Appendix-5. Soft Component (Technical Assistance) Plan

THE PREPARATORY SURVEY REPORT ON PROJECT FOR UPGRADING FOOD PRODUCTION INFRASTRUCTURE IN THE REPUBLIC OF SUDAN

SOFT COMPONENT PLAN

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JAPAN INTERNATIONAL COOPERATION AGENCY

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CONTENTS

1. BACKGROUND OF PLANNING SOFT COMPONENTS

1.1 Outline of the Grant Aid Project

The components of this grant aid project are shown in the table below. For two (2) schemes of Aliab and Kitiab in River Nile State, deteriorated diesel –driven pumps shall be replace to electric ones with installation of suction pipes and control panels and construction of new pump houses. For K14 pump station in Kassala State, only deteriorated three (3) electric pumps shall be replaced by new ones. New pump house is not planned.

Scheme	Project Components
Aliab scheme	・ Construction of a pump house ・ Installation of two (2) electric pumps ・ Installation of four (4) suction pipes, two (2) control panels ・ Cabling from transformer to control room ・ Construction of a discharge chamber and connection channel to the existing one
Kitiab scheme	・ Construction of a pump house ・ Installation of two electric pumps ・ Installation of four (4) suction pipes, two(2) control panels ・ Cabling from transformer to control room ・ Construction of a discharge chamber and connection channel to the existing one
K14 (NHAC)	・ Provision of three (3) pumps and motor, and three (3) control panels ・ Dispatch of engineers for installation of pumps, control panels and test run

1.2 Current Status of the Project Areas

1.2.1 River Nile State

The River Nile State is located at Northeast of the country and bordered with Egypt at North, and the River Nile flows from South to North in the center of the State. Ed Damar, the state capital, is about 280km away from Khartoum or about five (5) hour-drive. The state is categorized into extreme dry zone with annual rainfall of 57mm, and therefore irrigated agriculture is being practiced along both sides of the Nile River. There are many irrigation schemes, 145 schemes with the service area larger than 500 feddans (210ha) and 12,000 schemes with smaller than 500 feddans according to the state Ministry of Agriculture and Irrigation and Forestry (MoAIF) of the state, which are managed under a scheme committee. Since the land is owned by the government, most of farmers are tenants who are given with cultivation right. Averaged farm size is 1.9 to 3.5 feddans (0.90 to 1.47ha) and sorghum in the summer and wheat in the winter are cultivated mainly along with vegetables, dates and citrus etc.

1.2.2 Kassala State

Kassala state is located at the eastern part of Sudan and at distance of about 600 km or eight (8) to nine (9) hours by car from Khartoum. The eastern part of the state is bounded with Eritrea. Annual precipitation of the state is varied depending on location, lowest at northwestern part with less than 100mm and highest at southeastern part with 500 to 600mm. Vast rain-fed agriculture is practiced to produce sorghum and sesame and others, and irrigated agriculture using Atbara River is also practiced in the New Halfa Irrigation Scheme, one of national irrigation project, to produce sorghum,

groundnuts and cotton, wheat etc . However, irrigated area in the state is mere at 3.7% of cultivated area.

1.3 Current Status of the Irrigation Schemes

1.3.1 River Nile State

Two (2) schemes are old ones established in 1917 and 1942. Each scheme has a management committee headed by a scheme manager and a Farmer's Union to support the manager and Farm and Canal Guards in charge of gate operation and pump operators. The committee is managed by using water rate (fee) being collected from beneficial farmers.

Required irrigation service to meet farmer's request cannot be conducted at present because of deterioration of existing pumps and lack of cross sectional area of canals caused by sedimentation, which resulted in low collection rate of water rate excluding Aliab scheme that cause vicious cycle in management leading to insufficient maintenance of irrigation facilities

General constraints in irrigation subsector require improvement of irrigation service, increase of water rate collection rate, improvement of necessity for rehabilitation and replacement of pumps, canals, water gates, improvement of conventional agricultural technologies, strengthening of irrigation scheme organization and strengthening of agricultural extension services and so on.

1.3.2 Irrigated Areas by K14 Pump Station in Kassala State

The K14 pump station managed under MoAI and NHAC is the target of the grant aid project of Japan in Kassala state which is a national irrigation scheme. The K14 pump station was established in 1974 and irrigates 31,000 feddans (13,020ha) by three (3) electric pumps. The pumps need to be replaced due to deterioration. The K14 pump station serves for 11,000 households and 110,000 persons in 22 villages.

1.4 Present Agriculture in the Schemes

1.4.1 River Nile State

Crops mainly cultivated in the selected two (2) schemes in River Nile are wheat for winter (November to March) and sorghum for summer (April to October), and perennial crops such as citrus dates and alfalfa. Vegetable such as okra and tomatoes etc are also cultivated under irrigated condition. Meanwhile, cotton, sorghum, groundnuts and wheat and vegetables such as cucumber and okra etc are cultivated in K14 area in Kassala State.

Plowing is done by tractor equipped with plow on contract basis, and harvesting by combine or manual depending on crops, implying that the agriculture has been mechanized to some extent. Cereals are marketed mainly to local markets by individual farmers, and fruits are distributed to Khartoum, biggest consumption area, by middlemen. It can be said that those irrigation schemes with a long history have been developed to produce some principal products in the country. However, at the same time, the schemes with long history have been facing a problem issue of getting smaller in farm size as caused by repeated inheritance of farms.

1.4.2 K14 Areas

In the K14 areas, farmers settled from Old Halfa cultivate 15 feddans per household and 3 to 5 feddans per household settled from Nubia as well. They are cultivating sorghum, cotton, wheat and some vegetables such as okra, tomatoes, potatoes etc. As seen in cropping pattern, it is said that irrigation water is supplied with stability from summer to winter, which is different from River Nile State where

summer cultivation is difficult. Cropping plan is prepared by the Board of Directors taking into consideration food security and demand. Plowing cost on contract basis is 250 SDG per feddan. Harvesting of cotton and sorghum is practiced manually.

1.5 Necessity for the Soft Components

The reason for conducting the soft components as a part of the Project is to secure sustainability of outputs with implementation of the Project. Irrigation is dispensable for farmers to live on farming in dry zone and irrigation service must be sustainable to the future. To secure sustainability of the irrigation service, supporting for software such as strengthening of irrigation scheme in management and O & M of irrigation facilities is required to continue proper irrigation service for farmers in addition to renewal of deteriorated irrigation facilities, meaning that software is necessary to make a sustainable use of hardware.

In a wide sense, food production is a national policy and introduction of electric pumps to Aliab and Kitiab schemes under the national wheat production project forms a part of the policy. This grant aid project by JICA aims at supporting the national policy, and the proposed soft components will enable schemes and agencies concerned to realize sustainable O & M and management. By the way, the initial guidance on operation and maintenance of the provided pump facilities are not included in the proposed soft components, which shall be done by a contractor and pump maker as a part of construction and installation works.

1.6 Constraints to be Solved

1.6.1 Constraints in Agricultural Production

The followings can be identified as the problems/constraints to be solved in the aspect of agricultural production which are common in all the target schemes.

- Low productivity derived from conventional and extensive cultivation techniques
- Insufficient irrigation water supply to the terminal minor canals
- Lack of number of personnel for agricultural extension services
- Low land use efficiency
- In sufficient land leveling

1.6.2 Constraints in Irrigation Schemes

Problem issues on organizational management common to each scheme include the followings.

- Lack of management on basic data /information concerning the schemes
- Unstable water rate collection ratio
- Fragile financial status and lack of transparency
- Insufficient O&M works on canals

2. TARGET OF THE SOFT COMPONETS

After the project implementation, each of the subject grant aid project shall be operated and maintained in good condition for which each of agencies concerned has to play firmly their roles, and then sustainable O&M works be provided for the related facilities as pumping station, main canal, minor canals and terminal facilities. To enable the on-time and on-demand irrigation services to meet the farmers' requirement by the above-mentioned activities is the goal to be attained under the project. Based on this concept, the project soft component is to be formulated aiming at acquiring of necessary technologies and know how by each scheme on 1) management of relevant organizations and 2) O&M of irrigation

facilities.

3. OUTPUTS OF THE SOFT COMPONENTS

The outputs and accomplishments to be attained by implementing the soft components include the following two (2) items, in which each scheme, as the organization to provide sustainable irrigation services, has to materialize the project target of "Through managing the organization soundly and playing roles by each agency concerned, the O&M works could be performed thoroughly from pumping station, main canals, minor canals and up to the terminal facilities to enable on-time and on-demand irrigation water supply to meet the farmers requirement."

Output ①：Capacity Building of Scheme Management

（Activities）

- Fostering of leadership：

Through undertaking various activities for irrigation services and O&M works, capacity to be the good leader who can manage the scheme in sustainable manner could be built up.

- Compilation and management method of fundamental information on beneficial farm households:

Cadastral maps, areas, number of farmers, planned irrigation areas and irrigated areas, planted areas with crops, production and yields necessary for management of each scheme will be input and managed by a computer. Thereby, it will become easier to analyze trend of management data in chronological order.

- Training on scheme management:

Members of a board of directors of each irrigation scheme, representatives of farmers will acquire necessary various techniques on grasping farmer's needs, meeting, problem solution, water rate collection, budget planning, auditing, value chain analysis, and activity planning etc. Thereby, schemes will be managed well with sustainability.

- Training on how to grasp farmer's needs:

Members of a board of directors of each irrigation scheme will acquire techniques to grasp farmer's needs by using PCM, PRA, RRA methods to make use of the results for better irrigation services and agricultural extension services which will lead the schemes to higher water rate collection.

- Training on value adding

Members of a board of directors of each irrigation scheme and representatives of farmers will recognize necessity for selling crops at higher price as far as possible to get better profits through improvement of crop quality and processing.

- Establishment of collected water rate management system and its recording method:

It can be expected that water rate collection will become higher together with improvement of irrigation facilities under the Project, and status of water rate collection will be able to be analyzed by farmer and by canal systems by using computers, which will enable to grasp relationship between water rate collection and irrigation conditions in each scheme.

- Preparation of annual activity plan:

Annual irrigation schedule in accordance with cropping pattern planned, and schedules for meetings, seminars, and mutual works to maintain canals will be prepared properly and each scheme will be managed well based on the prepared annual activity plan.

- Preparation for assembly and ordinary meetings and recording :

Members of a board of directors of each irrigation scheme and representatives of farmers understand and require techniques on how to set up agenda, proceeding, preparation of discussion etc to conduct meetings and assemblies in a democratic manner.

- Safekeeping of ledgers, checks, receipts and recording of them:

Members of a board of directors, accountants, auditors in charge, and representatives of famers of each irrigation scheme will acquire skills for accounting management method to realize transparent financial management of schemes.

- Monthly basis reporting of accounting:

Members of a board of directors, accountants, auditors in charge will acquire skills for preparation of documents on accounting to report member farmers, which will contribute to keep transparency and more reliability to scheme committees.

- Training for accountants and auditors to keep transparency:

Accountants and auditors in charge will acquire points of auditing and methods.

- Collection and management of market data of crops and agricultural inputs:

Members of a board of directors and representatives of farmers will acquire management senses to sell crops at higher prices under advantageous condition for farmers.

Output ② : Capacity Building for Operation and Maintenance of the Irrigation Facilities

（Activities）

- Preparation of Inventory of irrigation facilities and management method:

Information about irrigation facilities of each scheme (number of units, capacity, construction year, rehabilitated year, status of deterioration, construction costs, rehabilitation costs etc) will be input into computers for better management.

- Understanding of the Laws including by-law for irrigation schemes:

Not only the members of a board of directors of a scheme, representatives of Farmer's Union, representatives of farmers will understand laws related to irrigation schemes to realize proper scheme management and water management.

- Preparation method of pump operation records:

Unified formats of O & M of pumps common for all schemes will be prepared, and canal and farm guards of each scheme will acquire recording method into computers for better facility management and water management.

- Training for canal & farm guards (gate keepers) to strengthen their capacity:

Canal and farm guards of each scheme will be able to handle gates and regulators to control water to irrigation blocks properly depending on water availability, and to record water level and volume as well.

- Preparation of annual activity plan for O & M:

Annual activity plan for O & M of irrigation facilities will be established properly taking into consideration irrigation schedule to make consistent management from upstream to tail end canals.

- Training on broad-based water management:

Proper water management in accordance with land use, planted crops and cultivation period will be conducted by each scheme, which will be applied in water management at on farm level and crop yields will increase thereby.

- Monitoring and feedback methods of the annual activity plan for O & M:

The annual activity plan set up as above mentioned will be monitored and its results will be fed back to the O & M plan under discussion in scheme to realize better O & M and sustainable use of irrigation facilities.

- Training on water requirement calculation using computers:

Scheme manager and members of board of directors acquire skills to calculate water requirement and proper operation hours based on cropping pattern to make on-time and quantitatively sufficient irrigation.

- Equitable water distribution:

Water distribution rules will be prepared based on agreement of member farmers to realize equitable water distribution at on farm level, and water rate collection will become higher thereby, resulting in improvement of financial status of schemes.

- Operation and maintenance of pumps:

Provided pumps by the Project will be operated and maintained properly based on the O & M manuals used in the initial guidance when the pumps were installed.

4. IDENTIFICATION OF ATTAINMENT OF OUTPUTS

Confirmation method on the planned outputs attained are indicated as the followings. The degree of attainment is to be judged by the indexes as shown below.

Confirmation method on the output attainment

Output	Indexes	Confirmation method
① Capacity for scheme management be improved	(1) More than 30 leader candidates receive the training and acquire knowledge	(1) Proportion of actual attendants and the results of post test
	(2) At all schemes, basic information can be managed on unified format in computer and renewed every time	(2) As per the result of questionnaire
	(3) 50 % of board members and representative of farmers participate and acquire skills on organization management	(3) -Same as (1)-
	(4) 50 % of board members and extension workers participate and acquire the skills on need-grasping technique	(4) -Same as (1)-
	(5) 50 % of board members and all the extension workers participate and acquire knowledge on value adding	(5) -Same as (1)-

Output	Indexes	Confirmation method
	(6) 50 % of board members and 10 % of farmers participate and acquire related knowledge	(6) -Same as (1)-
	(7) More than 50 % of board members participate and acquire know-how on activity plan preparation	(7) Proportion of actual attendants and result of practical preparation of activity plan
	(8) More than 50 % of board members and representative of farmers participate and acquire know-how on management of assembly meeting	(8) -Same as (1)-
	(9) More than 50 % of board members and all of accountants and auditors participate and acquire know-how on documents preparation and management manner	(9) - Same as (1)-
	(10) More than 50 % of board members and all accountants participate and acquire know-how on preparation of regular accounting report	(10) -Same as (1)-
	(11) 50 % of board members and all accountants and auditors participate and acquire skills on accounting and auditing	(11) -Same as (1)-
	(12) More than 50 % of board members and extension workers participate and acquire skills on management and recording of prices of farm inputs	(12) -Same as (1)-
②Scheme’s capacity on O&M of irrigation facilities be improved	(1) More than 50 % of board members participate and acquire skills/know-how for preparation of inventory and O&M of irrigation facilities by using personal computer	(1) Proportion of actual attendants and the result of test by actual practice by using PC after the training
	(2) More than 50 % of board members and extension workers participate and learn laws and regulations related with irrigation	(2) Proportion of actual attendants and the results of post test
	(3) More than 50 % of board member and canal & farm guards participate and acquire skills on recording pump operation	(3) -Same as (1)-

Output	Indexes	Confirmation method
	(4) All the canal & farm guards participate and acquire skills on water distribution techniques by gate operation	(4) -Same as (1)-
	(5) More than 50 % of board members participate and acquire skills to formulate the O&M activities plan	(5) Proportion of actual attendants and the results of practical plan formulation
	(6) More than 50 % of board members and more than 50 % of water inspector participate and acquire knowledge on broad-basis water management	(6) -Same as (1)-
	(7) More than 50 % of board members participate and acquire knowledge on monitoring and feed back	(7) -Same as (1)-
	(8) More than 50 % of board members participate and acquire know-how and techniques to calculate water demand and pump operation hours by PC	(8) Proportion of actual attendants and the result of practical calculation by using PC
	(9) Fair water distribution rules be formulated and agreed upon among the parties	(9) As per the result of questionnaire
	(10) All the pump operators participate and assure the management know-how and techniques learnt during the initial operation guidance	(10) -Same as (1)-

Were necessary technology and system consolidated? :

One of targeted schemes were established in 1917 and managing system has already been organized under a scheme manager and Farmer's Union to give advice the manager. However, it was judged that management and O & M system of existing schemes are weak to meet farmer's demand of on-time and quantitative irrigation as well as sustainable scheme management as seen in present low water rate collection, insufficient maintenance of canals etc. In addition, it is considered form the field survey on canals and gates that even state agencies concerned to O & M of irrigation schemes also do not fulfill their roles sufficiently

The pump operators in each scheme have experience of operating pumps and have techniques for maintenance but they are not used to operate and maintain electric typed pumps being provided by the Project to date. Therefore, it is indispensable to train them about guidance of initial operation by a contractor and pump makers.

Since the existing schemes are judged weak in management and O & M of irrigation facilities as the

results of the field survey, the proposed soft components were planned focusing on strengthening 1) scheme management capacity, and 2) O & M capacity of irrigation facilities in order to meet farmer's demand and establish strong schemes for sustainable management. Thereby the schemes will be strengthened so that they can manage and make O & M of irrigation facilities by Sudan side even after finishing this grant aid project.

Can each scheme hold meeting and manage farmers organization for O & M in cooperation with State agencies and village people? :

Role sharing between concerning agencies has been established to maintain from pump station to tail-end canals, and O & M such as repairing, rehabilitation, dredging and weeding of irrigation facilities have been practiced by agencies in charge, schemes and farmers. However, in fact smooth water flow is prevented due to sedimentation and weeds on every canal caused by insufficient maintenance from upstream to tail-end canals. Especially, poor maintenance of Abu-Ashreen canals and Abu-Shitta canals located at tail-end affect directly on-farm level irrigation. Maintenance of tail-end canals is in charge of farmers. But they are not organized for mutual works to maintain canals and have no budget for it.

Under the circumstances, the soft components propose that state office and schemes fulfill their roles in O & M using budget, and tail-end canals by farmer's mutual works one to two times a year, which will realize sustainable irrigation services. It is considered important to have practical mutual works to maintain tail-end canals by farmers. It is proposed to try to conduct mutual work to clean and dredge canals under initiative of schemes committees to verify effect of mutual works during implementation period of the Project. In this way, sustainable O & M of the schemes will be able to be realized by fulfilling prescribed roles of concerning organizations.

5. ACTIVITIES OF THE SOFT COMPONENTS (INPUT PLANNING)

Soft component activities include, among others, the followings

Programs	Technical Level	Target Groups	Activities
(1) Capacity Building of Scheme Management	**Current technical level :** ・It is difficult to grasp current management status of the schemes since all data and information is recorded on notes. ・Current irrigation services do not reach to tail-end farms ・Low water rate collection ・All schemes are in debt **Required technical level :** ・It is necessary to keep all data and information on computers for easier and sustainable management of the schemes in order to take over scheme management to the next	・Board members ・Representatives of Farmer's Union ・Agricultural extensionists	(1) Training for fostering leadership (2) Compilation & management methods of fundamental data & information about member farmers (3) Training on scheme management (4) Training on how to grasp farmer's needs (5) Training on how to add value to primary products (6) Training on establishment of water rate collection system and its management and recording (7) Training on how to make annual activity plan of schemes (8) Training on how to hold assembly, temporary meeting and how to make record

Programs	Technical Level	Target Groups	Activities
	generation. ・It is necessary to collect water rate at higher rate for sound management of the schemes		(9) How to prepare and manage ledger, checks, receipts and recording (10) Preparation of annual accounting report (11) Training for accountants and auditors on financial management to keep transparency (12) Record keeping of market prices of crops and fertilizers & other inputs
(2) Capacity Building for Operation and Maintenance of the Irrigation Facilities	**Current technical level：** ・Operators and mechanics have technology of disassemble and fabrication of pumps ・They are not used to make O & M of electric pumps ・Water distribution and pump operation are done according to their experiences ・Recording and management of pump operation are insufficient ・Canal maintenance such as dredging and weeding is not adequate **Required technical level：** ・Skills of water requirement calculation and pump operation hours based on cropping pattern using computers ・Technology on broad based water management ・Skills for equitable water distribution ・Monitoring skills ・Regular canal maintenance	・Board members ・Representatives of Farmer's Union ・Agricultural extensionists ・Canal & Farm Guards	(1) Preparation and management of inventory of irrigation facilities (2) Understanding of laws related to irrigation including irrigation scheme law (3) Preparation of pump operation records (4) Capacity building for Canal & Farm Guards（gate keepers） (5) Preparation of annual activity plan for O & M (6) Training on broad based water management (7) Training on monitoring and feed back of the annual activity plan (8) Training on water requirement calculation using computers (9) Equitable water management (10) O & M of the pumps provided

Implementation method：

The trainings for capacity building of scheme management and capacity building for operation and maintenance of the irrigation facilities shall be conducted separately in River Nile State and Kassala State because of long distance between the two (2) states. The trainings in River Nile State shall be given priority because of two (2) schemes as compared to one (1) scheme in Kassala State.

The language in the trainings shall be in Arabic. For the purpose, training manuals shall be

prepared in cooperation with Japanese experts and Sudanese experts in English and then local resources shall translate it into Arabic ones through a series of discussion to make it better ones, then various trainings shall be done by local resources. Since scheme management technologies need to be taken over to the next generation, the training shall be done selecting suitable local resources from MoAIF in River Nile State and NHAC in Kassala State. Sub-contract is not planned.

The venues shall be a conference room of MoAIF in River Nile State and the one in NHAC in Kassala State respectively.

The targets of the proposed trainings shall be personnel concerned to Aliab and Kitiab schemes in River Nile State and K14 in Kassala State. About 30 persons per time shall be invited to the trainings. Training period shall be planned as three (3) days per time.

As shown below, a Japanese expert for capacity building of scheme management with 5.0 man-months and a Japanese expert for capacity building for operation and maintenance of the Irrigation facilities with 5.0 man-months, 10.0 man-months in total shall be proposed in case of Japanese experts.

Meanwhile, for local resources, three (3) experts, one (1) each expert of scheme management, O & M expert, and financial experts, shall be assigned from MoAIF of River Nile State. Similarly, three (3) experts for the same sectors as River Nile State shall be procured from NHAC in Kassala State. In addition, two (2) interpreters cum translators, a facilitator, and two (2) drivers shall be availed for the implementation of the soft components.

6. PROCUREMENT OF RESOURCES FOR IMPLEMENTATION

Sub-contracting is not considered for the implementation of the proposed soft component. The reasons are that Arabic is the primary and predominant language in Sudan and there are quite few who can communicate in English even in the Governmental offices. In addition, JICA survey team could not find suitable candidates for local consultant who can perform the required services for capacity building of scheme management and O&M of irrigation facilities through two (2) terms of field survey conducted.

①Japanese Expert; 1 person (Strengthening /capacity building on management of water users organization)

The subject engineer shall have sufficient knowledge/experiences on the following items for the purpose to lead the subject irrigation schemes to secure sustainable management and capable to guide and lead the local resource persons expected.

- Management system of basic data/information by using PC
- Method for grasping farmer’s need by PCM etc
- Method to improve the water rate collection ratio
- Preparation of annual activities plan
- Financial management

At the initial stage of soft component implementation, the expert shall engage in domestic preparatory works, coordination with the Sudan side of government level and schemes concerned, preparation of training materials in collaboration with the local resources and preparation of training schedule as well for the smooth implementation of the soft component.

②Japanese expert; 1 person (Strengthening of O&M capabilities of irrigation facilities)

The subject engineer shall have sufficient knowledge/experiences on the following items of works to guide

the local resource persons.

- Inventory preparation on irrigation facilities by PC
- Water demands estimation
- Calculation of pump operating hours
- Broad based water management
- Water management at on-farm level
- Monitoring

③Local resources

The expertise of local resource persons who will assist the above Japanese experts to bee dispatched include the followings.

- Strengthening of management capacity of water users organization−2 persons

  (1 for RNS and 1 for Kassala state)

- Strengthening of O&M capacity for irrigation facilities−2 persons

  (1 for RNS and 1 for Kassala state)

- Strengthening of accounting/financial management capacity

  (1 for RNS and 1 for Kassala state)

Other than the above, 2 interpreters, 1 facilitator and 2 drivers are included in the local resource persons to be provided.

It is noted in this connection that the local resource candidates for lecturing on capacity building of scheme management and capacity building of O & M of irrigation facilities, and financial expert shall be procured from MoAIF in River Nile State and Irrigation Department of NHAC in Kassala State respectively.

The senior engineers in River Nile State and Kassala State are very familiar with every irrigation schemes and know about irrigation conditions, management status including constraints facing now and it is desirable to assign them as the local resources for trainings rather than hiring local consultants. The Japanese experts shall prepare training materials of each sector in English with local resource persons and the local resource persons shall translate it into Arabic with understanding the purposes and meanings of each item through translation works, and then provide the trainings as lecturers. In the actual trainings, Japanese experts shall assist them.

Interpreters, facilitator, and drivers shall be procured in addition to the engineers as above mentioned. A facilitator will be able to be procured from local NGOs etc in Khartoum.

Resource and items of work for implementation of soft component (1/4)

Support program	Activities	Target group	Person in-charge	Work items	RNS working days		K14 working days	
					Japanese	C/P	Japanese	C/P
Preparatory (Domestic)	Preparation for field work	-	Japanese	Soft component review and preparation for field work of plan	10.0days		1.0days	
total (Field)				Sub-total × 2 Japanese	22.0days			
Preparatory (Field)	Preparation	-	Japanese	Consultation with Sudan side on the actives pan/ preparation of schedule	5.0			
				Employment of local staff (Announcement, Tending, Evaluation, Contracting)	3.0			
				Office preparation	3.0			
Total (Preparation/ Field)				Sub-total × 2 Japanese	22.0days			
1. Strengthening of capacity for organization management	(1) Nourishing of leadership	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Preparation of training materials	2.0			
				Consultation with agencies and correction	0.5		0.5	
				Leadership training	2.0		1.0	
				Compiling of training output	0.5		0.5	
			Irrigation Scheme	Asst. preparation of materials ·arrangement for training		1.0		1.0
				Asst. training for leadership		2.0		2.0
				Asst. output compilation		1.0		1.0
	(2) Management in data/ information collection and processing · Concerning the beneficiary farmers	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Selection of matters to be recurred and format preparation	0.5			
				Preparation of training materials	1.0		1.0	
				Consultation with agencies and correction, additional and modification	1.0		0.5	
				Asst. output compilation	0.5		0.5	
			Irrigation Scheme	Management in data/ information providing		1.0		1.0
				Arrangement for training		2.0		2.0
				Asst. compiling of training output		1.0		1.0
	(3) Training for management of organization	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Preparation of training materials	2.0			
				Consultation with agencies and correction, additional and modification	1.0		0.5	
				Compiling of training output	1.0		1.0	
			Irrigation Scheme	Arrangement for training		2.0		1.0
				Asst. compiling of training output		1.0		1.0
	(4) Training for management of organization	Scheme Manager, Board Members, Agricultural extension workers	Japanese	Preparation of training materials	2.0			
				Training of PCM and RRA	1.5		1.0	
				Compiling of training output	0.5		0.5	
			Irrigation Scheme	Arrangement for training		2.0		1.0
				Asst. compiling of training output		1.0		1.0
	(5) Training for value adding	Scheme Manager, Agricultural extension workers, Representative of Farmer	Japanese	Survey/ examination on value adding for each crop	1.0		0.5	
				Preparation of materials and training	1.0		0.5	
				Compiling of training output	1.0		0.5	
			Irrigation Scheme	Survey on value added for each crop and participate in examination		1.0		1.0
	(6) Water rate collection/ management system and records preparation	Scheme Manager, Board Members, c of Farmer's Union	Japanese	Sample survey on water rate collection system	2.0		1.0	
				Drafting of water rate collection system	2.0		0.5	
				Consultation with state	2.0		1.0	
			Irrigation Scheme	Arrangement for farmers meeting and consensus building		1.0		1.0
				Trial and feedback for water rate collection		1.0		1.0
	(7) How to prepare annual activities plan	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Review on annual activities by scheme	1.0		1.0	
				Study tour to the advanced scheme	2.0			
				Preparation of training materials	1.0			

Resource and items of work for implementation of soft component (2/4)

Support program	Activities	Target group	Person in-charge	Work items	RNS working days		K14 working days	
					Japanese	C/P	Japanese	C/P
1. Strengthening of capacity for organization management	(7) How to prepare annual activities plan	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Support on annual activities by scheme	0.5		1.0	
				Compiling of training output	0.5		1.0	
		Scheme Manager, Board Members, Representative of Farmer's Union	Irrigation Scheme	Providing information on annual activities plan		1.0		1.0
				Arrangement for study tour		0.5		
				Participant in study tour		3.0		
				Asst. training		1.0		1.0
				Asst. compiling of training output		1.0		1.0
	(8) Holding of general assembly and meetings and minutes preparation	Scheme Manager, Board Members, Representative of Farmer's Union	Japanese	Study and review on assembly and meeting etc.	0.5		0.5	
				Preparation of materials and training	1.0		1.0	
				Compiling of training output	0.5		0.5	
			Irrigation Scheme	Providing on assembly and meeting		1.0		1.0
				Asst. compiling of training output		1.0		1.0
	(9) Management on books, ledges and receipts and recording	Scheme Manager, Board Members	Japanese	Study/ review on present financial statues and consultation with	2.0			
				Preparation of training material on financial aspect and training	1.0		1.0	
				Compiling of training output	1.0		1.0	
			Irrigation Scheme	Preparation of present financial arrangement data/ information		1.0		1.0
				Asst. compiling of training output		1.0		1.0
	(10) Preparation of financial reporting (Monthly)	Scheme Manager, Board Members	Japanese	Consultation with agencies and correction and examination	1.0		1.0	
				Training of follow-up	1.0		1.0	
			Irrigation Scheme	Presentation of present financial reporting		2.0		1.0
			Local finance	Preparation of materials and training		3.0		2.0
	(11) Capacity building for accountant and auditors for securing transparency	Scheme Manager, Finance, Auditor	Japanese	Audit issues and institutions CP, consultation with CPA	1.0			
				Training of follow-up	1.0			
			Irrigation Scheme	Providing information to members of the current accounting		2.0		
	(12) Records on prices of agricultural produces and fertilizer	Scheme Manager, Board Members, Agricultural extension workers	Japanese	Create data entry forms	1.0			
				Training	2.0		1.0	
				Training of follow-up	1.0		1.0	
			Irrigation Scheme	Collection of farm gate price and market price and providing		2.0		2.0
Sub-total : 1. Strengthening of capacity for organization management (1 Japanese, 4 C/P)					**44.0days**	**36.5days**	**22.0days**	**27.0days**
2. Strengthening of O & M capa for irrigation facilities	(1) Preparation/ management of inventory of irrigation facilities	Scheme Manager, Board Members	Japanese	Examination of survey method for irrigation facilities inventory	0.5			
				Determination of preparation manner for inventory list	0.5		0.5	
				Preparation of training materials	2.0		0.5	
				Training and compiling of training output	2.0		2.0	
			Irrigation Scheme	Implementation of inventory survey		3.0		2.0
				Preparation and compiling of inventory survey		2.0		2.0
				Asst. compiling of training output		0.5		0.5
	(2) Understanding on laws/ regulations for irrigation scheme	Scheme Manager, Board Members, Representative of Farmer	Japanese	Study on present irrigation laws/ regulations	1.0			
				Case study on irrigation law application	1.0			
				Holding of meeting for farmers awareness advancement on irrigation laws	1.0		1.0	
				Compiling of training output	1.0		1.0	

Resource and items of work for implementation of soft component (3/4)

Support program	Activities	Target group	Person in-charge	Work items	RNS working days		K14 working days	
					Japanese	C/P	Japanese	C/P
2. Strengthening of O & M capa for irrigation facilities	(2) Understanding on laws/ regulations for irrigation scheme	Scheme Manager, Board Members, Representative of Farmer	Irrigation Scheme	Asst. provide and study on present irrigation laws/		1.0		1.0
				Asst. sample study irrigation law application		1.0		1.0
				Asst. holding of meeting for farmers awareness advancement on irrigation laws		1.0		1.0
				Asst. compiling of training output		1.0		1.0
	(3) Records of pump operation	Scheme Manager, Pump Operator	Japanese	Selection of data item to be recorded format making and preparation	1.0		0.5	
				Preparation of training materials	1.0		0.5	
				Consultation with agencies and correction, additional and modification	1.0		0.5	
				Compiling of training output	1.0		1.0	
			Irrigation Scheme	Information about pump operation and provision of operation record		1.0		0.5
				Asst. preparation of training materials		1.0		0.5
				Asst. compiling of training output		1.0		1.0
	(4) Capacity building for Canal & Farm Guards	Scheme Manager、 Canal & Farm Guards	Japanese	Preparation of training materials	3.0		0.5	
				Consultation with agencies and correction, additional and modification	2.0		0.5	
				Compiling of training output	2.0		1.0	
			Irrigation Scheme	Provision of information concerning the roles by Canal & Farm Guards		2.0		2.0
				Arrangement of training		2.0		2.0
				Asst. compiling of training output		1.0		1.0
	(5) Formulation of annual O & M activities	Scheme Manager, Board Members, Farmer's Union, Representative of Farmer	Japanese	Review on O & M activities by scheme	2.0		0.5	
				Prior consultation and preparation of training materials	2.0		0.5	
				Support for formulating O & M activities plan	2.0		0.5	
				Study on training subjects with C/P	1.0		0.5	
				Supervising on training	1.0		1.0	
			Irrigation Scheme	Study tour to the advanced scheme		3.0		3.0
				Compiling of training output		1.0		1.0
				Formulating O & M activities plan		3.0		1.0
	(6) Training on broad base water management	Scheme Manager, Board Members	Japanese	Reviw on present broad base water management	0.5		0.5	
				Study on broad base water management plan (draft)	1.5		0.5	
				Examination of training programs	0.5		0.5	
				Study on training subjects with C/P	0.5		0.5	
				Supervising on training	1.0		1.0	
			Irrigation Scheme	Provision of broad base water management		2.0		2.0
				Asst. compiling of training output		1.0		1.0
				Formulation of broad base water management plan		2.0		2.0
	(7) Monitoring and feedback on annual O & M activities	Scheme Manager, Board Members	Japanese	Study on monitoring items and preparation of format	1.0			
				Preparation of training materials	1.0			
				Consultation with agencies and correction	1.0		0.5	
				Compiling of training output	1.0		0.5	
			Irrigation Scheme	Check on degree of attainment for each activities under the plan		2.0		1.0
				Fealdback to actions based on the monitoring results		1.0		1.0

Resource and items of work for implementation of soft component (4/4)

Support program	Activities	Target group	Person in-charge	Work items	RNS working days		K14 working days	
					Japanese	C/P	Japanese	C/P
2. Strengthening of O & M capa for irrigation facilities	(7) Ditto	Scheme Manager, Board Members	Irrigation Scheme	Modification of activities plan, finalization		2.0		1.0
				Asst. compiling of training output		1.0		1.0
	(8) Water demands computation by PC	Scheme Manager, Board Member, Farmer's Union	Japanese	Water demand calculation and study on calculation formula for pump operating	2.0		0.5	
				Practices on water demand calculation by using PC	2.0		1.0	
			Irrigation Scheme	Providing of existing method to determine water demands and pump operating		2.0		2.0
	(9) Fair water distribution	Scheme Manager, Board Members, Farmer's Union, Agricultural extension workers	Japanese	Study on roles for water distribution existing in the scheme	1.0		1.0	
				Holding of workshop for determination of water distribution rule	1.0		1.0	
				Preparation of materials and training	1.0		1.0	
				Compiling of training output	1.0		1.0	
			Irrigation Scheme	Collection of existing water distribution rules and provision		2.0		2.0
				Arrangement for WS		1.0		1.0
				Asst. compiling of training output		1.0		1.0
	(10) Operation of pump and maintenance	Scheme Manager, Board Members, Pump Operator	Japanese	Guidance of 20 items based on the manual used during pump installation				
				Method of pump operation recording (Hours and electricity consumption)				
				Compiling of training output				
				Arrangement for WS				
				Asst. compiling of training output				
			Irrigation Scheme	Providing information on pump operation		2.0		2.0
				Asst. compiling of training output		1.0		1.0
Sub-total : Strengthening of capacity for organization management (1 Japanese, 2 C/P)					**44.0days**	**44.5days**	**22.0days**	**38.5days**
3. Past project activities	(1) Monitoring of irrigation conditions and feedback	Scheme Manager, Board Members, Farmer's Union, Agricultural extension workers	Japanese	Confirmation of annual activities performed	2.0	2.0	2.0	2.0
				Confirmation of water rate collection	3.0	4.0	3.0	4.0
				Confirmation of accounting report (Books/ ledgers)	3.0	4.0	3.0	4.0
				Compilation of output report	3.0	1.0	3.0	1.0
	(2) Analysis on water supply and water rate collection ratio	Scheme Manager, Board Members, Pump Operator	Irrigation Scheme	Confirmation of condition of O & M activities	2.0	3.0	2.0	3.0
				Confirmation of records of O & M activities	3.0	3.0	3.0	3.0
				Confirmation of recording of facilities operation	3.0	3.0	3.0	3.0
				Compilation of output report	3.0	1.0	3.0	1.0
Sub-total : Past project activities x each activity 1 Japanese Expert					**22.0days**	**21.0days**	**22.0days**	**21.0days**

Grand Total

		RNS		K14	
		Japanese	C/P	Japanese	C/P
Domestic activities	1. Preparation of field activities as a whole (2 Japanese)	22.0days			
	Total domestic activities (2 Japanese)	**22.0日 (1.0MM)**			
Field activities	1. Preparatory (2 Japanese)	22.0days	-	-	-
	2. Strengthening of capacity for organization management (1 Japanese)	44.0days	36.5days	22.0days	27.0days
	3. Strengthening of O & M capa for irrigation facilities (1 Japanese)	44.0days	44.5days	22.0days	38.5days
	4. Past project activities (2 Japanese)	22.0days	21.0days	22.0days	21.0days
	Total field activities	132.0days (6.0MM)	102.0days (4.6MM)	66.0days (3.0MM)	86.5days (3.9MM)
	Total field activities (2 Japanese)	**198.0日 (9.0MM)**			
	Total field activities (2 C/P)	**188.5日 (9.0MM)**			

※Capacity utilization(1/(22days/30days))= 1.36

7. SCHEDULE OF THE SOFT COMPONENT IMPLEMENTATION

Activities under the soft component implementation shall be started from the domestic preparatory works in early October, 2014 and be terminated at the end of October 2015 as indicated in the implementation schedule. From the mid June 2014, the installation and test run of pump and motor are scheduled to be undertaken and therefore the field works of soft component will be implemented from mid October 2014. The idea is to consolidate the overall basics of soft component activities in RNS first to be followed by the similar activities in Kassala state.

At the same time of completion of construction works scheduled on October 2015, a follow-up training program will be conducted again to grade up further the O&M capacities built-up already. All the construction works is scheduled to be totally completed at the end of October 2015. Simultaneously the following soft component activities are to be completed.

1) Monitoring on irrigation conditions and farming activities after the rehabilitation of pumps and Feed-back

2) Analysis on the co-relationship between the irrigation water supplied and the water rate Collection ratio

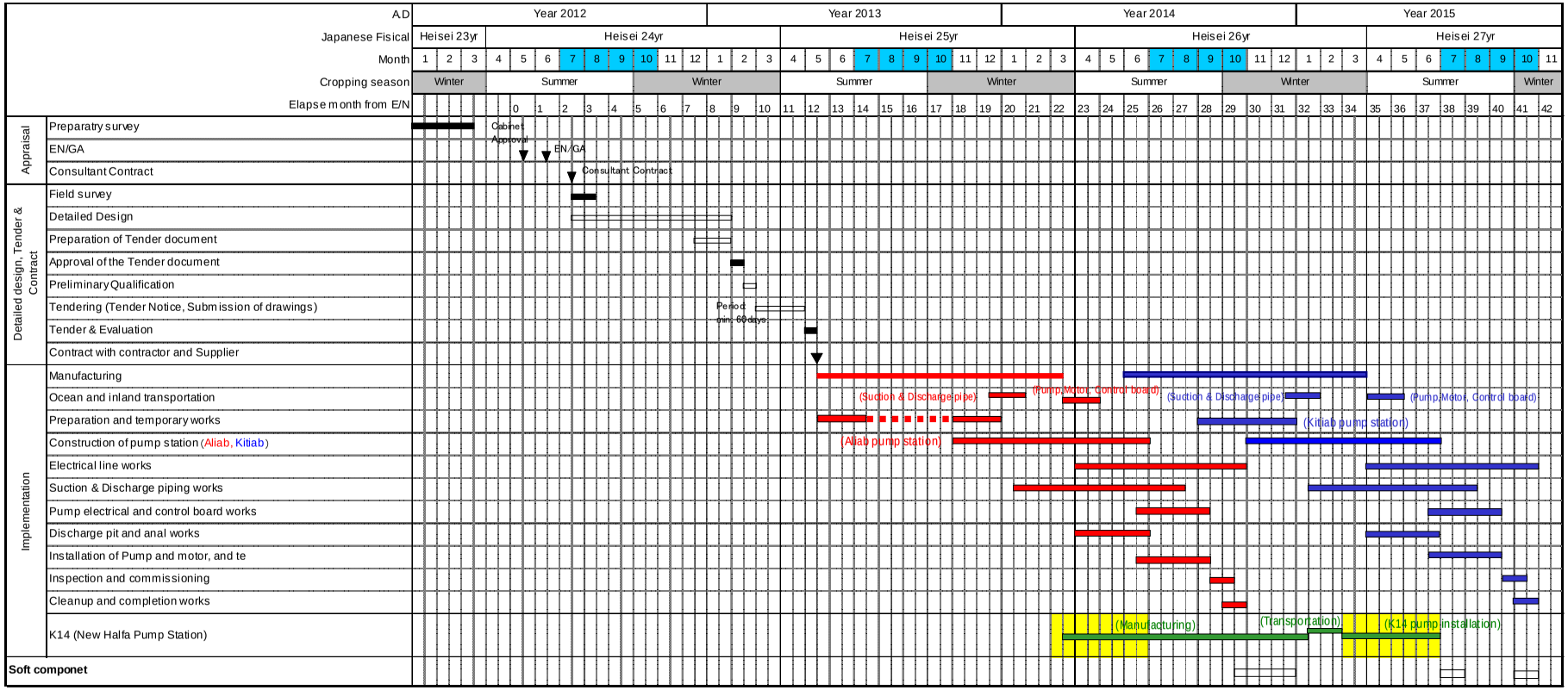
The implementation schedule covering the project construction works and soft component is as shown below.

Shedule of the Proposed Soft Compontes

: Preparation in domestic, : River Nile state, : Kassala State,

A.D	2014							2015									
Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	OCT
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Preparation period (discusssion with agencies concerned etc)																	
1.1 Preparation in domestic																	
1.2 Preparation of project office																	
1.3 Arrangement for local resources																	
1.4 Discussuin with C/P agencies about shedule etc																	
2. Strengthening of O & M capa for irrigation facilities																	
2.1 Strengthening of capacity for organization management																	
(1) Nourishing of leadership																	
(2) Management in data/ information collection and processing ･Concerning the beneficiary farmers																	
(3) Training for management of organization																	
(4) Training for management of organization（PCM, RRA workshop）																	
(5) Training for value adding																	
(6) Water rate collection/ management system and records preparation																	
(7) How to prepare annual activities plan																	
(8) Holding of general assembly and meetings and minutes preparation																	
(9) Management on books, ledges and receipts and recording																	
(10) Preparation of financial reporting (Monthly)																	
(11) Capacity building for accountant and auditors for securing transparency																	
(12) Records on prices of agricultural produces and fertilizer																	
2.2 Strengthening of capacity for organization management																	
(1) Preparation/ management of inventory of irrigation facilities																	
(2) Understanding on laws/ regulations for irrigation scheme																	
(3) Records of pump operation																	
(4) Capacity building for Canal & Farm Guards																	
(5) Formulation of annual O & M activities																	
(6) Training on broad base water management																	
(7) Monitoring and feedback on annual O & M activities																	
(8) Water demands computation by PC																	
(9) Fair water distribution																	
(10) Operation of pump and maintenance																	
2.3 Strengthening of capacity for organization management																	
(1) Monitoring of irrigation conditions and feedback																	
(2) Analysis on water supply and water rate collection ratio																	
3. Assignment Plan																	
3.1 Japanese Experts																	
(1) Expert in charge of strengthening scheme management capacity (1person）						RN								K14			
(2) Expert in charge of strengthening O & M capacity of schmes (1person）						RN								K14			
3.2 Local Resources																	
(1) Experts in charge of strengthening scheme management capacitiy : one from each state)						RN								K14			
(2) Experts in charge of strengthening O & M capapcity of irrigation facilitie (2persons:one from each state)						RN								K14			
(3) Experts in charge of strengtheining of finacial management (2 persons：one from each state)						RN								K14			
(4) Interpreter/translators (2 persons)						RN								K14			
(5) Facilitator （1人：NGO）																	
(6) Drivers（2persons)						RN								K14			

Schedule for Implementation



8. OUTCOMES OF THE SOFT COMPONENTS

As the results of the proposed soft components, 1) completion report of the soft components, 2) manual for capacity building of scheme management and 3) manual for capacity building of O & M of irrigation facilities shall be prepared. In addition, results of the workshop and results of pre- and post tests shall be attached. These documents shall be submitted to JICA and Sudan government.

