)
Ib5(114.0)
Ib4(94.0)
Mosque
School
Engineering Irrigation
Irrigation Department
Water Pipe Line
Pipe 250
Badraman Canal
Dirout Canal
Ibrahimia street
Ibrahimia Canal
Railway Station
Rail way Station
Bahr Yusef Canal
River Bed Protection
Sheet Pile
Temporary Bridge
Diversion Channel Sheet Pile
Double Sheet Pile
Abo Gabal Canal
Irad Delgaw Canal
Illegal Building
Al Gomhoria street
Sahalya Canal
Saad Zagloul street
El Gaesh street
FOR REFERENCE
0
100m
SCALE 1:2,000
PROJECT :
Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector
Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators
TITLE :
General Plan of Temporary works (1)
(Badraman)
DRW. NO.
TW-01
SANYU CONSULTANTS INC.
PREPARED BY :
CHECKED BY :
APPROVED BY :
DATE :
DATE :
DATE :
DATE :

AT-35

General Layout of New Dirout Group of Regulators



PROJECT :
Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

TITLE :	DRW. NO.
General Plan of Temporary Works (2) (Diroutiah)	TW-02

SANYU CONSULTANTS INC.

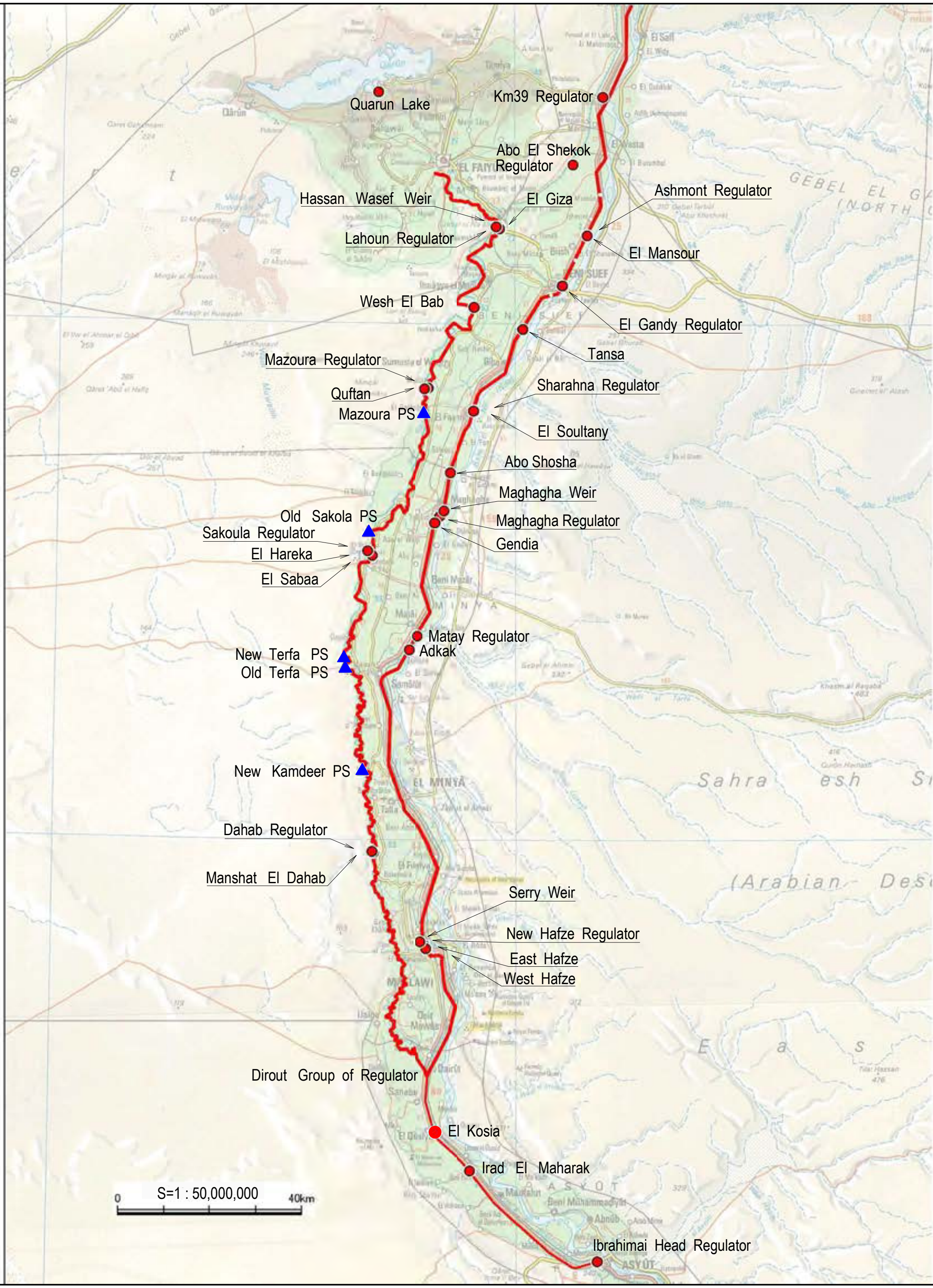
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