9. ESTIMATED PROJECT COST OF THE SOFT COMPONENTS

The estimated costs for the proposed soft components are shown below:

Items		Costs (thousands Japanese Yen)
1	Direct personnel expenses	*****
2	Direct costs	*****
3	Indirect costs	*****
Total		*****

10. RESPONSIBILITY OF SUDAN SIDE

10.1 Sustainable Activities Required to be done by the Sudan Side

Irrigation is indispensable for the two (2) states of River Nile and Kassala where are not blessed with enough precipitation for agriculture . In the two (2) states, most of people living in irrigation scheme areas are relying on farming. Therefore, irrigation services by scheme committees have to be sustainable and everlasting to support farmer's living standard, regional economy and food safety.

Each scheme committee is required to manage scheme and make O & M of provided irrigation facilities by the Project in accordance with prescribed roles using collected water rate. Similarly, beneficial farmers have to conduct dredging and weeding in Abu Ashreen and Abu Shitta canals as their duty one (1) to two (2) times a year. State MoAARI is also required to maintain and repair major and sub-minor canals. Thereby consistent maintenance of canals from upstream to tail-end will be able to be realized and sustainable irrigation services will be executed. At present, since irrigation schemes are generally weak in O & M of irrigation facilities and scheme management, thereby implementation of the proposed soft components will contribute to strengthen them.

10.2 Possibility for Execution

The targeted four (4) schemes have been managed based on the prescribed roles because of necessity for irrigation in dry areas. Kitiab scheme established in 1917 and Aliab scheme established in 1942 have experiences of management and O & M for long time though there are some weakness. Therefore, it is considered that they have already basis to conduct the soft components under the grant aid Project. Especially, Aliab will become a good model of better management and O & M of irrigation facilities for other schemes though there are still rooms for improvement, and there are potential to realize consistent O & M of canals from upstream to tail-end along with improved scheme management by implementing soft components.

10.3 Predictable Limiting Factors

The predicted limiting factor will be securing of budget. Especially, beneficial farmers in charge of maintaining tail-end canals are not organized for O & M purpose and have no budget for it. Therefore, mutual work by them is the only mean, which will assure necessary labors for O & M only for tail-end canals irrigating their farm lots. However, in case of middle scale rehabilitation or

renovation, they have to request financial and technical supports to scheme or state MoAIF. As to pumps, in fact scheme manages though MoAI is in charge. It is required to provide budget for renovation and rehabilitation when necessary according to the prescribed roles. MoAIF in River Nile State and NHAC in Kassala State are also requested to provide budget to conduct regular maintenance of irrigation facilities. Otherwise, it may be difficult to realize on-time and quantitatively adequate irrigation.

10.4 Countermeasures against Limiting Factors

The collected water rate is the only revenue source for management and O & M for scheme committee. Each scheme committee is required to recognize that provision of quality irrigation services and on-time and quantitative irrigation to meet farmer's request will lead to higher water rate collection. However, in fact, each scheme is in debt more or less. If scheme and farmers cannot make O & M of irrigation facilities by their financial capability, MoAIF is required to support them financially. In case, MoAIF cannot assist them, Federal MoAI should support them financially. It is also necessary for K14 in Kassala State to apply the same supporting measures as well as those in River Nile State.

Appendix -6 References

Appendix -6.1 Selection of Targeted Irrigation Schemes for the Project

6 irrigation schemes in River Nile State and New Halfa irrigation scheme Kilo 14 in Kassala State are evaluated on their viabilities in accordance with the policy of the Grant Aid Project aiming at prioritization and selection of the targeted schemes for the Project.

Conditions required to be resided in the schemes for introducing the Grant Aid Project in compliance with its objective are considered as follows which are considered as the evaluation criteria for prioritization:

1) Intake pump and canal system will function well in sound conditions after rehabilitated and/or modified for some parts as required,
2) Scheme shall have a certain organization established for sustainable operation and maintenance continuously after the Project,
3) Appropriateness of the benefit against the investment is secured through attaining higher productivity derived from upgrading of food production infrastructure and soft component (technical assistance) to be implemented by the Project,
4) It is valid and urgent to introduce the Project for stabilization of the peoples' livelihood and alleviation of poverty,
5) Project covers large number of beneficial population, and
6) Project covers extensive irrigation area.

In accordance with the above criteria, each scheme is evaluated as shown in **(Table A-6-1)** by referring to the survey data in **(Table A-6-2)** Evaluation for Prioritization on the Irrigation Schemes.

Table A-6-1 Comparison for Prioritization of the Irrigation Schemes

Evaluation Items	Weighting Factor	Bauga	Kadabas	Aliab	Kitiab	Sayal	Elsha heed	New Halfa kilo 14
① Functional Soundness of the Pump and Canal facilities	(Require -ment for eligibility)	●	△	△	△	●	×	●
② Existence of Organization for Sustainable Operation and Maintenance	(Require -ment for eligibility)	●	△	●	●	△	×	●
③ Effectiveness for Increase of Production and Adequateness of Investment against Benefit	4	(5) 20	(2) 8	(7) 28	(6) 24	(3) 12	(1) 4	(4) 16
④ Urgency for Stabilization of the People's Livelihood and Poverty Alleviation	3	(3) 9	(6) 18	(1) 3	(4) 12	(2) 6	(5) 15	(7) 21
⑤ Large Number of Beneficial Population	2	(2) 4	(4) 8	(3) 6	(6) 12	(1) 2	(5) 10	(7) 14
⑥ Extensiveness of the Irrigation Area	1	(2) 2	(3) 3	(4) 4	(5) 5	(1) 1	(6) 6	(7) 7
Total Points		35	37	41	53	21	35	58
Order of Priority		5	4	3	2	6	(7)	1

Note : In the items①and②, ● indicates "Soundness", △indicates "Insufficient" and × indicates "Malfunction"

Outlines of evaluation result are explained as follows:

① Functional Soundness of the Intake Pump and Canal facilities

Sound function of the irrigation system, even if it is maintained by rehabilitation or partial replacement, is the minimum requirement to secure smooth and effective operation of the scheme.
As to the Elshaheed irrigation scheme which is indicated by "x" mark,

- The existing uncompleted canal can not cover the whole irrigation area planned and has been destroyed by floods from wadi.
- The pump and canal flow capacity are just a half of the requirement. Furthermore, flow capacity of pipeline between pump station and canals are also insufficient.
- Canal has lost its function. It needs redesign and reconstruction of entire canal system.

In other schemes, there are some deterioration of the gates, shortage of canal flow sections, blockage of the siphon, so forth, and those are required to be rehabilitated. But, it is possible to recover their canal function

② Existence of the organization for sustainable scheme management and farming

Number two ② is the most important requirement for sustainable operation and management of the scheme for future.

As to the Elshaheed scheme, which is indicated by second "×" mark.

- Elshaheed scheme is managed under the State at present and entire irrigation activity is suspended. (the year from 2006 to 2009, it was operated).
- In other schemes except Elshaheed, administrative scheme councils are organized and it manages the schemes almost well. Therefore, it is expected to manage the scheme sustainably after the introduction of the Grant Aid Project.

③ Effectiveness in production increase and adequateness of investment against benefit (B/C ratio)

- It is expected that the crop production will be increased because stable and sufficient irrigation water supply will be achieved by Grant Aid Project and farming is also expected to be improved along with the increase of irrigation water.
- Increase of crop production is estimated based on the assumption that around 80% of the difference between the previous highest yield and the present average one on the wheat production can be increased, and the same ratio is applied to all of annual crop production.
- Production of perennial crop is assumed not to be increased by the improvement of irrigation water supply due to the fixed plantation area and varieties.
- B/C ratio estimated between investment and crop production value for 20 years is given at 20.02 for Aliab and 0.11 for Elshaheed.
- Numbering of order is given from lower to higher in parentheses "( )".

④ Urgency for stabilization of the People's Livelihood and Poverty alleviation

- This is mainly evaluated by the minimum required cost per month to manage family livelihood. As the result, order of poverty degree is "K14、Kadabas, Elshaheed, Kitiab, Bauga, Sayal and Aliab" indicating the urgency and the requirement of the introduction of the Grant Aid Project.

⑤ Large number of beneficial Population (Desirably, Grant Aid Project requires to cover larger population)

- Order of beneficiary population from large number is K14, Kitiab, Elshaheed, Kadabas, Aliab, Bauga and Sayal.

⑥ Extensiveness of Irrigation Area (Grant Aid Project shall cover the large area)

- Order of irrigation area from large coverage is K14, Elshaheed, Kitiab, Aliab, Kadabas, Bauga and Sayal.

Weighting is made in accordance with the importance for the objective of the Grant Aid Project to the order of each evaluation item. Prioritization is given in accordance with the total point of the schemes.

As the result, the following three (3) schemes are selected as the target ones for Japan's Grant Aid Project taking the total investment cost and effectiveness of the Project into consideration.

1. New Halfa irrigation scheme Kilo 14 in Kassala State
2. Kitiab irrigation scheme in River Nile State
3. Aliab irrigation scheme in River Nile State

Table A-6-2 Evaluation for Prioritization on the Irrigation Schemes

	Schemes		Bauga	Kadabas	Aliab	Kitiab	Sayal	Elshaheed	New Halfa K14
Basic Data	Established Year		1917	2000	1942	1917	1974	2001	1974
	Irrigation Area in Feddan	fed.	4,500 (2)	4,800 (3)	5,250 (4)	5,700 (5)	2,800 (1)	10,000 (6)	31,000 (7)
	Irrigation Area in Hectare	ha	1,890	2,016	2,205	2,394	1,176	4,200	13,020
	Max. Irrigation Water Requirement (Emerging Month)	m^3/s	5.89 (Apr)	4.37 (Mar)	3.58 (Jan)	3.93 (Feb)	2.87 (Feb)	12.3 (Feb)	7.0 (Oct)
Functional Soundness of Pump and Canal / Sufficiency of Irrigation Water	Actual Capacity of Pump	m^3/s	4.00	0.80	3.50	4.00	4.00	6.00	10.50
	Sufficiency of Irrigation Wate	%	67.9	18.3	97.8	101.8	139.4	48.8	100.0
	Problems of the Existing Pum		One pump is under repair (Engine capa is too small so that it is operated at 70% speed)	Two(2) motor pumps are temporarily installed on the ground.	One unit is out of order. Two(2) units are installed out-door having cavitations and submergence problems.	Main pump station has a capacity of $4.75m^3/s$. One unit is out-door having submergence problem. One floating pump is working at the end of scheme area.	Two (2) units of pump are out of order.	No problem is found.	High risk of malfunction of pump is concerned due to use of long duration for nearly 40 years. Procurement of spare parts is getting difficult.
	New motor pumps supplied by NWPP (Horizontal shaft centrifugal volute pump & motor)		2 units, capacity of $2m^3/s$ in total	—	2 units, capacity of $2m^3/s$ in total	2 units, capacity of $2m^3/s$ in total	2 units, capacity of $2m^3/s$ in total (Vertical shaft centrifugal pump)	-	-
	Flow capacity of canal	m^3/s	5.87	7.46	0.44	3.07	2.01	5.81	N.A.
	Excess or deficiency of canal capacity	m^3/s	-0.02	+3.09	-3.14	-0.86	-0.83	-6.49	N.A.
	Functional Soundness of Canal Facilities		Insufficient dredging at the mids:ream of canal. No problem other than this.	Almost no canal maintenance is conducted at present due to small irrigation area of only 1,100 fed. The siphon of canal has been plugged by sedimentation.	Ordinal maintenance is conducted, however, canal has insufficient capacity and needs enlargement.	Flow capacity of canal is insufficient. Many Abu Ashreen canals are distributed from major canal directly which causes water shortage.	Flow capacity of canal is insufficient. Rotational irrigation by two blocks divided the scheme into east and west ones. Enlargement of canal is required for 1 km of upstream section.	Immature canal can not cover whole irrigation area and has been destroyed by flood of wadi. Flow capacity of pipeline from pump station and canals are insufficient too. Canal elevation is considerably low totally. ×	Although a certain level of deterioration is existed on some distribution facilities, none of serious problem is found in water conveyance function.
	Excess or deficiency of irrigation water in a farmland		・Water is not seriously short but insufficient. ・Water will be enough if taking new pumps into consideration.	・Present water sufficiency is 80% because irrigation water of $0.8m^3/s$ is supplied for farmland of only 1,100fed. ・Water sufficiency is only 18.3% against whole irrigation area of 4,800fed.	・Water is not enough, and supplied unstable because main pumps are installed out-door. ・Water will be enough if taking new pumps into consideration.	・Although pump capacity is enough, water is short due to small flow capacity of canal and supplemented by floating pump at the end of scheme. Much water leakage from discharge pipe of floating pump is observed.	・Pump capacity is enough because irrigation area is reduced in the year of 2000 from 9,000fed to 2,800fed. ・Water flow capacity is short at the upstream portion of canal for 1.0km in length.	・Pump discharge capacity is half of the requirement. ・Canal flow capacity is also half of the requirement. ・Canal lost its function. ・Entire irrigation activity is suspended. ×	・It is supposed that operation units and operation hour is rather short if compare with other area. Accordingly, water is likely to be short.
Organization of O & M	Number of Staff of Scheme Committee	Person	40	8	37	48	24	7	54
	Number of Staff for Pump Operation	Person	12	3	9	15	4	2	6
Estimation of Crop Production Value and that after yield increase	Total Existing Planted Area	fed	5,230	1,100	5,753	4,520	2,377	(1,110)	31,000
	Cropping Intensity		1.16	0.23	1.10	0.79	0.85	-	1.00
	Yield of Wheat (average)	kg/fed	1,000	800	1,100	800	800		700
	-ditto- (highest yield)	kg/fed	1,500	1,100	2,800	1,400	1600		800
	Gross Crop Production Value	MSDG	18.44	1.94	35.49	23.31	6.08	0.11	43.90
	-ditto- (per plantd area)	SDG/fed	3,525	1,760	6,168	5,157	2,559	100	1,416
	Ratio of Annual Crops	%	31	100	70	44	91	100	100
	Ratio of Perennial Crops	%	69	0	30	56	9	0	0
	Estimated Crop production Value after yield increase	MSDG	19.58	9.31	61.24	29.46	10.51	1.00	48.92
	(It is estimated based on that 80% of the difference between highest and average yields can be achieved. It is applied to annual crops)		(+1.14)	(+7.37)	(+25.75)	(+6.15)	(+4.43)	(Gross crop production expected)	(+5.02)
O & M Cost	Annual O & M Cost	MSDG	0.993	0.873	1.554	1.700	1.046	2.982	7.750
				(= 0.2MSDG/1,100fed*4,800fed)			(Estimated in proportion of area with Kitiab)		(= 250SDG/fed*31,000fed)
Beneficial Population and Livelihood	No. of Farmer Households	Household	2,200	2,200	1,500	3,000	452	3,300	11,000
	No. of beneficiaries (population)	Person	8,800 (2)	12,000 (4)	10,500 (3)	21,000 (6)	3,200 (1)	19,800 (5)	110,000 (7)
	Average farm size owned	fed/family	2.0	2.2	3.5	1.9	2.0	3.0	2.8
	Average Family size	persons/ family	4	5.5	7	7	7	6	10
	Minimum requirement to manage a family per month	SDG/ household	700	500	2,100	750	1,500	600	500
	-ditto- (per person)	SDG/person	175 (3)	91 (6)	300 (1)	107 (4)	214 (2)	100 (5)	50 (7)
BC Ratio	Crop production for 20years(B	M・Yen	11,750	5,587	36,742	17,678	6,304	600	29,350
	Renovation cost for facility	M・Yen	1,010	980	903	953	732	3,593	440
	O & M Cost for 20 years	M・Yen	596	524	932	1,020	628	1,789	4,650
	Investment cost for 20 years(C	M・Yen	1,606	1,504	1,835	1,973	1,360	5,382	5,090
	Crop Production(20years)/ Investment(20years)	(B/C)	**7.32** (5)	**3.72** (2)	**20.02** (7)	**8.96** (6)	**4.64** (3)	**0.11** (1)	**5.77** (4)
Conditions	Necessity & Urgency of rehabilitation		Low	High	Median	Median	Low	High	Median

Appendix -6.2 Organizational Chart

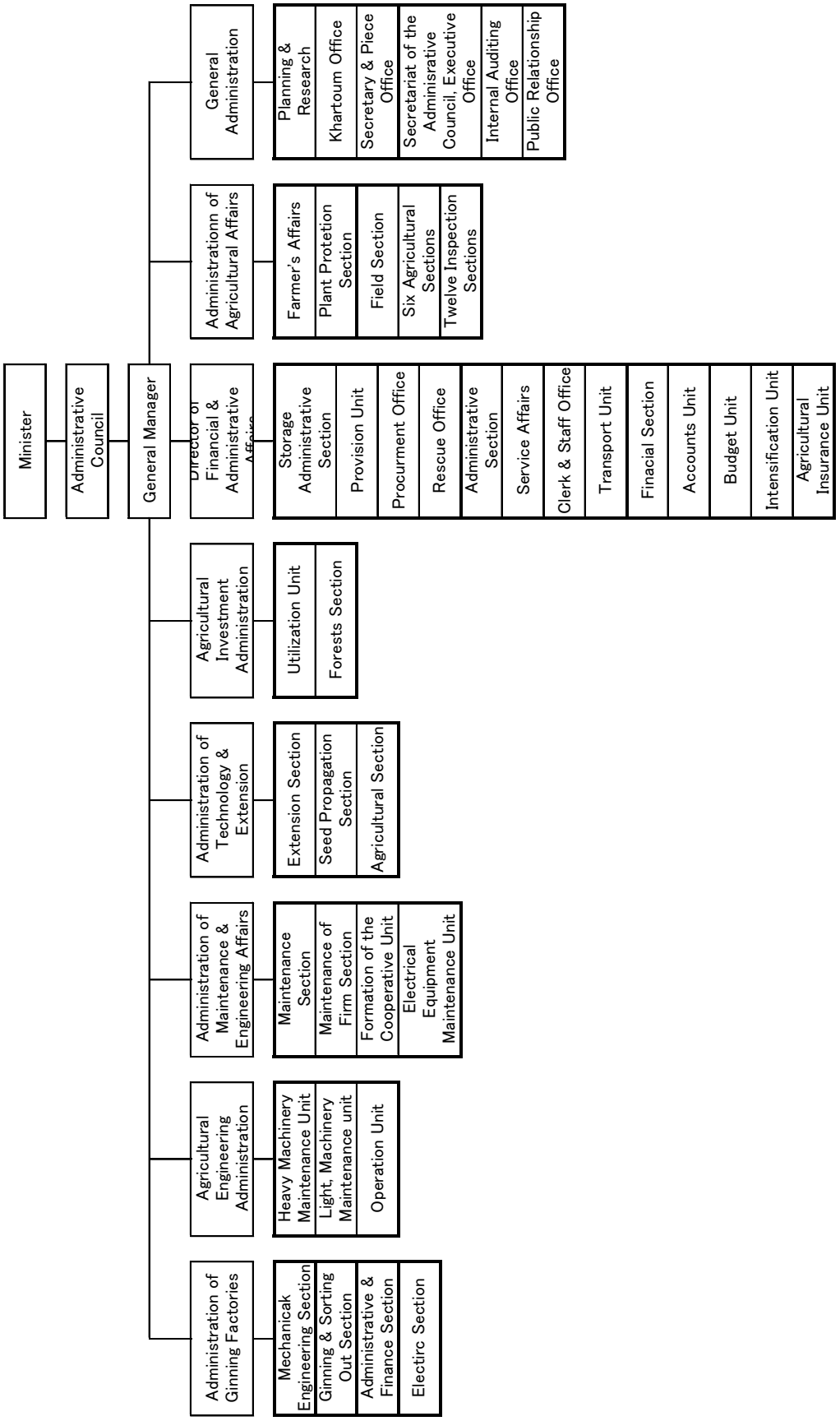


Figure A-6-2-1 Organization Chart of the Federal Ministry of Agriculture and Forestry (as of May 2011)

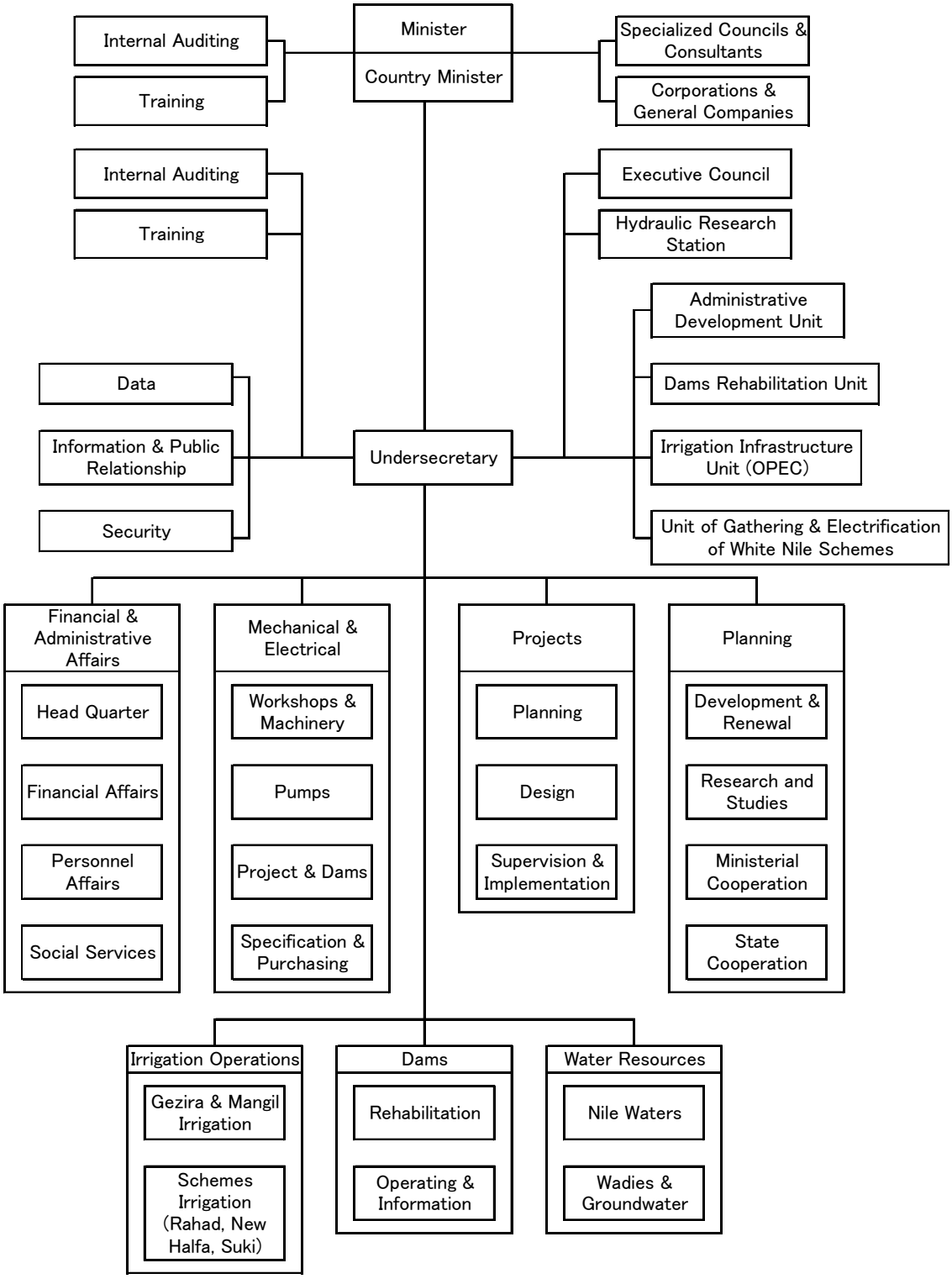


Figure A-6-2-2　Organization Chart of the Ministry of Irrigation and Water Resources (as of Aug 2011)

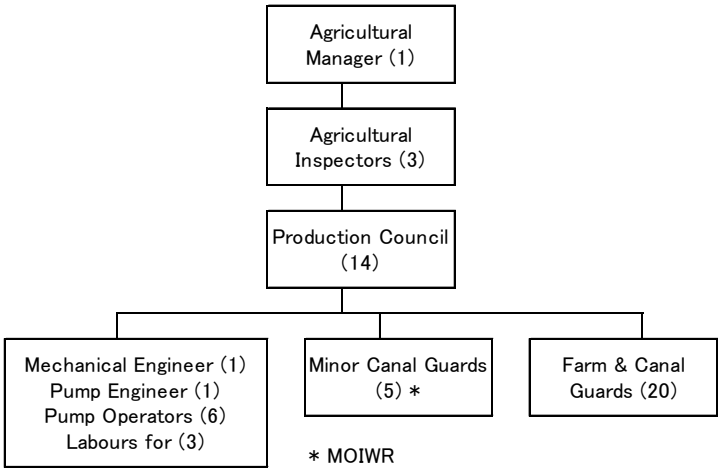


Figure A-6-2-3 Organization Chart of K14 Area

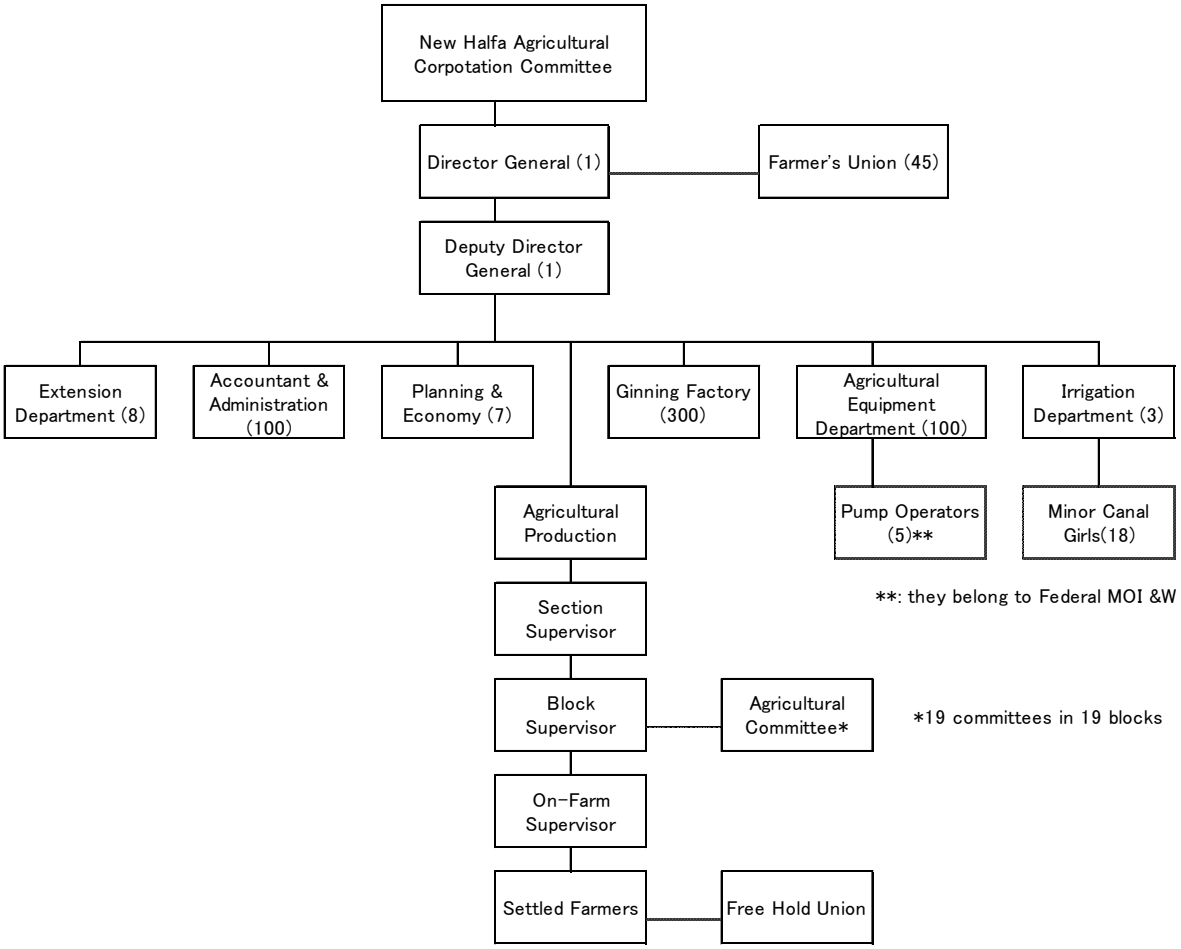
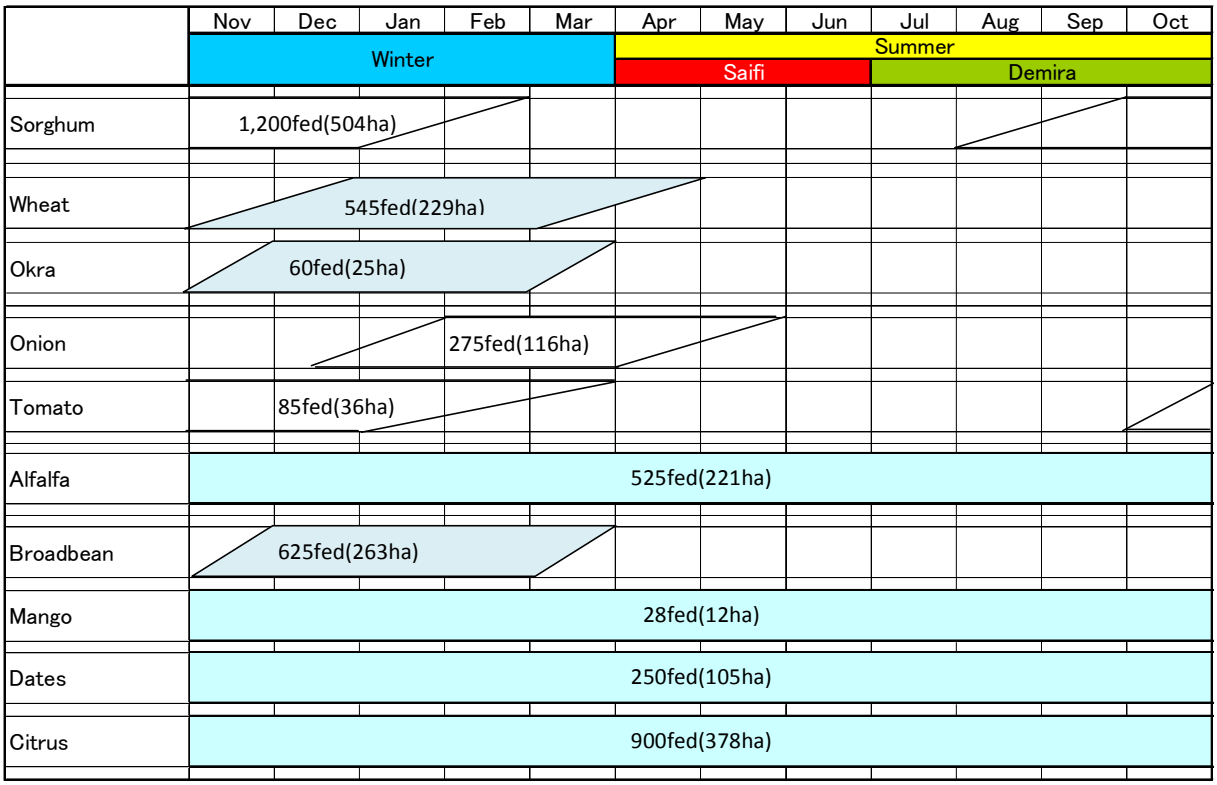


Figure A-6-2-4 Organization Chart of the New Halfa Agricutural Corporation

Appendix -6.3 Cropping Schedule and Cropping Area

Table A-6-3-1 Cropping Schedule and Cropping Area (Aliab Scheme)

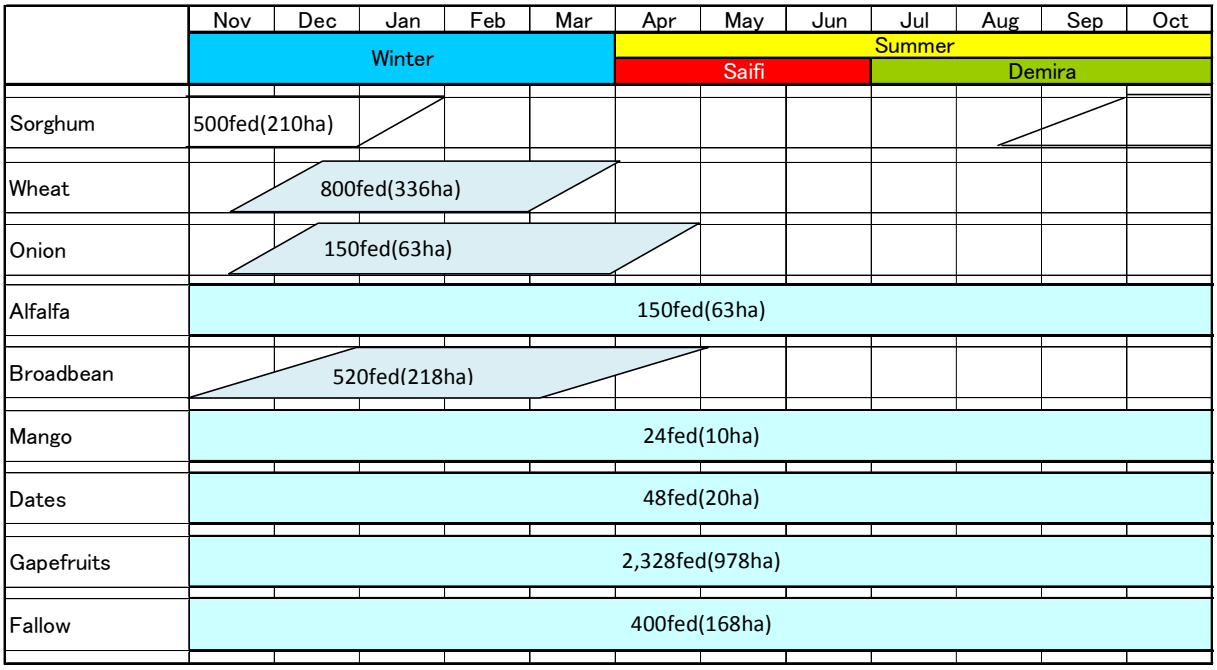


Irrigation Water requirement

Crops	Area (%)			Water requirement(mm/month)									
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Sorgham	13	183.4	168.2	40.6	0	0	0	0	0	0	38.8	123.6	206.1
	13	168.2	184.6	166.2	45.8	0	0	0	0	0	0	39.4	107.7
Wheat	6	65.9	182.2	211.1	192	48.4	0	0	0	0	0	0	0
	6	0	69.8	183.8	221.6	252.9	51	0	0	0	0	0	0
Okra	1	65.8	149.9	189.3	199.7	107.6	0	0	0	0	0	0	0
	1	0	131.1	174.7	200.5	247	0	0	0	0	0	0	0
Onion	3	0	69.4	145	193	263.9	120.2	0	0	0	0	0	0
	3	0	0	70.1	150.2	252.3	290.3	117.9	0	0	0	0	0
Tomato	1	182.2	209.7	62.4	0	0	0	0	0	0	0	0	73.8
	1	58.7	182.3	207.7	70.6	0	0	0	0	0	0	0	0
	1	0	62.6	183.9	219.4	100.4	0	0	0	0	0	0	0
Alfalfa	12	72.1	72.6	72	75.6	99.9	199.7	255.3	286.7	280.7	238	246.6	212.6
Broad beans	7	47	121.7	184.6	200.2	105.9	0	0	0	0	0	0	0
	7	0	96.2	158.3	200.3	245.8	0	0	0	0	0	0	0
Mango	1	162.3	163.4	162	179.9	260.3	312	302.1	339.3	332.1	272.8	267.9	225.6
Dates	6	162.3	163.4	162	170	227	278.5	267	299.8	293.5	248.9	257.9	229.1
Citrus	21	126.2	127.1	126.3	133.2	176.5	194.5	181.6	203.9	201.6	186.7	193.5	172.5
Net scheme irr.req. (mm/month)	(1)	102.5	132.5	135.7	125	128	100	91.4	98.6	97	90.5	109.6	119.3
Net scheme irr.req. (mm/day)	(2)	3.4	4.3	4.4	4.5	4.1	3.3	2.9	3.3	3.1	2.9	3.7	3.8
Net scheme irr.req. per area(//s/ha)	(3)	0.4	0.49	0.51	0.52	0.48	0.39	0.34	0.38	0.36	0.34	0.42	0.45
〃 (m^3/s/1000fd)	(4)	0.17	0.21	0.21	0.22	0.20	0.16	0.14	0.16	0.15	0.14	0.18	0.19
Irrigation efficiency	(5)	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Gross scheme irr.req (m^3/s/1000fd)	(6)	0.38	0.47	0.49	0.50	0.46	0.37	0.32	0.36	0.34	0.32	0.40	0.43
Irrigation water requirement (m^3/s/1000fd)	(7)	0.40	0.49	0.51	0.52	0.48	0.39	0.34	0.38	0.36	0.34	0.42	0.45
Irrigated area(fd)	(8)	4,307	5,250	5,250	4,659	3,902	2,714	2,219	2,053	2,053	2,776	3,500	3,533
Required pump discharge(m^3/s)	(9)	2.30	3.44	3.58	3.24	2.50	1.41	1.01	1.04	0.99	1.26	1.96	2.12

note: (1) Calculated by CROPWAT
Σ{water requiremnet × area(%)}
(2) =(1)/days of the month
(3) =(2)×10,000/86,400
(4) =(3)×0.42 (1feddan＝0.42ha)
(6) =(4)/(5)
(7) =(6)×(1+0.05)
(9) =(7)×(8)/1,000×24/18(Operation hour)
irr.req.＝irrigation requirement

Table A-6-3-2 Cropping Schedule and Cropping Area (Kitiab Scheme)

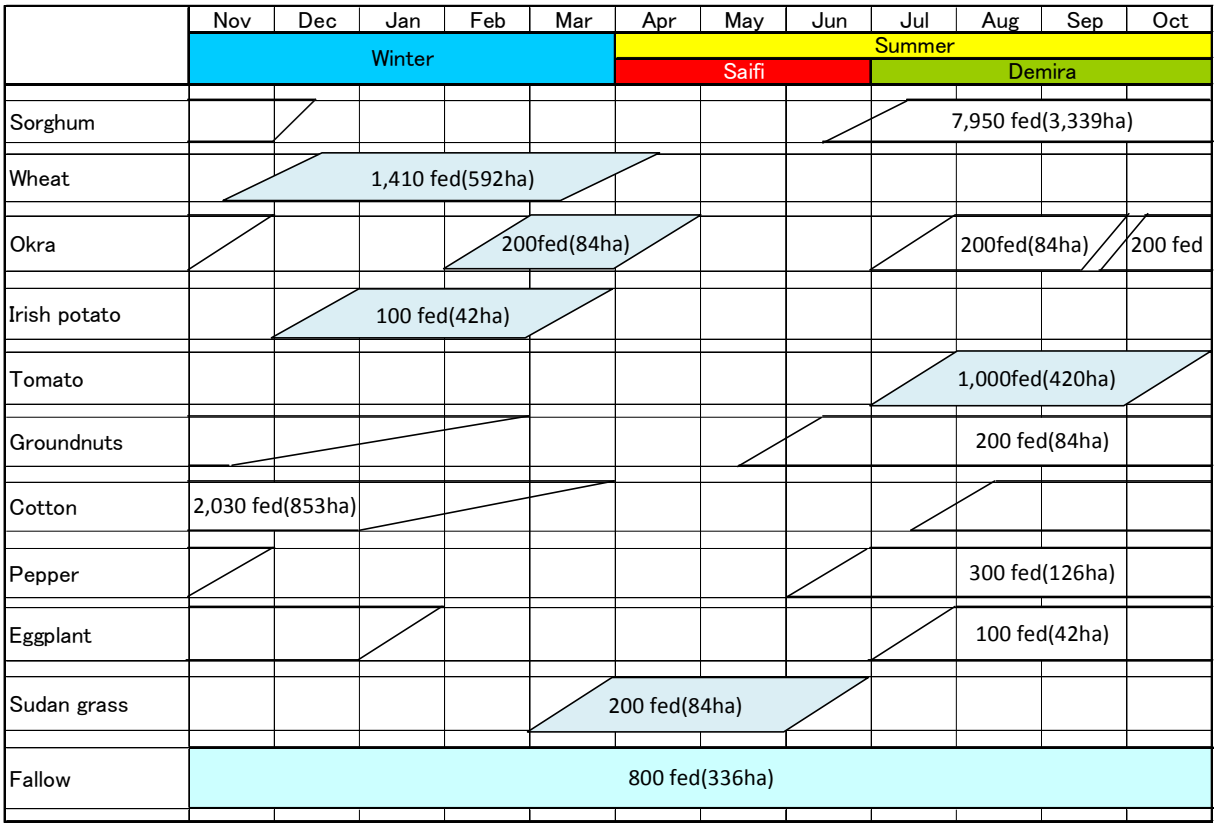


Irrigation Water requirement

Crops	Area (%)	Water requirement(mm/month)											
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Sorghum	6	184.6	170.7	44.6	0	0	0	0	0	0	0	39.6	154.1
	5	170.9	185.6	124.7	0	0	0	0	0	0	0	0	88.4
Wheat	9	0	142.3	208.4	196.6	54	0	0	0	0	0	0	0
	9	0	69.8	184.7	222.7	156.6	0	0	0	0	0	0	0
Onion	1	0	130.2	165.2	200.3	264.4	130.3	0	0	0	0	0	0
	2	0	69.4	145.1	193.4	264.4	267.1	0	0	0	0	0	0
Alfalfa	3	72.1	72.6	72	75.6	99.9	199.7	255.3	286.7	280.7	238	246.6	212.6
Broad beans	6	47	121.7	184.6	200.2	105.9	0	0	0	0	0	0	0
	6	0	49.6	123.5	194.4	264.1	114.9	0	0	0	0	0	0
Mango	1	162.3	163.4	162	179.9	260.3	312	302.1	339.3	332.1	272.8	267.9	225.6
Dates	1	162.3	163.4	162	170	227	278.5	267	299.8	293.5	248.9	257.9	229.1
Grapefruite	51	126.2	127.1	126.3	133.2	176.5	194.5	181.6	203.9	201.6	186.7	193.5	172.5
Net scheme irr.req. (mm/month)	(1)	92.2	121.8	137.1	141	146.9	124.6	106	119	117.5	107.6	113.7	112.6
Net scheme irr.req. (mm/day)	(2)	3.1	3.9	4.4	5	4.7	4.2	3.4	4	3.8	3.5	3.8	3.6
Net scheme irr.req. per area(//s/ha)	(3)	0.36	0.45	0.51	0.58	0.55	0.48	0.4	0.46	0.44	0.4	0.44	0.42
〃 (m^3/s/1000fd)	(4)	0.15	0.19	0.21	0.24	0.23	0.20	0.17	0.19	0.18	0.17	0.18	0.18
Irrigation efficiency	(5)	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Gross scheme irr.req (m^3/s/1000fd)	(6)	0.34	0.43	0.49	0.55	0.53	0.46	0.38	0.44	0.42	0.38	0.42	0.40
Irrigation water requirement (m^3/s/1000fd)	(7)	0.36	0.45	0.51	0.58	0.55	0.48	0.40	0.46	0.44	0.40	0.44	0.42
Irrigated area(fd)	(8)	4,174	5,700	5,700	5,069	5,069	3,733	3,216	3,216	3,216	3,216	3,531	3,846
Required pump discharge(m^3/s)	(9)	2.01	3.43	3.88	3.93	3.73	2.39	1.72	1.98	1.89	1.72	2.08	2.16

note: (1) Calculated by CROPWAT
Σ{water requiremnet × area(%)}
(2) =(1)/days of the month
(3) =(2) × 10,000/86,400
(4) =(3) × 0.42 (1feddan＝0.42ha)
(6) =(4)/(5)
(7) =(6) × (1+0.05)
(9) =(7) × (8)/1,000 × 24/18(Operation hour)
irr.req.＝irrigation requirement