AT-5. Water Management System

PLATE NO. : 1

Project Location Map

S=1 : 50,000,000



LEGEND

- : MAIN CANAL
- : REGULATOR, INTAKE, WEIR, LAKE
- : PUMP STATION

AT-37

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

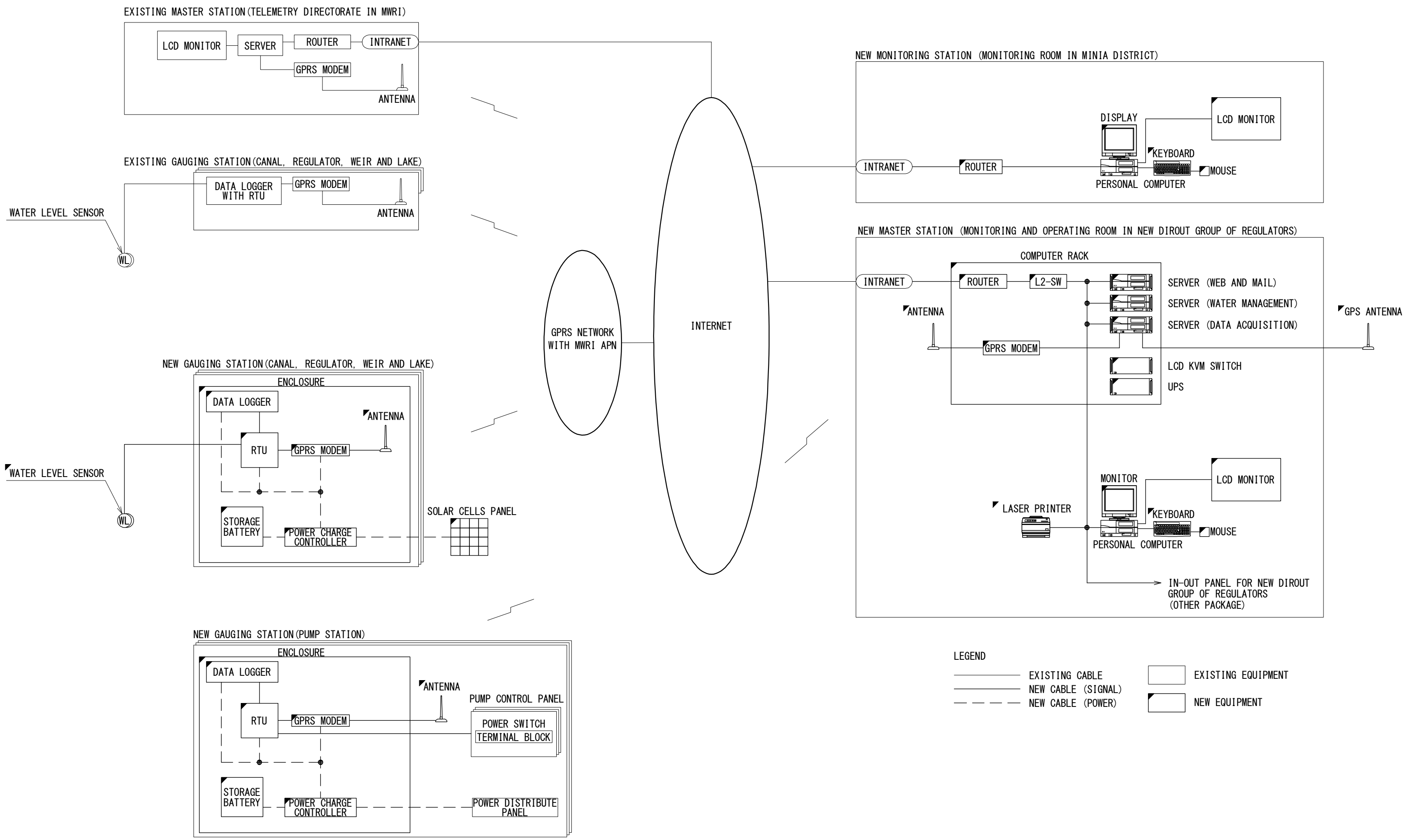
Project Location Map	DRW. NO. WM-1

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

PLATE NO.: 2

SYSTEM DIAGRAM



AT-38

QUANTITY OF GAUGING STATION

TYPE-A (ONE WATER LEVEL SENSOR)

	IBRAHIMIA	BAHR YUSEF
ASSIUT	0	0
WEST MINIA	1	0
EAST MINIA	1	0
BENI SUEF	0	1
FAYOUM	0	1

TYPE-B (TWO WATER LEVEL SENSORS)