Table A-6-3-3 Cropping Schedule and Cropping Area (New Halfa K14 Scheme)



New Halfa (K14)

Crops	Area (%)	Water requirement(mm/month)											
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Sorghum	34	123.7	0	0	0	0	0	0	0	77.1	169.8	221.8	206.7
	34	163.3	39.4	0	0	0	0	0	0	37	116.4	205.7	207.2
Wheat	6	0	123.6	205.4	211.7	167.3	0	0	0	0	0	0	0
	6	0	60.2	180.9	211.7	257.3	45.6	0	0	0	0	0	0
Okra	2	0	0	0	0	0	0	0	0	90.3	232.2	88.1	0
	2	172.9	0	0	0	0	0	0	0	0	0	0	161.8
	2	0	0.00	0	69.3	251.6	117.20	0	0	0	0	0	0
Irish Potato	1	0	43.2	168.8	207.2	100.1	0	0	0	0	0	0	0
Tomato	4	0	0	0	0	0	0	0	0	78.1	231	244.7	73.5
	4	0	0	0	0	0	0	0	0	0	166.1	243.8	195.6
Groudnut	1	127.7	0	0	0	0	0	0	0	49.3	133.4	236.9	229.8
	1	184	50.20	0	0	0	0.00	0	0	0	91.9	182.8	230.9
Cotton	9	211.1	182.7	123.4	0	0	0	0	0	0	77.6	149.8	239.5
	8	211.1	196.6	167	43.1	0	0	0	0	0	42.2	95.7	207.6
Pepper	1	62	0	0	0	0	0	0	0	81.4	151.9	223.2	229	207.9
	1	153.8	0	0	0	0	0	0	0	137.8	180.9	226.5	213.4
Eggplant	1	184.5	169	52.8	0	0	0	0	0	86.3	157	183.8	210.6
Sudangrass	2	0	0	0	0	68.2	157	245.5	97.3	0	0	0	0
Net scheme irr.req. (mm/month)	(1)	144.1	59.7	51.6	34.4	33.9	8.2	4.9	2.8	48	136.1	198.4	203.8
Net scheme irr.req. (mm/day)	(2)	4.8	1.9	1.7	1.2	1.1	0.3	0.2	0.1	1.5	4.4	6.6	6.6
Net scheme irr.req. per area(//s/ha)	(3)	0.56	0.22	0.19	0.14	0.13	0.03	0.02	0.01	0.18	0.51	0.77	0.76
〃 (m^3/s/1000fd)	(4)	0.24	0.09	0.08	0.06	0.05	0.01	0.01	0.00	0.08	0.21	0.32	0.32
Irrigation efficiency	(5)	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Gross scheme irr.req (m^3/s/1000fd)	(6)	0.44	0.17	0.15	0.11	0.10	0.02	0.02	0.01	0.14	0.40	0.61	0.60
Irrigation water requirement (m^3/s/1000fd	(7)	0.47	0.18	0.16	0.12	0.11	0.02	0.02	0.01	0.15	0.42	0.64	0.63
Irrigated area(fd)	(8)	10,780	6,910	3,640	2,525	1,810	1,105	200	200	8,970	11,600	11,600	11,600
Required pump discharge(m^3/s)	(9)	6.70	1.69	0.77	0.39	0.26	0.04	0.00	0.00	1.79	6.56	9.91	9.78

note: (1) Calculated by CROPWAT
Σ{water requiremnet × area(%)/100}
(2) =(1)/days of the month
(3) =(2) × 10,000/86,400
(4) =(3) × 0.42 (1feddan＝0.42ha)
(6) =(4)/(5)
(7) =(6) × (1+0.05)
(9) =(7) × (8)/1,000 × 24/18(Operation hour)
irr.req.＝irrigation requirement

Figure A-6-3-4 Calculating Table of Cropping Acreage (1/2)

Aliab (Design Irrgation Area 5,250 feddan) (feddan)

Crops	Area (feddan)		%	Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct	
Sorghum	1200	600	13	600	600	600	600	600															600	600	600	600	600
		600	13	600	600	600	600	600	600	600															600	600	600
Wheat	545	272	6		272	272	272	272	272	272	272	272															
		273	6				273	273	273	273	273	273	273	273													
Okra	60	30	1		30	30	30	30	30	30	30	30															
		30	1			30	30	30	30	30	30	30	30														
Onion	275	137	3				137	137	137	137	137	137	137	137													
		138	3						138	138	138	138	138	138	138												
Tomato	85	28	1	28	28	28	28	28																			28
		28	1		28	28	28	28	28	28																	
		29	1				29	29	29	29	29	29															
Alfalfa	525	525	12	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525
Broad bean	625	312	7		312	312	312	312	312	312	312	312															
		313	7			313	313	313	313	313	313	313	313														
Mango	28	28	1	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Date Palm	250	250	6	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Citrus	900	900	21	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
Maximum area=		4,355	103	2,931	3,573	3,916	4,355	4,355	3,865	3,865	3,237	3,237	2,594	2,251	1,841	1,841	1,703	1,703	1,703	1,703	1,703	1,703	2,303	2,303	2,903	2,903	2,931

Monthly average net cropping acreage	4,355	Conversion ratio	3,573		4,355		4,355		3,865		3,237		2,251		1,841		1,703		1,703		2,303		2,903		2,931	
Conversion to design irrigation area	5,250	1.206	4,307		5,250		5,250		4,659		3,902		2,714		2,219		2,053		2,053		2,776		3,500		3,533	

Kitiab (Design Irrgation Area 5,700 feddan) (feddan)

Crops	Area (feddan)		%	Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct	
Sorghum	500	250	6	250	250	250	250	250																250	250	250
		250	5	250	250	250	250	250	250																	250	250
Wheat	800	400	9			400	400	400	400	400	400	400															
		400	9				400	400	400	400	400	400	400														
Onion	150	75	1			75	75	75	75	75	75	75	75	75													
		75	2				75	75	75	75	75	75	75	75	75												
Alfalfa	150	150	3	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Broad bean	520	260	6		260	260	260	260	260	260	260	260															
		260	6				260	260	260	260	260	260	260	260													
Mango	24	24	1	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Date Palm	48	48	1	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Grapefruites	2328	2,328	51	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328	2,328
Maximum area=		4,520	100	3,050	3,310	3,785	4,520	4,520	4,270	4,020	4,020	4,020	3,360	2,960	2,625	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,800	3,050	3,050

Monthly average net cropping acreage	4,520	Conversion ratio	3,310		4,520		4,520		4,020		4,020		2,960		2,550		2,550		2,550		2,550		2,800		3,050	
Conversion to design irrigation area	5,700	1.261	4,174		5,700		5,700		5,069		5,069		3,733		3,216		3,216		3,216		3,216		3,531		3,846	

Figure A-6-3-4 Calculating Table of Cropping Acreage (2/2)

NewHalfa (feddan)

Crops	Area (feddan)		%	Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct	
Sorghum	7950	3,975	34	3,975	3,975															3,975	3,975	3,975	3,975	3,975	3,975	3,975	3,975
		3,975	34	3,975	3,975	3,975															3,795	3,795	3,795	3,795	3,795	3,795	3,795
Wheat	1410	705	6			705	705	705	705	705	705	705	705														
		705	6				705	705	705	705	705	705	705	705													
Okra	200	200	2	200	200						200	200	200	200							200	200	200	200		200	200
Irish Potato	100	100	1				100	100	100	100	100	100															
Tomato	1000	500	4																		500	500	500	500	500	500	
		500	4																			500	500	500	500	500	500
Grundnut	200	100	1	100	100																100	100	100	100	100	100	100
		100	1	100	100	100																100	100	100	100	100	100
Cotton	2030	1,015	9	1,015	1,015	1,015	1,015	1,015	1,015													1,015	1,015	1,015	1,015	1,015	1,015
		1,015	8	1,015	1,015	1,015	1,015	1,015	1,015	1,015													1,015	1,015	1,015	1,015	1,015
Pepper	300	150	1	150															150	150	150	150	150	150	150	150	150
		150	1	150	150															150	150	150	150	150	150	150	150
Eggplant	100	100	1	100	100	100	100	100													100	100	100	100	100	100	100
Sudan grass	200	200	2										200	200	200	200	200	200									
Maximum area=		11,600	115	10,780	10,630	6,910	3,640	3,640	3,540	2,525	1,710	1,710	1,810	1,105	200	200	200	200	150	4,275	8,970	10,585	11,600	11,600	11,400	11,600	11,100

Monthly average net cropping acreage	11,600	Conversion ratio	10,780	6,910	3,640	2,525	1,810	1,105	200	200	8,970	11,600	11,600	11,600
Conversion to design irrigation area	11,600	1.000	10,780	6,910	3,640	2,525	1,810	1,105	200	200	8,970	11,600	11,600	11,600

Note : For New Halfa scheme with having 31,000 feddan of total irrigation area, the annual maximum area is estimated as indicated above taking into account the rotation which irrigation practiced partly for each year.

Appendix -6.4 Monthly Average Actual Head and Total Head of Pump

Figure A-6-4-1 Monthly Average Actual Head and Total Head of Pump

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of Days		31	28	31	30	31	30	31	31	30	31	30	31
Aliab	Discharge (m^3/s)	3.58	3.24	2.50	1.41	1.01	1.04	0.99	1.26	1.96	2.12	2.30	3.44
	Pump Number	4	4	4	4	4	4	4	4	4	4	4	4
	Suction WL (m)	348.02	347.74	347.65	348.19	348.24	348.25	349.99	353.36	352.80	350.10	348.86	348.35
	Discharge WL (m)	355.9	355.9	355.9	355.9	355.9	355.9	355.9	355.9	355.9	355.9	355.9	355.9
	Actual Head (m)	7.88	8.16	8.25	7.71	7.66	7.65	5.91	2.54	3.10	5.80	7.04	7.55
	Suction Loss Head(m)	0.39	0.32	0.19	0.06	0.03	0.03	0.03	0.05	0.12	0.14	0.16	0.36
	Discharge Loss Head (m)	2.27	1.86	1.11	0.36	0.18	0.19	0.17	0.28	0.68	0.80	0.94	2.10
	Pipe Loss Head (m)	2.66	2.18	1.30	0.42	0.21	0.23	0.20	0.33	0.80	0.94	1.10	2.45
	Total Head (m)	10.53	10.33	9.55	8.12	7.87	7.88	6.11	2.87	3.90	6.73	8.14	10.00
Kitiab	Discharge (m^3/s)	3.88	3.93	3.73	2.39	1.72	1.98	1.89	1.72	2.08	2.16	2.01	3.43
	Pump Number	4	4	4	4	4	4	4	4	4	4	4	4
	Suction WL (m)	348.75	348.47	348.38	348.92	348.97	348.98	350.72	354.09	353.53	350.83	349.59	349.08
	Discharge WL (m)	356.1	356.1	356.1	356.1	356.1	356.1	356.1	356.1	356.1	356.1	356.1	356.1
	Actual Head (m)	7.35	7.63	7.72	7.18	7.13	7.12	5.38	2.01	2.57	5.27	6.51	7.02
	Suction Loss Head(m)	0.42	0.43	0.39	0.16	0.08	0.11	0.10	0.08	0.12	0.13	0.11	0.33
	Discharge Loss Head (m)	2.67	2.73	2.46	1.02	0.52	0.69	0.63	0.52	0.76	0.83	0.71	2.08
	Pipe Head Loss (m)	3.09	3.16	2.85	1.18	0.61	0.80	0.73	0.61	0.88	0.96	0.83	2.41
	Total Head (m)	10.44	10.79	10.57	8.35	7.73	7.92	6.12	2.62	3.46	6.22	7.34	9.43

Note: Discharge is calculated on condition of 18 hours operation of pump per day.

Figure A-6-5-1 Pump Shaft Power & Required Power

1 Pump shaft power

$L = 0.163 \cdot Q \cdot H \cdot \gamma / (\eta / 100)$

L: Pump shaft power

Q: Discharge (m^3/min)

H: Total head (m)

γ : Specific gravity, 1.0 (kgf/ℓ)

η : Pump efficiency (%)

2. Required power

$P = L \cdot (1+A) / \eta t$

P: Required power (kW)

L: Pump shaft power (kW)

A: Allowance (0.15)

η t: Transmit efficiency (1.0)

	Item	Aliab Irrigation Scheme	Kitiab Irrigation Scheme	K14 Pump Station
1	Discharge (m^3/s)	1.00	1.00	3.50
2	Discharge (m^3/min)	60.00	60.00	210.00
3	Max. actual head (m)	8.60	8.10	8.80
4	Pipe head loss (m)	3.32	3.28	0.80
5	Total head (m)	11.92	11.38	9.60
6	Designed total head (m)	12.00	11.40	9.60
7	Specific gravity	1.00	1.00	1.00
8	Pump efficiency (5)	80.0	80.0	80.5
	Pump shaft power (kW)	**147**	**139**	**408**
1	Allowance	0.15	0.15	0.15
2	Transmit efficiency	1.00	1.00	1.00
	Required power (kW)	**168.71**	**160.27**	**469.44**
	Designed power (kW)	**170**	**160**	**480**

Figure A-6-6-1 Output of Mortor and Required Capasity of Transfer (1/2)

No.	Item	kW	Qty	Eff.	P.F.	kVA/ unit	kVA/ amount	Max. requirement (kVA) for main motor starting			Required Trans Capa. (kVA)
								Already started	Starting: peak; 6 times Permissible; 80% (Ans = kVA*6*0.8)	Total	Impedance: 7% Permissible V drop: 10% Capa = (total)*(impedance)/(V drop)
① Aliab Irrigation Scheme											
I. Main Power											
1	Main pump motor (1)	170	2	0.9	0.95	198.83	397.66	397.66	0	397.66	
2	Main pump motor (2)	200	2	0.9	0.95	233.92	467.84	233.92	1,122.81	1,356.73	
3	Discharge valve motor	1.5	4	0.85	0.8	2.21	8.82	0.00		0.00	
	Sub-total							631.58	1,122.81	1,754.39	
II. Auxiliary power										0.00	
1	Vacuum pump motor	15	2	0.85	0.8	22.06	44.12	22.06	0	22.06	
2	Deep well motor	3.7	2	0.85	0.8	5.44	10.88	5.44	0	5.44	
3	Drainage (Sump) pump motor	1.5	1	0.85	0.8	2.21	2.21	0.00	0.00	0.00	
4	Overhead crane motor	8.3	1	0.85	0.8	12.21	12.21	0.00	0.00	0.00	
		0.92	1	0.85	0.8	1.35	1.35	0.00	0.00	0.00	
		0.92	2	0.85	0.8	1.35	2.71	0.00	0.00	0.00	
5	Lighting panel						10.00	10.00	0.00	10.00	
	Sub-total							37.50	0.00	37.50	
Total								669.08	1,122.81	1,791.89	1,254.32
Designed transformer capacity:											**1,500**
② Kitiab Irrigation Scheme											
I. Main Power											
1	Main pump motor (1)	160	2	0.9	0.95	187.13	374.27	374.27	0	374.27	
2	Main pump motor (2)	200	2	0.9	0.95	233.92	467.84	233.92	1,122.81	1,356.73	
3	Discharge valve motor	1.5	4	0.85	0.8	2.21	8.82	0.00		0.00	
	Sub-total							608.19	1,122.81	1,730.99	
II. Auxiliary power										0.00	
1	Vacuum pump motor	15	2	0.85	0.8	22.06	44.12	22.06	0	22.06	
2	Deep well motor	3.7	2	0.85	0.8	5.44	10.88	5.44	0	5.44	
3	Drainage (Sump) pump motor	1.5	1	0.85	0.8	2.21	2.21	0.00	0.00	0.00	
4	Overhead crane motor	8.3	1	0.85	0.8	12.21	12.21	0.00	0.00	0.00	
		0.92	1	0.85	0.8	1.35	1.35	0.00	0.00	0.00	
		0.92	2	0.85	0.8	1.35	2.71	0.00	0.00	0.00	
5	Lighting panel						10.00	10.00	0.00	10.00	
	Sub-total							37.50	0.00	37.50	
Total								645.69	1,122.81	1,768.49	1,237.95
Designed transformer capacity:											**1,500**

Figure A-6-6-1　Output of Mortor and Required Capasity of Transfer (2/2)

No.	Item	kW	Qty	Eff.	P.F.	kVA/ unit	kVA/ amount	Max. requirement (kVA) for main motor starting			Required Trans Capa. (kVA)
								Already started	Starting: peak; 6 times Permissible; 80% (Ans = kVA*6*0.8)	Total	Impedance: 7% Permissible V drop: 10% Capa = (total)*(impedance)/(V drop)
③ K14 Pump Station											
I. Main Power											
1	Main pump motor (1)	480	1	0.92	0.95	549.20	549.20	549.20	0	549.20	
2	Main pump motor (2)	480	2	0.92	0.95	549.20	1,098.40	549.20	2,636.16	3,185.35	
3	Discharge valve motor	(none)									
	Sub-total							1,098.40	2,636.16	3,734.55	
II. Auxiliary power										0.00	
1	Vacuum pump motor	(none)									
2	Deep well motor	(none)									
3	Drainage (Sump) pump motor	(none)									
4	Overhead crane motor	(manual crane)									
5	Lighting panel	(spare, if necessry)					10.00	10.00	0.00	10.00	
	Sub-total							10.00	0.00	10.00	
Total								1,108.40	2,636.16	3,744.55	2,621.19
Designed transformer capacity:											**3,000**

Appendix -6.7 Schematic Diagram of Undertakings for Irrigateion Scheame

(1) Undertakings of Ariab Pump Station

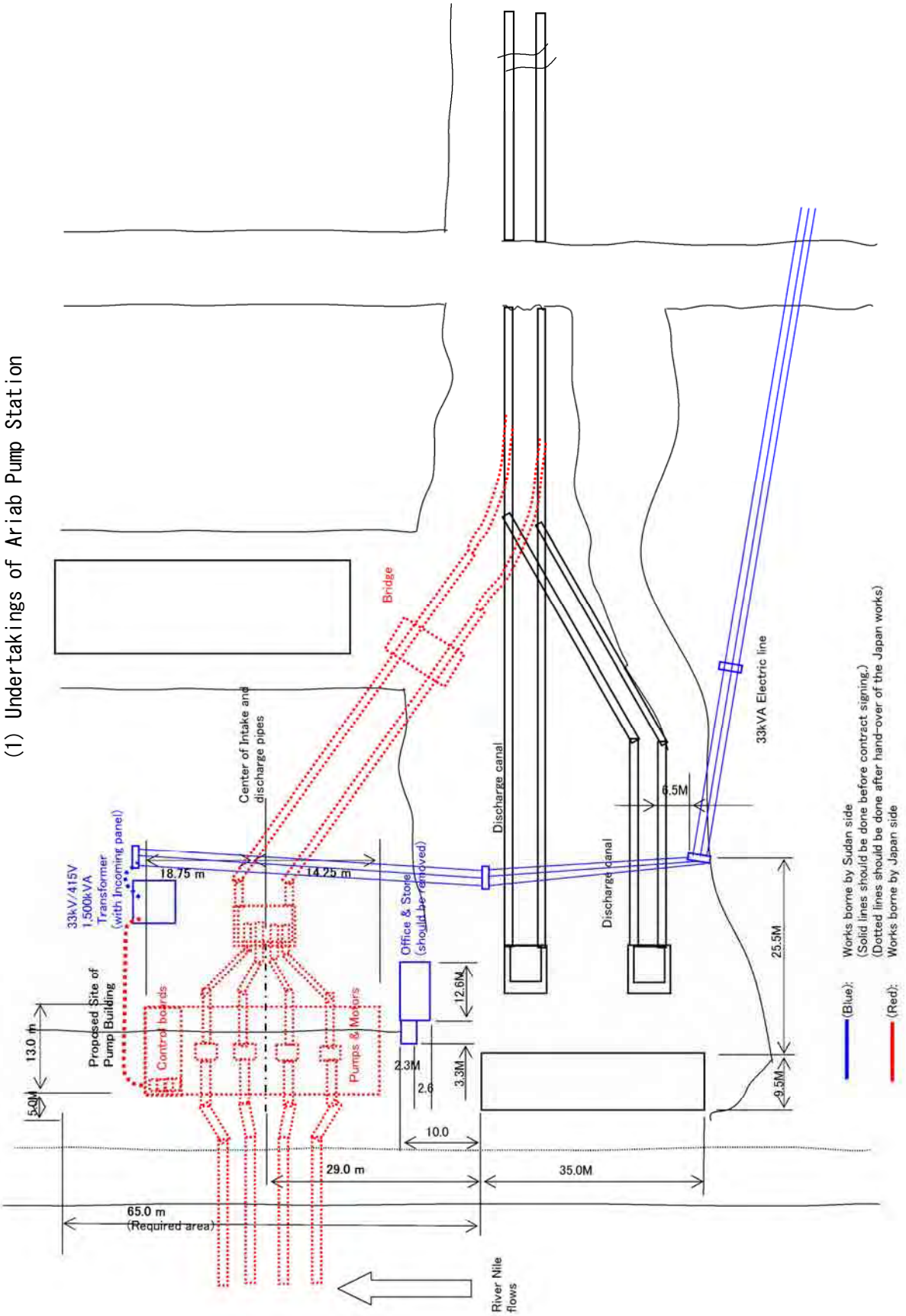


Figure A-6-7-1 Undertakings of Ariab Pump Station

(2) Undertakings of Kitiab Pump Station

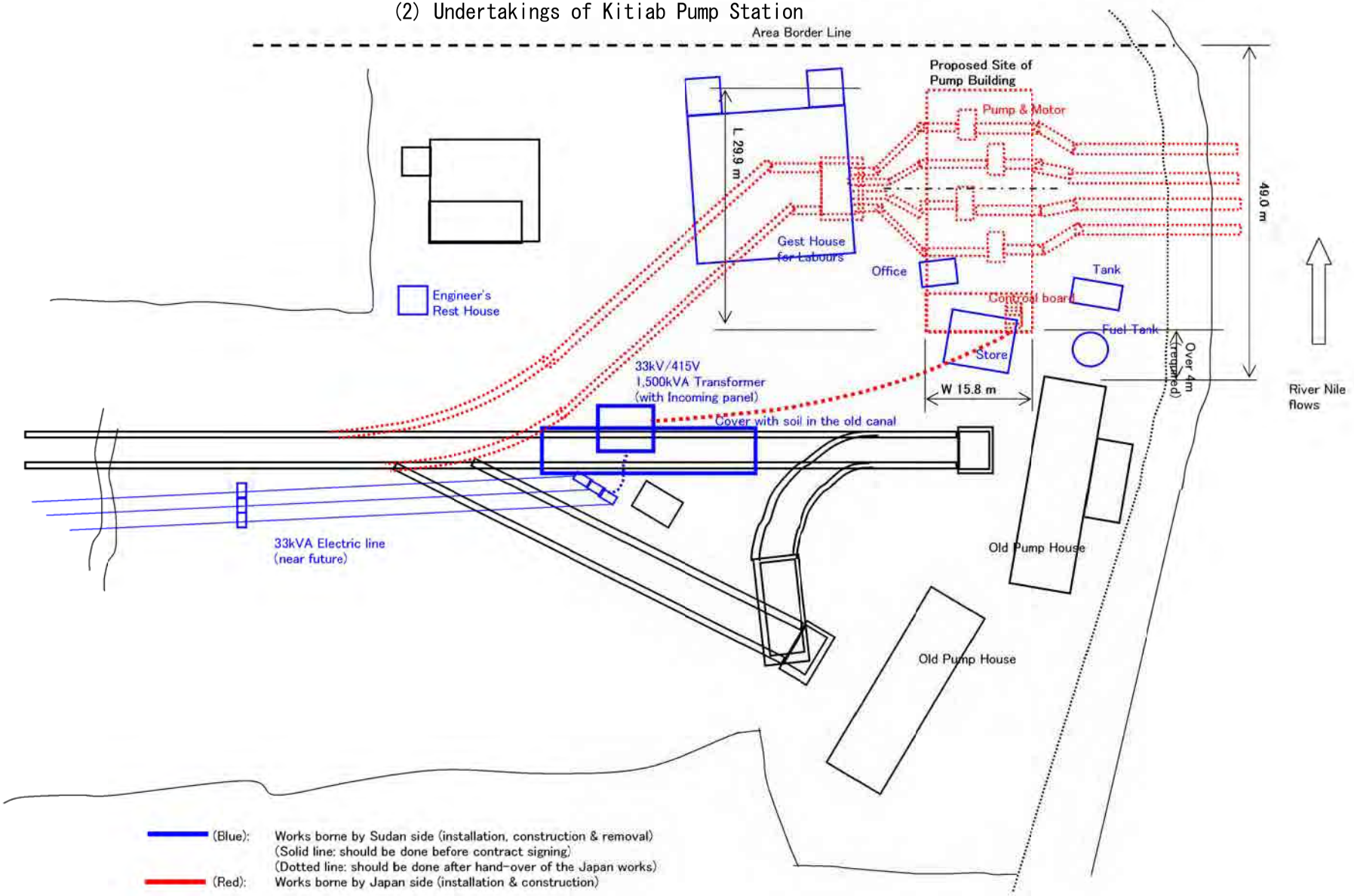


Figure A-6-7-2 Undertakings of Kitiab Pump Station

(3) Undertakings of K14 Pump Station

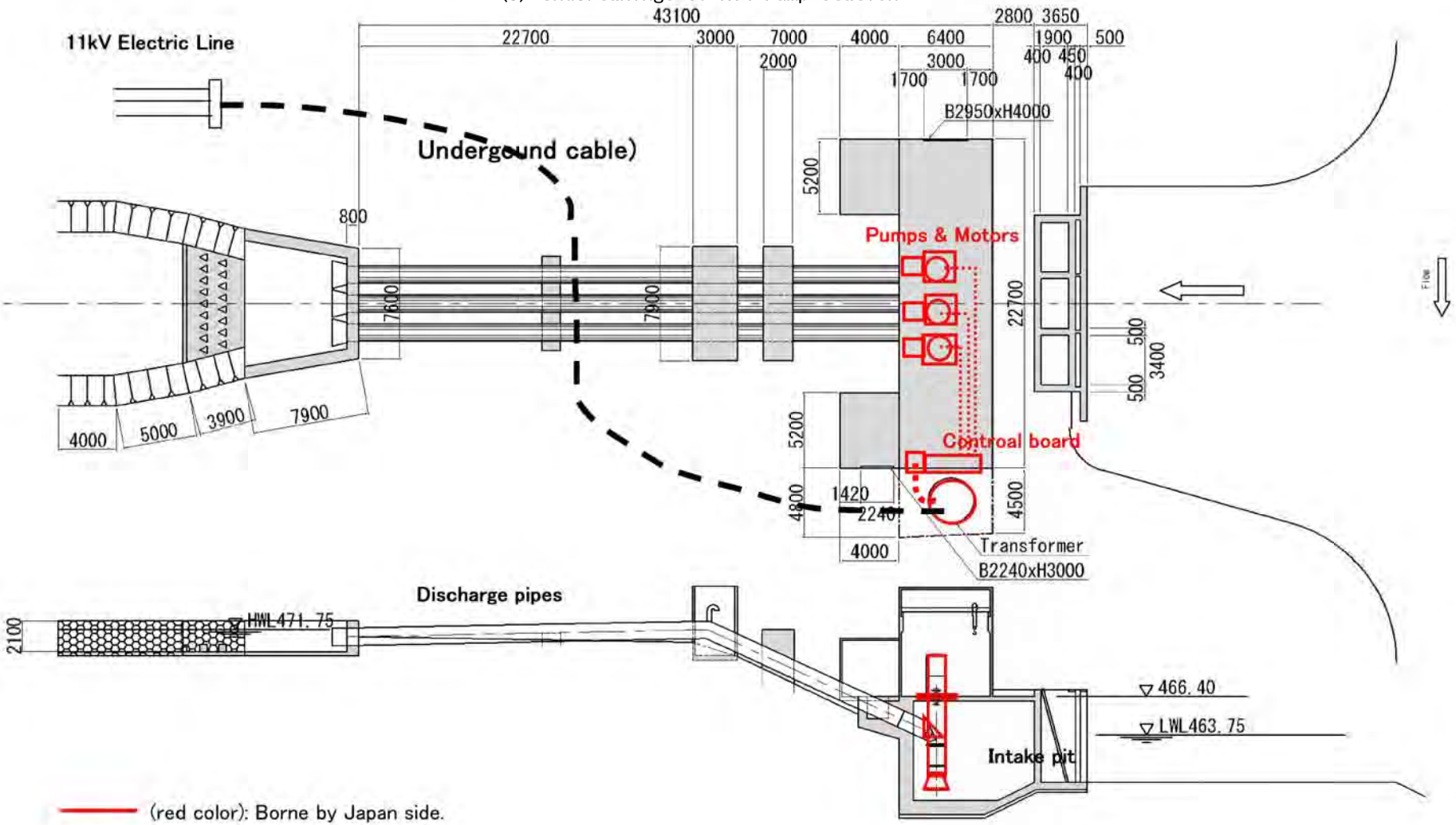


Figure A-6-7-3 Undertakings of K14 Pump Station

Appendix -6.8 Envieonmental Approval

HCENR

Higher Council for Environment & Natural Resources

HCENR

Environmental Approval (7/2011)

The Higher Council for Environment & Natural Resources (**HCENR**) received the Environmental Impact Assessment Repot (EIA) of **Upgrading Food Production Infrastructure in Northern Sudan (Aliab, Kitiab and Kadabas Agriculture Schemes**, from **The Ministry of Agriculture Animal Resources and Irrigation (River Nile State)** for evaluation. The report covered almost all aspects that need to be assessed.

HCENR technical committee carried out the evaluation of the EIA, with aim of determining the extent to which the EIA was done in conformity and compliance with the **Environmental protection Act 2001**. The evaluation has focused on various components of the (EIA) report, analyzing it, showing areas of strength and citing some comments.

The essence of this approval is proof of acceptance by (**HCENR**) technical committee, hence **The Ministry of Agriculture Animal Resources and Irrigation (River Nile State)**, shall cater and comply with (**HCENR**) instructions.

This approval is in full conformity with **Environmental protection Act 2001**. Now and from here on the (**HCENR**) granted **The Ministry of Agriculture Animal Resources and Irrigation (River Nile State)** to construct, Commission, and maintain.

Prof. Saadeldin Ibrahim Izzeldin
Secretary General
Khartoum September 2011

Appendix -6.9 Monitoring Plan and Environmental Checklist

Table A-6-9-1 Monitoring Plan

Monitoring Plan

If some items are judged to be monitored by JICA as result of environmental review, monitoring shall be done according to the following formats, and also the monitored data shall be submitted to JICA regularly through the executing agency of the project

When deciding monitoring items, frequency and method etc, attention must be paid to phasing and life cycle of the project (such as phasing of construction and operation etc).

1．Approvals and Explanation to the beneficial peoples

Monitoring Items	Situation during Monitoring Period
Responses/Actions to Comments and Guidance from Governmental Authorities	―――

2．Mitigation Measures

－Air Quality（Data on Emission Gas and Ambient Air Quality)

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

－Water Quality（Data on Wastewater and Ambient Water Quality)

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

－Wastes

Monitoring Items	Situation during Monitoring Period
(Methods) ・Physical check shall be done to make sure that construction wastes and excavated soil are treated properly according to the standard. (Duration) During the construction period (Frequency) Once a month	

－Noise/Vibration

Monitoring Items	Situation during Monitoring Period
(Methods) ・Physical check on noise and vibration generated by heavy machinery such as excavation machine, crane, etc and operation conditions shall be done at the sites.	

・Hearing to people shall be done to know complaints about the rehabilitation works. (Duration) During the construction period (Frequency) Once a month	

－Odor

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

－Traffic

Monitoring Items	Situation during Monitoring Period
(Methods) ・Physical check shall be done whether traffic jam occurs or not by site visiting. ・Physical check shall be done whether the necessary measures for safety are executed or not by visiting sites . (Duration) During the construction period (Frequency) Everyday	

３． Natural Environment

－Ecosystem

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

４． Social Environment

－Resettlement

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

－Living/Livelihood

Monitoring Items	Situation during Monitoring Period
Not applicable	―――

Table A-6-9-2 Environmental Checklist (1/4)

Environmental Checklist: 16. Agriculture, Irrigation and Livestock Industry (1)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) Y (d) N	(a) Have submitted the EIA Report to MoEFPD(Ministry of Environmernt, Forestry and Physical Development in River Nile State) in August 2011. (b) Be approved from late September to early October, 2011. (c) Incident is not expected. (d) Not neccesary.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The Project was approved from representatives of the scheme. (b) It is not Negative comments from stakeholders to the project. Further comments from the public or regulatory authorities, is reflected in the project execution plan.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) There have been proposed to compare the three (3).
2 Pollution Control	(1) Water Quality	(a) Are considerations given to water pollution of the surrounding water bodies, such as rivers and groundwater by effluents or leachates from agricultural lands? Are adequate use/disposal standards for fertilizers, agrochemicals, and livestock wastes established? Is a framework established to increase awareness of the standards among farmers? (b) Is a monitoring framework established for water pollution of rivers and groundwater?	(a) Y (b) Y	The project has no effect on water quality.
	(2) Wastes	(a) Are wastes properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) Waste is managed in accordance with the monitoring plan.
	(3) Soil Contamination	(a) Is there a possibility that impacts in irrigated lands, such as salinization of soils will result? (b) Are adequate measures taken to prevent soil contamination of irrigated lands by agrochemicals, heavy metals and other hazardous substances? (c) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans?	(a) N (b) N (c) Y	(a) Threat of salinity has not been reported. (b) Integrated and other alternatives pesticare used. (c) Pesticides committees and pesticides council are making the plans for proper use.
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) This project, in order to secure water for irrigation from the Nile, there is no pumping of groundwater.
	(5) Odor	(a) Are there any odor sources? Is there a possibility that odor problems will occur to the inhabitants?	(a) N	(a) This project will not occur odor.

Table A-6-9-2 Environmental Checklist (2/4)

Environmental Checklist: 16. Agriculture, Irrigation and Livestock Industry (2)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) It was confirmed by field surveys and interviews.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the project will result in the loss of breeding and feeding grounds for valuable wildlife? If they are lost, are there substitutes for the grounds near the original locations? (d) Is there a possibility that overgrazing will cause ecological degradation, such as impacts on wildlife habitats and desertification? (e) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(a) N (b) N (c) N (d) N (e) N	(a) The project is not included. (b) Habitats of rare species are not included in the project area. (c) Breeding sites and feeding grounds of rare species are not lost by the project. There are alternate locations in the vicinity. (d) The ecological impact of the project is not due to overgrazing. (e) The project does not impact.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) N	(a) No involuntary resettlement occur and all the preparations had been done to minimize the impacts caused by the resettlement if happen. (b) Because there's no resettlement happen. (c) No resettlement happen. (d) No resettlement happen. (e) No resettlement happen. (f) No resettlement happen. (g) No resettlement happen. (h) No resettlement happen. (i)No resettlement happen. (j) No resettlement happen.

Note : Reasons of (c)~(j) in 4 have been modified in accordance with the JICA's comment.

Table A-6-9-2 Environmental Checklist (3/4)

Environmental Checklist: 16. Agriculture, Irrigation and Livestock Industry (3)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is proper allotment made for rights to agricultural land use? Is there a possibility that the allotment will result in inequitable distribution or usurpation of land and available resources? (c) Are proper allotments, such as water rights allotment in the project area made? Is there a possibility that the allotments will result in inequitable distribution or usurpation of water rights and available resources? (d) Is there a possibility that the amount of water used (surface water, groundwater) by the project will adversely the downstream fisheries and water uses? (e) Is there a possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? Is adequate consideration given to public health education, if necessary?	(a) N (b) N (c) N (d) N (e) N	The project does not impact on all items.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The project does not impact.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project does not impact.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) N	Ethnic minorities and indigenous peoples do not impact.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	The implementation of the project consideres the safety of the working individuals by conducting proper trainings on safety. Adequate trainings are given for equipment handling to avoid accidents. Security gurads are installed in strategic location for proper implementaion of safety in the project area.

Table A-6-9-2 Environmental Checklist (4/4)

Environmental Checklist: 16. Agriculture, Irrigation and Livestock Industry (4)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) N (c) N	(a) These measures will be executed so that it is less impacted in during construction (b) There is no impact on the natural environment. (c) There is no impact on the social environment.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	All items are determined by the monitoring plan prepared by MoAARFI.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry checklist should also be checked. (b) For the projects including construction of large-scale weirs, reservoirs, and dams, where necessary, pertinent items described in the Hydropower, Dams and Reservoirs checklist should also be checked.	(a) N (b) N	(a) The project dose not impact. (b) Wear, reservoir, dam does not construct.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) The project does not impact.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Appendix -6.10 Cost of canal works for target area

Cost estimation of canal works for the Target schemes (SDG)

Item	unit	qty	unit price	price
1. Cost of the canal works and related structure				
Aliab scheme	set	1.0	278,837.9	278,838
Kitiab scheme	set	1.0	1,074,810.0	1,074,810
Kadabas scheme	set	1.0	1,218,485.4	1,218,485
Total cost				2,572,133
			(Round)	2,572,000

US$= 81.57 （960,000 US$）

1SDG= 30.44 （78,292,000 YEN）

Cost estimation of canal works for the Aliab scheme (SDG)

Item	unit	qty	unit price	price
A. Direct expense				
1. Excavation by the backhoe				
Main canal	m3	20,978.9	4.0	83,915
Minor canal	m3	0.0	4.0	0
2. Embankment and back fill by the bulldozer or backhoe				
Main canal	m3	4,271.6	3.0	12,815
Minor canal	m3	0.0	3.0	0
3. Transportation of the soil for embankment	m3	4,271.6	12.0	51,259
4. Regulator or distributor works				
Manufacture of the gate	set	3.0	22,500.0	67,500
Installation of the gate	set	3.0	12,500.0	37,500
	set	1.0	500.0	500
5. Related structure works				
Wet masonry works	m2	0.0	200.0	0
B. Site expense	%	10.0		25,349
D. Total cost				278,838

Cost estimation of canal works for the Kitiab scheme (SDG)

Item	unit	qty	unit price	price
A. Direct expense				
1. Excavation by the backhoe				
Main canal	m3	35,900.0	4.0	143,600
Minor canal	m3	0.0	4.0	0
2. Embankment and back fill by the bulldozer or backhoe				
Main canal	m3	46,200.0	3.0	138,600
Minor canal	m3	0.0	3.0	0
3. Transportation of the soil for embankment	m3	46,200.0	12.0	554,400
4. Regulator or distributor works				
Manufacture of the gate	set	4.0	22,500.0	90,000
Installation of the gate	set	4.0	12,500.0	50,000
	set	1.0	500.0	500
5. Related structure works				
Wet masonry works	m2	0.0	200.0	0
B. Site expense	%	10.0		97,710
D. Total cost				1,074,810

Aliab Quantity of Earth Work (1/1)

Station	Distance	Aliab : Main canal					
		Excavation			Embankment		
		Section (m^2)	Mean (m^2)	Q'ty (m^3)	Section (m^2)	Mean (m^2)	Q'ty (m^3)
3,400	100	0.0	2.15	215.00	0.0	0.30	30.00
3,600	200	4.3	2.15	430.00	0.6	0.30	60.00
4,200	100	0.0	4.10	410.00	0.0	0.05	5.00
4,400	200	8.2	8.55	1,710.00	0.1	0.10	20.00
4,600	200	8.9	8.70	1,740.00	0.1	0.05	10.00
4,800	200	8.5	8.15	1,630.00	0.0	0.00	0.00
5,000	200	7.8	7.75	1,550.00	0.0	0.05	10.00
5,200	200	7.7	7.35	1,470.00	0.1	0.20	40.00
5,400	200	7.0	7.60	1,520.00	0.3	0.30	60.00
5,600	200	8.2	7.60	1,520.00	0.3	0.25	50.00
5,800	200	7.0	3.50	700.00	0.2	0.10	20.00
6,400	100	0.0	0.95	95.00	0.0	1.95	195.00
6,600	200	1.9	2.90	580.00	3.9	2.15	430.00
6,800	200	3.9	3.60	720.00	0.4	1.00	200.00
7,000	200	3.3	3.80	760.00	1.6	1.75	350.00
7,200	200	4.3	4.00	800.00	1.9	1.30	260.00
7,400	200	2.3	3.10	620.00	2.0	2.45	490.00
7,600	200	3.7	3.80	760.00	0.7	1.80	360.00
7,800	200	1.7	0.85	170.00	2.6	1.30	260.00
8,000	200	3.9	1.95	390.00	2.9	1.45	290.00
10,000	100	8.4	6.10	610.00	0.0	0.15	15.00
10,200	200	5.6	4.70	940.00	0.1	0.20	40.00
10,400	1	6.7	5.15	5.15	0.2	0.50	0.50
10,600	200	3.8	3.70	740.00	0.3	0.55	110.00
10,800	2	4.8	3.70	7.40	0.5	2.45	4.90
11,000	200	3.6	3.10	620.00	0.8	2.60	520.00
11,200	3	4.2	2.10	6.30	0.8	0.40	1.20
11,400	200	2.6	1.30	260.00	4.4	2.20	440.00
合計				20,978.85			4,271.60

Station	Distance	Kitiab : Main canal					
		Excavation			Embankment		
		Section (m^2)	Mean (m^2)	Q'ty (m^3)	Section (m^2)	Mean (m^2)	Q'ty (m^3)
0	0	5.3	11.65	0.00	3.3	1.65	0.00
200	200	18.0	12.70	2,540.00	0.0	1.15	230.00
400	200	7.4	4.85	970.00	2.3	4.25	850.00
600	200	2.3	3.85	770.00	6.2	4.05	810.00
800	200	5.4	5.80	1,160.00	1.9	2.00	400.00
1,000	200	6.2	5.95	1,190.00	2.1	1.90	380.00
1,200	200	5.7	4.95	990.00	1.7	2.15	430.00
1,400	200	4.2	4.70	940.00	2.6	2.90	580.00
1,600	200	5.2	5.20	1,040.00	3.2	3.80	760.00
1,800	200	5.2	4.50	900.00	4.4	3.05	610.00
2,000	200	3.8	3.80	760.00	1.7	4.10	820.00
2,200	200	3.8	4.65	930.00	6.5	4.75	950.00
2,400	200	5.5	4.20	840.00	3.0	2.30	460.00
2,600	200	2.9	3.05	610.00	1.6	1.95	390.00
2,800	200	3.2	4.15	830.00	2.3	1.55	310.00
3,000	200	5.1	3.05	610.00	0.8	1.95	390.00
3,200	200	1.0	2.05	410.00	3.1	2.80	560.00
3,400	200	3.1	3.10	620.00	2.5	3.10	620.00
3,600	200	3.1	2.30	460.00	3.7	4.65	930.00
3,800	200	1.5	1.85	370.00	5.6	4.90	980.00
4,000	200	2.2	2.35	470.00	4.2	3.55	710.00
4,200	200	2.5	2.20	440.00	2.9	3.40	680.00
4,400	200	1.9	1.90	380.00	3.9	3.90	780.00
4,600	200	1.9	2.20	440.00	3.9	3.15	630.00
4,800	200	2.5	3.65	730.00	2.4	1.70	340.00
5,000	200	4.8	3.65	730.00	1.0	1.50	300.00
5,200	200	2.5	2.30	460.00	2.0	1.95	390.00
5,400	200	2.1	2.30	460.00	1.9	2.50	500.00
5,600	200	2.5	2.20	440.00	3.1	3.20	640.00
5,800	200	1.9	2.10	420.00	3.3	2.75	550.00
6,000	200	2.3	2.15	430.00	2.2	3.50	700.00
6,200	200	2.0	2.15	430.00	4.8	4.25	850.00
6,400	200	2.3	3.45	690.00	3.7	3.65	730.00
6,600	200	4.6	2.70	540.00	3.6	4.65	930.00
6,800	200	0.8	0.85	170.00	5.7	4.90	980.00
7,000	200	0.9	1.20	240.00	4.1	4.00	800.00
7,200	200	1.5	1.25	250.00	3.9	3.60	720.00
7,400	200	1.0	1.35	270.00	3.3	4.25	850.00
7,600	200	1.7	2.35	470.00	5.2	4.55	910.00
7,800	200	3.0	2.50	500.00	3.9	3.65	730.00
8,000	200	2.0	2.15	430.00	3.4	4.05	810.00
8,200	200	2.3	2.30	460.00	4.7	3.80	760.00
8,400	200	2.3	2.70	540.00	2.9	3.10	620.00
8,600	200	3.1	2.45	490.00	3.3	3.75	750.00
8,800	200	1.8	1.90	380.00	4.2	4.25	850.00
9,000	200	2.0	2.00	400.00	4.3	5.55	1,110.00
9,200	200	2.0	1.85	370.00	6.8	6.55	1,310.00
9,400	200	1.7	1.85	370.00	6.3	5.45	1,090.00
9,600	200	2.0	3.20	640.00	4.6	3.10	620.00
9,800	200	4.4	3.20	640.00	1.6	3.05	610.00
10,000	200	2.0	1.80	360.00	4.5	5.10	1,020.00
合計							