	IBRAHIMIA	BAHR YUSEF
ASSIUT	3	0
WEST MINIA	0	5
EAST MINIA	7	0
BENI SUEF	7	7
FAYOUM	0	0

TYPE-PUMP

	BAHR YUSEF
ASSIUT	0
WEST MINIA	3
EAST MINIA	0
BENI SUEF	2
FAYOUM	0

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for
Construction of the New Dirout Group of Regulators

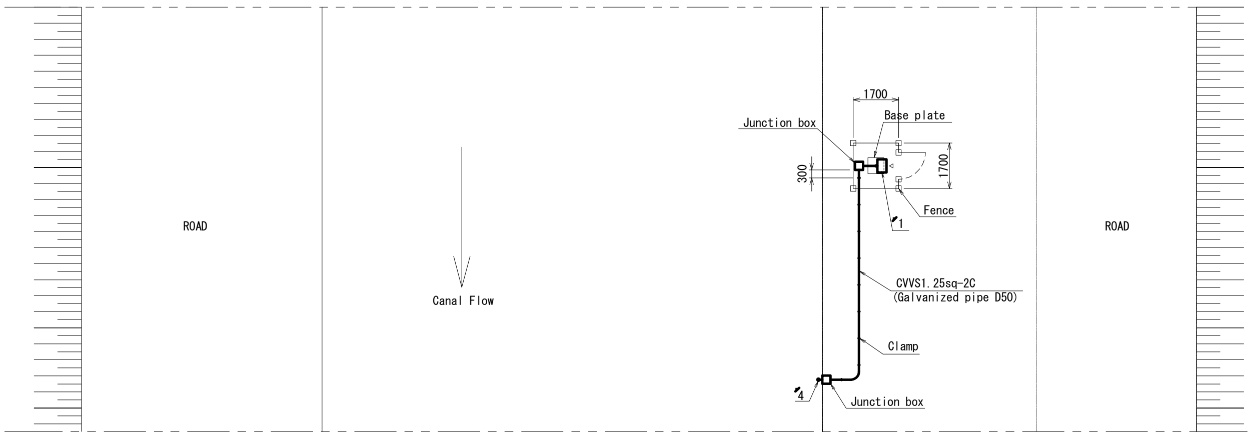
SYSTEM DIAGRAM

DRW. NO. WM-2

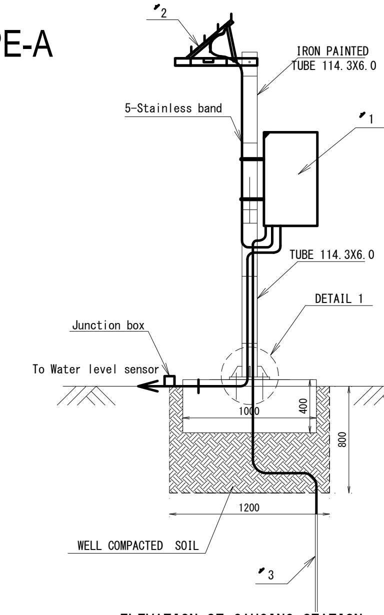
SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

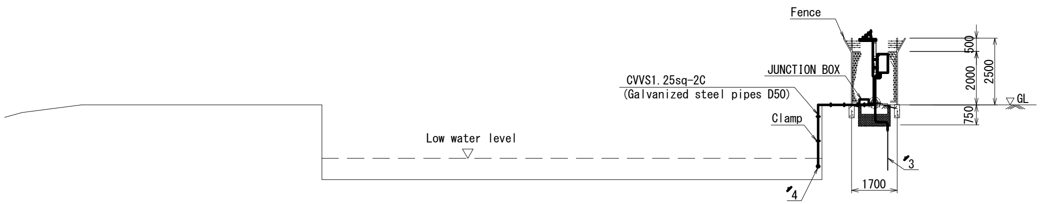
TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-A



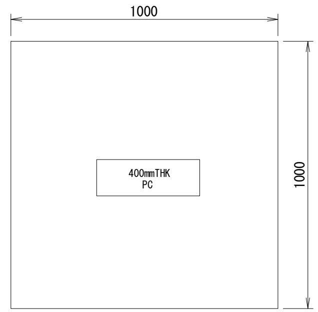
TYPICAL LOCATION
(1:100)



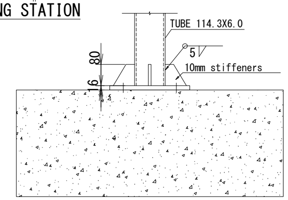
ELEVATION OF GAUGING STATION
(1:20)



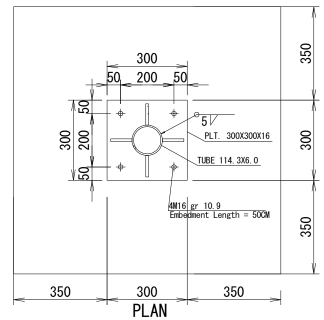
CROSS SECTION
(1:100)



PLAIN CONCRETE DIMENSIONS
(1:10)



ELEVATION
(1:10)