Station	Distance	Kitiab : Main canal					
		Excavation			Embankment		
		Section (m^2)	Mean (m^2)	Q'ty (m^3)	Section (m^2)	Mean (m^2)	Q'ty (m^3)
10,200	200	1.6	1.70	340.00	5.7	5.75	1,150.00
10,400	200	1.8	2.05	410.00	5.8	4.40	880.00
10,600	200	2.3	2.30	460.00	3.0	3.00	600.00
10,800	200	2.3	2.15	430.00	3.0	3.70	740.00
11,000	200	2.0	1.60	320.00	4.4	5.25	1,050.00
11,200	200	1.2	1.35	270.00	6.1	5.35	1,070.00
11,400	200	1.5	1.75	350.00	4.6	4.90	980.00
11,600	200	2.0	1.15	230.00	5.2	5.70	1,140.00
11,800	200	0.3	1.25	250.00	6.2	5.05	1,010.00
12,000	200	2.2	1.50	300.00	3.9	4.15	830.00
12,200	200	0.8	1.70	340.00	4.4	4.00	800.00
12,400	200	2.6	3.70	740.00	3.6	3.95	790.00
12,600	200	4.8	2.40	480.00	4.3	2.15	430.00
合計				35,900.00			46,200.00

Appendix -6.11 Plan of canal works for target area

Appendix -6.11-1 Plan of Aliab canal works

Aliab Scheme Irrigation Project
General Layout of Canal Line

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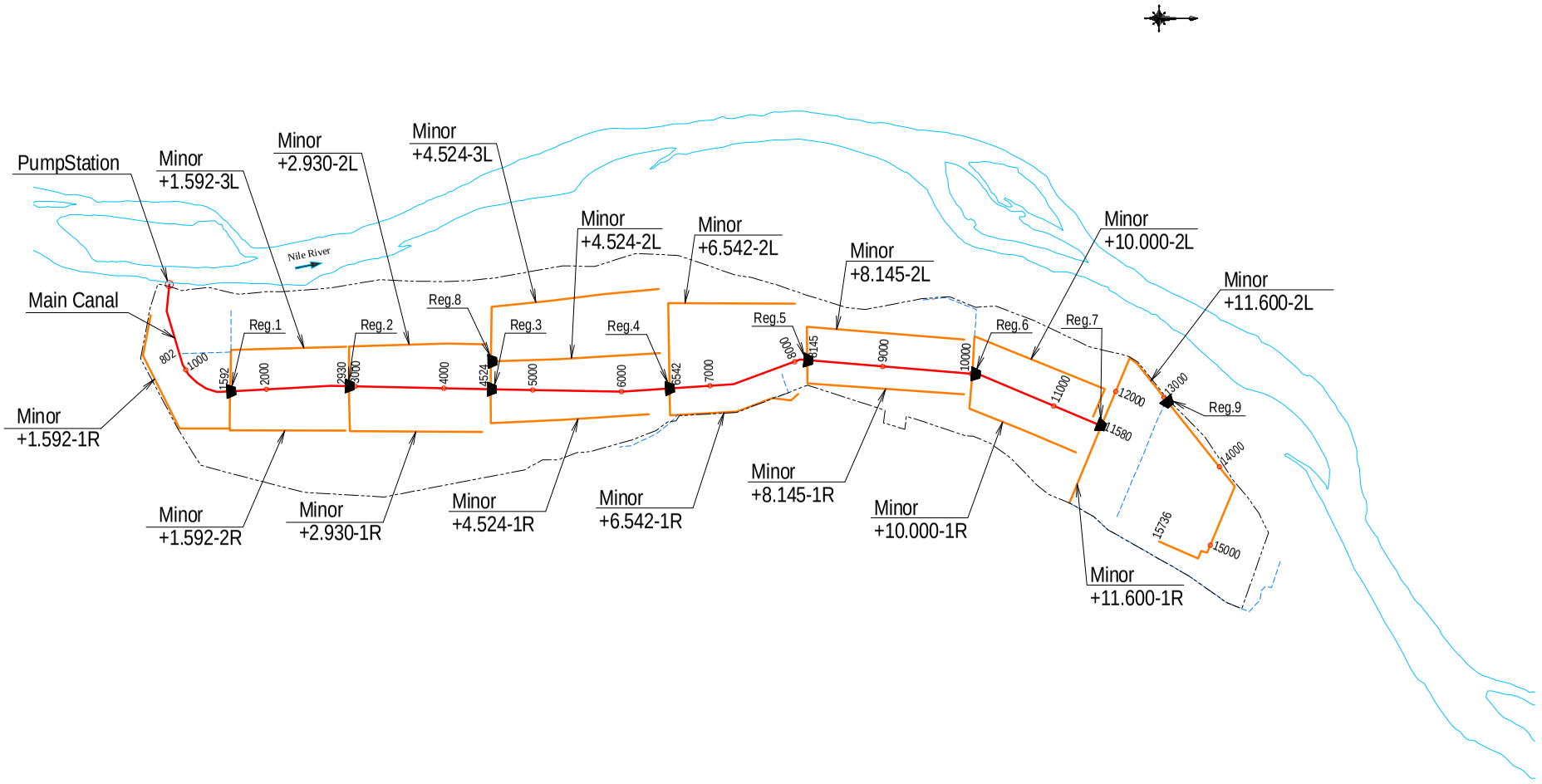


A6-35

Scheme infomation

Irrigation Area	2,205ha(5,250fed)
Main Canal Length	11.6km
Minor Canal Length	32.5km

Legend

:Main Canal

:Minor Canal

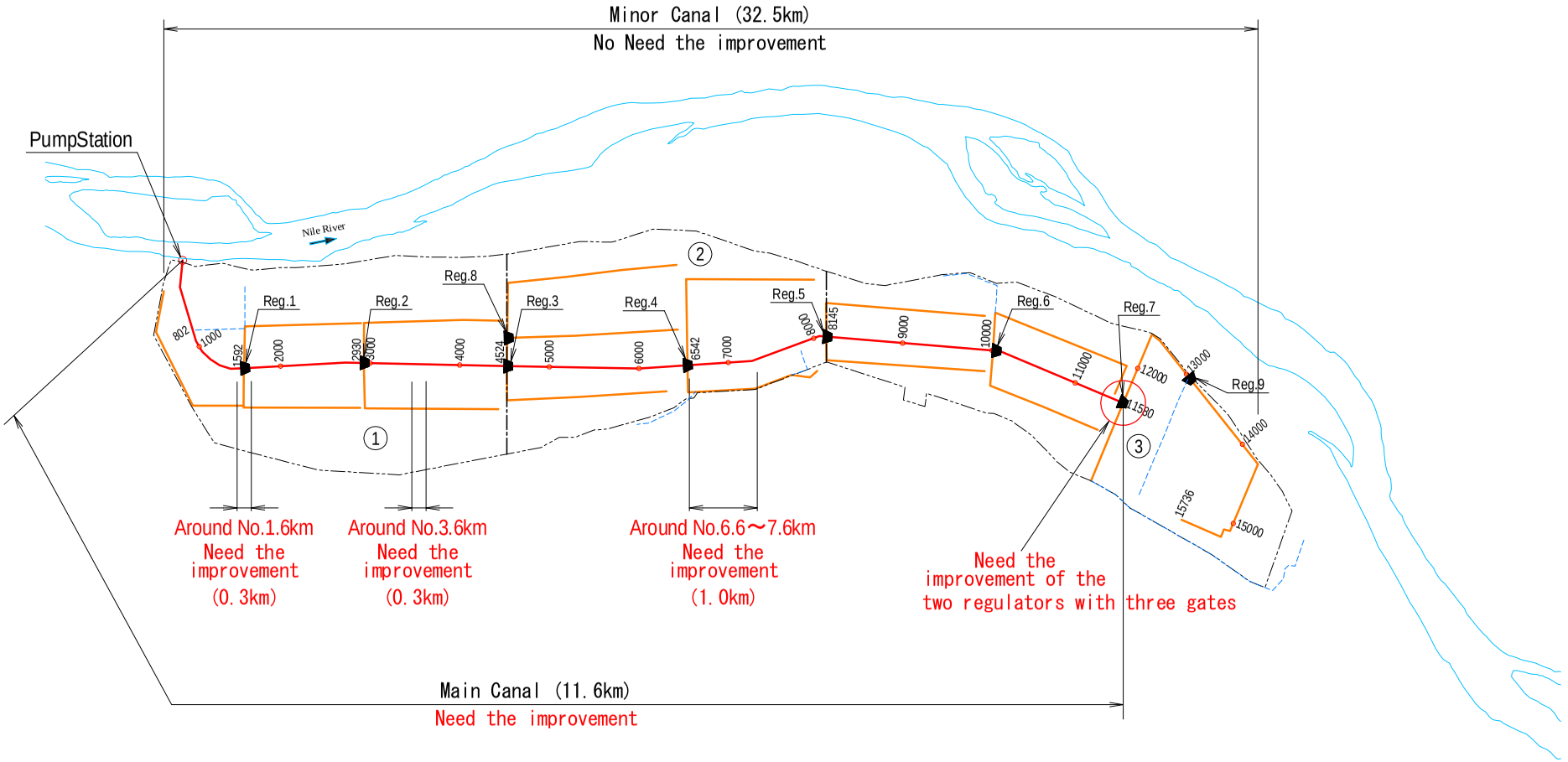
0 2500m

SCALE 1:50000

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE:						
PROJECT: General Layout of Canal Line						
PROJECT: 01-1	SCALE S=1:50000	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
General Layout of Canal Line

SCALE S=1:50000



Legend

:Main Canal

:Minor Canal

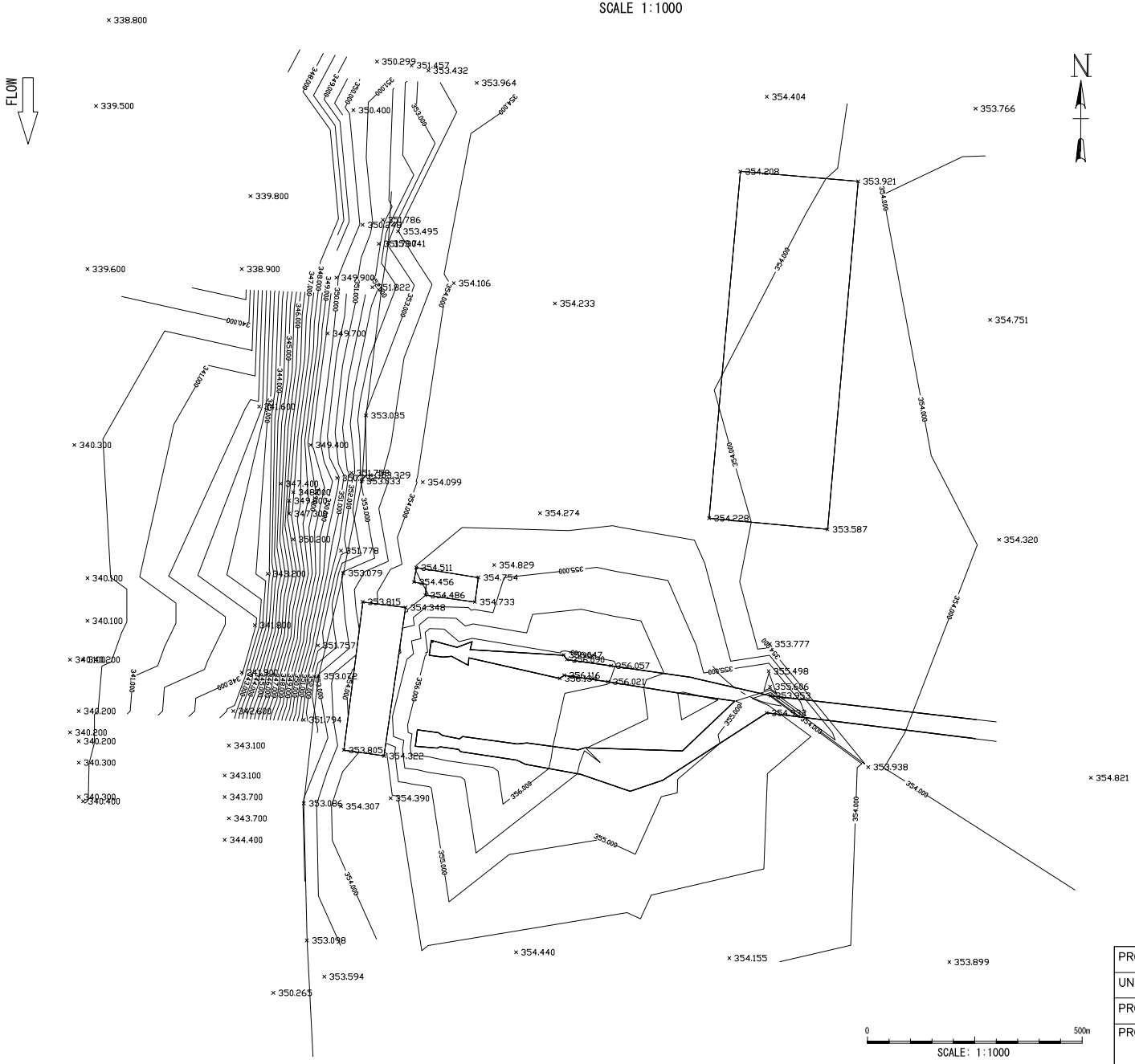
0 2500m

SCALE 1:50000

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE:						
PROJECT: General Layout of Canal Line						
PROJECT: 01-2	SCALE S=1:50000	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Contour Map

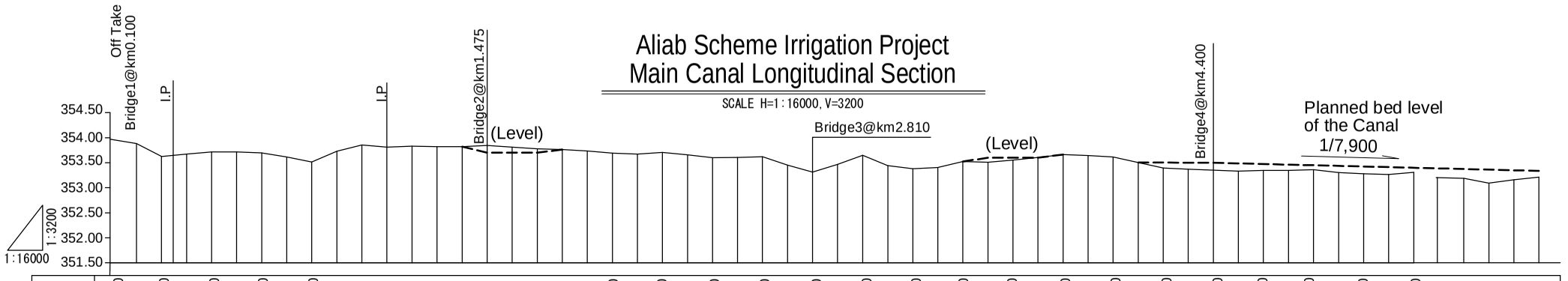
SCALE 1:1000



PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Plane Surver Area						
PROJECT: Contour Map						
PROJECT: 01-3	SCALE H=1:1000	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Longitudinal Section

SCALE H=1:16000, V=3200

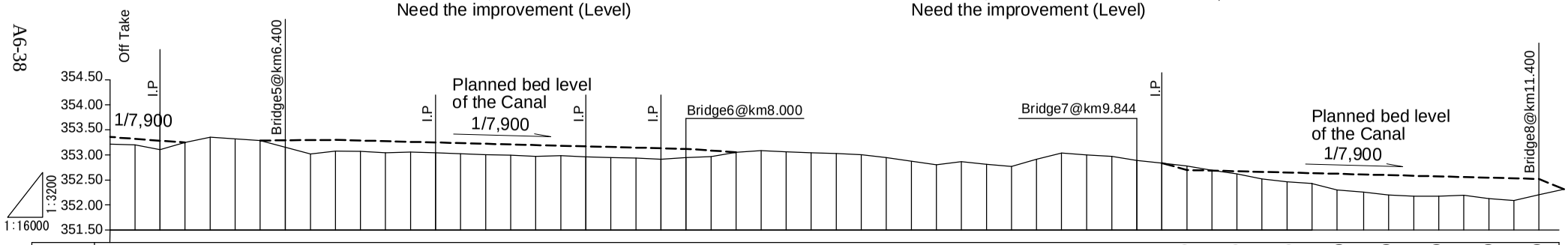


DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.400	2.600	2.800	3.000	3.200	3.400	3.600	3.800	4.000	4.200	4.400	4.600	4.800	5.000	5.200	5.400	5.600
Actual B.L	353.953	353.827	353.564	353.619	353.647	353.643	353.632	353.552	353.612	353.452	353.668	353.803	353.751	353.770	353.757	353.756	353.778	353.742	353.716	353.700	353.670	353.633	353.617	353.645	353.594	353.533	353.544	353.553	353.392	353.248	353.410	353.587	353.383	353.323	353.339	353.475	353.452	353.497	353.555	353.615	353.581	353.550	353.444	353.333	353.308	353.287	353.271	353.284	353.287	353.305	353.241	353.222	353.208	353.252	353.127	353.024	353.100	353.160
Planned B.L									353.700														353.600																353.500								353.470		353.450		353.420		353.400		353.370		353.350		

Around 1.6km
Need the improvement (Level)

Around 3.6km
Need the improvement (Level)

4.4km～5.8km
Need the improvement (1/7,900)



DIST (km)	5.800	6.000	6.200	6.400	6.600	6.800	7.000	7.200	7.400	7.600	7.800	8.000	8.200	8.400	8.600	8.800	9.000	9.200	9.400	9.600	9.800	10.000	10.200	10.400	10.600	10.800	11.000	11.200	11.400
Actual B.L	353.137	353.044	353.193	353.292	353.258	353.231	353.042	352.950	353.026	353.016	352.980	352.995	353.029	352.967	352.941	352.928	352.924	352.927	352.904	352.872	352.866	352.850	352.882	352.914	352.988	353.029	353.011	352.979	352.967	352.953	352.882	352.809	352.746	352.808	352.756	352.709	352.841	352.980	352.940	352.908	352.833	352.768	352.707	352.634	352.551	352.456	352.405	352.364	352.303	352.253	352.195	352.166	352.170	352.193	352.132	352.088	352.207
Planned B.L	353.320				353.300	353.270	353.250	353.220	353.200	353.170	353.150	353.120										352.700	352.670		352.650		352.620		352.600		352.570		352.550		352.520

4.4km～5.8km
Need the improvement (1/7,900)

6.6km～8.0km
Need the improvement (1/7,900)

10.0km～11.4km
Need the improvement (1/7,900)

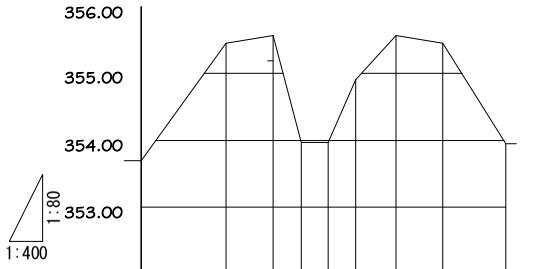
Legend
: Actual B.L.
: Planned B.L.

0 800m
SCALE 1:16000

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Irrigation Project						
PROJECT:						
PROJECT: 02	SCALE H=1:16000 V=1:3200	UNIT	SIZE	SHEET	PROJ.No.	REV.

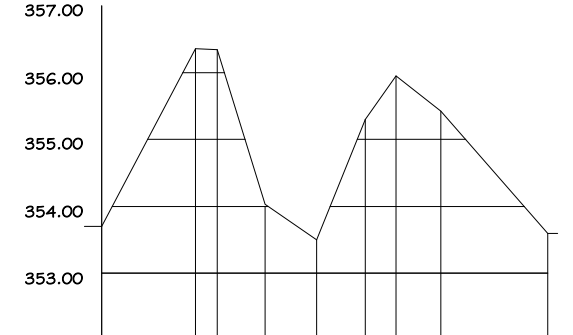
Aliab Scheme Irrigation Project
Main Canal Cross Section(1/10)

SCALE H=1:400, V=1:80



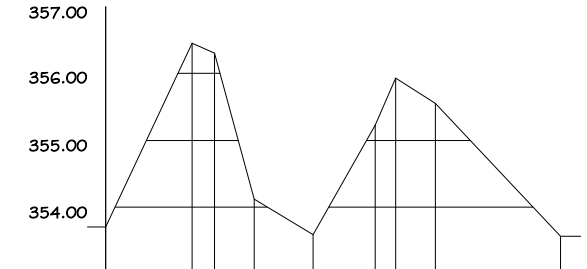
DIST	0.00	6.35	9.87	11.97	16.06	19.04	22.56	27.28
G.L	353.777	355.498	355.606	353.953	353.953	354.932	355.498	355.606	353.936

Main Canal - Ch 0.00km



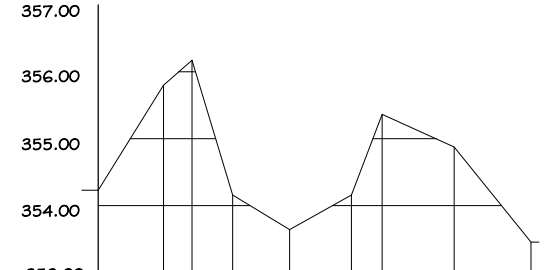
DIST	0.00	7.02	8.67	12.25	19.74	22.06	25.41	33.41
G.L	353.701	356.411	356.383	354.064	353.564	355.363	355.905	355.507	353.598

Main Canal - Ch 0.20km



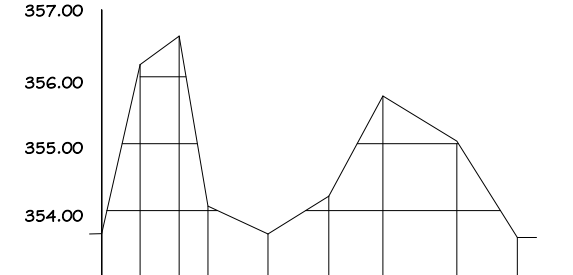
DIST	0.00	6.47	8.15	11.10	20.17	21.69	24.67	34.04
G.L	353.701	356.411	356.383	354.064	353.647	355.363	355.905	355.507	353.598

Main Canal - Ch 0.40km



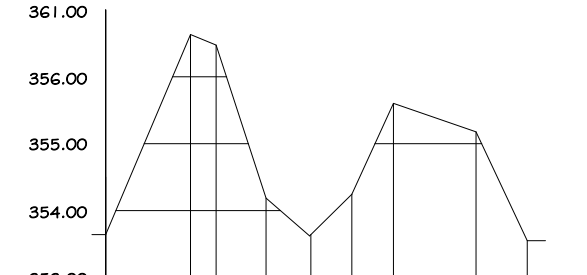
DIST	0.00	4.87	7.00	10.05	18.95	21.24	26.64	32.37
G.L	354.142	355.805	356.078	354.038	353.632	354.038	355.387	354.934	353.471

Main Canal - Ch 0.60km



DIST	0.00	5.80	5.80	7.95	17.01	21.07	26.60	31.13
G.L	353.648	356.266	356.896	354.131	353.612	354.164	355.789	355.137	353.562

Main Canal - Ch 0.80km



DIST	0.00	6.34	8.25	12.01	18.40	21.55	27.72	31.54
G.L	353.662	356.726	356.607	354.224	353.668	354.290	355.586	355.356	353.567

Main Canal - Ch 1.00km

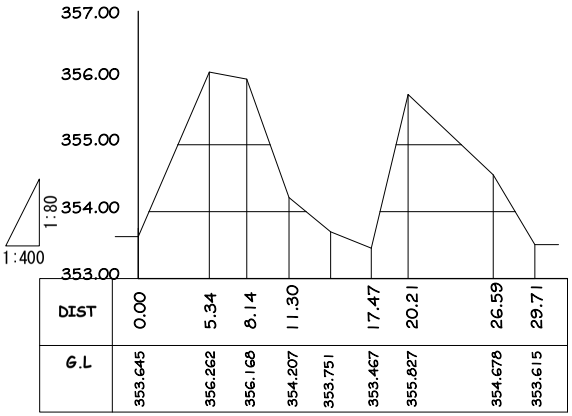
A6-39

0 20m
SCALE: 1:400

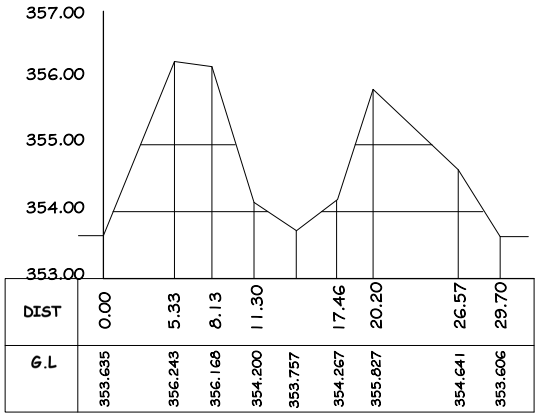
PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (0.00,0.20,0.40,0.60,0.80,1.00km)						
PROJECT: 03-1	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Cross Section(2/10)

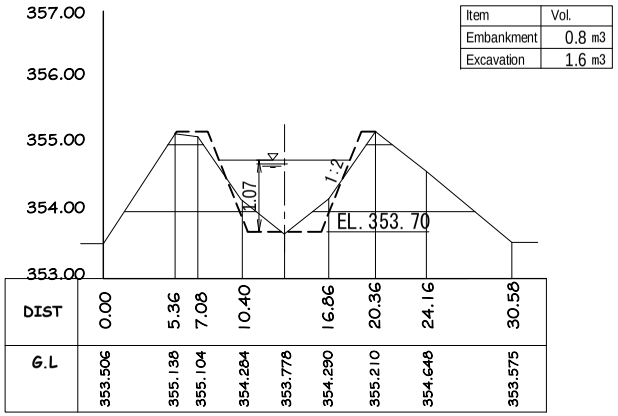
SCALE H=1:400, V=1:80



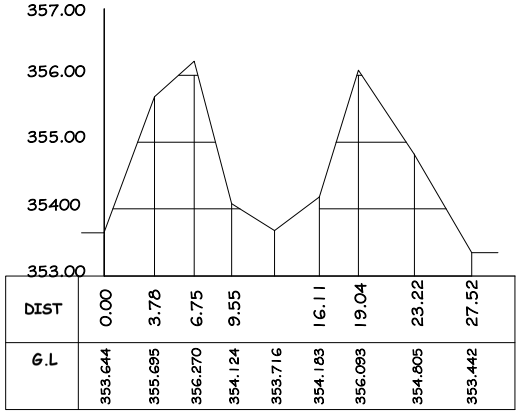
Main Canal - Ch 1.20km



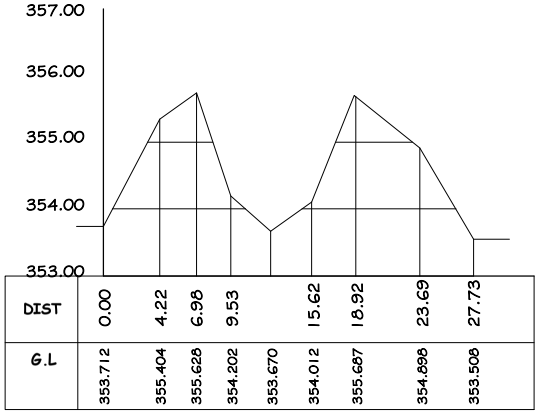
Main Canal - Ch 1.40km



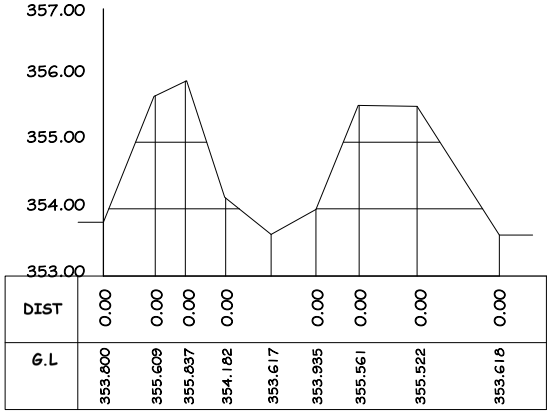
Main Canal - Ch 1.60km



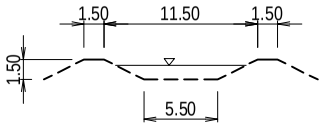
Main Canal - Ch 1.80km



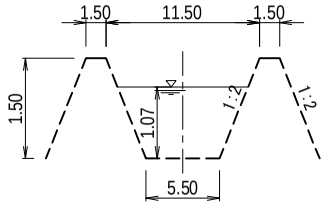
Main Canal - Ch 2.00km



Main Canal - Ch 2.20km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

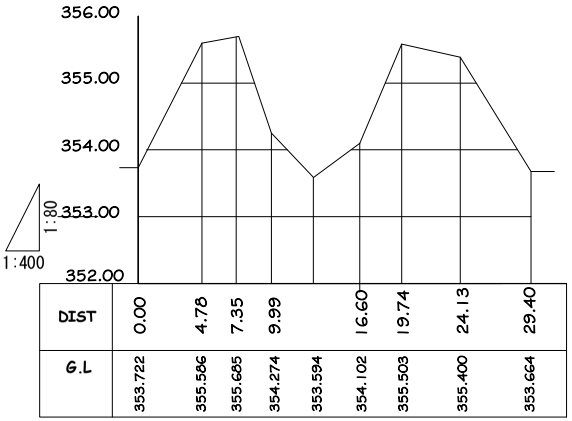
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (1.20,1.40,1.60,1.80,2.00,2.20km)						
PROJECT: 03-2	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

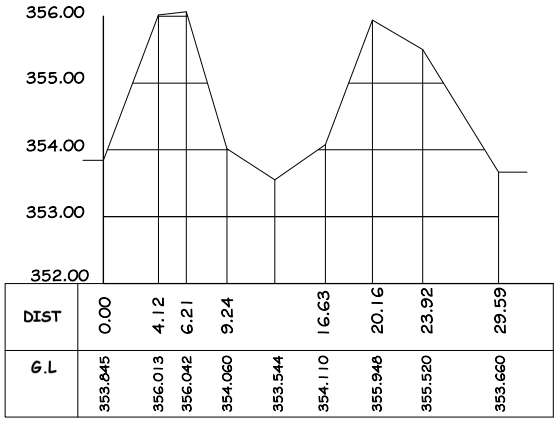
Aliab Scheme Irrigation Project
Main Canal Cross Section(3/10)

SCALE H=1:400, V=1:80



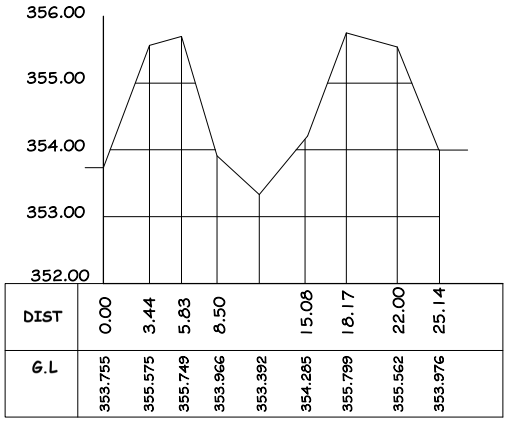
DIST	0.00	4.78	7.35	9.99	16.60	19.74	24.13	29.40
G.L	353.722	355.586	355.685	354.274	353.594	354.102	355.503	355.400	353.664

Main Canal - Ch 2.40km



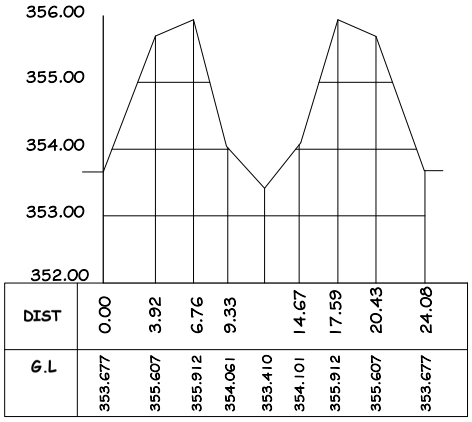
DIST	0.00	4.12	6.21	9.24	16.63	20.16	23.92	29.59
G.L	353.845	356.013	356.042	354.060	353.544	354.110	355.948	355.520	353.660

Main Canal - Ch 2.60km



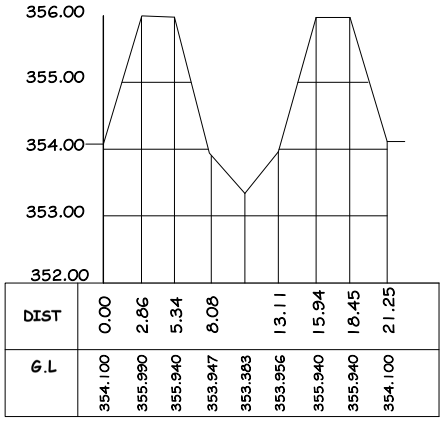
DIST	0.00	3.44	5.83	8.50	15.08	18.17	22.00	25.14
G.L	353.755	355.575	355.749	353.966	353.392	354.285	355.799	355.562	353.976

Main Canal - Ch 2.80km



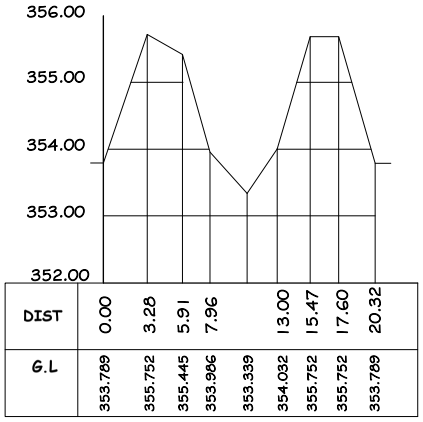
DIST	0.00	3.92	6.76	9.33	14.67	17.59	20.43	24.08
G.L	353.677	355.607	355.912	354.061	353.410	354.101	355.912	355.607	353.677

Main Canal - Ch 3.00km



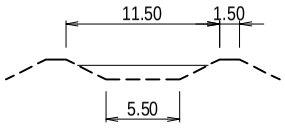
DIST	0.00	2.86	5.34	8.08	13.11	15.94	18.45	21.25
G.L	354.100	355.990	355.940	353.947	353.383	353.956	355.940	355.940	354.100

Main Canal - Ch 3.20km

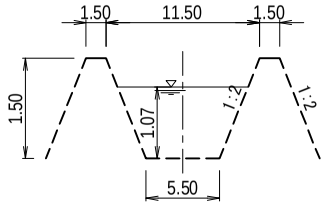


DIST	0.00	3.28	5.91	7.96	13.00	15.47	17.60	20.32
G.L	353.789	355.752	355.445	353.986	353.339	354.032	355.752	355.752	353.789

Main Canal - Ch 3.40km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

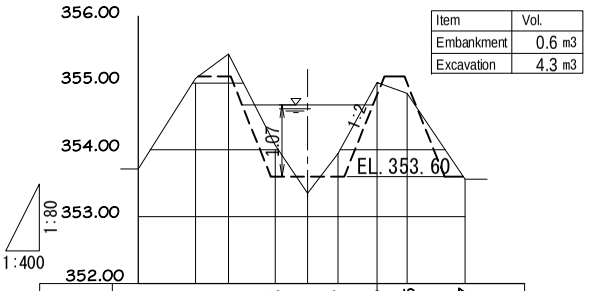
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (2.40,2.60,2.80,3.00,3.20,3.40km)						
PROJECT: 03-3	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Cross Section(4/10)

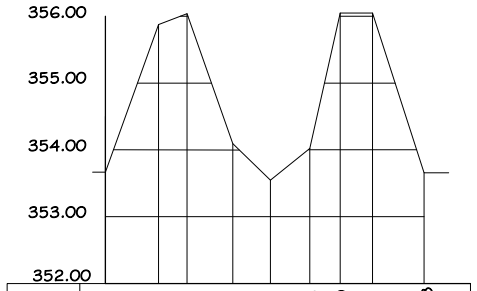
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	0.6 m3
Excavation	4.3 m3

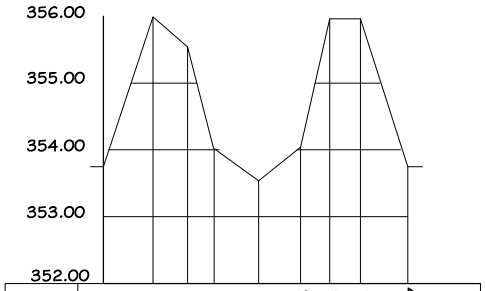
DIST	0.00	4.29	6.77	10.26	14.97	17.89	20.15	24.47
G.L	353.741	355.271	355.481	354.190	353.452	354.087	355.097	355.018	353.671

Main Canal - Ch 3.60km



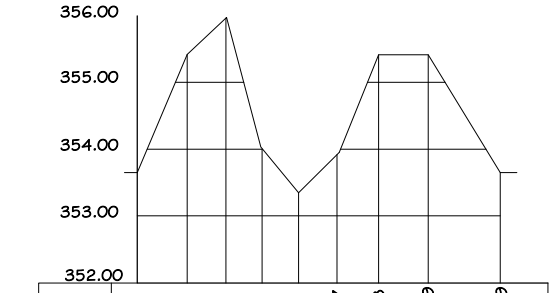
DIST	0.00	3.98	6.12	9.53	15.33	17.60	20.01	23.88
G.L	353.662	355.893	356.042	354.102	353.555	354.029	356.042	356.042	353.662

Main Canal - Ch 3.80km



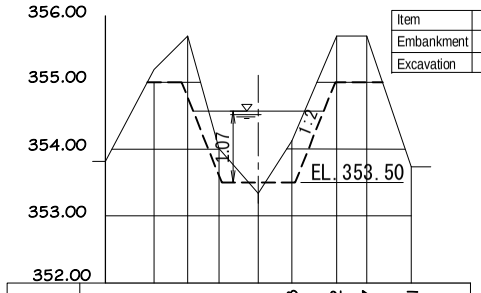
DIST	0.00	3.72	6.30	8.29	14.76	16.93	19.23	22.77
G.L	353.714	355.923	355.567	354.015	353.581	354.020	355.923	355.923	353.714

Main Canal - Ch 4.00km



DIST	0.00	3.74	6.67	9.35	14.97	18.08	21.79	27.19
G.L	353.694	355.520	355.901	354.129	353.444	353.940	355.520	355.520	353.659

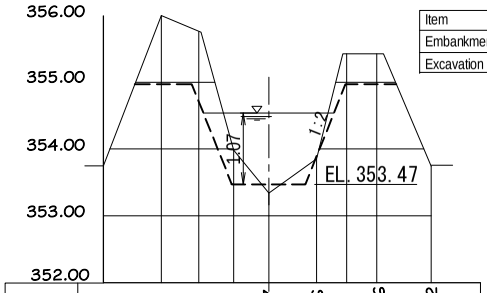
Main Canal - Ch 4.20km



Item	Vol.
Embankment	0.1 m3
Excavation	8.2 m3

DIST	0.00	3.65	6.16	8.50	13.98	17.32	19.57	22.91
G.L	353.821	355.324	355.679	354.068	353.308	354.150	355.679	355.679	353.821

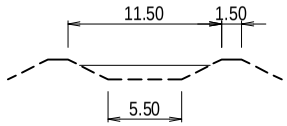
Main Canal - Ch 4.40km



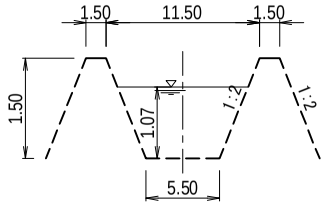
Item	Vol.
Embankment	0.1 m3
Excavation	8.9 m3

DIST	0.00	4.33	7.14	9.75	12.37	15.96	18.21	20.46	24.52
G.L	353.756	356.000	355.784	353.920	353.271	353.847	355.463	355.463	353.756

Main Canal - Ch 4.60km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

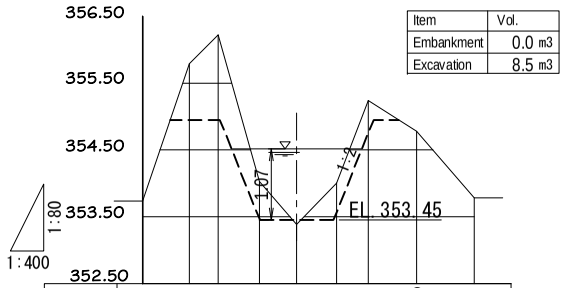
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (3.60,3.80,4.00,4.20,4.40,4.60km)						
PROJECT: 03-4	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Cross Section(5/10)

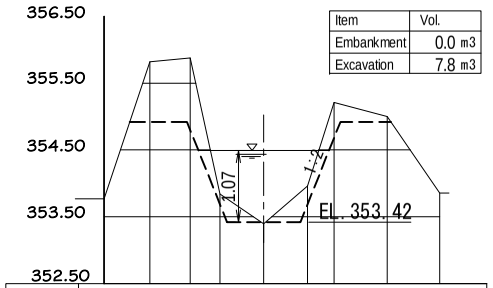
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	0.0 m3
Excavation	8.5 m3

DIST	0.00	3.50	5.66	8.75	14.52	16.89	20.50	24.81
G.L	353.749	355.737	356.221	354.033	353.267	354.004	355.225	354.792	353.775

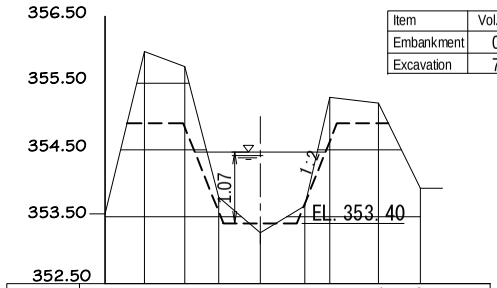
Main Canal - Ch 4.80km



Item	Vol.
Embankment	0.0 m3
Excavation	7.8 m3

DIST	0.00	3.44	6.46	8.69	15.24	17.24	21.23	25.13
G.L	353.750	355.761	355.834	353.676	353.241	354.028	355.217	355.011	353.826

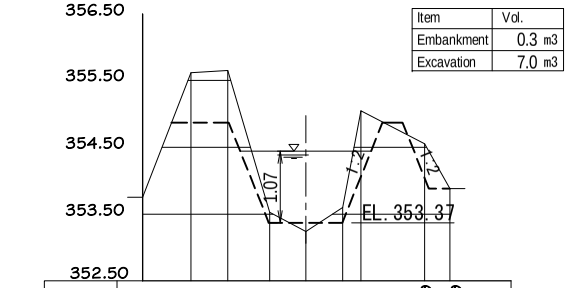
Main Canal - Ch 5.00km



Item	Vol.
Embankment	0.1 m3
Excavation	7.7 m3

DIST	0.00	2.94	5.96	8.49	14.95	16.82	20.46	23.59
G.L	354.038	355.864	355.642	353.819	353.208	353.603	355.283	355.072	353.857

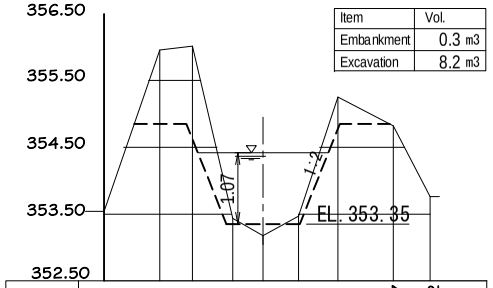
Main Canal - Ch 5.20km



Item	Vol.
Embankment	0.3 m3
Excavation	7.0 m3

DIST	0.00	3.62	6.37	9.51	14.96	16.34	21.09	22.99
G.L	353.750	355.522	355.549	353.527	353.127	353.588	355.013	354.494	353.831

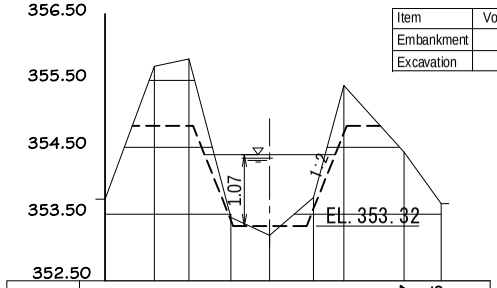
Main Canal - Ch 5.40km



Item	Vol.
Embankment	0.3 m3
Excavation	8.2 m3

DIST	0.00	4.18	6.62	9.63	14.59	17.51	21.67	24.42
G.L	353.58	355.879	355.913	353.463	353.100	353.498	355.293	354.748	353.808

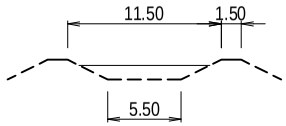
Main Canal - Ch 5.60km



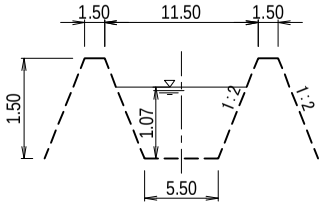
Item	Vol.
Embankment	0.2 m3
Excavation	7.0 m3

DIST	0.00	3.69	6.28	9.41	15.59	17.87	22.37	25.15
G.L	353.655	355.598	355.695	353.393	353.137	353.688	355.355	354.349	353.697

Main Canal - Ch 5.80km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

———— :Actual B.L.