PLAN
(1:10)

NOTE :
a) Fence must be set around the gauging station
b) When the facility installed can be identified from outside, special precautionary measures from theft should accompany itself
c) Especially, the measurement device installed on the outside must set up where it is not stolen easily
d) Outdoor wiring of cable must use the pipe or the cable trough
e) Indoor wiring of cable must use the cable duct or pipe
f) JUNCTION BOX must be set up when there is bending of the cable three times
g) Pipe must be the stainless steel or the galvanizing steel
h) The total amount of the sectional area of the cable must be adjusted to 30[%] or less of the sectional area in pipe, duct and trough
i) Pipe must be clasped by holdfast. And, holdfast should be clamped with the anchor bolt.
j) Clamping pipe by the holdfast from JUNCTION BOX within 500[mm]
k) The holdfast is clasped by intervals within 1500[mm]
l) Length of cable must be less than 100[m]
m) Copper plate for the grounding should be installed near the station, and laid on underground 700 mm or more
n) Resistance of copper plate should be less than 100 [ohm]
o) Solar panel should be set up in the direction where the cell side is facing to the sun
p) Irradiating sunlight onto cell side of solar panels should not be obstructed
q) The inclination angle of solar panel must be adjusted after installed
r) Equipments must protect from the induced lightning

LIST OF EQUIPMENT

No	ITEM	REMARK
1	ENCLOSURE	
2	SOLAR PANEL	
3	GROUNDING ROD	
4	WATER LEVEL SENSOR	

LEGEND :
- NEW CABLE
- NEW EQUIPMENT

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Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

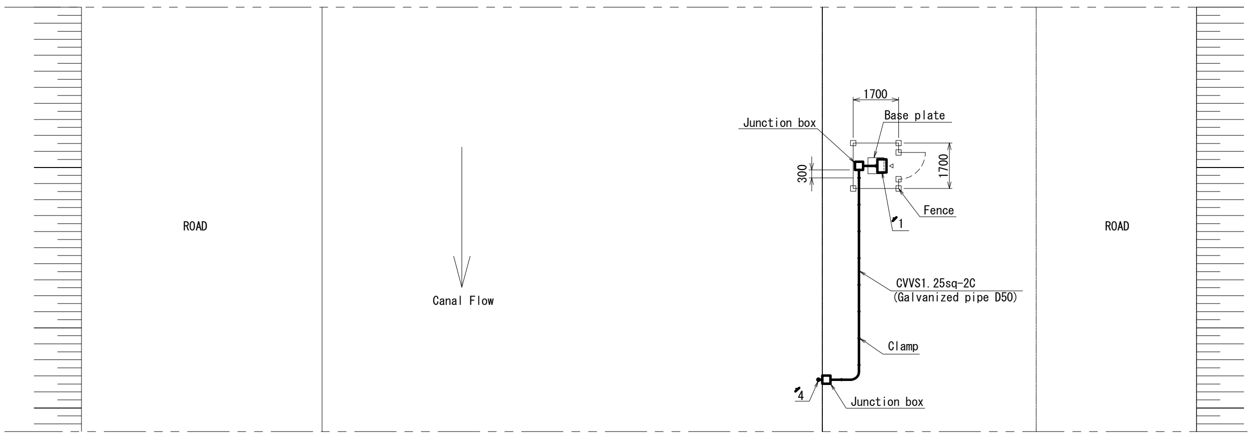
TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-A	DRW. NO. WM-3

SANYU CONSULTANTS INC.

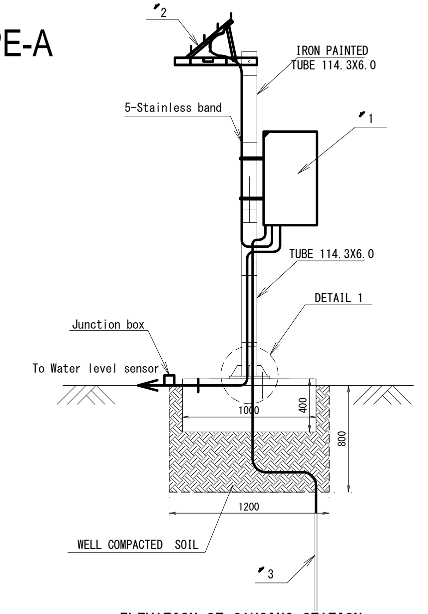
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

PLATE NO.: 3

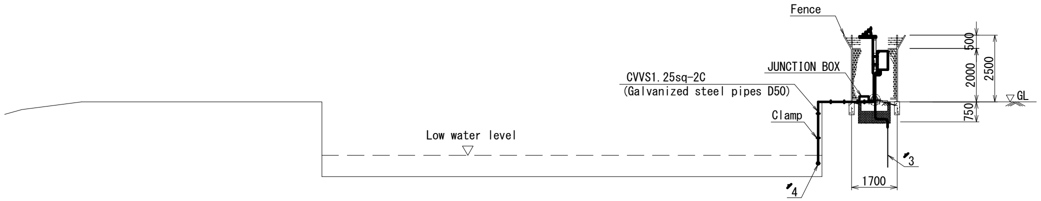
TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-A



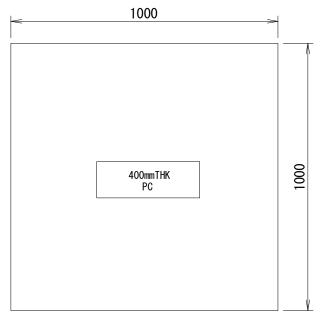
TYPICAL LOCATION
(1:100)



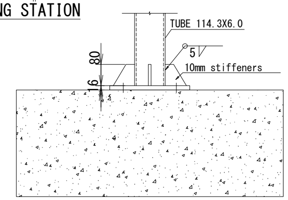
ELEVATION OF GAUGING STATION
(1:20)



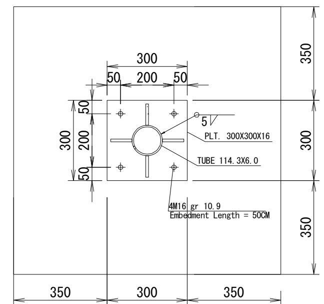
CROSS SECTION
(1:100)



PLAIN CONCRETE DIMENSIONS
(1:10)



ELEVATION
(1:10)



PLAN
(1:10)

NOTE :
a) Fence must be set around the gauging station
b) When the facility installed can be identified from outside, special precautionary measures from theft should accompany itself
c) Especially, the measurement device installed on the outside must set up where it is not stolen easily
d) Outdoor wiring of cable must use the pipe or the cable trough
e) Indoor wiring of cable must use the cable duct or pipe
f) JUNCTION BOX must be set up when there is bending of the cable three times
g) Pipe must be the stainless steel or the galvanizing steel
h) The total amount of the sectional area of the cable must be adjusted to 30[%] or less of the sectional area in pipe, duct and trough
i) Pipe must be clasped by holdfast. And, holdfast should be clamped with the anchor bolt.
j) Clamping pipe by the holdfast from JUNCTION BOX within 500[mm]
k) The holdfast is clasped by intervals within 1500[mm]
l) Length of cable must be less than 100[m]
m) Copper plate for the grounding should be installed near the station, and laid on underground 700 mm or more
n) Resistance of copper plate should be less than 100 [ohm]
o) Solar panel should be set up in the direction where the cell side is facing to the sun
p) Irradiating sunlight onto cell side of solar panels should not be obstructed
q) The inclination angle of solar panel must be adjusted after installed
r) Equipments must protect from the induced lightning

LIST OF EQUIPMENT

No	ITEM	REMARK
1	ENCLOSURE	
2	SOLAR PANEL	
3	GROUNDING ROD	
4	WATER LEVEL SENSOR	

LEGEND :

NEW CABLE

NEW EQUIPMENT

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-A

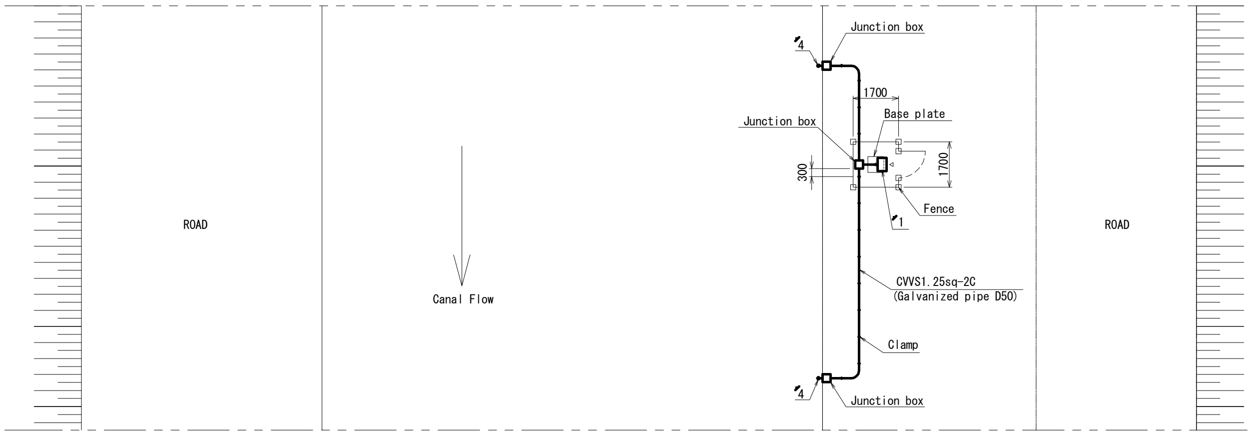
DRW. NO.
WM-3

SANYU CONSULTANTS INC.