– – – – – :Planned B.L.

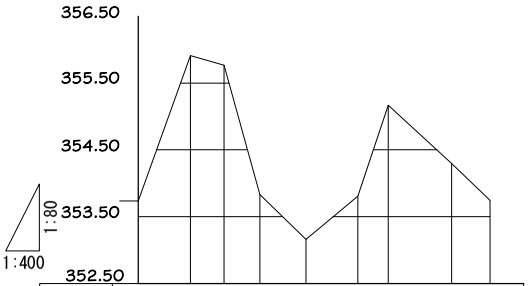
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (4.80,5.00,5.20,5.40,5.60,5.80km)						
PROJECT: 03-5	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

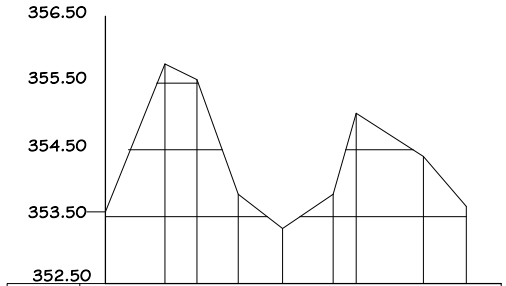
Aliab Scheme Irrigation Project
Main Canal Cross Section(6/10)

SCALE H=1:400, V=1:80



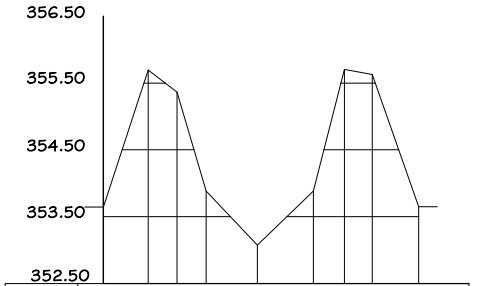
DIST	0.00	3.92	6.42	9.12	12.57	16.45	18.72	23.49	26.35
G.L	353.660	355.671	355.804	353.786	353.193	353.706	355.198	354.323	353.659

Main Canal - Ch 6.00km



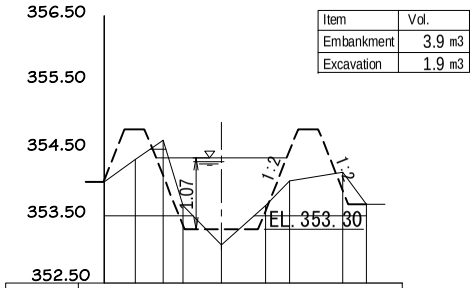
DIST	0.00	4.46	6.86	9.95	17.05	18.80	23.82	27.03
G.L	353.539	355.710	355.520	353.801	353.256	353.801	354.995	353.801	353.614

Main Canal - Ch 6.20km



DIST	0.00	3.35	5.51	7.70	15.71	18.02	20.13	23.61
G.L	353.573	355.567	355.337	353.843	353.042	353.843	355.567	355.537	353.552

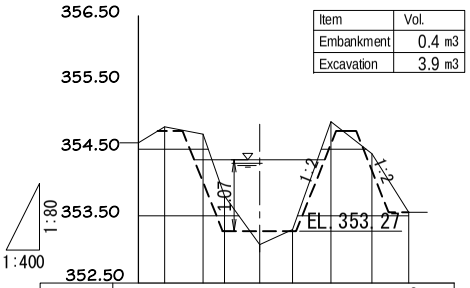
Main Canal - Ch 6.40km



Item	Vol.
Embankment	3.9 m3
Excaviation	1.9 m3

DIST	0.00	2.35	4.42	5.92	12.11	13.90	17.86	19.64
G.L	354.016	354.426	354.538	353.635	353.026	353.635	354.004	354.073	353.657

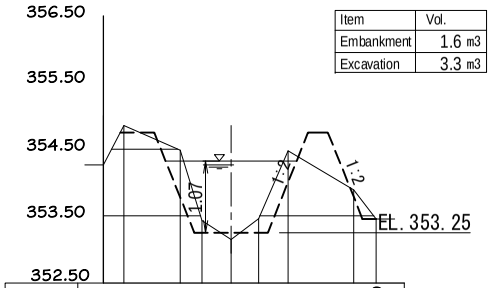
Main Canal - Ch 6.60km



Item	Vol.
Embankment	0.4 m3
Excaviation	3.9 m3

DIST	0.00	1.97	4.85	6.46	11.56	14.44	17.49	20.25
G.L	354.542	354.762	354.546	353.763	352.980	353.322	354.789	354.432	353.513

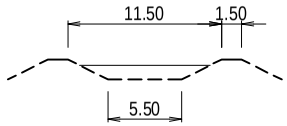
Main Canal - Ch 6.80km



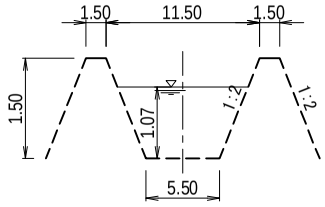
Item	Vol.
Embankment	1.6 m3
Excaviation	3.3 m3

DIST	0.00	1.53	5.75	7.37	11.61	13.83	18.74	20.40
G.L	354.218	354.671	354.435	353.362	353.029	353.393	354.358	353.846	353.471

Main Canal - Ch 7.00km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

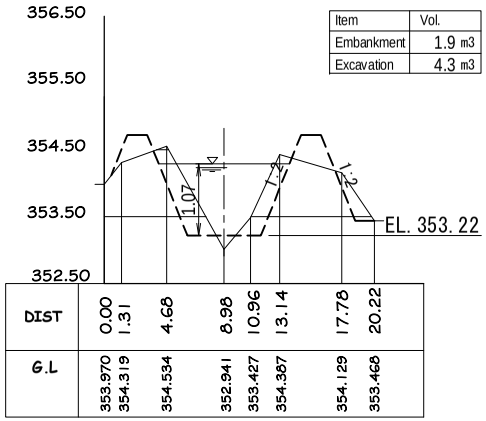
0 20m

SCALE: 1:400

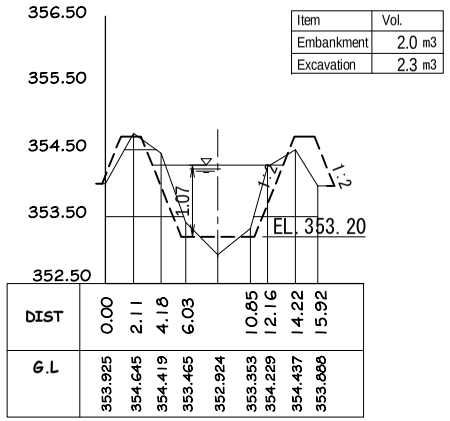
PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (6.00,6.20,6.40,6.60,6.80,7.00km)						
PROJECT: 03-6	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Cross Section(7/10)

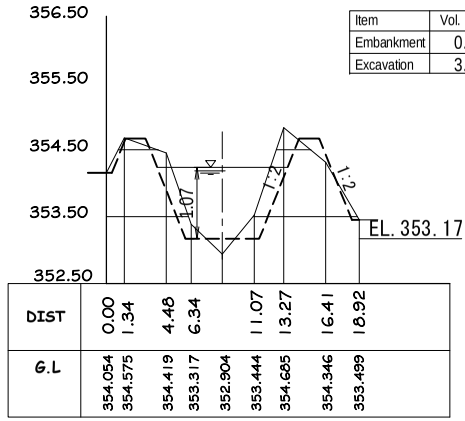
SCALE H=1:400, V=1:80



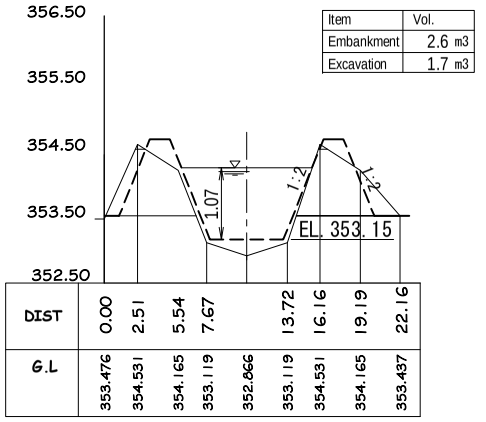
Main Canal - Ch 7.20km



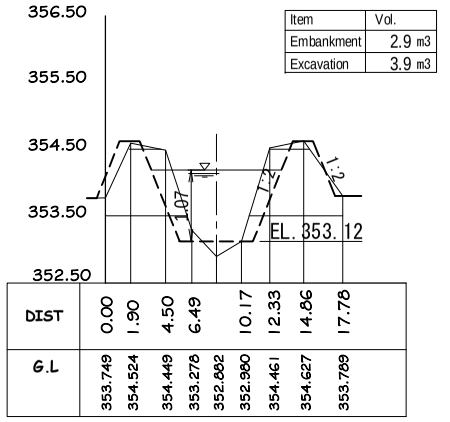
Main Canal - Ch 7.40km



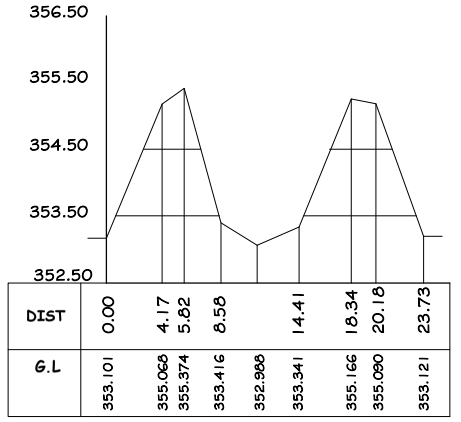
Main Canal - Ch 7.60km



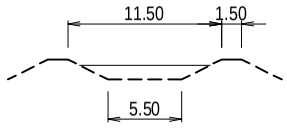
Main Canal - Ch 7.80km



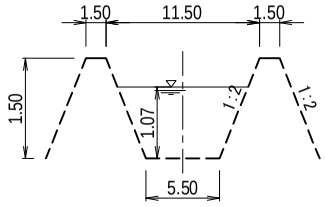
Main Canal - Ch 8.00km



Main Canal - Ch 8.20km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B.L.

: Planned B.L.

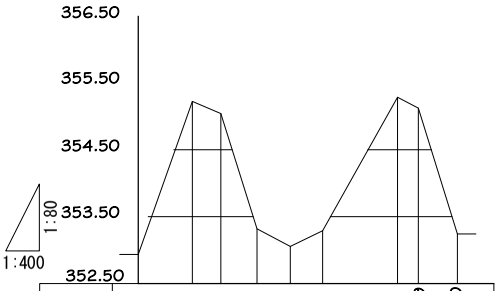
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (7.20,7.40,7.60,7.80,8.00,8.20km)						
PROJECT: 03-7	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

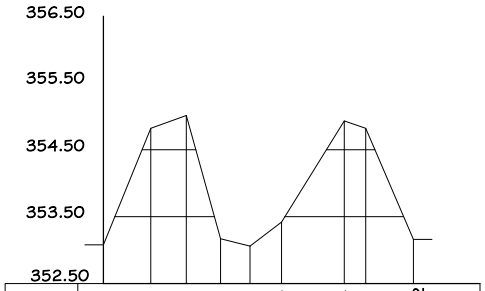
Aliab Scheme Irrigation Project
Main Canal Cross Section(8/10)

SCALE H=1:400, V=1:80



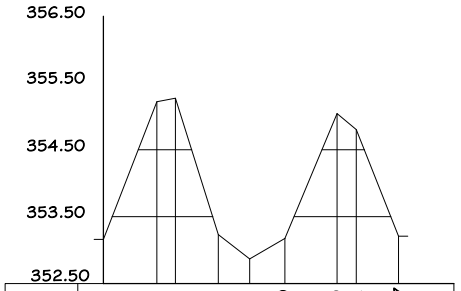
DIST	0.00	4.08	6.19	8.89	13.81	19.41	20.99	23.90
G.L	352.962	355.196	355.034	353.331	353.011	353.288	355.272	355.093	353.240

Main Canal - Ch 8.40km



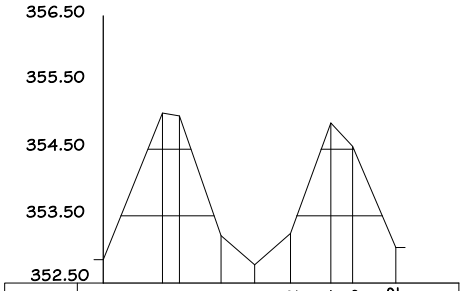
DIST	0.00	3.55	6.21	8.77	13.34	18.04	19.65	23.22
G.L	353.006	354.796	355.02	353.243	352.967	353.345	354.866	354.795	353.201

Main Canal - Ch 8.60km



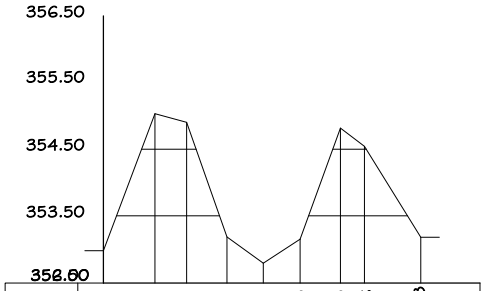
DIST	0.00	4.00	5.39	8.60	13.60	17.49	18.92	22.07
G.L	353.042	355.281	355.296	353.282	352.882	353.168	355.004	354.760	353.180

Main Canal - Ch 8.80km



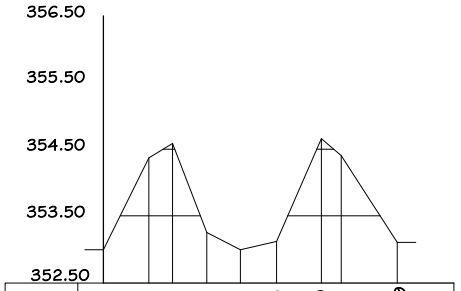
DIST	0.00	4.45	5.71	8.82	14.02	17.04	18.68	21.92
G.L	352.812	355.014	354.971	353.105	352.746	353.177	354.892	354.522	353.008

Main Canal - Ch 9.00km



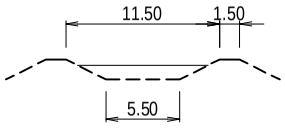
DIST	0.00	3.86	6.23	9.26	14.75	17.75	19.56	23.78
G.L	352.840	354.999	354.873	353.224	352.756	353.153	354.738	354.515	353.082

Main Canal - Ch 9.20km

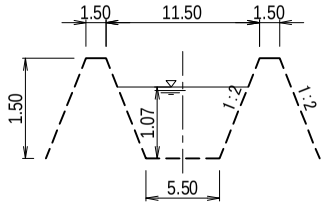


DIST	0.00	3.40	5.18	7.73	12.95	16.29	17.81	21.99
G.L	352.922	354.388	354.498	353.248	352.841	353.085	354.522	354.391	353.001

Main Canal - Ch 9.40km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

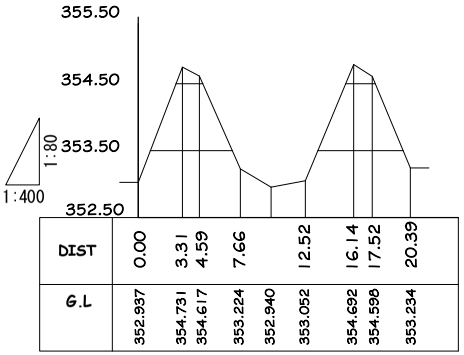
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (8.40,8.60,8.80,9.00,9.20,9.40km)						
PROJECT: 03-8	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

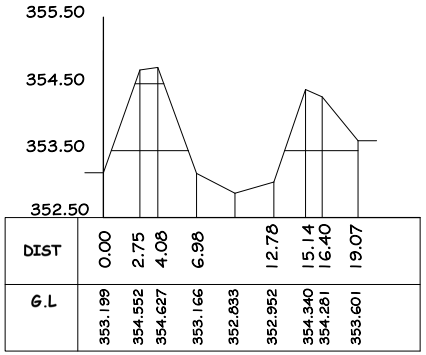
Aliab Scheme Irrigation Project
Main Canal Cross Section(9/10)

SCALE H=1:400, V=1:80



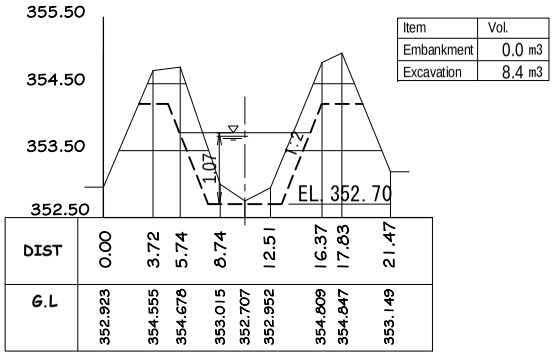
DIST	0.00	3.31	4.59	7.66	12.52	16.14	17.52	20.39
G.L	352.937	354.731	354.617	353.224	352.940	353.052	354.692	354.598	353.234

Main Canal - Ch 9.60km



DIST	0.00	2.75	4.08	6.98	12.78	15.14	16.40	19.07
G.L	353.199	354.552	354.627	353.166	352.833	352.952	354.340	354.261	353.601

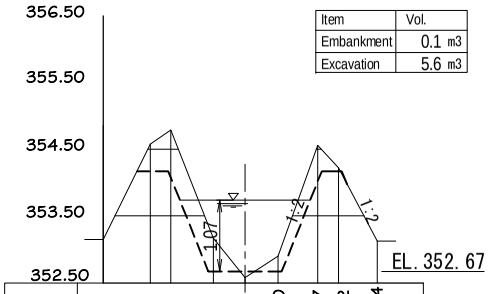
Main Canal - Ch 9.80km



Item	Vol.
Embankment	0.0 m3
Excavation	8.4 m3

DIST	0.00	3.72	5.74	8.74	12.51	16.37	17.83	21.47
G.L	352.923	354.555	354.678	353.015	352.707	352.952	354.809	354.847	353.149

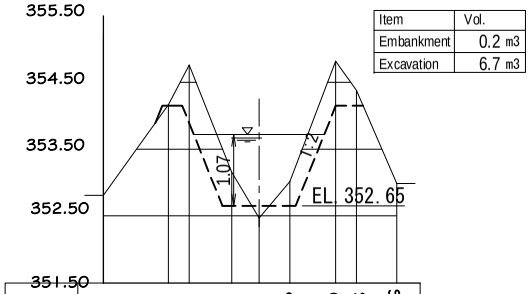
Main Canal - Ch 10.00km



Item	Vol.
Embankment	0.1 m3
Excavation	5.6 m3

DIST	0.00	3.55	5.07	8.25	13.10	16.07	17.62	20.54
G.L	353.043	354.534	354.678	353.125	352.551	352.842	354.484	354.237	353.040

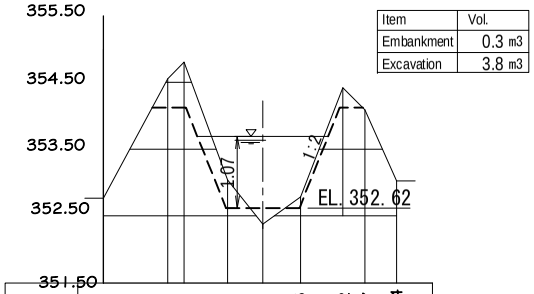
Main Canal - Ch 10.20km



Item	Vol.
Embankment	0.2 m3
Excavation	6.7 m3

DIST	0.00	4.88	6.43	9.62	13.98	17.39	18.96	21.96
G.L	352.674	354.310	354.634	353.042	352.405	352.954	354.674	354.395	352.895

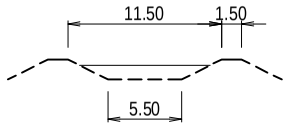
Main Canal - Ch 10.40km



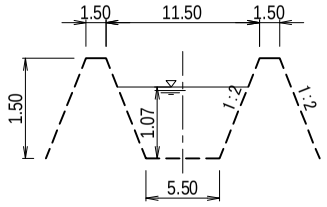
Item	Vol.
Embankment	0.3 m3
Excavation	3.8 m3

DIST	0.00	4.82	6.01	9.28	14.75	17.92	19.57	21.94
G.L	352.575	354.467	354.709	353.024	352.303	352.790	354.340	354.119	352.985

Main Canal - Ch 10.60km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B.L.

: Planned B.L.

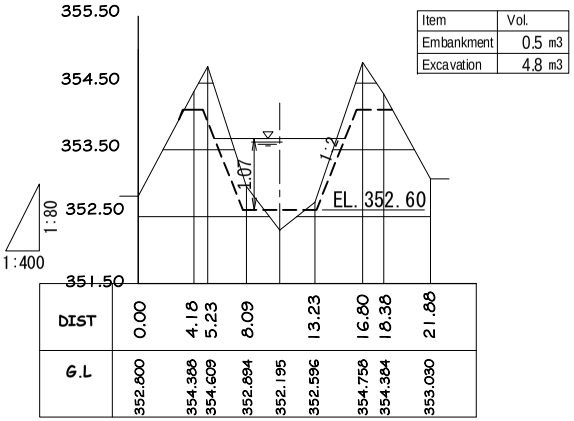
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (9.60,9.80,10.00,10.20,10.40,10.60km)						
PROJECT: 03-9	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Main Canal Cross Section(10/10)

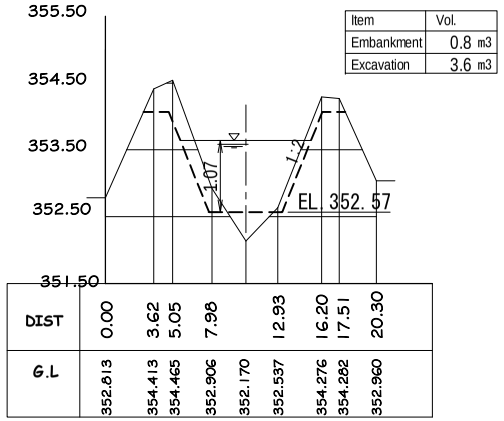
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	0.5 m3
Excavation	4.8 m3

DIST	0.00	4.18	5.23	8.09	13.23	16.80	18.38	21.88
G.L	352.800	354.388	354.609	352.894	352.195	352.596	354.758	354.384	353.030

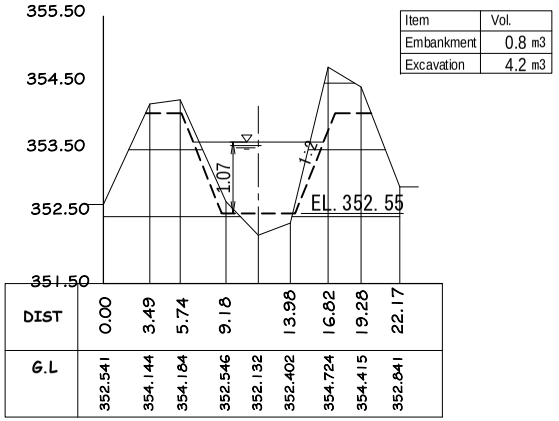
Main Canal - Ch 10.80km



Item	Vol.
Embankment	0.8 m3
Excavation	3.6 m3

DIST	0.00	3.62	5.05	7.98	12.93	16.20	17.51	20.30
G.L	352.813	354.413	354.465	352.906	352.170	352.537	354.276	354.282	352.960

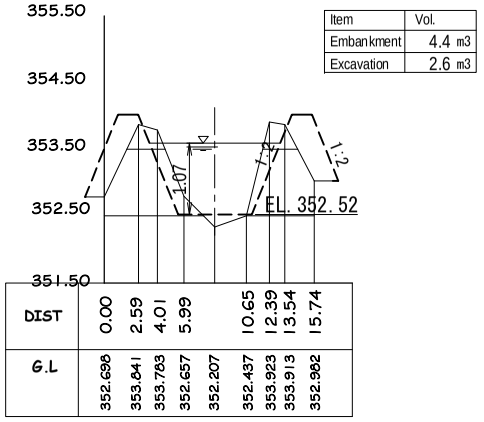
Main Canal - Ch 11.00km



Item	Vol.
Embankment	0.8 m3
Excavation	4.2 m3

DIST	0.00	3.49	5.74	9.18	13.98	16.82	19.28	22.17
G.L	352.541	354.144	354.184	352.546	352.132	352.402	354.724	354.415	352.841

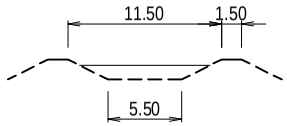
Main Canal - Ch 11.20km



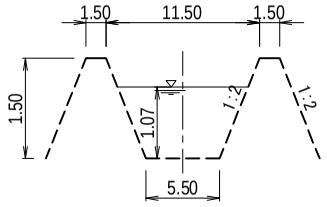
Item	Vol.
Embankment	4.4 m3
Excavation	2.6 m3

DIST	0.00	2.59	4.01	5.99	10.65	12.39	13.54	15.74
G.L	352.698	353.841	353.783	352.657	352.207	352.437	353.923	353.913	352.982

Main Canal - Ch 11.40km



Standard Cross Section of
Main Canal by same scale H & V



Standard Cross Section of
Main Canal by different scale H & V

Legend

: Actual B.L.

: Planned B.L.

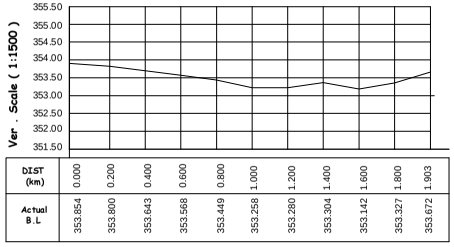
0 20m

SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (10.80,11.00,11.20,11.40km)						
PROJECT: 03-10	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

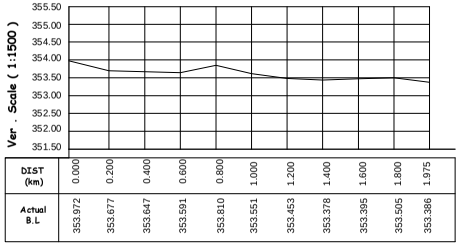
Ariab Scheme Irrigation Project
Minor Canal Longitudinal Section

SCALE H=1:30000,V=1500



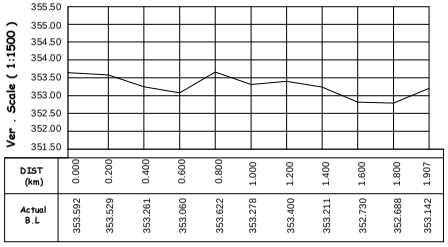
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.903
Actual B.L	353.854	353.800	353.643	353.568	353.449	353.258	353.280	353.304	353.142	353.327	353.672

Longitudinal Profile Minor Canal +1.592-1R
Hor scale (1:30000)



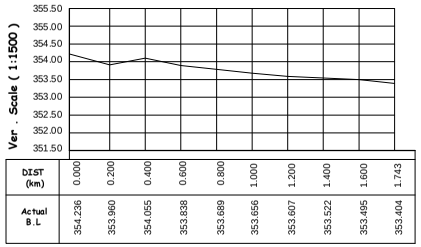
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.975
Actual B.L	353.972	353.677	353.647	353.591	353.810	353.551	353.453	353.378	353.395	353.505	353.386

Longitudinal Profile Minor Canal +2.930-1R
Hor scale (1:30000)



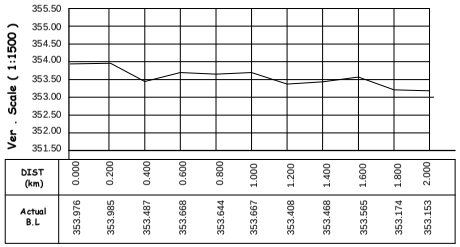
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.907
Actual B.L	353.592	353.529	353.261	353.060	353.622	353.278	353.400	353.211	352.730	352.688	353.142

Longitudinal Profile Minor Canal +4.524-2L
Hor scale (1:30000)



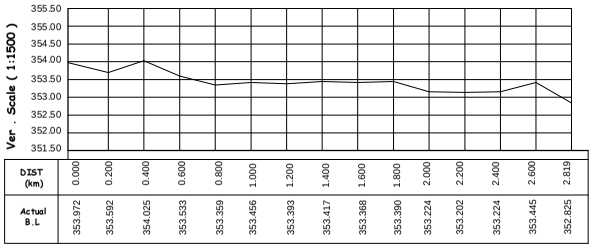
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.743
Actual B.L	354.236	353.960	354.055	353.838	353.689	353.656	353.607	353.522	353.495	353.404

Longitudinal Profile Minor Canal +1.592-2R
Hor scale (1:30000)



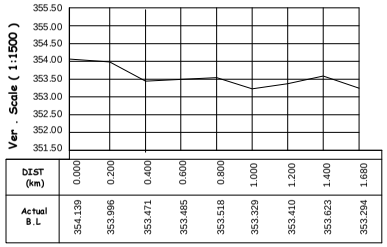
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000
Actual B.L	353.976	353.985	353.487	353.668	353.644	353.667	353.408	353.468	353.565	353.174	353.153

Longitudinal Profile Minor Canal +2.930-2L
Hor scale (1:30000)



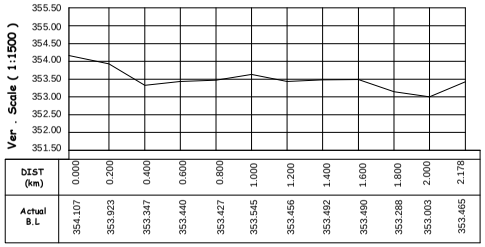
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.400	2.600	2.819
Actual B.L	353.972	353.592	354.025	353.533	353.359	353.456	353.393	353.417	353.368	353.390	353.224	353.202	353.224	353.445	352.825

Longitudinal Profile Minor Canal +4.524-3L
Hor scale (1:30000)



DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.680
Actual B.L	354.139	353.996	353.471	353.485	353.518	353.329	353.410	353.623	353.294

Longitudinal Profile Minor Canal +1.592-3L
Hor scale (1:30000)



DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.178
Actual B.L	354.107	353.923	353.347	353.440	353.427	353.545	353.456	353.492	353.490	353.288	353.003	353.465

Longitudinal Profile Minor Canal +4.524-1R
Hor scale (1:30000)

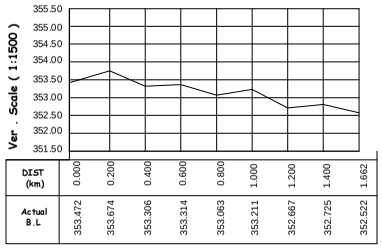
0 1500m

SCALE 1:30000

PROJECT: Ariab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Longitudinal Section						
PROJECT: Longitudinal Profile Minor Canal						
PROJECT: 04-1	SCALE H=1:30000 V=1:1500	UNIT	SIZE	SHEET	PROJ.No.	REV.

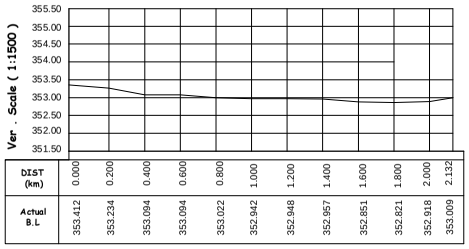
Ariab Scheme Irrigation Project
Minor Canal Longitudinal Section

SCALE H=1:30000,V=1500



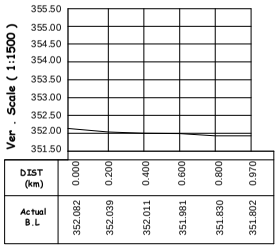
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.662
Actual B.L	353.472	353.674	353.306	353.314	353.063	353.211	352.667	352.725	352.522

Longitudinal Profile Minor Canal +6.542-1R
Hor scale (1:30000)



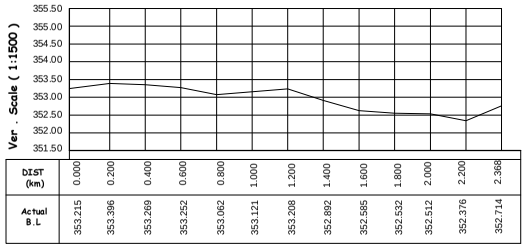
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.132
Actual B.L	353.412	353.234	353.094	353.094	353.022	352.942	352.948	352.957	352.851	352.821	352.818	353.009

Longitudinal Profile Minor Canal +8.145-2L
Hor scale (1:30000)



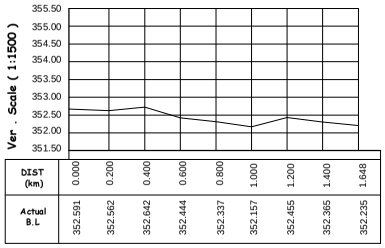
DIST (km)	0.000	0.200	0.400	0.600	0.800	0.970
Actual B.L	352.082	352.039	352.011	351.981	351.830	351.802

Longitudinal Profile Minor Canal +11.600-1R
Hor scale (1:30000)



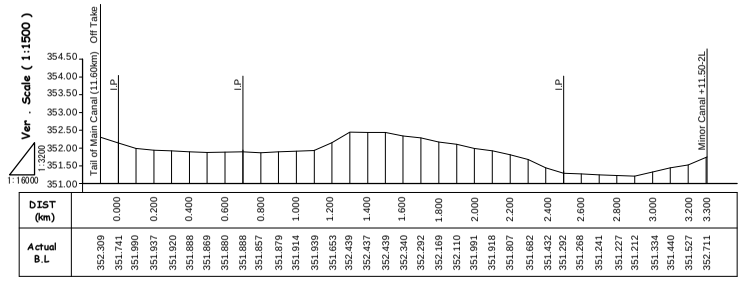
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.368
Actual B.L	353.215	353.396	353.269	353.252	353.062	353.121	353.208	352.892	352.585	352.532	352.512	352.376	352.714

Longitudinal Profile Minor Canal +6.542-2L
Hor scale (1:30000)



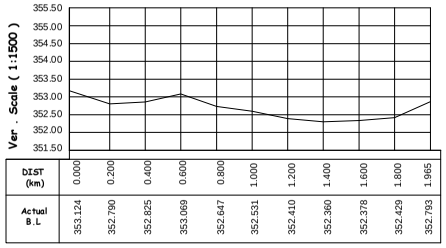
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.648
Actual B.L	352.591	352.562	352.642	352.444	352.337	352.157	352.455	352.365	352.235

Longitudinal Profile Minor Canal +10.000-1R
Hor scale (1:30000)



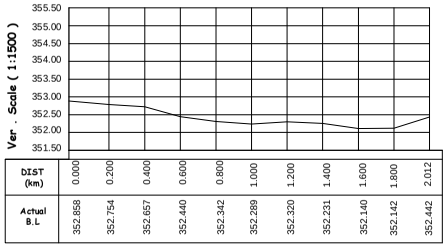
DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.400	2.600	2.800	3.000	3.200	3.300
Actual B.L	352.309	351.741	351.990	351.937	351.920	351.888	351.869	351.880	351.888	351.857	351.879	351.914	351.939	351.653	352.439	352.437	352.439	352.340	352.292	352.169	352.110	351.991	351.918	351.807	351.682	351.432	351.292	351.268	351.241	351.227	351.212	351.334	351.440	351.527	352.711

Longitudinal Profile Minor Canal +11.60-2L
Hor scale (1:30000)



DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.965
Actual B.L	353.124	352.790	352.825	353.069	352.647	352.531	352.410	352.360	352.378	352.429	352.793

Longitudinal Profile Minor Canal +8.145-1R
Hor scale (1:30000)



DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.012
Actual B.L	352.858	352.754	352.657	352.440	352.342	352.289	352.320	352.231	352.140	352.142	352.442

Longitudinal Profile Minor Canal +10.000-2L
Hor scale (1:30000)

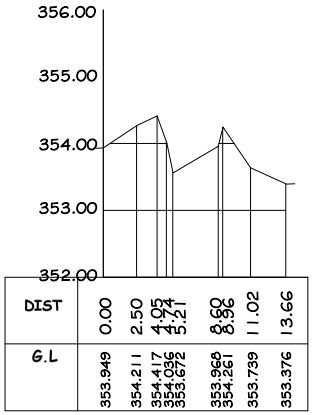
0 1500m
SCALE 1:30000

PROJECT: Ariab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Longitudinal Section						
PROJECT: Longitudinal Profile Minor Canal						
PROJECT: 04-2	SCALE H=1:30000 V=1:1500	UNIT	SIZE	SHEET	PROJ.No.	REV.

Minor Canal+1.592-1R

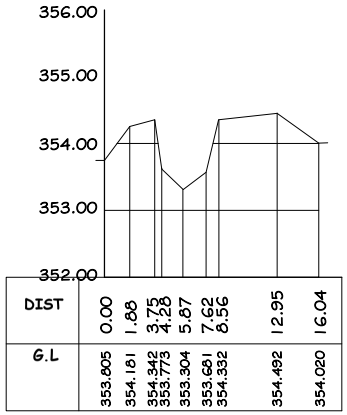
Aliab Scheme Irrigation Project
Minor Canal Cross Section(1/8)

SCALE H=1:400, V=1:80



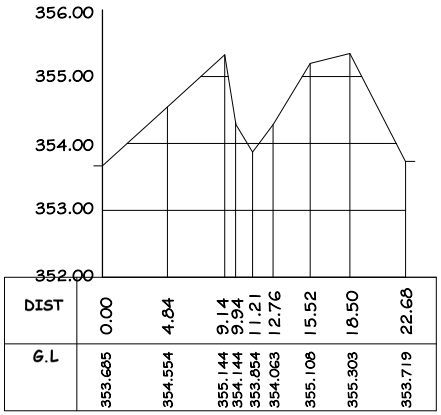
DIST	0.00	2.50	4.05	4.74	5.21	8.60	8.86	11.02	13.66
G.L	353.949	354.211	354.417	354.036	353.672	353.968	354.261	353.739	353.376

Minor Canal+1.592-1R - Cross Section At The Beginning



DIST	0.00	1.88	3.75	4.28	5.87	7.62	8.56	12.95	16.04
G.L	353.805	354.161	354.342	353.773	353.304	353.681	354.332	354.492	354.020

Minor Canal+1.592-1R - Cross Section At The Middle

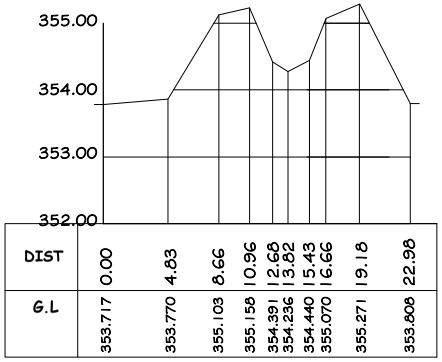


DIST	0.00	4.84	9.14	9.94	11.21	12.76	15.52	18.50	22.68
G.L	353.685	354.554	355.144	354.144	353.854	354.063	355.108	355.303	353.719

Minor Canal+1.592-1R - Cross Section At The End

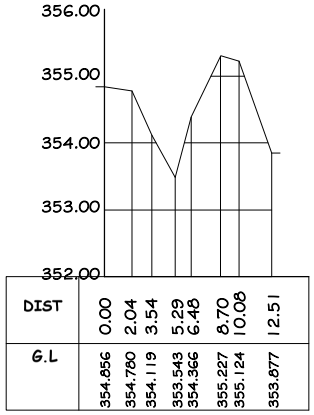
A6-51

Minor Canal+1.592-2R



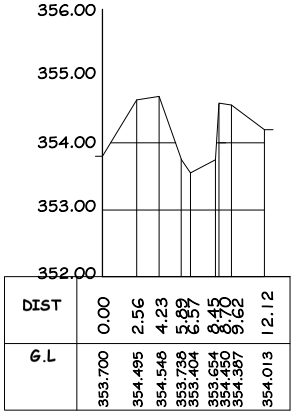
DIST	0.00	4.83	8.66	10.96	12.68	13.82	15.43	16.66	19.18	22.98
G.L	353.717	353.770	355.103	355.158	354.391	354.236	354.440	355.070	355.271	353.808

Minor Canal+1.592-2R - Cross Section At The Beginning



DIST	0.00	2.04	3.54	5.29	6.48	8.70	10.08	12.51
G.L	354.856	354.780	354.119	353.543	354.366	355.227	355.124	353.877

Minor Canal+1.592-2R - Cross Section At The Middle



DIST	0.00	2.56	4.23	5.89	6.57	8.45	8.70	9.62	12.12
G.L	353.700	354.495	354.548	353.738	353.404	353.654	354.450	354.387	354.013

Minor Canal+1.592-2R - Cross Section At The End

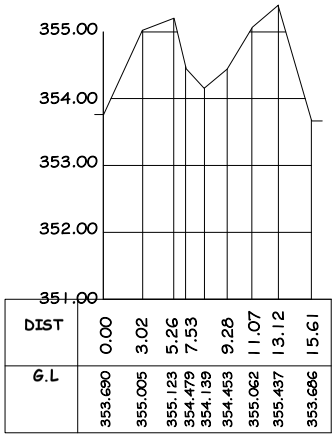
0 20m
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/8)						
PROJECT:						
PROJECT: 05-1	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(2/8)

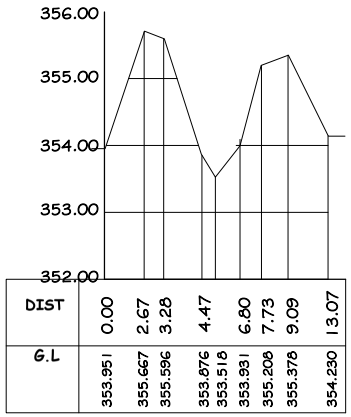
SCALE H=1:400, V=1:80

Minor Canal+1.592-3L



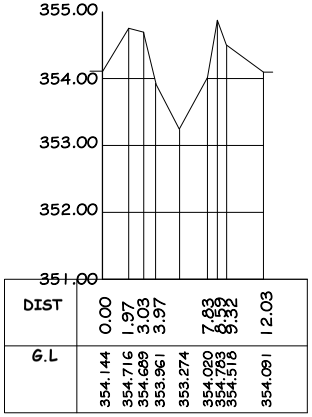
DIST	0.00	3.02	5.26	7.53	9.28	11.07	13.12	15.61
G.L	353.690	355.005	355.123	354.479	354.139	354.453	355.062	355.437	353.686

Minor Canal+1.592-3L - Cross Section At The Beginning



DIST	0.00	2.67	3.28	4.47	6.80	7.73	9.09	13.07
G.L	353.951	355.667	355.596	353.876	353.518	353.931	355.208	355.378	354.230

Minor Canal+1.592-3L - Cross Section At The Middle

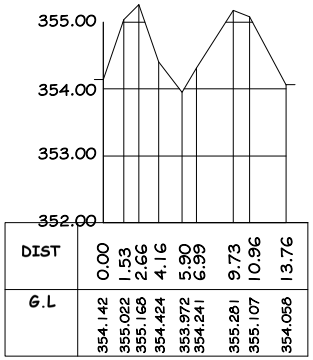


DIST	0.00	1.97	3.03	3.97	7.83	8.53	9.32	12.03
G.L	354.144	354.716	354.689	353.961	353.274	354.020	354.783	354.518	354.091

Minor Canal+1.592-3L - Cross Section At The End

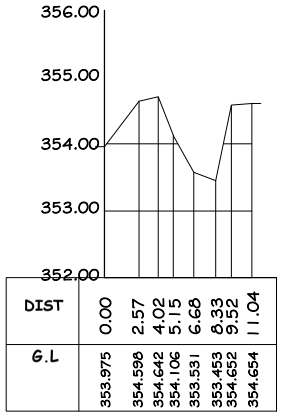
A6-52

Minor Canal+2.930-1R



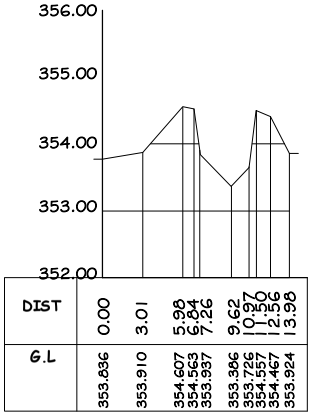
DIST	0.00	1.53	2.66	4.16	5.90	6.99	9.73	10.96	13.76
G.L	354.142	355.022	355.168	354.424	353.972	354.241	355.281	355.107	354.056

Minor Canal+2.930-1R - Cross Section At The Beginning



DIST	0.00	2.57	4.02	5.15	6.68	8.33	9.52	11.04
G.L	353.975	354.598	354.642	354.106	353.531	353.453	354.652	354.654

Minor Canal+2.930-1R - Cross Section At The Middle



DIST	0.00	3.01	5.98	6.84	7.26	9.62	10.97	12.56	13.98
G.L	353.836	353.910	354.607	354.563	353.937	353.396	353.726	354.557	354.467	353.924

Minor Canal+2.930-1R - Cross Section At The End

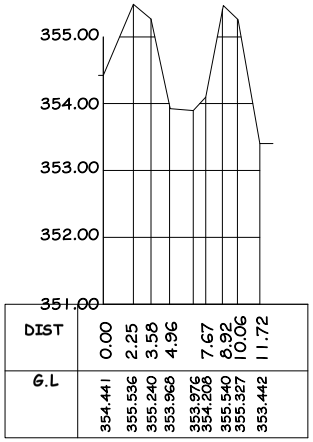
0 20m
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(2/8)						
PROJECT:						
PROJECT: 05-2	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(3/8)

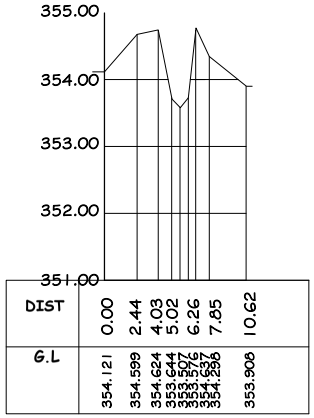
SCALE H=1:400, V=1:80

Minor Canal+2.930-2L



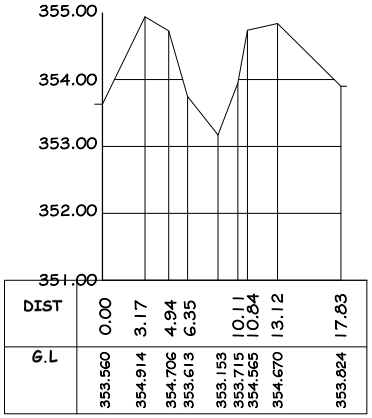
DIST	0.00	2.25	3.58	4.96	7.67	8.92	10.06	11.72
G.L	354.441	355.536	355.240	353.966	353.976	354.208	355.540	355.327	353.442

Minor Canal+2.930-2L - Cross Section At The Beginning



DIST	0.00	2.44	4.03	5.02	6.26	7.85	10.62
G.L	354.121	354.599	354.624	353.644	353.507	354.296	353.908

Minor Canal+2.930-2L - Cross Section At The Middle

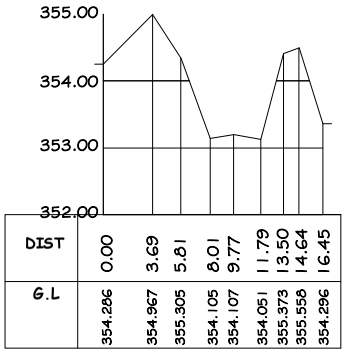


DIST	0.00	3.17	4.94	6.35	10.11	10.84	13.12	17.83
G.L	353.560	354.914	354.706	353.613	353.153	353.715	354.565	354.670	353.824

Minor Canal+2.930-2L - Cross Section At The End

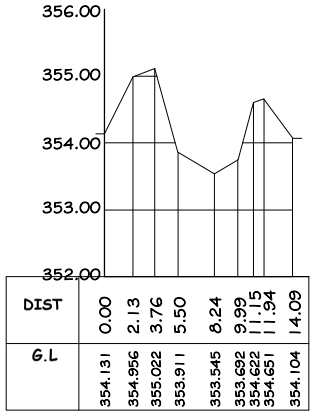
A6-53

Minor Canal+4.524-1R



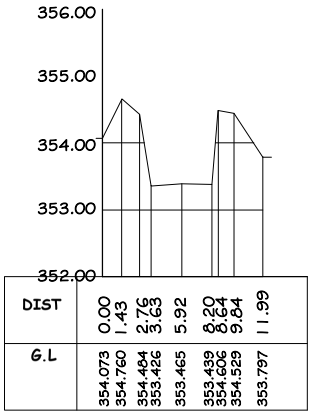
DIST	0.00	3.69	5.81	8.01	9.77	11.79	13.50	14.64	16.45
G.L	354.286	354.967	355.305	354.105	354.107	354.051	355.373	355.558	354.296

Minor Canal+4.524-1R - Cross Section At The Beginning



DIST	0.00	2.13	3.76	5.50	8.24	9.99	11.15	11.94	14.09
G.L	354.131	354.956	355.022	353.911	353.545	353.692	354.622	354.651	354.104

Minor Canal+4.524-1R - Cross Section At The Middle



DIST	0.00	1.43	2.76	3.63	5.92	8.20	8.64	9.84	11.99
G.L	354.073	354.760	354.484	353.426	353.465	353.439	354.426	354.529	353.797

Minor Canal+4.524-1R - Cross Section At The End

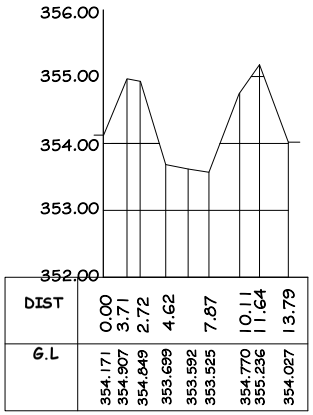
0 20m
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(3/8)						
PROJECT:						
PROJECT: 05-3	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(4/8)

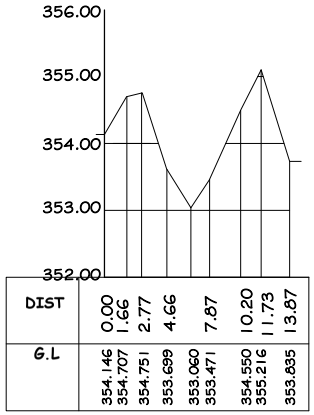
SCALE H=1:400, V=1:80

Minor Canal+4.524-2L



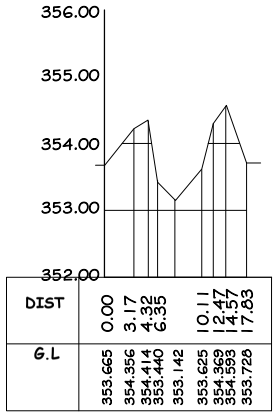
DIST	0.00	3.71	2.72	4.62	7.87	10.11	13.79
G.L	354.171	354.907	354.849	353.699	353.592	353.525	354.770	355.236	354.027

Minor Canal+4.524-2L - Cross Section At The Beginning



DIST	0.00	1.66	2.77	4.66	7.87	10.20	11.73	13.87
G.L	354.146	354.707	354.751	353.699	353.060	353.471	354.550	355.216	353.835

Minor Canal+4.524-2L - Cross Section At The Middle

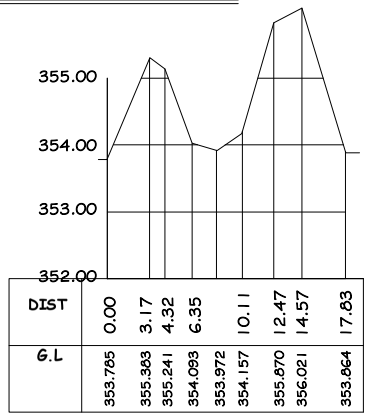


DIST	0.00	3.17	4.32	6.35	10.11	12.47	14.57	17.83
G.L	353.665	354.356	354.414	353.440	353.142	353.625	354.369	354.593	353.726

Minor Canal+4.524-2L - Cross Section At The End

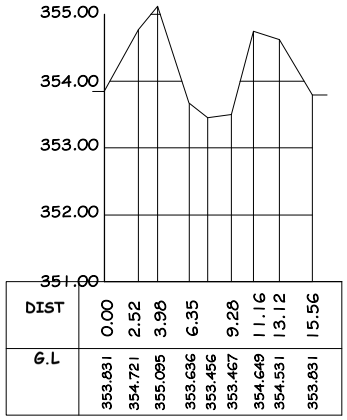
A6-54

Minor Canal+4.524-3L



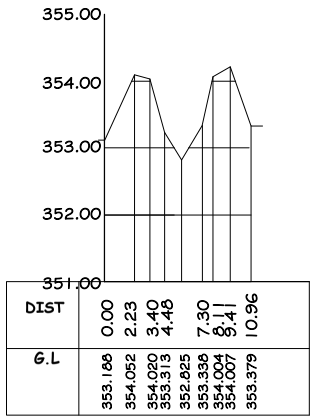
DIST	0.00	3.17	4.32	6.35	10.11	12.47	14.57	17.83
G.L	353.785	355.383	355.241	354.093	353.972	354.157	355.870	356.021	353.864

Minor Canal+4.524-3L - Cross Section At The Beginning



DIST	0.00	2.52	3.98	6.35	9.28	11.16	13.12	15.56
G.L	353.831	354.721	355.095	353.636	353.456	353.467	354.649	354.531	353.831

Minor Canal+4.524-3L - Cross Section At The Middle



DIST	0.00	2.23	3.40	4.48	7.30	8.11	9.41	10.96
G.L	353.186	354.052	354.020	353.313	352.825	353.336	354.004	354.007	353.379

Minor Canal+4.524-3L - Cross Section At The End

0 20m

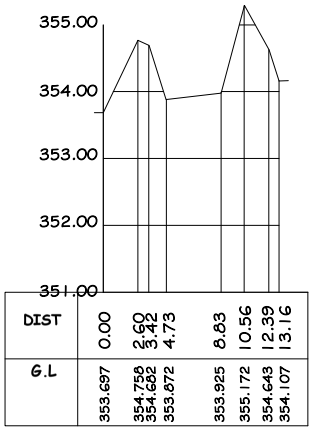
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(4/8)						
PROJECT:						
PROJECT: 05-4	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(5/8)

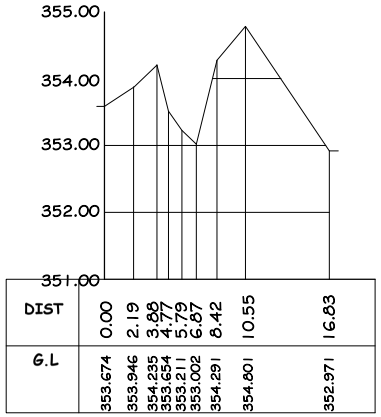
SCALE H=1:400, V=1:80

Minor Canal+6.542-1R



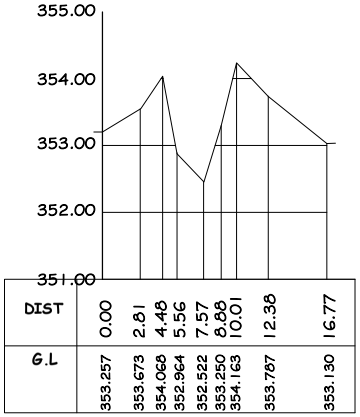
DIST	0.00	2.60	3.42	4.73	8.83	10.56	12.39	13.16
G.L	353.697	354.756	354.682	353.672	353.925	355.172	354.643	354.107

Minor Canal+6.542-1R - Cross Section At The Beginning



DIST	0.00	2.19	3.88	4.77	5.79	6.87	8.42	10.55	16.83
G.L	353.674	353.946	354.235	353.654	353.211	353.002	354.291	354.801	352.971

Minor Canal+6.542-1R - Cross Section At The Middle

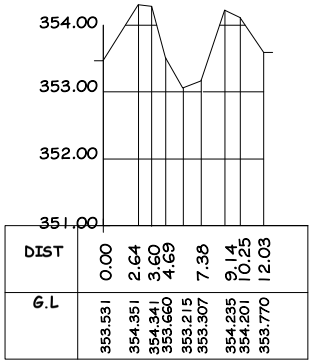


DIST	0.00	2.81	4.48	5.56	7.57	8.88	10.01	12.38	16.77
G.L	353.257	353.673	354.068	352.964	352.522	353.250	354.163	353.787	353.130

Minor Canal+6.542-1R - Cross Section At The End

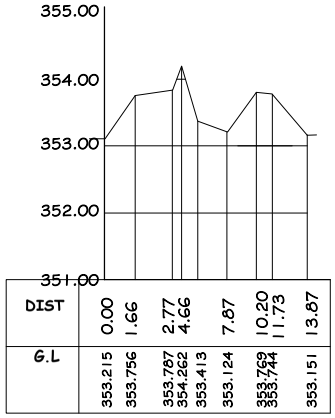
A6-55

Minor Canal+6.542-2L



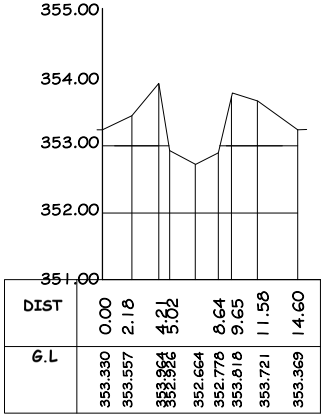
DIST	0.00	2.64	3.60	4.69	7.38	9.14	10.25	12.03
G.L	353.531	354.351	354.341	353.660	353.215	353.307	354.235	354.201	353.770

Minor Canal+6.542-2L - Cross Section At The Beginning



DIST	0.00	1.66	2.77	4.66	7.87	10.20	11.73	13.87
G.L	353.215	353.756	353.787	354.262	353.413	353.124	353.769	353.744	353.151

Minor Canal+6.542-2L - Cross Section At The Middle



DIST	0.00	2.18	4.21	5.02	8.64	9.65	11.58	14.60
G.L	353.330	353.557	353.364	352.926	352.664	352.776	353.818	353.721	353.369

Minor Canal+6.542-1L - Cross Section At The End

0 20m

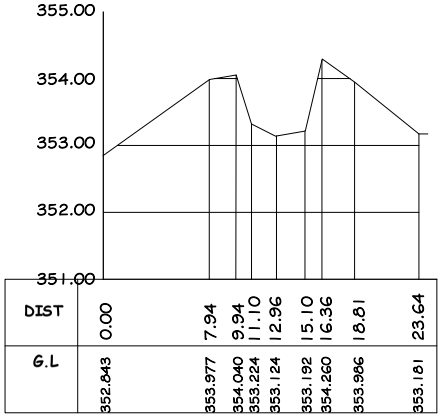
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(5/8)						
PROJECT:						
PROJECT: 05-5	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

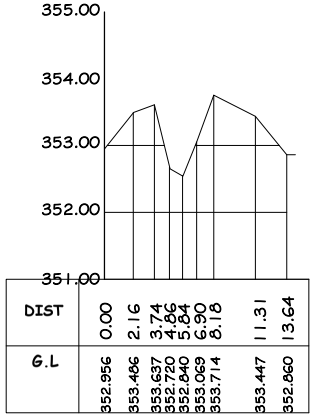
Minor Canal+8.145-1R

Aliab Scheme Irrigation Project
Minor Canal Cross Section(6/8)

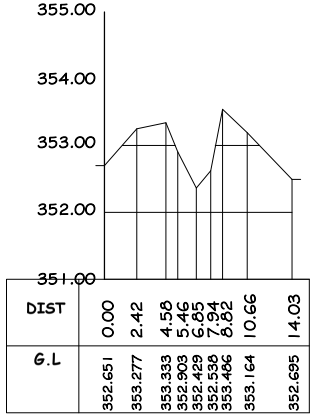
SCALE H=1:400, V=1:80



Minor Canal+8.145-1R - Cross Section At The Beginning



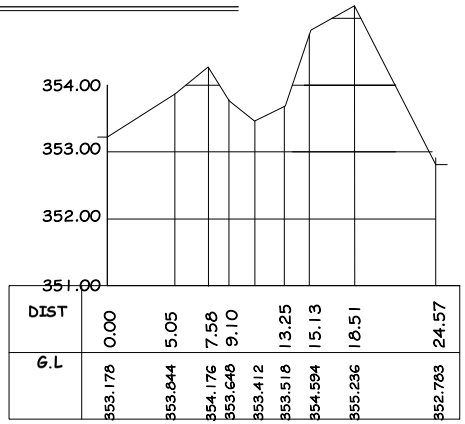
Minor Canal+8.145-1R - Cross Section At The Middle



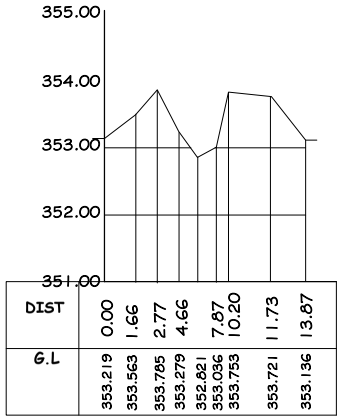
Minor Canal+8.145-1R - Cross Section At The End

A6-56

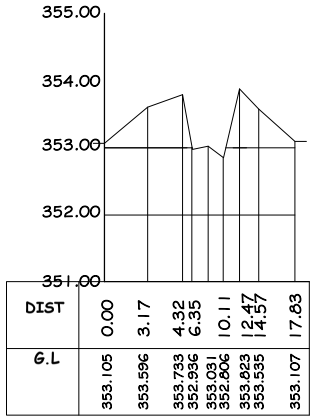
Minor Canal+8.145-2L



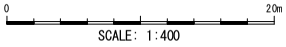
Minor Canal+8.145-2L - Cross Section At The Beginning



Minor Canal+8.145-2L - Cross Section At The Middle



Minor Canal+8.145-2L - Cross Section At The End

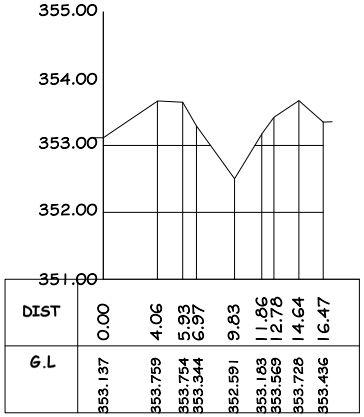


PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(6/8)						
PROJECT:						
PROJECT: 05-6	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(7/8)

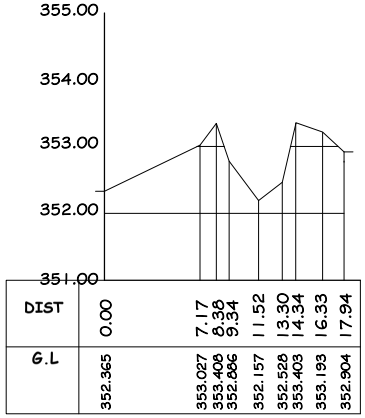
SCALE H=1:400, V=1:80

Minor Canal+10.000-1R



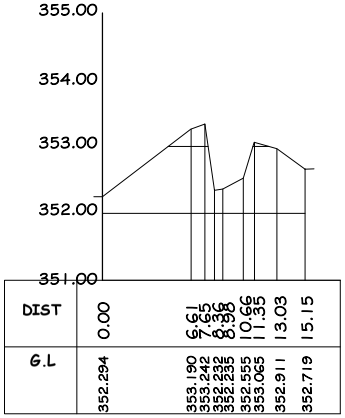
DIST	0.00	4.06	5.93	6.97	9.83	11.86	12.78	14.64	16.47
G.L	353.137	353.759	353.754	353.344	352.591	353.183	353.569	353.726	353.436

Minor Canal+10.000-1R - Cross Section At The Beginning



DIST	0.00	7.17	8.38	9.34	11.52	13.30	14.34	16.33	17.94
G.L	352.365	353.027	353.408	352.886	352.157	352.528	353.403	353.193	352.904

Minor Canal+10.000-1R - Cross Section At The Middle

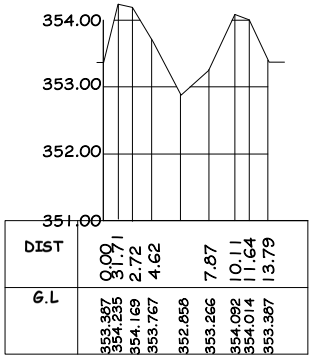


DIST	0.00	6.61	7.65	8.36	8.98	10.66	11.35	13.03	15.15
G.L	352.294	353.190	353.242	352.232	352.235	352.555	353.065	352.911	352.719

Minor Canal+10.000-1R - Cross Section At The End

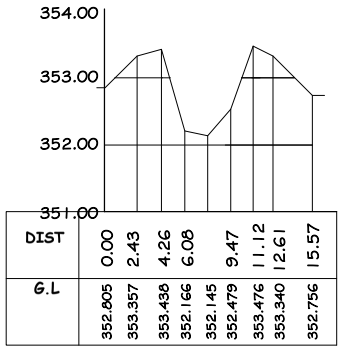
A6-57

Minor Canal+10.000-2L



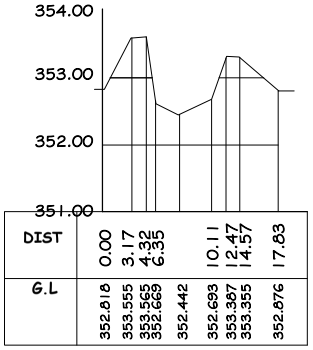
DIST	0.00	3.71	2.72	4.62	7.87	10.11	11.64	13.79
G.L	353.387	354.235	354.169	353.767	352.856	353.266	354.092	354.014	353.387

Minor Canal+10.000-2L - Cross Section At The Beginning



DIST	0.00	2.43	4.26	6.08	9.47	11.12	12.61	15.57
G.L	352.805	353.357	353.438	352.166	352.145	352.479	353.476	353.340	352.756

Minor Canal+10.000-2L - Cross Section At The Middle



DIST	0.00	3.17	4.32	6.35	10.11	12.47	14.57	17.83
G.L	352.816	353.555	353.565	352.669	352.442	352.693	353.387	353.355	352.876

Minor Canal+10.000-2L - Cross Section At The End

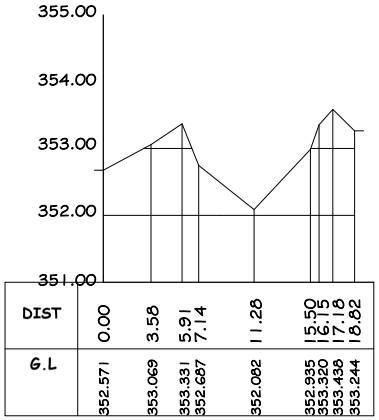
0 20m
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(7/8)						
PROJECT:						
PROJECT: 05-7	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Aliab Scheme Irrigation Project
Minor Canal Cross Section(8/8)

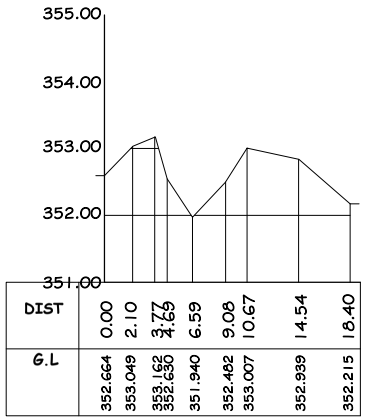
SCALE H=1:400, V=1:80

Minor Canal+11.600-1R



DIST	0.00	3.58	5.91	7.14	11.28	15.50	16.15	17.18	18.82
G.L	352.571	353.069	353.331	352.687	352.082	352.935	353.320	353.438	353.244

Minor Canal+11.600-1R - Cross Section At The Beginning

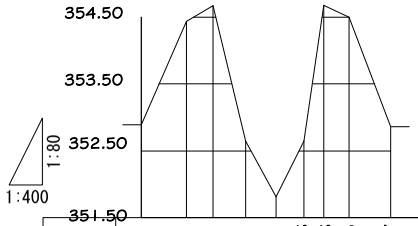


DIST	0.00	2.10	3.77	4.69	6.59	9.08	10.67	14.54	18.40
G.L	352.664	353.049	353.162	352.630	351.940	352.462	353.007	352.939	352.215

Minor Canal+11.600-1R - Cross Section At The End

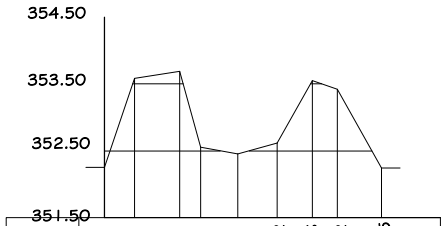
A6-58

Minor Canal+11.600-2L



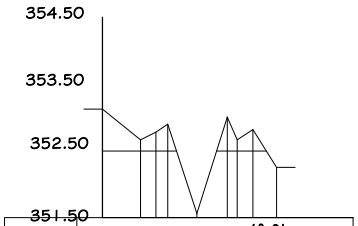
DIST	0.00	3.38	5.38	7.82	12.16	13.66	15.55	18.67
G.L	352.746	354.399	354.544	352.607	351.741	352.607	354.554	354.437	352.771

Minor Canal +11.60-2L - Cross Section At The Beginning



DIST	0.00	2.24	5.63	7.21	12.92	15.56	17.42	20.75
G.L	352.239	353.487	353.576	352.515	352.340	352.554	353.513	353.396	352.249

Minor Canal +11.60-2L Cross Section At The Middle



DIST	0.00	2.83	3.99	4.88	9.32	11.07	11.26	13.02
G.L	353.121	352.604	352.692	352.830	351.527	352.895	352.688	352.705	352.252

Minor Canal +11.60-2L Cross Section At The End

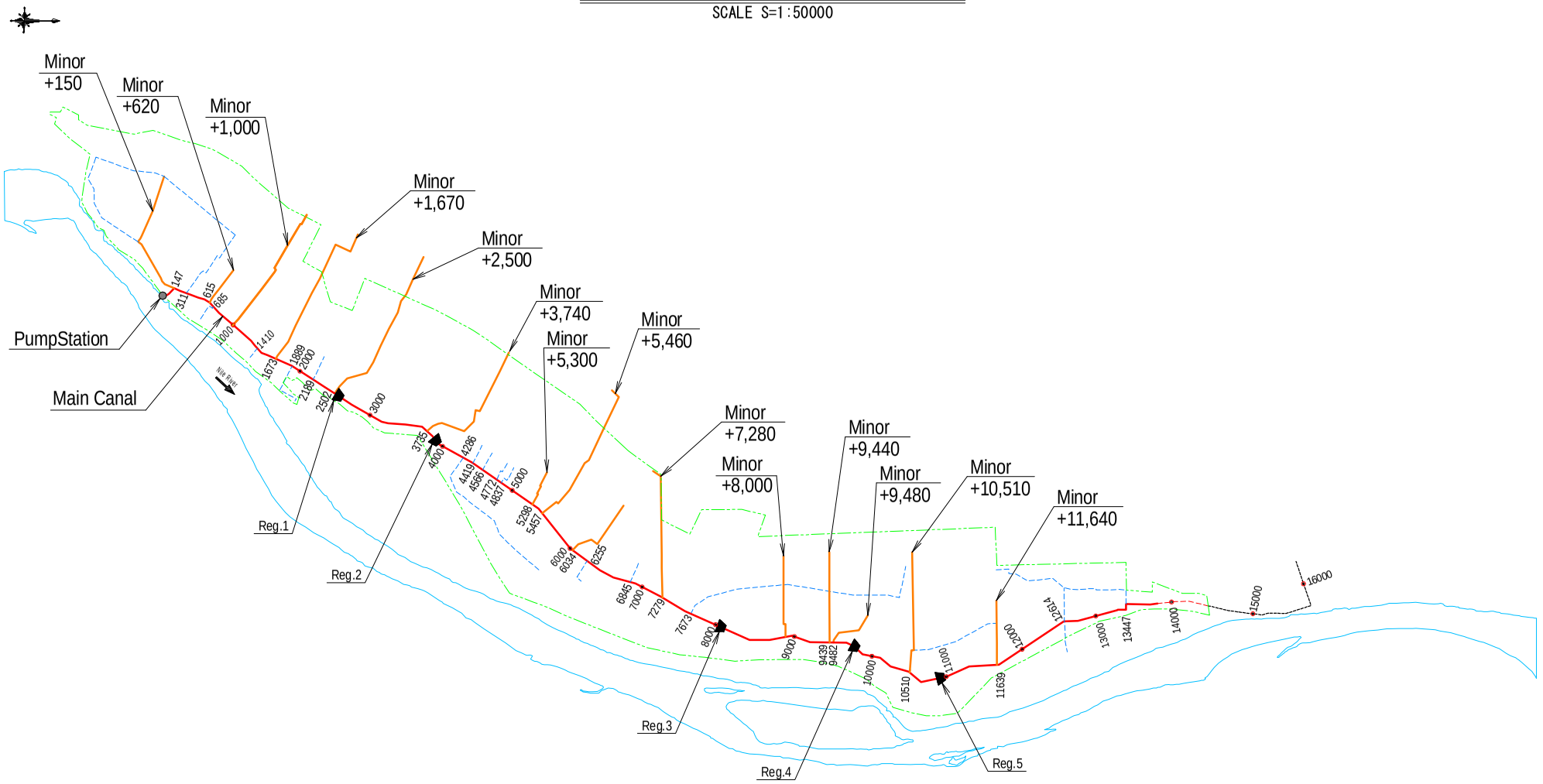
0 20m
SCALE: 1:400

PROJECT: Aliab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(8/8)						
PROJECT:						
PROJECT: 05-8	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Appendix -6.11-2 Plan of Kitiab canal works

Kitiab Scheme Irrigation Project
General Layout of Canal Line

SCALE S=1:50000



A6-60

Scheme infomation	
Irrigation Area	2,394ha(5,700fed)
Main Canal Length	13.8km
Minor Canal Length	9.8km

Legend

:Main Canal

:Minor Canal

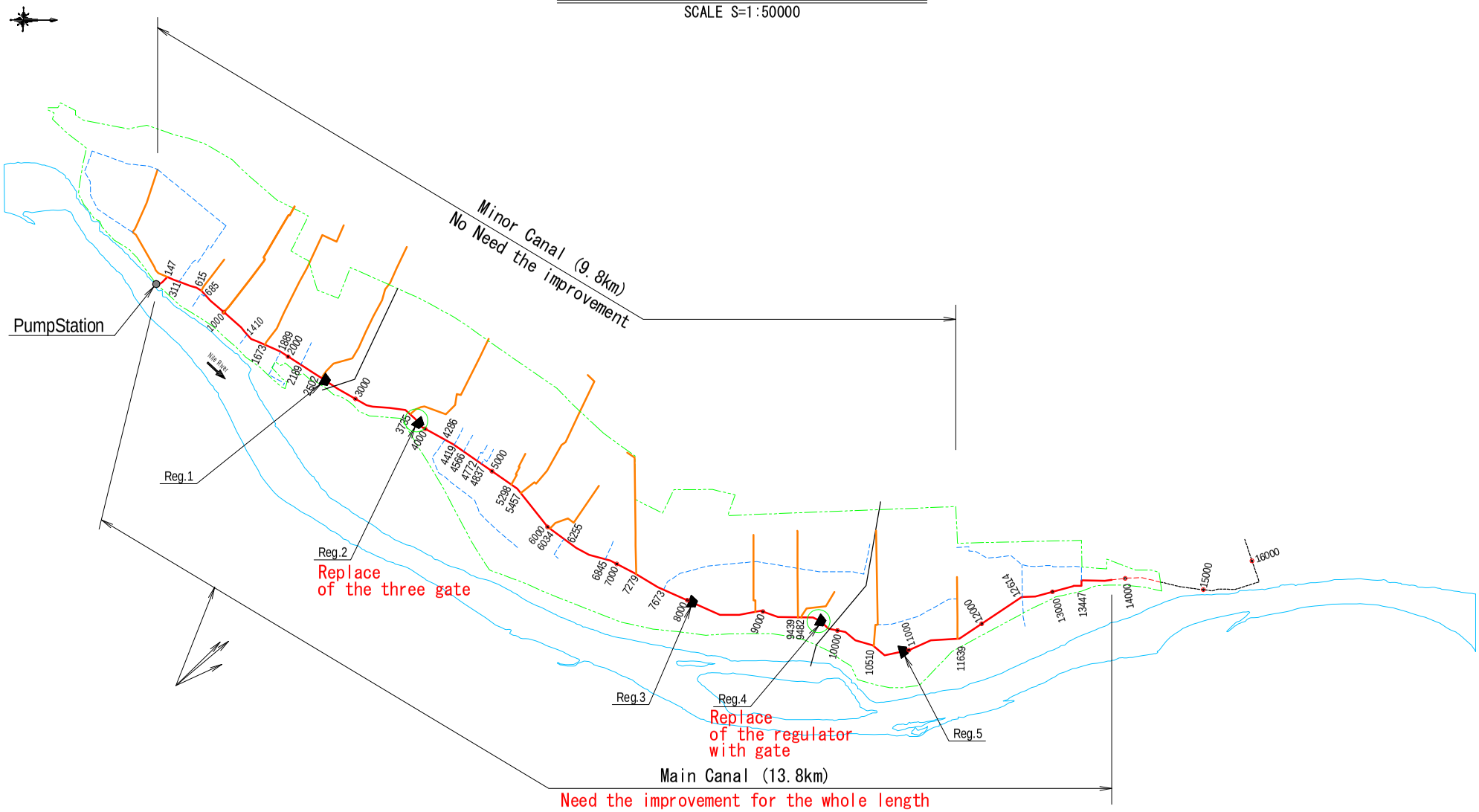
0 2500m

SCALE 1:50000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE:						
PROJECT: General Layout of Canal Line						
PROJECT: 01-1	SCALE S=1:50000	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
General Layout of Canal Line

SCALE S=1:50000



Legend

:Main Canal

:Minor Canal

0 2500m

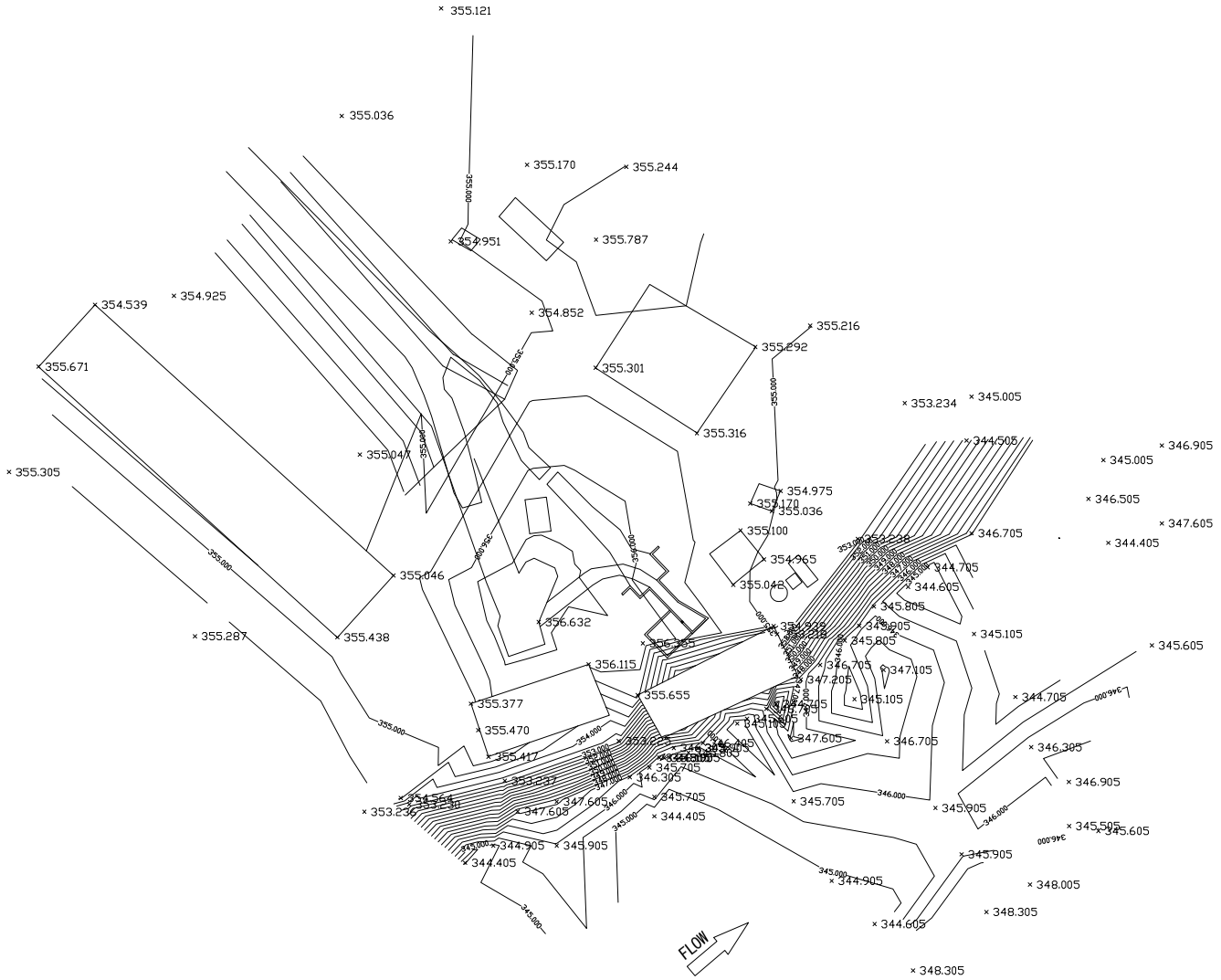
SCALE 1:50000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE:						
PROJECT: General Layout of Canal Line						
PROJECT: 01-2	SCALE S=1:50000	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-61

Kitiab Scheme Irrigation Project
Contour Map

SCALE 1:1000



0 500m

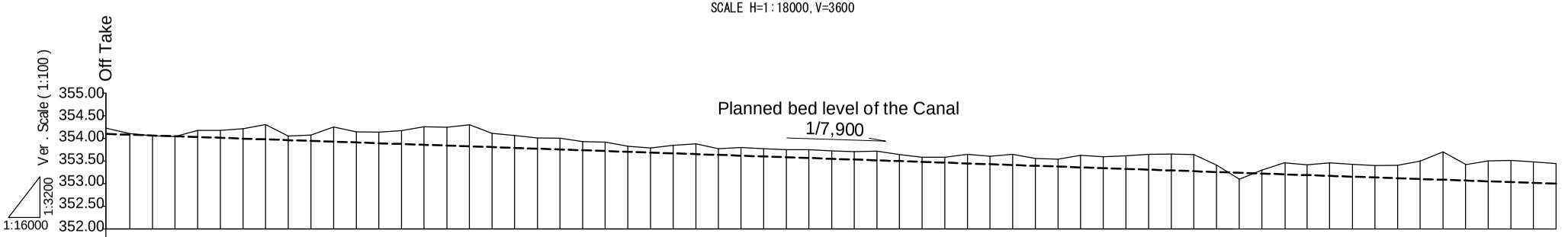
SCALE: 1:1000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Plane Surver Area						
PROJECT: Contour Map						
PROJECT: 01-3	SCALE H=1:1000	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-62

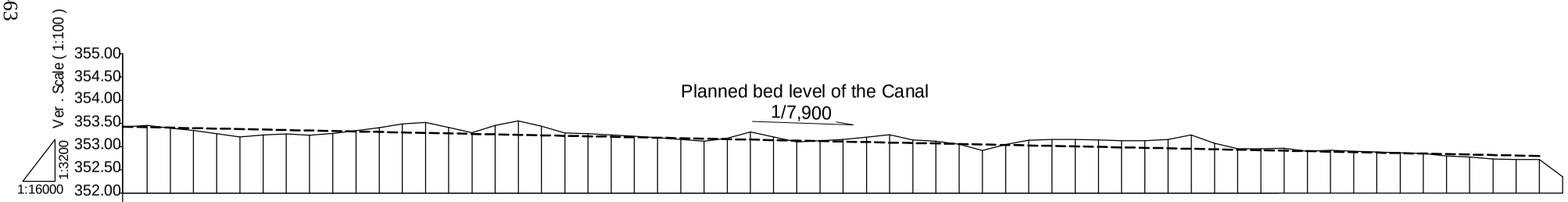
Kitiab Scheme Irrigation Project
Main Canal Longitudinal Section

SCALE H=1:18000, V=3600



DIST (km)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.400	2.600	2.800	3.000	3.200	3.400	3.600	3.800	4.000	4.200	4.400	4.600	4.800	5.000	5.200	5.400	5.600	5.800	6.000	6.200	6.400
Actual B.L	354.210	354.104	354.059	354.045	354.182	354.186	354.210	354.313	354.056	354.085	354.259	354.151	354.137	354.170	354.262	354.244	354.301	354.113	354.072	354.007	354.001	353.938	353.926	353.829	353.784	353.856	353.899	353.772	353.803	353.775	353.753	353.757	353.729	353.712	353.724	353.651	353.586	353.584	353.647	353.608	353.647	353.558	353.543	353.622	353.581	353.615	353.644	353.660	353.644	353.412	353.106	353.318	353.472	353.429	353.462	353.420	353.402	353.405	353.500	353.709	353.432	353.507	353.539	353.481	353.457
Planned B.L	354.10		354.08		354.06		354.04		354.02		354.00		353.98		353.96		353.94		353.91		353.89		353.87		353.85		353.83		353.81		353.79		353.77		353.75		353.73		353.71		353.69		353.67		353.65		353.63		353.61		353.58		353.56		353.54		353.52		353.50		353.48		353.45		353.44

Need the improvement for 12.8km (whole length)



DIST (km)	6.600	6.800	7.000	7.200	7.400	7.600	7.800	8.000	8.200	8.400	8.600	8.800	9.000	9.200	9.400	9.600	9.800	10.000	10.200	10.400	10.600	10.800	11.000	11.200	11.400	11.600	11.800	12.000	12.200	12.400	12.600
Actual B.L	353.434	353.462	353.406	353.351	353.282	353.217	353.255	353.287	353.259	353.296	353.349	353.418	353.495	353.521	353.427	353.309	353.471	353.563	353.440	353.299	353.282	353.267	353.228	353.197	353.156	353.111	353.180	353.322	353.214	353.111	353.136	353.163	353.209	353.272	353.154	353.122	353.067	352.921	353.050	353.137	353.149	353.156	353.141	353.134	353.138	353.165	353.250	353.096	352.960	352.942	352.966	352.907	352.922	352.902	352.895	352.877	352.858	352.805	352.772	352.739	352.727	352.723	352.363
Planned B.L		353.42		353.40		353.38		353.36		353.34		353.32		353.30		353.28		353.25		353.23		353.21		353.19		353.17		353.15		353.13		353.11		353.09		353.07		353.05		353.03		353.01		352.99		352.97		352.95		352.92		352.90		352.88		352.86		352.84		352.82		352.80	

Need the improvement for 12.8km (whole length)

A6-63

Legend

——— : Actual B.L.

- - - - - - : Planned B.L.