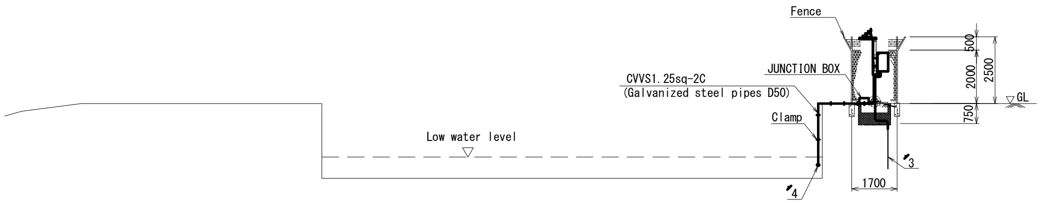
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

PLATE NO.: 4

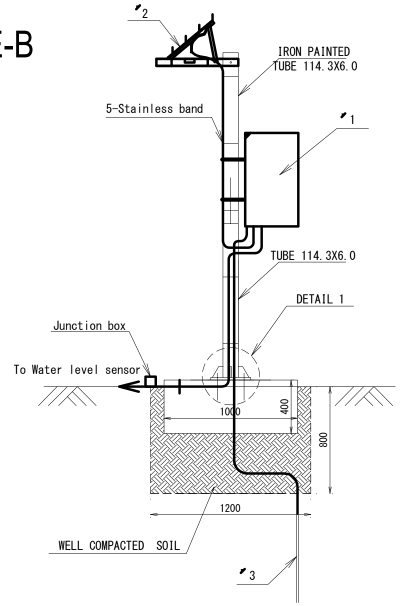
TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-B



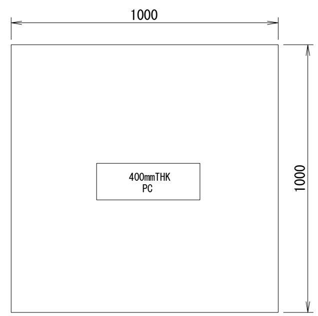
TYPICAL LOCATION
(1:100)



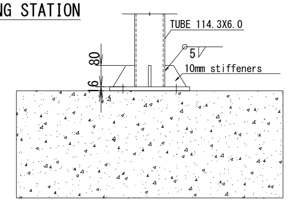
CROSS SECTION
(1:100)



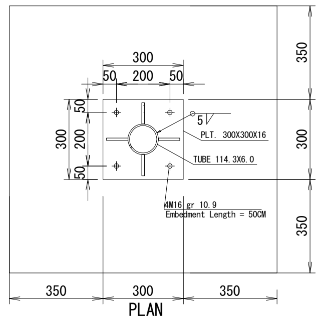
ELEVATION OF GAUGING STATION
(1:20)



PLAIN CONCRETE DIMENSIONS
(1:10)



ELEVATION
(1:10)



PLAN
(1:10)

NOTE :
a) Fence must be set around the gauging station
b) When the facility installed can be identified from outside, special precautionary measures from theft should accompany itself
c) Especially, the measurement device installed on the outside must set up where it is not stolen easily
d) Outdoor wiring of cable must use the pipe or the cable trough
e) Indoor wiring of cable must use the cable duct or pipe
f) JUNCTION BOX must be set up when there is bending of the cable three times
g) Pipe must be the stainless steel or the galvanizing steel
h) The total amount of the sectional area of the cable must be adjusted to 30[%] or less of the sectional area in pipe, duct and trough
i) Pipe must be clasped by holdfast. And, holdfast should be clamped with the anchor bolt.
j) Clamping pipe by the holdfast from JUNCTION BOX within 500[mm]
k) The holdfast is clasped by intervals within 1500[mm]
l) Length of cable must be less than 100[m]
m) Copper plate for the grounding should be installed near the station, and laid on underground 700 mm or more
n) Resistance of copper plate should be less than 100 [ohm]
o) Solar panel should be set up in the direction where the cell side is facing to the sun
p) Irradiating sunlight onto cell side of solar panels should not be obstructed
q) The inclination angle of solar panel must be adjusted after installed
r) Equipments must protect from the induced lightning

LIST OF EQUIPMENT

No	ITEM	REMARK
1	ENCLOSURE	
2	SOLAR PANEL	
3	GROUNDING ROD	
4	WATER LEVEL SENSOR	

LEGEND :