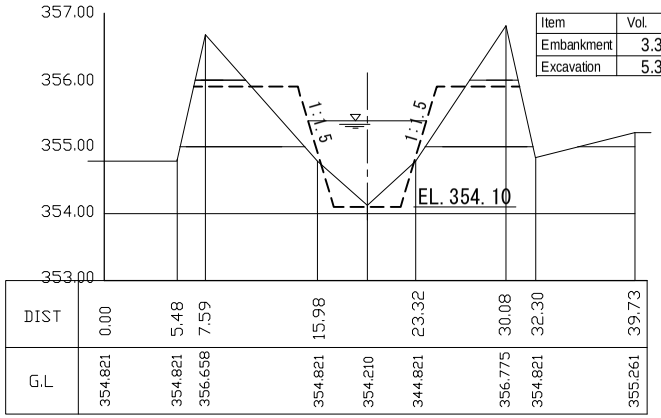
0 800m

SCALE 1:16000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Irrigation Project						
PROJECT:						
PROJECT: 02	SCALE H=1:18000 V=1:3600	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Main Canal Cross Section(1/11)

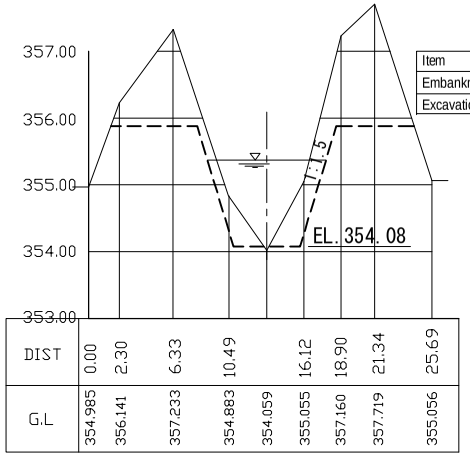
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	3.3 m3
Excavation	5.3 m3

DIST	0.00	5.48	7.59	15.98	23.32	30.08	32.30	39.73
G.L	354.821	354.821	356.658	354.821	354.210	354.821	356.775	354.821	355.261

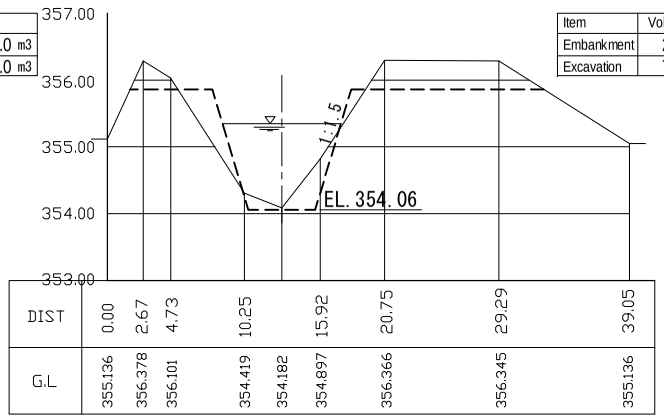
Main Canal - Cross Section at Ch 0.00km



Item	Vol.
Embankment	0.0 m3
Excavation	18.0 m3

DIST	0.00	2.30	6.33	10.49	16.12	18.90	21.34	25.69
G.L	354.985	356.141	357.233	354.883	354.059	355.055	357.160	357.719	355.056

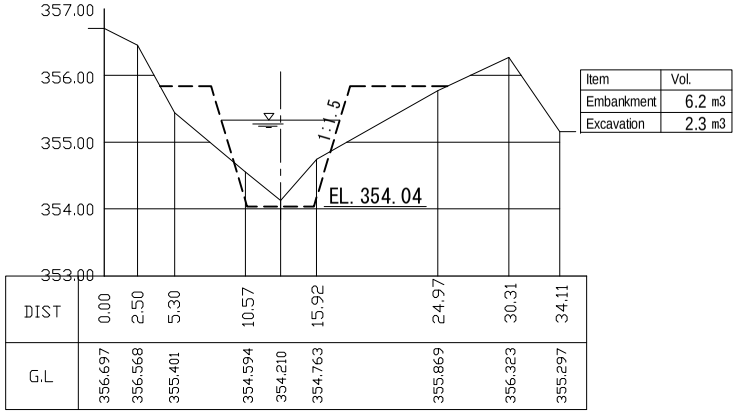
Main Canal - Cross Section at Ch 0.20km



Item	Vol.
Embankment	2.3 m3
Excavation	7.4 m3

DIST	0.00	2.67	4.73	10.25	15.92	20.75	29.29	39.05
G.L	355.136	356.378	356.101	354.419	354.182	354.897	356.366	356.345	355.136

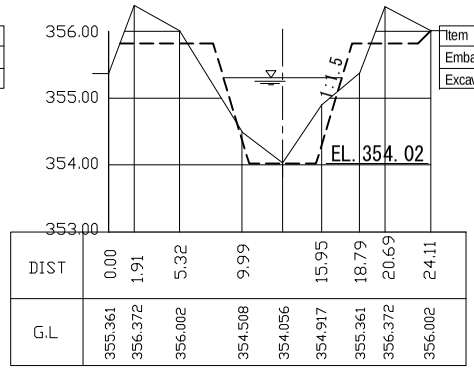
Main Canal - Cross Section at Ch 0.40km



Item	Vol.
Embankment	6.2 m3
Excavation	2.3 m3

DIST	0.00	2.50	5.30	10.57	15.92	24.97	30.31	34.11
G.L	356.697	356.568	355.401	354.594	354.210	354.763	355.869	356.323	355.297

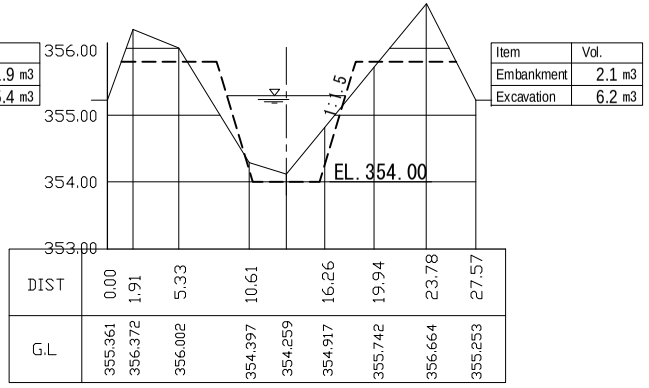
Main Canal - Cross Section at Ch 0.60km



Item	Vol.
Embankment	1.9 m3
Excavation	5.4 m3

DIST	0.00	1.91	5.32	9.99	15.95	18.79	20.69	24.11
G.L	355.361	356.372	356.002	354.508	354.056	354.917	355.361	356.372	356.002

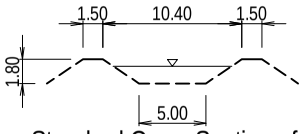
Main Canal - Cross Section at Ch 0.80km



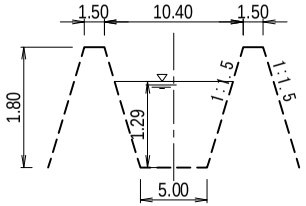
Item	Vol.
Embankment	2.1 m3
Excavation	6.2 m3

DIST	0.00	1.91	5.33	10.61	16.26	19.94	23.78	27.57
G.L	355.361	356.372	356.002	354.397	354.259	354.917	355.742	356.664	355.253

Main Canal - Cross Section at Ch 1.00km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

0 20m

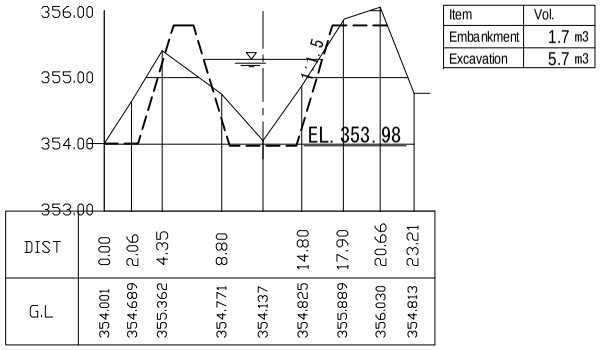
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (0.00,0.20,0.40,0.60,0.80,1.00km)						
PROJECT: 03-1	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-64

Kitiab Scheme Irrigation Project
Main Canal Cross Section(2/11)

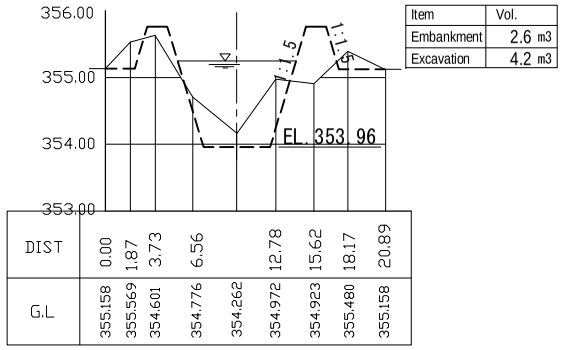
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	1.7 m3
Excavation	5.7 m3

DIST	0.00	2.05	4.35	8.80		14.80	17.90	20.66	23.21
G.L	354.001	354.689	355.362	354.771	354.137	354.825	355.889	356.030	354.813

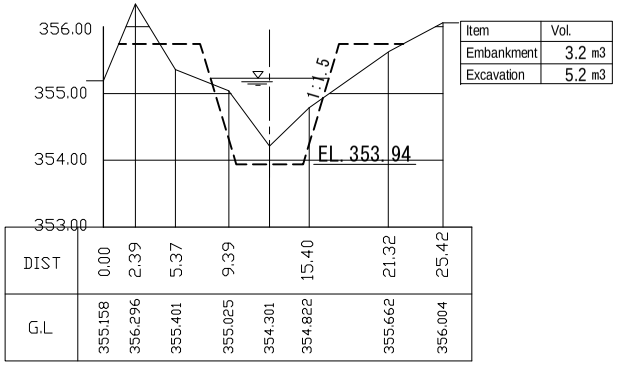
Main Canal - Cross Section at Ch 1.20km



Item	Vol.
Embankment	2.6 m3
Excavation	4.2 m3

DIST	0.00	1.87	3.73	6.56		12.78	15.62	18.17	20.89
G.L	355.158	355.569	354.601	354.776	354.262	354.972	354.923	355.480	355.158

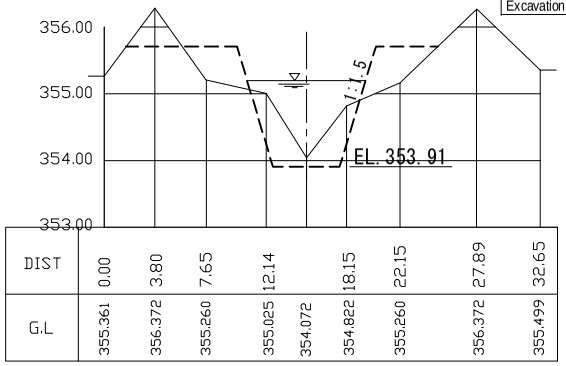
Main Canal - Cross Section at Ch 1.40km



Item	Vol.
Embankment	3.2 m3
Excavation	5.2 m3

DIST	0.00	2.39	5.37	9.39		15.40		21.32	25.42
G.L	355.158	356.296	355.401	355.025	354.301	354.822		355.662	356.004

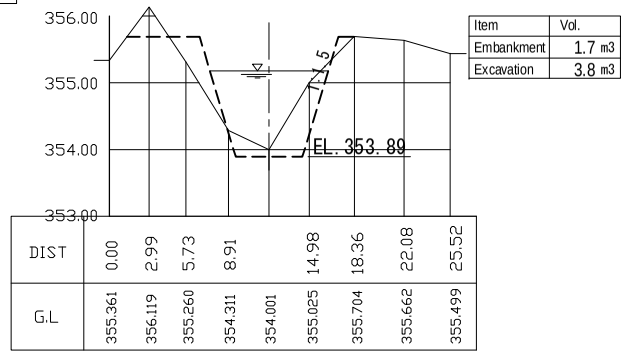
Main Canal - Cross Section at Ch 1.60km



Item	Vol.
Embankment	4.4 m3
Excavation	5.2 m3

DIST	0.00	3.80	7.65	12.14		18.15	22.15		27.89	32.65
G.L	355.361	356.372	355.260	355.025	354.072	354.822	355.260		356.372	355.499

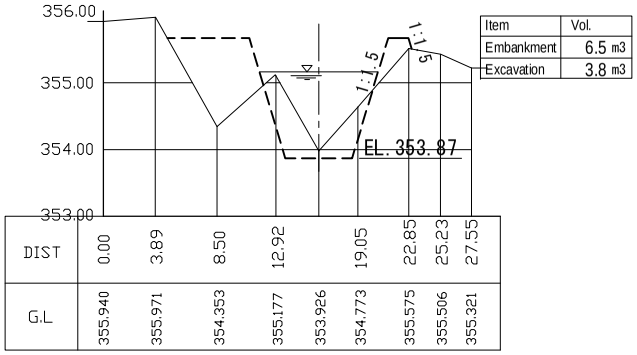
Main Canal - Cross Section at Ch 1.80km



Item	Vol.
Embankment	1.7 m3
Excavation	3.8 m3

DIST	0.00	2.99	5.73	8.91		14.98	18.36	22.08	25.52
G.L	355.361	356.119	355.260	354.311	354.001	355.025	355.704	355.662	355.499

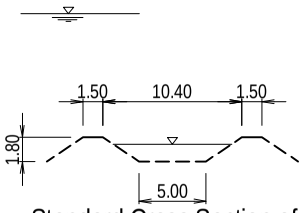
Main Canal - Cross Section at Ch 2.00km



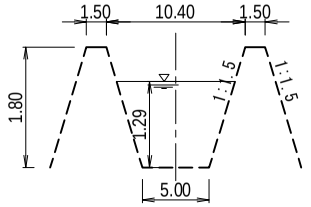
Item	Vol.
Embankment	6.5 m3
Excavation	3.8 m3

DIST	0.00	3.89	8.50	12.92		19.05	22.85	25.23	27.55
G.L	355.940	355.971	354.353	355.177	353.926	354.773	355.575	355.506	355.321

Main Canal - Cross Section at Ch 2.20km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

0 20m

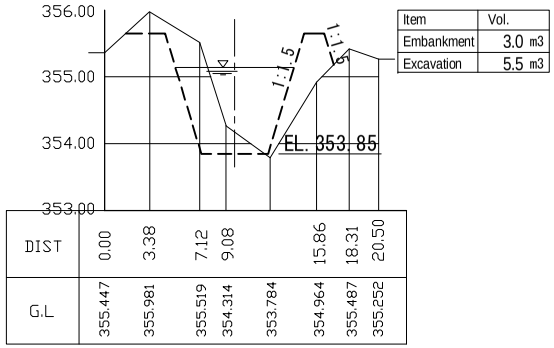
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (1.20,1.40,1.60,1.80,2.00,2.20km)						
PROJECT: 03-2	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-65

Kitiab Scheme Irrigation Project
Main Canal Cross Section(3/11)

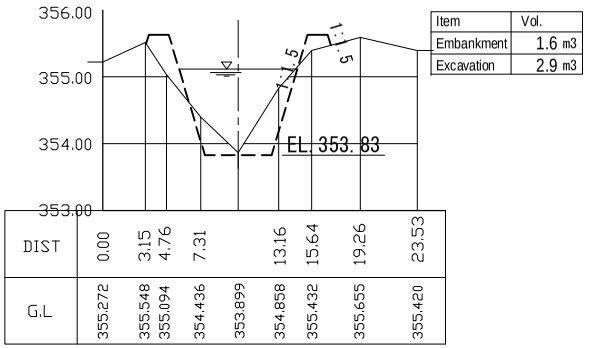
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	3.0 m3
Excavation	5.5 m3

DIST	0.00	3.38	7.12	9.08	15.86	18.31	20.50
G.L	355.447	355.981	355.519	354.314	353.784	354.964	355.487	355.252

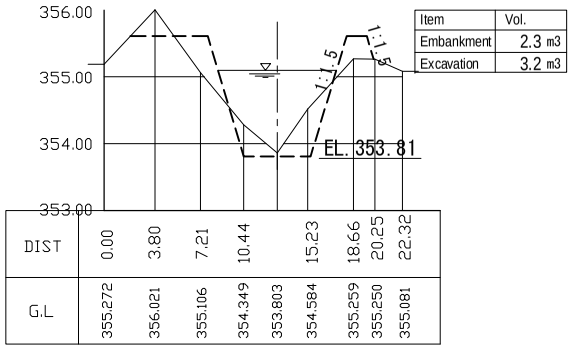
Main Canal - Cross Section at Ch 2.40km



Item	Vol.
Embankment	1.6 m3
Excavation	2.9 m3

DIST	0.00	3.15	4.76	7.31	13.16	15.64	19.26	23.53
G.L	355.272	355.548	355.094	354.436	353.899	354.858	355.432	355.655	355.420

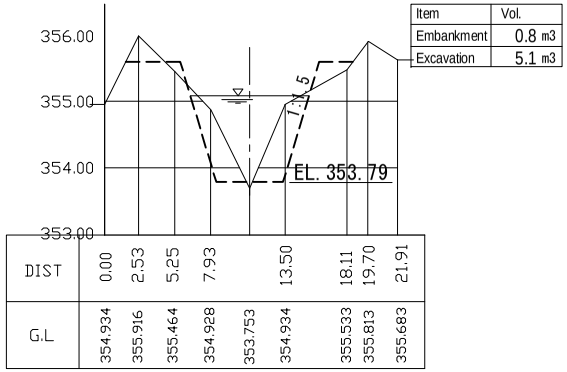
Main Canal - Cross Section at Ch 2.60km



Item	Vol.
Embankment	2.3 m3
Excavation	3.2 m3

DIST	0.00	3.80	7.21	10.44	15.23	18.66	20.25	22.32
G.L	355.272	356.021	355.106	354.349	353.803	354.584	355.259	355.250	355.081

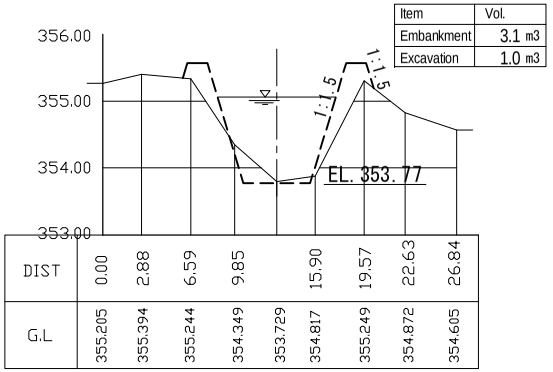
Main Canal - Cross Section at Ch 2.80km



Item	Vol.
Embankment	0.8 m3
Excavation	5.1 m3

DIST	0.00	2.53	5.25	7.93	13.50	18.11	19.70	21.91
G.L	354.934	355.916	355.464	354.928	353.753	354.934	355.533	355.813	355.683

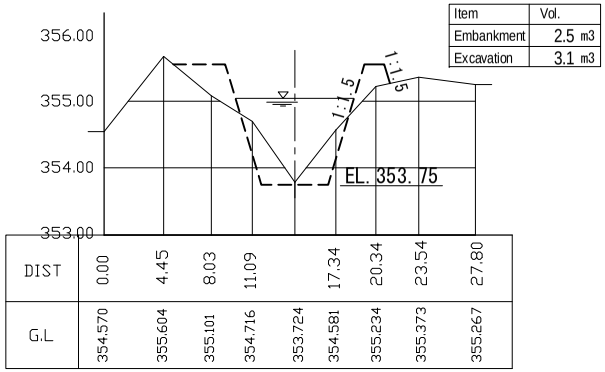
Main Canal - Cross Section at Ch 3.00km



Item	Vol.
Embankment	3.1 m3
Excavation	1.0 m3

DIST	0.00	2.88	6.59	9.85	15.90	19.57	22.63	26.84
G.L	355.205	355.394	355.244	354.349	353.729	354.817	355.249	354.872	354.605

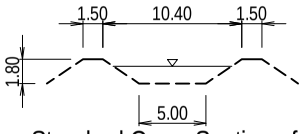
Main Canal - Cross Section at Ch 3.20km



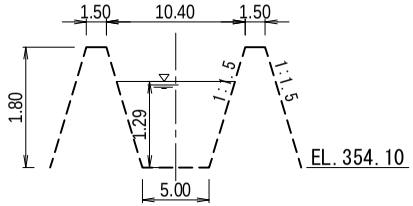
Item	Vol.
Embankment	2.5 m3
Excavation	3.1 m3

DIST	0.00	4.45	8.03	11.09	17.34	20.34	23.54	27.80
G.L	354.570	355.604	355.101	354.716	353.724	354.581	355.234	355.373	355.267

Main Canal - Cross Section at Ch 3.40km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

——— : Actual B. L.

– – – – – – : Planned B. L.

0 20m

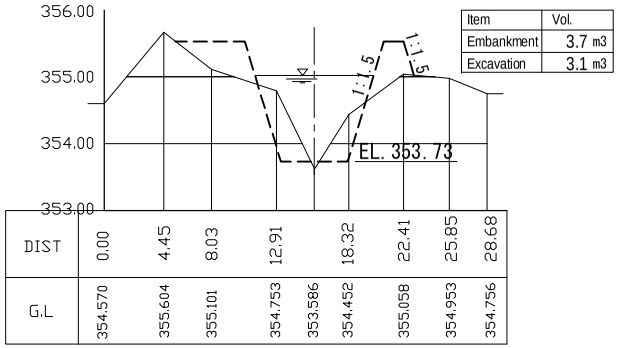
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (2.40,2.60,2.80,3.00,3.20,3.40km)						
PROJECT: 03-3	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-66

Kitiab Scheme Irrigation Project
Main Canal Cross Section(4/11)

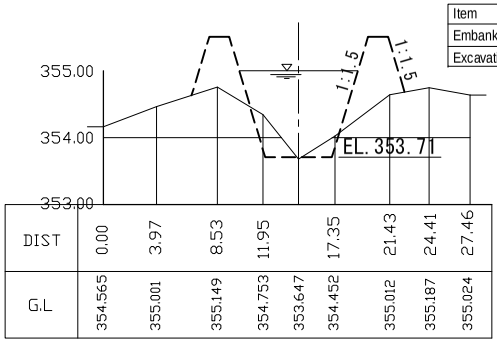
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	3.7 m3
Excavation	3.1 m3

DIST	0.00	4.45	8.03	12.91	18.32	22.41	25.85	28.68
G.L	354.570	355.604	355.101	354.753	353.586	354.452	355.058	354.953	354.756

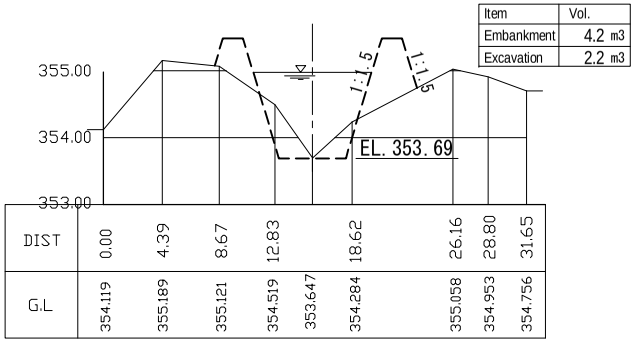
Main Canal - Cross Section at Ch 3.60km



Item	Vol.
Embankment	5.6 m3
Excavation	1.5 m3

DIST	0.00	3.97	8.53	11.95	17.35	21.43	24.41	27.46
G.L	354.565	355.001	355.149	354.753	353.647	354.452	355.012	355.187	355.024

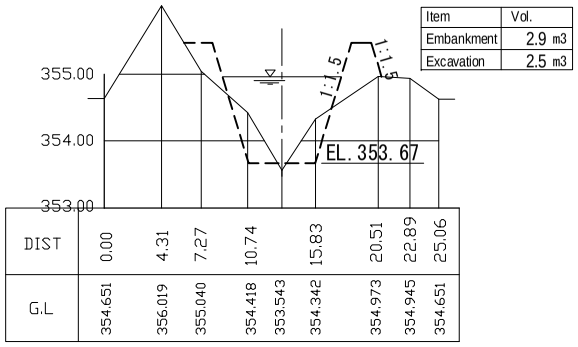
Main Canal - Cross Section at Ch 3.80km



Item	Vol.
Embankment	4.2 m3
Excavation	2.2 m3

DIST	0.00	4.39	8.67	12.83	18.62	26.16	28.80	31.65
G.L	354.119	355.189	355.121	354.519	353.647	354.284	355.058	354.953	354.756

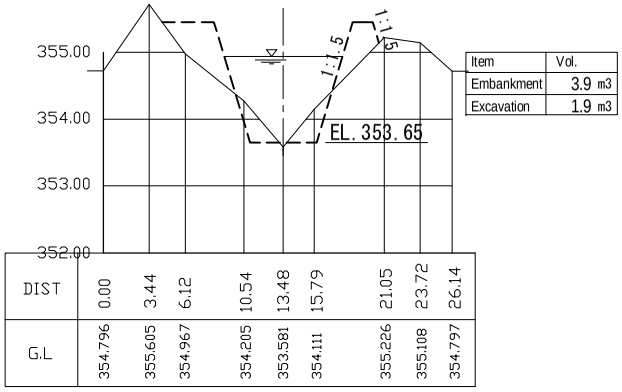
Main Canal - Cross Section at Ch 4.00km



Item	Vol.
Embankment	2.9 m3
Excavation	2.5 m3

DIST	0.00	4.31	7.27	10.74	15.83	20.51	22.89	25.06
G.L	354.651	356.019	355.040	354.418	353.543	354.342	354.973	354.945	354.651

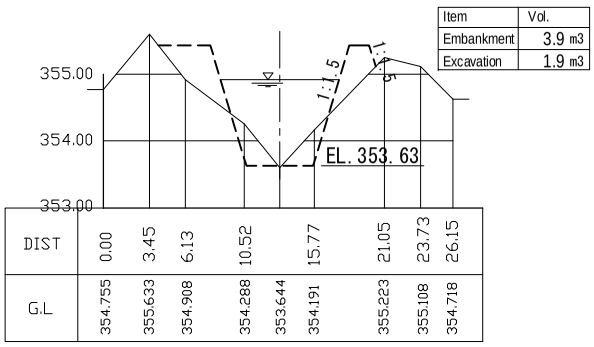
Main Canal - Cross Section at Ch 4.20km



Item	Vol.
Embankment	3.9 m3
Excavation	1.9 m3

DIST	0.00	3.44	6.12	10.54	13.48	15.79	21.05	23.72	26.14
G.L	354.796	355.605	354.967	354.205	353.581	354.111	355.226	355.108	354.797

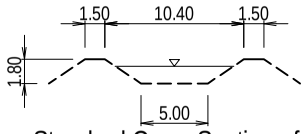
Main Canal - Cross Section at Ch 4.40km



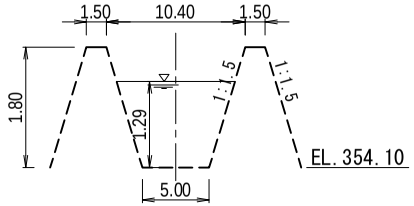
Item	Vol.
Embankment	3.9 m3
Excavation	1.9 m3

DIST	0.00	3.45	6.13	10.52	15.77	21.05	23.73	26.15
G.L	354.755	355.633	354.908	354.288	353.644	354.191	355.223	355.108	354.718

Main Canal - Cross Section at Ch 4.60km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

0 20m

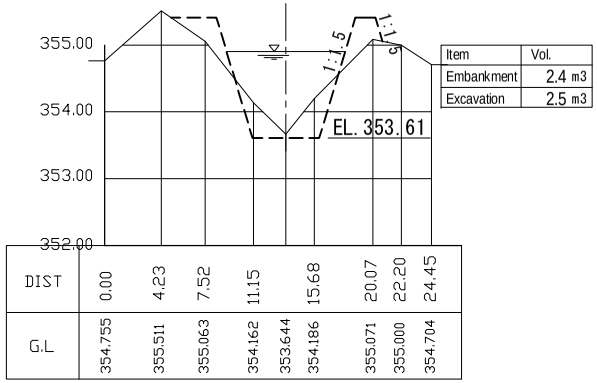
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (3.60,3.80,4.00,4.20,4.40,4.60km)						
PROJECT: 03-4	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-67

Kitiab Scheme Irrigation Project
Main Canal Cross Section(5/11)

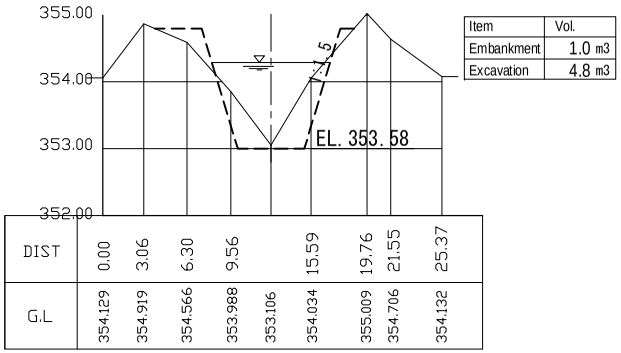
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	2.4 m3
Excavation	2.5 m3

DIST	0.00	4.23	7.52	11.15		15.68		20.07	22.20	24.45
G.L	354.755	355.511	355.063	354.162	353.644	354.186		355.071	355.000	354.704

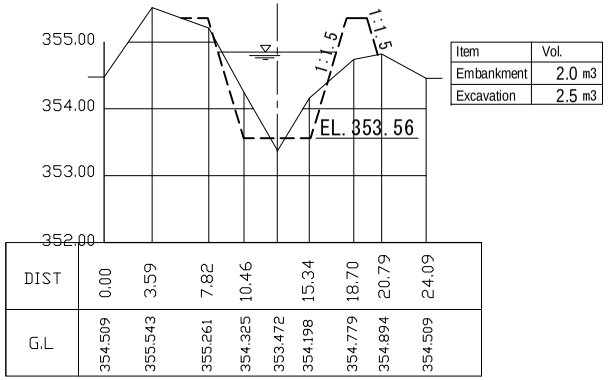
Main Canal - Cross Section at Ch 4.80km



Item	Vol.
Embankment	1.0 m3
Excavation	4.8 m3

DIST	0.00	3.06	6.30	9.56		15.59	19.76	21.55	25.37
G.L	354.129	354.919	354.566	353.988	353.106	354.034	355.009	354.706	354.132

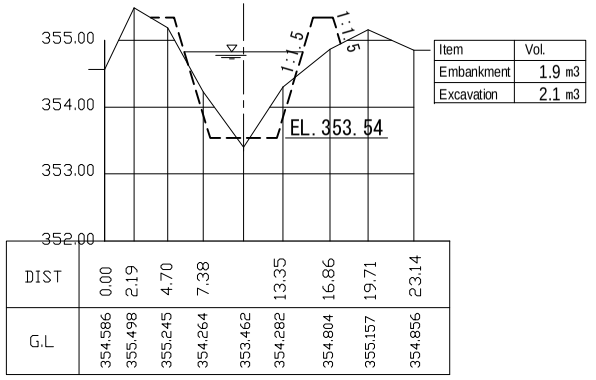
Main Canal - Cross Section at Ch 5.00km



Item	Vol.
Embankment	2.0 m3
Excavation	2.5 m3

DIST	0.00	3.59	7.82	10.46		15.34	18.70	20.79	24.09
G.L	354.509	355.543	355.261	354.325	353.472	354.198	354.779	354.894	354.509

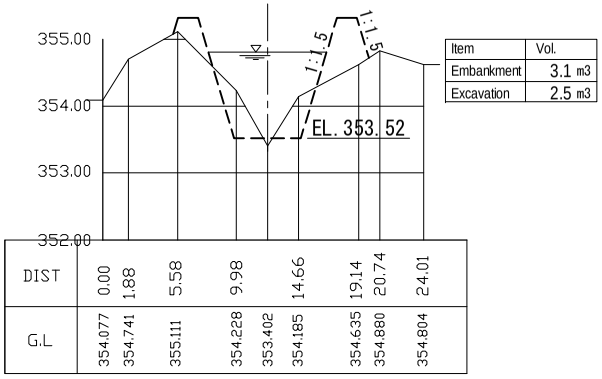
Main Canal - Cross Section at Ch 5.20km



Item	Vol.
Embankment	1.9 m3
Excavation	2.1 m3

DIST	0.00	2.19	4.70	7.38		13.35	16.86	19.71	23.14
G.L	354.586	355.498	355.245	354.264	353.462	354.282	354.804	355.157	354.856

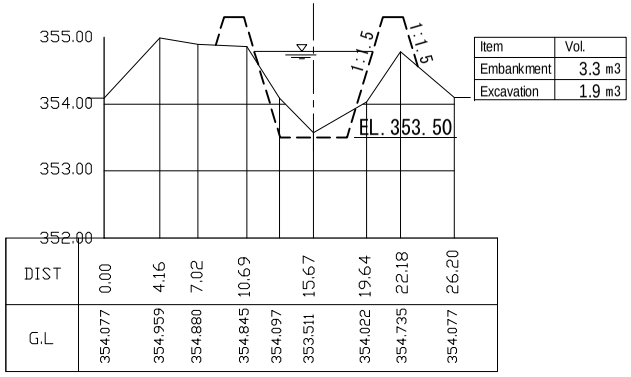
Main Canal - Cross Section at Ch 5.40km



Item	Vol.
Embankment	3.1 m3
Excavation	2.5 m3

DIST	0.00	1.88	5.58	9.98		14.66	19.14	20.74	24.01
G.L	354.077	354.741	355.111	354.228	353.402	354.185	354.635	354.880	354.804

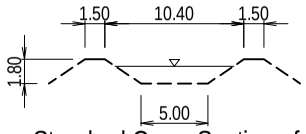
Main Canal - Cross Section at Ch 5.60km



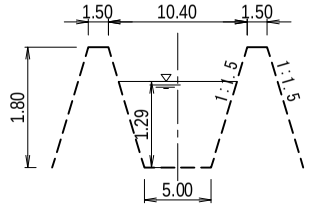
Item	Vol.
Embankment	3.3 m3
Excavation	1.9 m3

DIST	0.00	4.16	7.02	10.69		15.67	19.64	22.18	26.20
G.L	354.077	354.959	354.880	354.845	354.097	353.511	354.022	354.735	354.077

Main Canal - Cross Section at Ch 5.80km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B.L.

: Planned B.L.

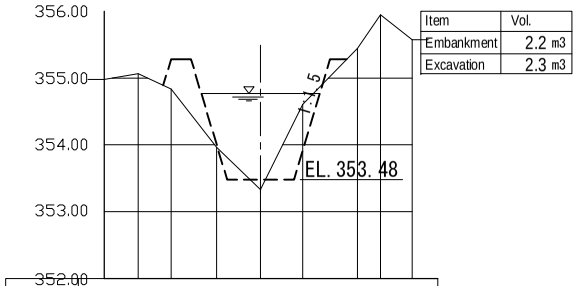
0 20m

SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (4.80,5.00,5.20,5.40,5.60,5.80km)						
PROJECT: 03-5	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Main Canal Cross Section(6/11)

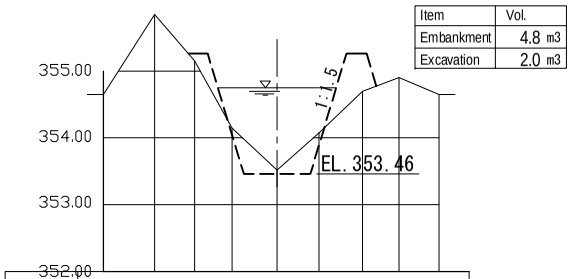
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	2.2 m3
Excavation	2.3 m3

DIST	0.00	2.54	5.02	8.42		14.85	18.96	20.70	23.06
G.L	354.977	355.064	354.840	353.994	353.432	354.603	355.503	355.964	355.675

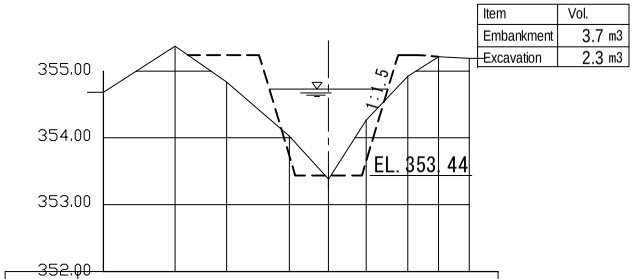
Main Canal - Cross Section at Ch 6.00km



Item	Vol.
Embankment	4.8 m3
Excavation	2.0 m3

DIST	0.00	3.84	6.82	9.64		16.15	19.42	22.16	25.13
G.L	354.647	355.846	355.136	354.135	353.539	354.064	354.718	354.905	354.647

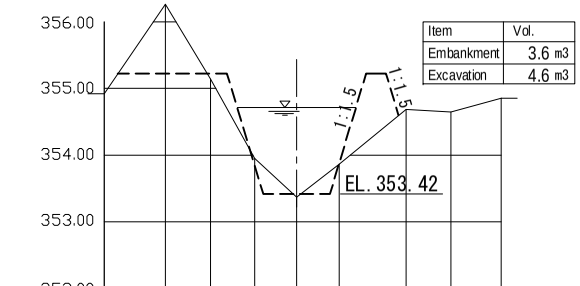
Main Canal - Cross Section at Ch 6.20km



Item	Vol.
Embankment	3.7 m3
Excavation	2.3 m3

DIST	0.00	5.35	9.22	13.91		19.66	22.79	25.09	27.37
G.L	354.647	355.349	354.875	354.041	353.457	354.251	354.959	355.170	355.142

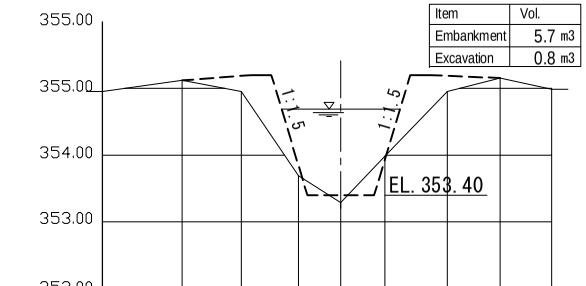
Main Canal - Cross Section at Ch 6.40km



Item	Vol.
Embankment	3.6 m3
Excavation	4.6 m3

DIST	0.00	4.58	7.97	11.29		17.60	22.59	25.97	29.73
G.L	354.875	356.209	355.065	353.979	353.462	353.890	354.672	354.610	354.740

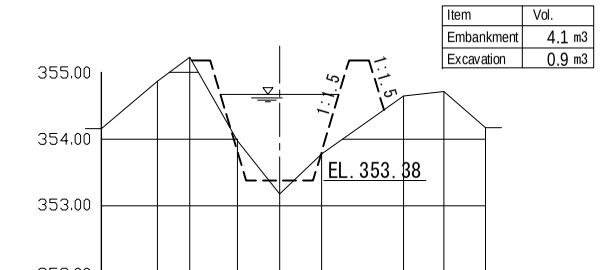
Main Canal - Cross Section at Ch 6.60km



Item	Vol.
Embankment	5.7 m3
Excavation	0.8 m3

DIST	0.00	5.96	10.41	14.68		21.17	25.82	29.79	33.66
G.L	354.924	355.192	354.976	353.642	353.351	353.931	354.913	355.126	354.995

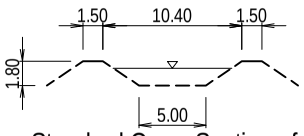
Main Canal - Cross Section at Ch 6.80km



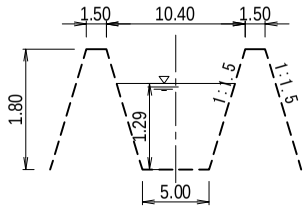
Item	Vol.
Embankment	4.1 m3
Excavation	0.9 m3

DIST	0.00	4.19	6.61	10.16		16.47	22.62	25.64	28.75
G.L	354.158	354.810	355.108	353.961	353.217	353.760	354.614	354.653	354.177

Main Canal - Cross Section at Ch 7.00km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B. L.

: Planned B. L.

0 20m

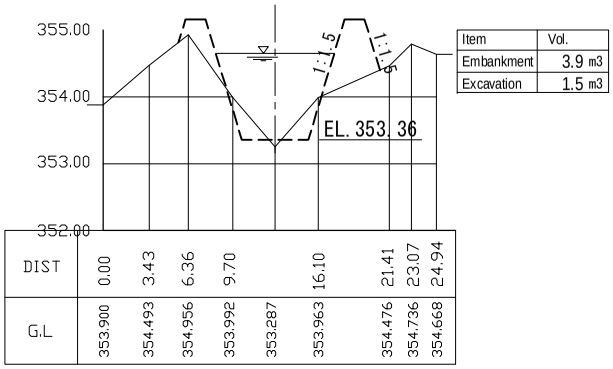
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (6.00,6.20,6.40,6.60,6.80,7.00km)						
PROJECT: 03-6	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

A6-69

Kitiab Scheme Irrigation Project
Main Canal Cross Section(7/11)

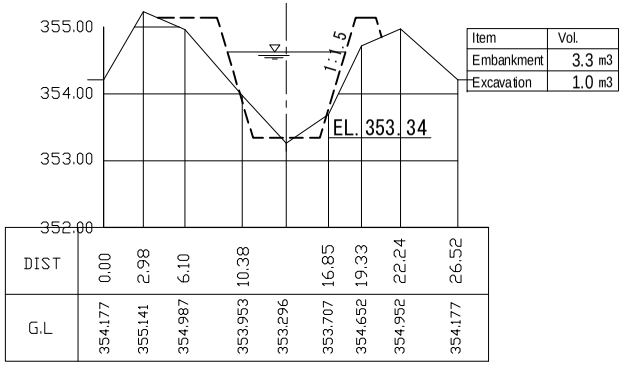
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	3.9 m3
Excavation	1.5 m3

DIST	0.00	3.43	6.36	9.70	16.10	21.41	23.07	24.94
G.L	353.900	354.493	354.956	353.992	353.287	353.963	354.476	354.736	354.668

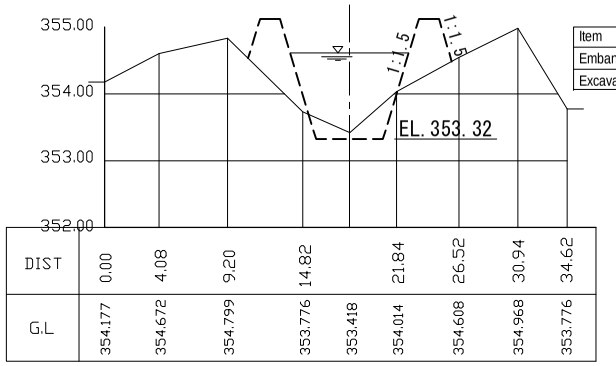
Main Canal - Cross Section at Ch 7.20km



Item	Vol.
Embankment	3.3 m3
Excavation	1.0 m3

DIST	0.00	2.98	6.10	10.38	16.85	19.33	22.24	26.52
G.L	354.177	355.141	354.987	353.953	353.296	353.707	354.652	354.952	354.177

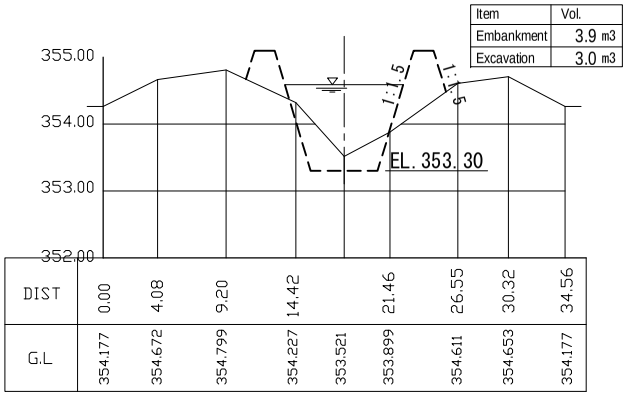
Main Canal - Cross Section at Ch 7.40km



Item	Vol.
Embankment	5.2 m3
Excavation	1.7 m3

DIST	0.00	4.08	9.20	14.82	21.84	26.52	30.94	34.62
G.L	354.177	354.672	354.799	353.776	353.418	354.014	354.608	354.968	353.776

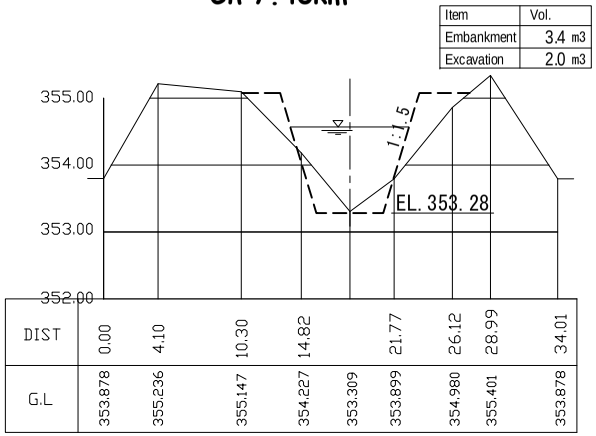
Main Canal - Cross Section at Ch 7.60km



Item	Vol.
Embankment	3.9 m3
Excavation	3.0 m3

DIST	0.00	4.08	9.20	14.42	21.46	26.55	30.32	34.56
G.L	354.177	354.672	354.799	354.227	353.521	353.899	354.611	354.653	354.177

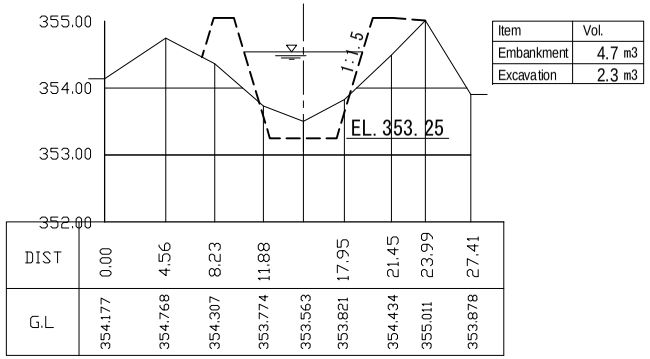
Main Canal - Cross Section at Ch 7.80km



Item	Vol.
Embankment	3.4 m3
Excavation	2.0 m3

DIST	0.00	4.10	10.30	14.82	21.77	26.12	28.99	34.01
G.L	353.878	355.236	355.147	354.227	353.309	353.899	354.980	355.401	353.878

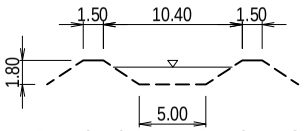
Main Canal - Cross Section at Ch 8.00km



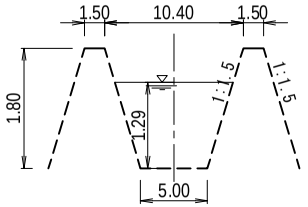
Item	Vol.
Embankment	4.7 m3
Excavation	2.3 m3

DIST	0.00	4.56	8.23	11.88	17.95	21.45	23.99	27.41
G.L	354.177	354.768	354.307	353.774	353.563	353.821	354.434	355.011	353.878

Main Canal - Cross Section at Ch 8.20km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

——— :Actual B.L.