NEW CABLE

NEW EQUIPMENT

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

TYPICAL FACILITY LAYOUT PLAN FOR GAUGING STATION TYPE-B	DRW. NO. WM-4

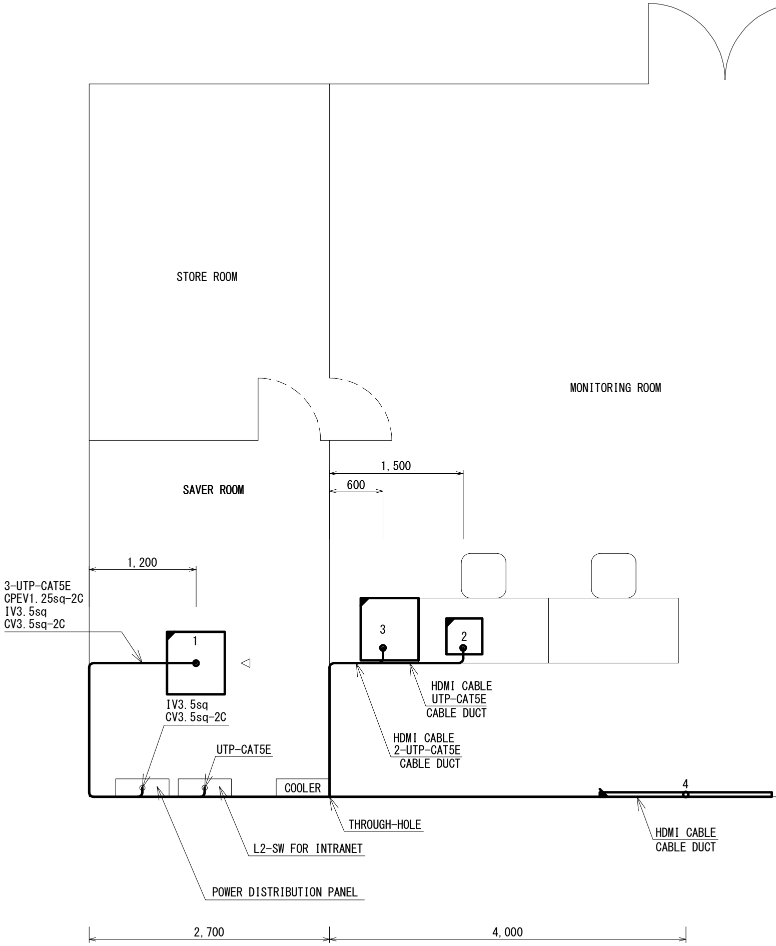
SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

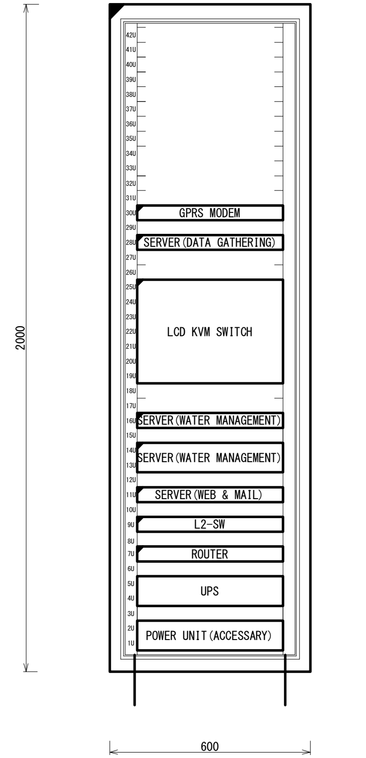
PLATE NO.: 5

AT-41

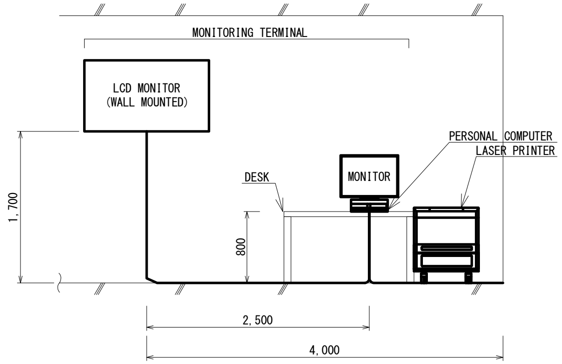
FLOOR PLAN FOR MONITORING AND OPERATING ROOM



Floor Plan
(S=1/30)



Front Elevation of COMPUTER RACK
(S=1/8)



Front Elevation of MONITORING TERMINAL
(S=1/30)

LIST OF EQUIPMENT

No.	NAME OF EQUIPMENT	REMARKS
1	COMPUTER RACK	
2	PERSONAL COMPUTER(MONITORING TERMINAL)	
3	LASER PRINTER	
4	LCD MONITOR(60 INCH)	WALL MOUNTED

LEGEND

: NEW EQUIPMENT　　: NEW CABLE

: EXISTING EQUIPMENT

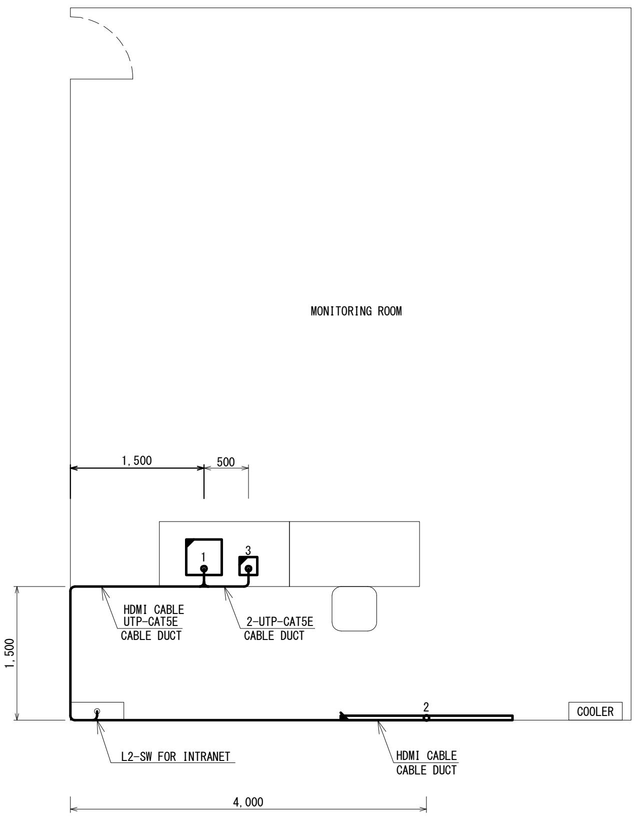
NOTE :
a) Outdoor wiring of cable must use the pipe or the cable trough
b) Indoor wiring of cable must use the cable duct or pipe
c) JUNCTION BOX must be set up when there is bending of the cable three times
d) Pipe must be the stainless steel or the galvanizing steel
e) The total amount of the sectional area of the cable must be adjusted to 30[%] or less of the sectional area in pipe, duct and trough
f) Pipe must be clasped by holdfast. And, holdfast should be clamped with the anchor bolt.
g) Clamping pipe by the holdfast from JUNCTION BOX within 500[mm]
h) The holdfast is clasped by intervals within 1500[mm]
i) Length of Metallic LAN Cable Length must be less than 100[m]
j) Equipments must protect from the induced lightning
k) Put neither wiring cable for the signal nor the wiring cable for the electric power in the same pipe
l) The facility set up must adopt the requirement which means earthquake-proof, shockproof, water-proof and any proof the government required.
m) The facility must be painted from surroundings of the site in an unremarkable color.

Arab Republic of Egypt Ministry of Water Resources and Irrigation Reservoir and Grand Barrages Sector	
Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators	
FLOOR PLAN FOR MONITORING AND OPERATING ROOM	DRW. NO. WM-5
SANYU CONSULTANTS INC.	

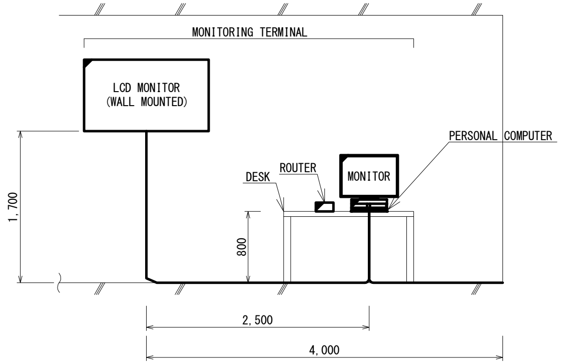
	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :

PLATE NO.: 6

FLOOR PLAN FOR MONITORING ROOM IN MINIA



Floor Plan
(S=1/30)



Front Elevation of MONITORING TERMINAL
(S=1/30)

LIST OF EQUIPMENT

No.	NAME OF EQUIPMENT	REMARKS
1	MONITORING TERMINAL	
2	LCD MONITOR	
3	ROUTER	

LEGEND

: NEW EQUIPMENT
: EXISTING EQUIPMENT
: NEW CABLE

NOTE :
a) Outdoor wiring of cable must use the pipe or the cable trough
b) Indoor wiring of cable must use the cable duct or pipe
c) JUNCTION BOX must be set up when there is bending of the cable three times
d) Pipe must be the stainless steel or the galvanizing steel
e) The total amount of the sectional area of the cable must be adjusted to 30[%] or less of the sectional area in pipe, duct and trough
f) Pipe must be clasped by holdfast. And, holdfast should be clamped with the anchor bolt.
g) Clamping pipe by the holdfast from JUNCTION BOX within 500[mm]
h) The holdfast is clasped by intervals within 1500[mm]
i) Length of Metallic LAN Cable Length must be less than 100[m]
j) Equipments must protect from the induced lightning
k) Put neither wiring cable for the signal nor the wiring cable for the electric power in the same pipe
l) The facility set up must adopt the requirement which means earthquake-proof, shockproof, water-proof and any proof the government required.
m) The facility must be painted from surroundings of the site in an unremarkable color.

Arab Republic of Egypt
Ministry of Water Resources and Irrigation
Reservoir and Grand Barrages Sector

Detailed Design Study on the Project for Construction of the New Dirout Group of Regulators

FLOOR PLAN FOR MONITORING ROOM IN MINIA	DRW. NO. WM-6

SANYU CONSULTANTS INC.

	PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :	DATE :