– – – – – :Planned B.L.

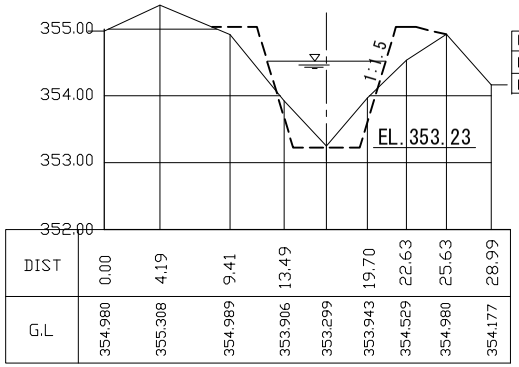
0 20m

SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (7.20,7.40,7.60,7.80,8.00,8.20km)						
PROJECT: 03-7	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Main Canal Cross Section(8/11)

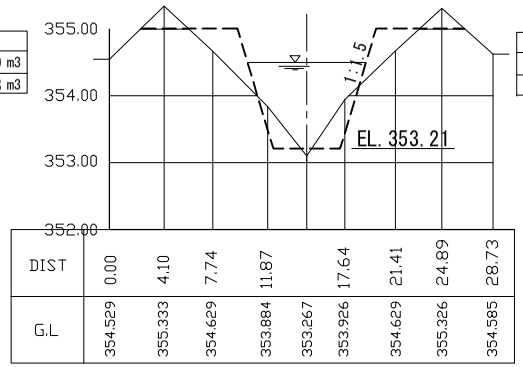
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	2.9 m3
Excavation	2.3 m3

DIST	0.00	4.19	9.41	13.49		19.70	22.63	25.63	28.99
G.L	354.980	355.308	354.989	353.906	353.299	353.943	354.529	354.980	354.177

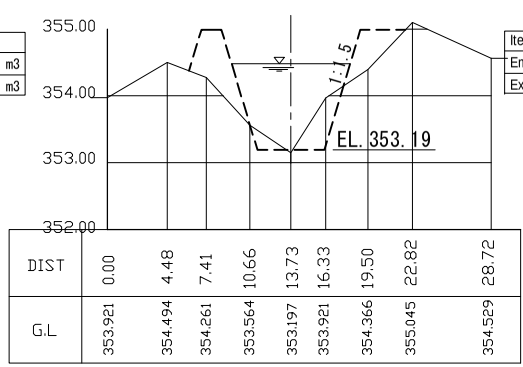
Main Canal - Cross Section at Ch 8.40km



Item	Vol.
Embankment	3.3 m3
Excavation	3.1 m3

DIST	0.00	4.10	7.74	11.87		17.64	21.41	24.89	28.73
G.L	354.529	355.333	354.629	353.884	353.267	353.926	354.629	355.326	354.585

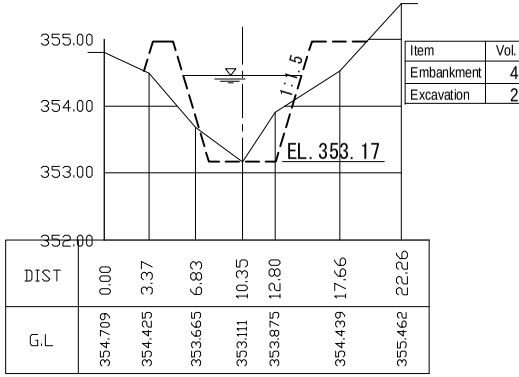
Main Canal - Cross Section at Ch 8.60km



Item	Vol.
Embankment	4.2 m3
Excavation	1.8 m3

DIST	0.00	4.48	7.41	10.66	13.73	16.33	19.50	22.82	28.72
G.L	353.921	354.494	354.261	353.564	353.197	353.921	354.366	355.045	354.529

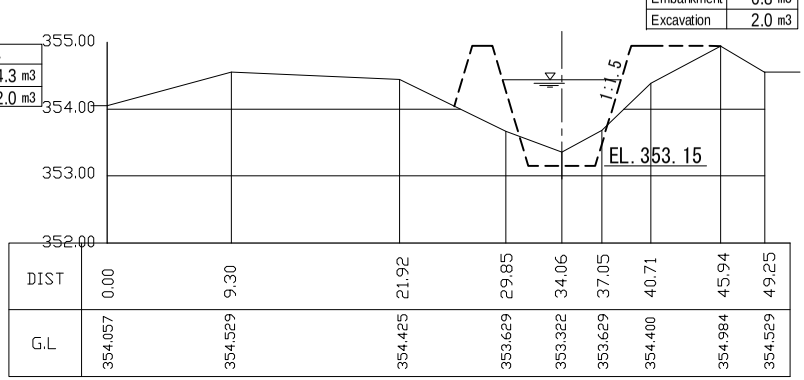
Main Canal - Cross Section at Ch 8.80km



Item	Vol.
Embankment	4.3 m3
Excavation	2.0 m3

DIST	0.00	3.37	6.83	10.35	12.80	17.66	22.26
G.L	354.709	354.425	353.665	353.111	353.875	354.439	355.462

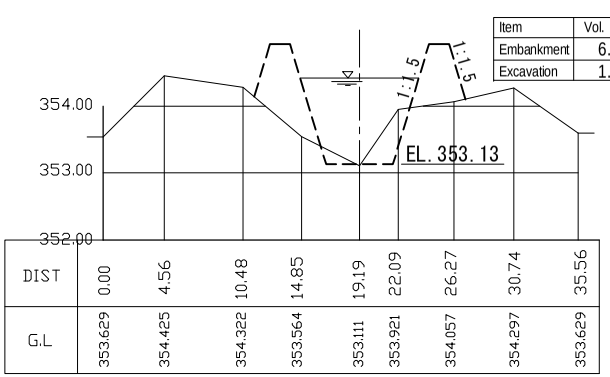
Main Canal - Cross Section at Ch 9.00km



Item	Vol.
Embankment	6.8 m3
Excavation	2.0 m3

DIST	0.00	9.30	21.92	29.85	34.06	37.05	40.71	45.94	49.25
G.L	354.057	354.529	354.425	353.629	353.322	353.629	354.400	354.984	354.529

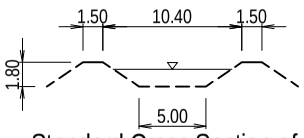
Main Canal - Cross Section at Ch 9.20km



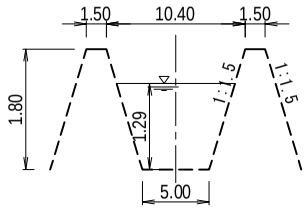
Item	Vol.
Embankment	6.3 m3
Excavation	1.7 m3

DIST	0.00	4.56	10.48	14.85	19.19	22.09	26.27	30.74	35.56
G.L	353.629	354.425	354.322	353.564	353.111	353.921	354.057	354.297	353.629

Main Canal - Cross Section at Ch 9.40km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

: Actual B.L.

: Planned B.L.

0 20m

SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (8.40,8.60,8.80,9.00,9.20,9.40km)						
PROJECT: 03-8	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

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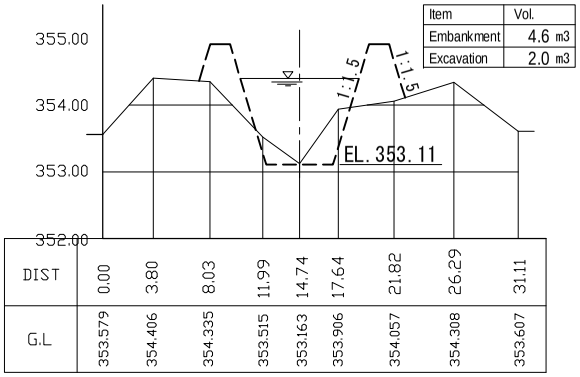
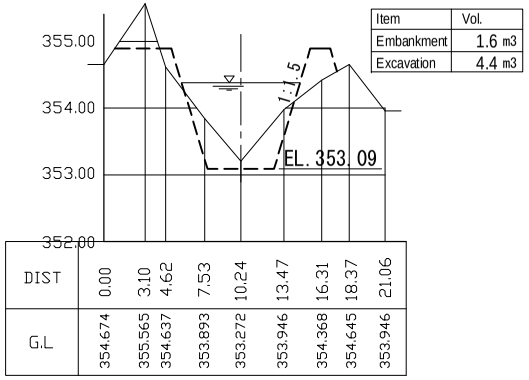
Kitiab Scheme Irrigation Project
Main Canal Cross Section(9/11)

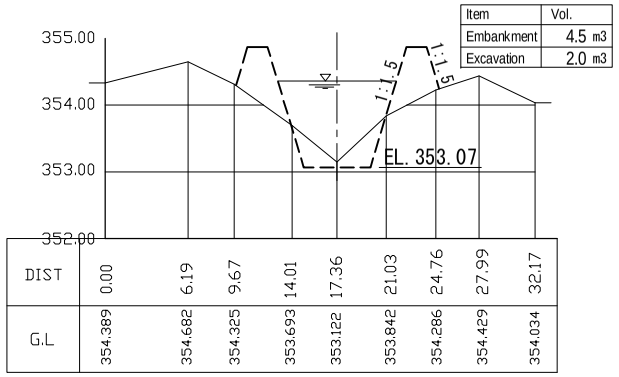
SCALE H=1:400, V=1:80



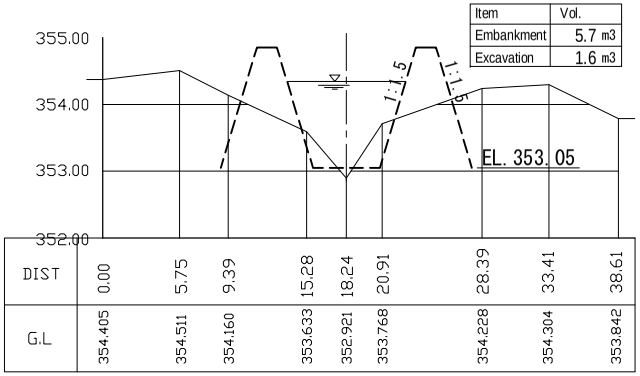
Main Canal - Cross Section at Ch 9.60km



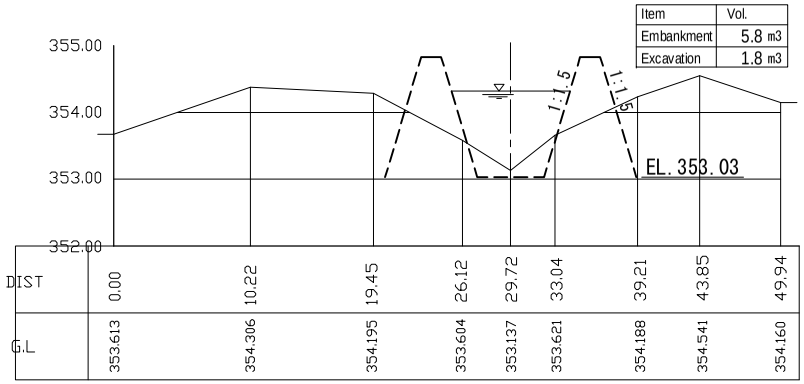
Main Canal - Cross Section at Ch 9.80km



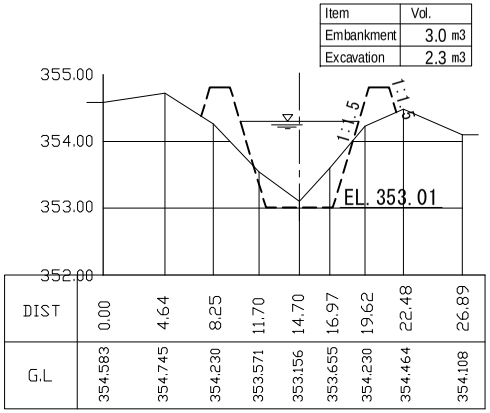
Main Canal - Cross Section at Ch 10.00km



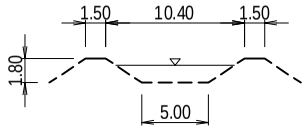
Main Canal - Cross Section at Ch 10.20km



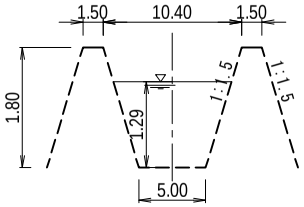
Main Canal - Cross Section at Ch 10.40km



Main Canal - Cross Section at Ch 10.60km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

——— :Actual B.L.

– – – – – :Planned B.L.

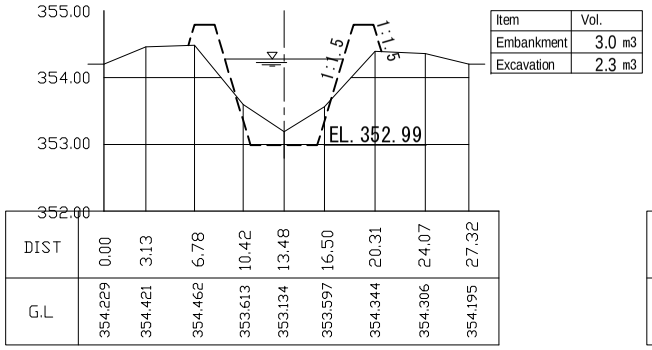
0 20m

SCALE : 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (9.60,9.80,10.00,10.20,10.40,10.60km)						
PROJECT: 03-9	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Main Canal Cross Section(10/11)

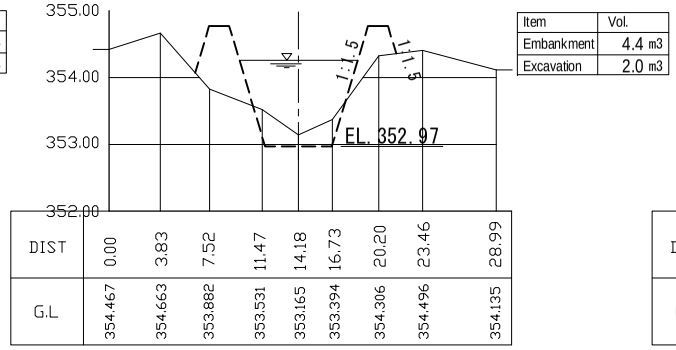
SCALE H=1:400, V=1:80



Item	Vol.
Embankment	3.0 m3
Excavation	2.3 m3

DIST	0.00	3.13	6.78	10.42	13.48	16.50	20.31	24.07	27.32
G.L	354.229	354.421	354.462	353.613	353.134	353.597	354.344	354.306	354.195

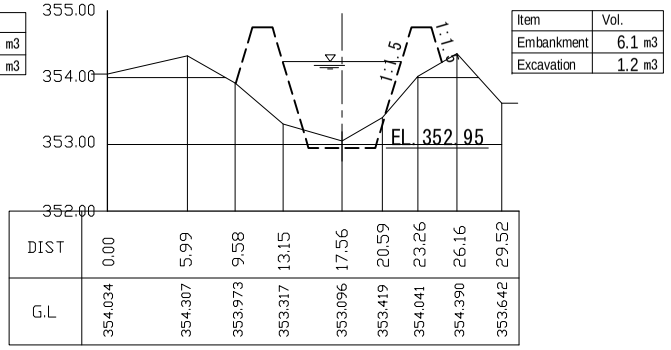
Main Canal - Cross Section at Ch 10.80km



Item	Vol.
Embankment	4.4 m3
Excavation	2.0 m3

DIST	0.00	3.83	7.52	11.47	14.18	16.73	20.20	23.46	28.99
G.L	354.467	354.663	353.882	353.531	353.165	353.394	354.306	354.496	354.135

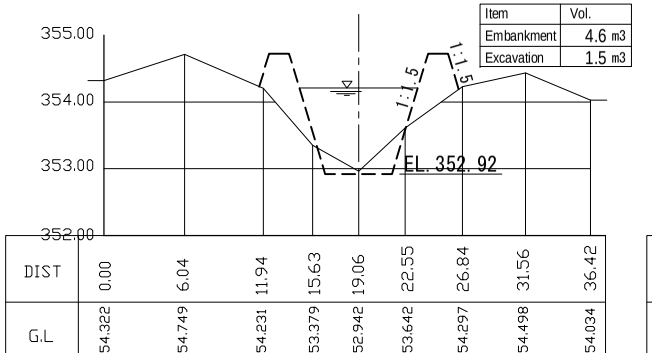
Main Canal - Cross Section at Ch 11.00km



Item	Vol.
Embankment	6.1 m3
Excavation	1.2 m3

DIST	0.00	5.99	9.58	13.15	17.56	20.59	23.26	26.16	29.52
G.L	354.034	354.307	353.973	353.317	353.096	353.419	354.041	354.390	353.642

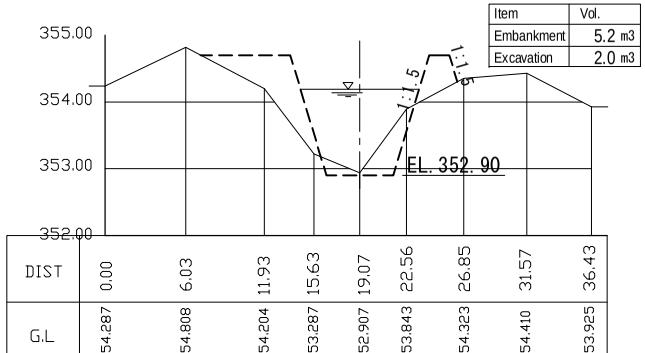
Main Canal - Cross Section at Ch 11.20km



Item	Vol.
Embankment	4.6 m3
Excavation	1.5 m3

DIST	0.00	6.04	11.94	15.63	19.06	22.55	26.84	31.56	36.42
G.L	354.322	354.749	354.231	353.379	352.942	353.642	354.297	354.498	354.034

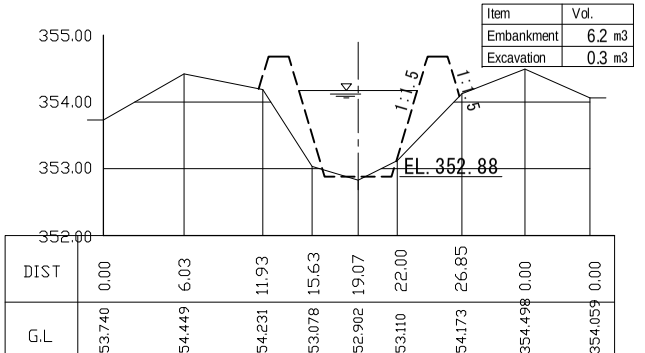
Main Canal - Cross Section at Ch 11.40km



Item	Vol.
Embankment	5.2 m3
Excavation	2.0 m3

DIST	0.00	6.03	11.93	15.63	19.07	22.56	26.85	31.57	36.43
G.L	354.287	354.808	354.204	353.287	352.907	353.843	354.323	354.410	353.925

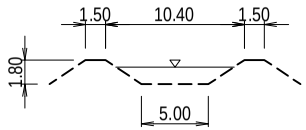
Main Canal - Cross Section at Ch 11.60km



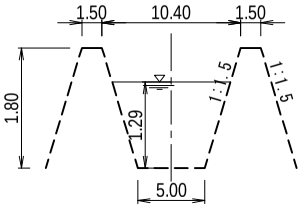
Item	Vol.
Embankment	6.2 m3
Excavation	0.3 m3

DIST	0.00	6.03	11.93	15.63	19.07	22.00	26.85	0.00	0.00
G.L	353.740	354.449	354.231	353.078	352.902	353.110	354.173	354.498	354.059

Main Canal - Cross Section at Ch 11.80km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

:Actual B.L.

:Planned B.L.

0 20m

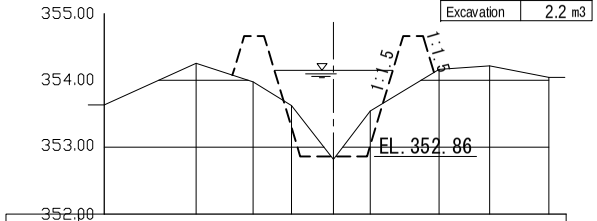
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (10.80,11.00,11.20,11.40,11.60,11.80km)						
PROJECT: 03-10	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Main Canal Cross Section(11/11)

SCALE H=1:400, V=1:80

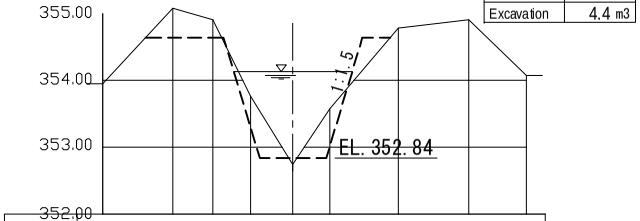
Item	Vol.
Embankment	3.9 m3
Excavation	2.2 m3



DIST	0.00	6.88	11.14	13.99	17.16	19.90	25.05	28.83	33.27
G.L	353.638	354.295	353.957	353.717	352.877	353.628	354.271	354.296	354.120

Main Canal - Cross Section at Ch 12.00km

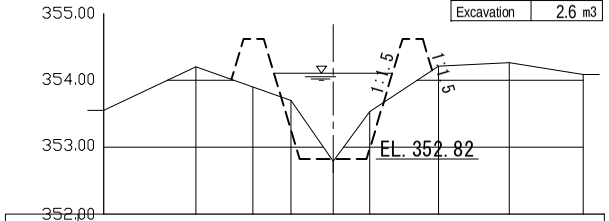
Item	Vol.
Embankment	0.8 m3
Excavation	4.4 m3



DIST	0.00	5.24	8.23	11.09	14.25	17.00	22.14	27.42	31.72
G.L	353.938	355.086	354.914	353.767	352.805	353.578	354.826	354.924	354.134

Main Canal - Cross Section at Ch 12.20km

Item	Vol.
Embankment	3.6 m3
Excavation	2.6 m3

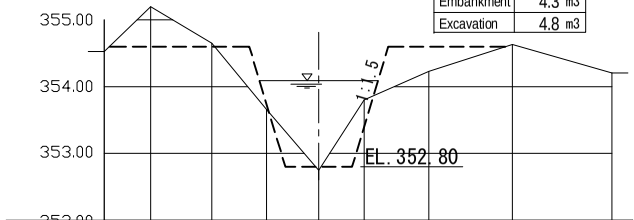


DIST	0.00	6.88	11.15	14.00	17.16	19.91	25.06	30.34	35.88
G.L	353.538	354.274	353.914	353.767	352.739	353.578	354.246	354.264	354.120

Main Canal - Cross Section at Ch 12.40km

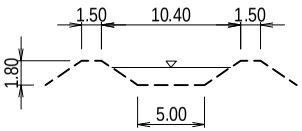
A6-74

Item	Vol.
Embankment	4.3 m3
Excavation	4.8 m3

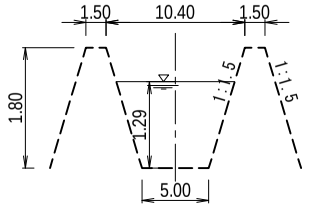


DIST	0.00	3.47	8.04	12.13	16.04	19.43	24.30	30.53	37.97
G.L	354.538	355.136	354.550	353.655	352.723	353.808	354.264	354.551	354.246

Main Canal - Cross Section at Ch 12.60km



Standard Cross Section of Main Canal by same scale H & V



Standard Cross Section of Main Canal by different scale H & V

Legend

:Actual B.L.

:Planned B.L.

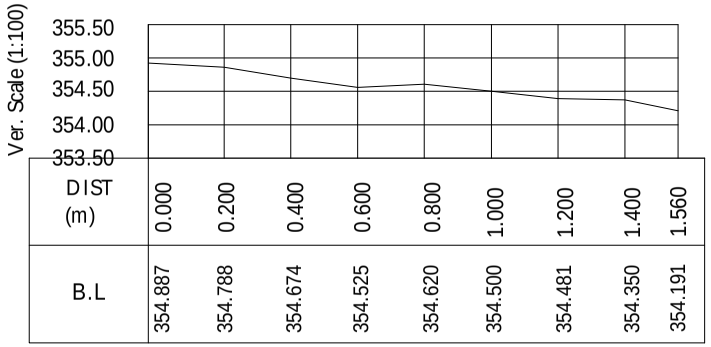
0 20m

SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Main Canal Cross Section						
PROJECT: Cross Sections (12.00,12.20,12.40,12.60km)						
PROJECT: 03-11	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Minor Canal Longitudinal Profile(1/4)

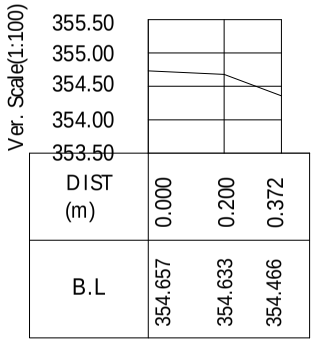
SCALE H=1:16000, V=3200



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.560
B.L	354.887	354.788	354.674	354.525	354.620	354.500	354.481	354.350	354.191

Longitudinal Profile Minor Canal +150

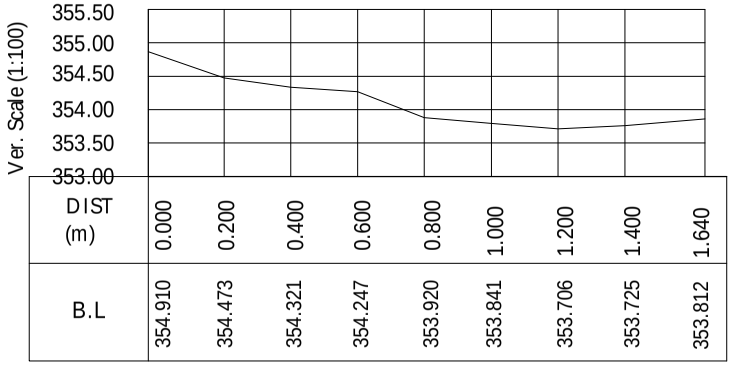
Hor scale (1:30000)



DIST (m)	0.000	0.200	0.372
B.L	354.657	354.633	354.466

Longitudinal Profile Minor Canal +620

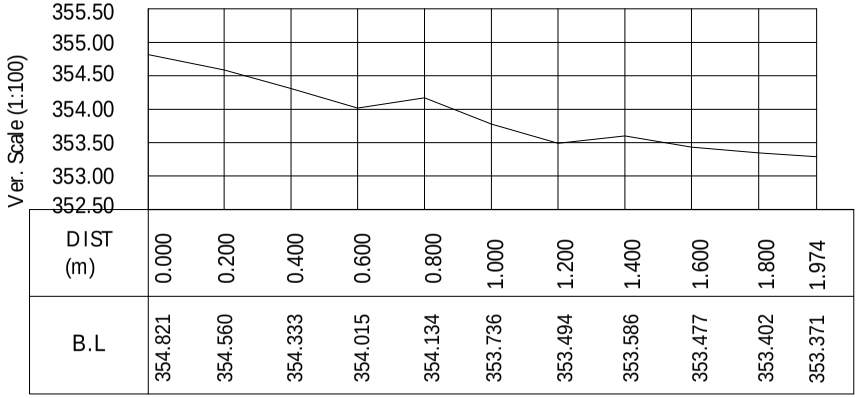
Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.640
B.L	354.910	354.473	354.321	354.247	353.920	353.841	353.706	353.725	353.812

Longitudinal Profile Minor Canal +1,000

Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.974
B.L	354.821	354.560	354.333	354.015	354.134	353.736	353.494	353.586	353.477	353.402	353.371

Longitudinal Profile Minor Canal +1,670

Hor scale (1:30000)

A6-75

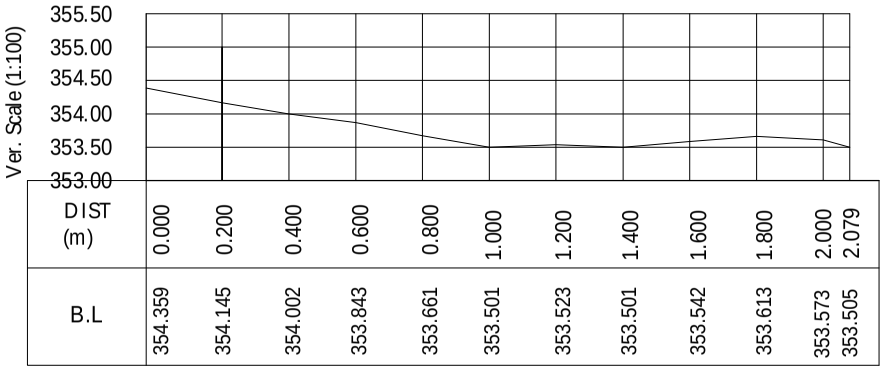
0 800m

SCALE 1:16000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Longitudinal Profile						
PROJECT:						
PROJECT: 04-1	SCALE H=1:16000 V=1:3200	UNIT	SIZE	SHEET	PROJ.No.	REV.

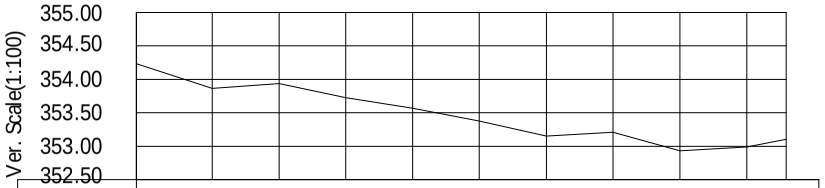
Kitiab Scheme Irrigation Project
Minor Canal Longitudinal Profile(2/4)

SCALE H=1:16000, V=3200



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.079
B.L	354.359	354.145	354.002	353.843	353.661	353.501	353.523	353.501	353.542	353.613	353.573	353.505

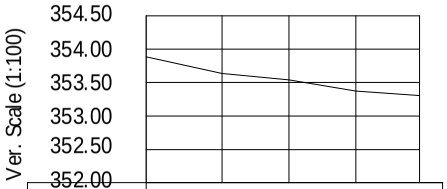
Longitudinal Profile Minor Canal +2,500
Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	1.919
B.L	354.201	353.899	353.975	353.708	353.587	353.489	353.152	353.190	352.928	352.957	353.156

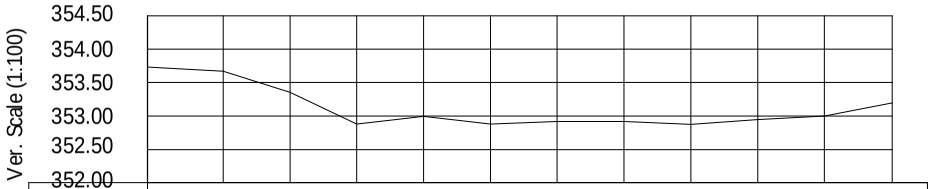
Longitudinal Profile Minor Canal +3,740
Hor scale (1:30000)

A6-76



DIST (m)	0.000	0.200	0.400	0.600	0.791
B.L	353.887	353.614	353.505	353.427	353.333

Longitudinal Profile Minor Canal +5,300
Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000	2.203
B.L	353.742	353.679	353.333	352.878	352.998	352.854	352.917	352.904	352.885	352.923	353.006	353.150

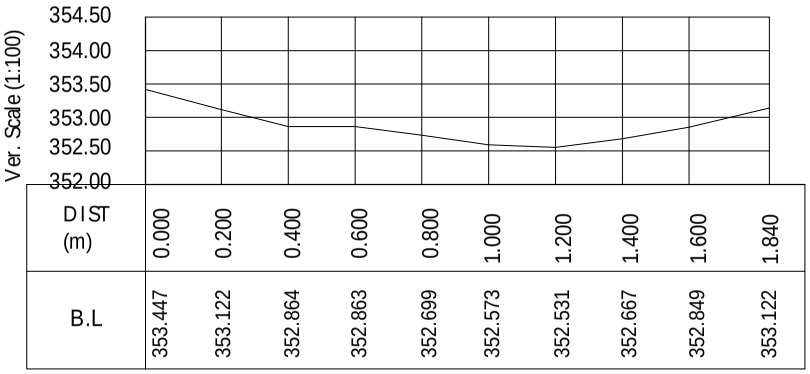
Longitudinal Profile Minor Canal +5,460
Hor scale (1:30000)

0 800m
SCALE 1:16000

PROJECT:	Kitiab Scheme Irrigation Project					
UNIT TITLE:	Minor Canal Longitudinal Profile					
PROJECT:						
PROJECT:	SCALE	UNIT	SIZE	SHEET	PROJ.No.	REV.
04-2	H=1:16000 V=1:3200					

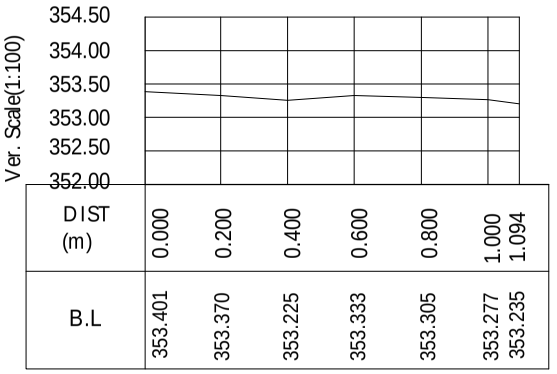
Kitiab Scheme Irrigation Project
Minor Canal Longitudinal Profile(3/4)

SCALE H=1:16000, V=3200



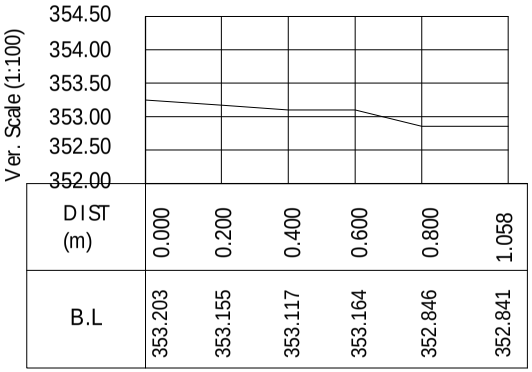
DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.600	1.840
B.L	353.447	353.122	352.864	352.863	352.699	352.573	352.531	352.667	352.849	353.122

Longitudinal Profile Minor Canal +7,280
Hor scale (1:30000)



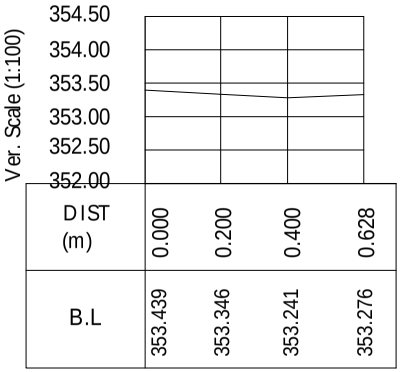
DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.094
B.L	353.401	353.370	353.225	353.333	353.305	353.277	353.235

Longitudinal Profile Minor Canal +8,000
Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.058
B.L	353.203	353.155	353.117	353.164	352.846	352.841

Longitudinal Profile Minor Canal +9,440



DIST (m)	0.000	0.200	0.400	0.628
B.L	353.439	353.346	353.241	353.276

Longitudinal Profile Minor Canal +9,480
Hor scale (1:30000)

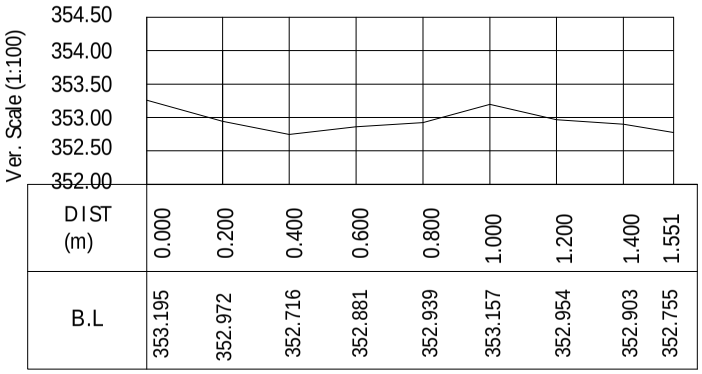
A6-77

0 800m
SCALE 1:16000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Longitudinal Profile						
PROJECT:						
PROJECT: 04-3	SCALE H=1:16000 V=1:3200	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Minor Canal Longitudinal Profile(4/4)

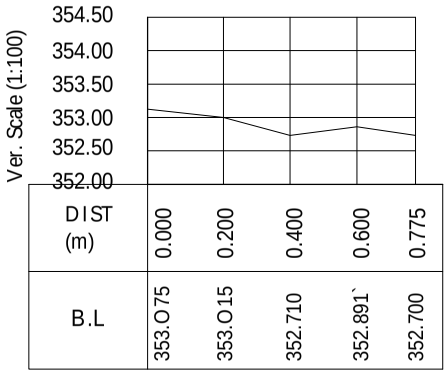
SCALE H=1:16000, V=3200



DIST (m)	0.000	0.200	0.400	0.600	0.800	1.000	1.200	1.400	1.551
B.L	353.195	352.972	352.716	352.881	352.939	353.157	352.954	352.903	352.755

Longitudinal Profile Minor Canal +10,510

Hor scale (1:30000)



DIST (m)	0.000	0.200	0.400	0.600	0.775
B.L	353.075	353.015	352.710	352.891	352.700

Longitudinal Profile Minor Canal +11,640

Hor scale (1:30000)

A6-78

0 800m

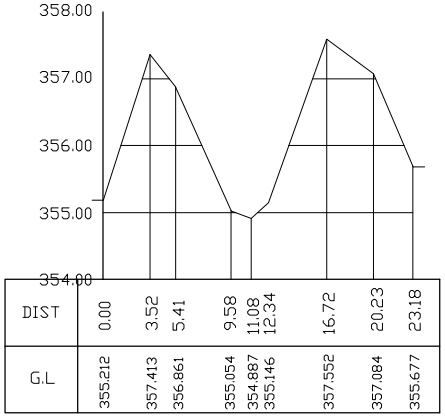
SCALE 1:16000

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Longitudinal Profile						
PROJECT:						
PROJECT: 04-4	SCALE H=1:16000 V=1:3200	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Minor Canal Cross Section(1/7)

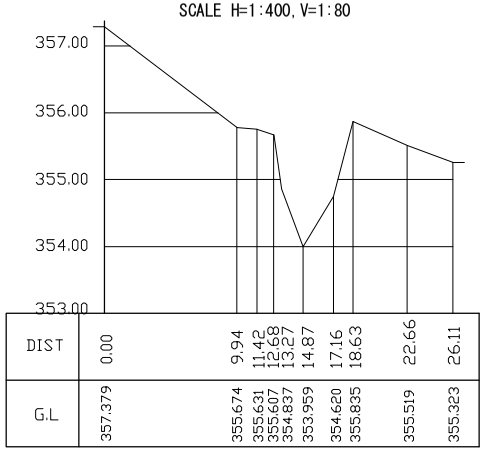
SCALE H=1:400, V=1:80

Minor Canal +150



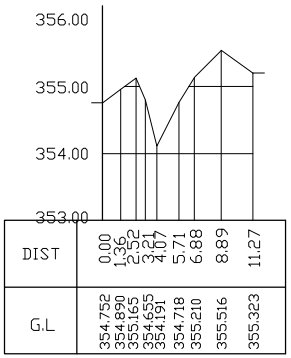
DIST	0.00	3.52	5.41	9.58	11.08	12.34	16.72	20.23	23.18
G.L	355.212	357.413	356.861	355.054	354.887	355.146	357.552	357.084	355.677

Minor Canal +150 - Cross Section At The Beginning



DIST	0.00	9.94	11.42	12.68	13.27	14.87	17.16	18.63	22.66	26.11
G.L	357.379	355.674	355.631	355.607	354.837	353.959	354.620	355.835	355.519	355.323

Minor Canal +150 - Cross Section At The Middle

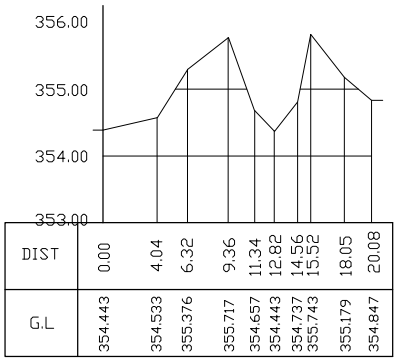


DIST	0.00	1.36	2.52	3.21	4.07	5.71	6.88	8.89	11.27
G.L	354.752	354.890	355.165	354.655	354.191	354.718	355.210	355.516	355.323

Minor Canal +150 - Cross Section At The End

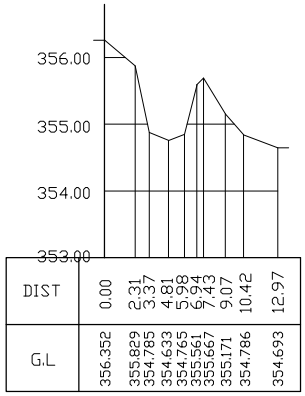
A6-79

Minor Canal+620



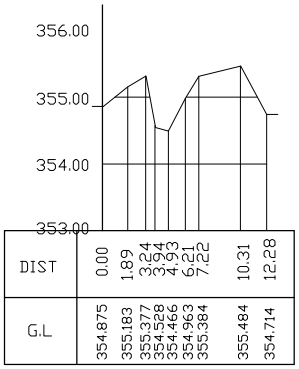
DIST	0.00	4.04	6.32	9.36	11.34	12.82	14.56	15.52	18.05	20.08
G.L	354.443	354.533	355.376	355.717	354.657	354.443	354.737	355.743	355.179	354.847

Minor Canal +620 - Cross Section At The Beginning



DIST	0.00	2.31	3.37	4.81	5.98	6.94	7.43	9.07	10.42	12.97
G.L	356.352	355.829	354.785	354.633	354.765	355.561	355.667	355.171	354.786	354.693

Minor Canal +620 - Cross Section At The Middle



DIST	0.00	1.89	3.24	3.94	4.93	6.21	7.22	10.31	12.28
G.L	354.875	355.183	355.377	354.528	354.466	354.963	355.384	355.484	354.714

Minor Canal +620 - Cross Section At The End

0 20m

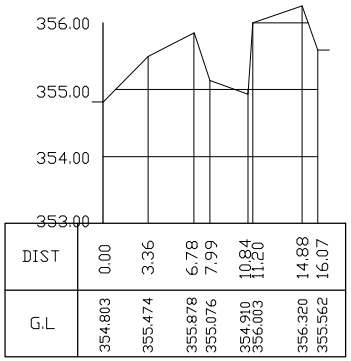
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-1	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Minor Canal Cross Section(2/7)

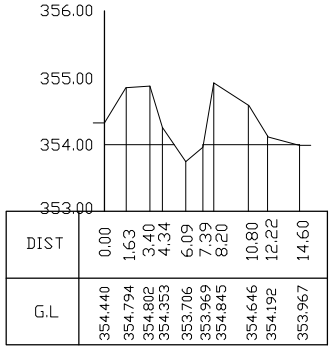
SCALE H=1:400, V=1:80

Minor Canal +1000



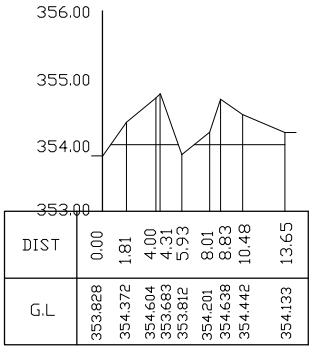
DIST	0.00	3.36	6.78	7.99	10.84	11.20	14.88	16.07
G.L	354.803	355.474	355.878	355.076	354.910	356.003	356.320	355.562

Minor Canal +1000 - Cross Section At The Beginning



DIST	0.00	1.63	3.40	4.34	6.09	7.39	8.20	10.80	12.22	14.60
G.L	354.440	354.794	354.802	354.353	353.706	353.969	354.845	354.646	354.192	353.967

Minor Canal +1000 - Cross Section At The Middle

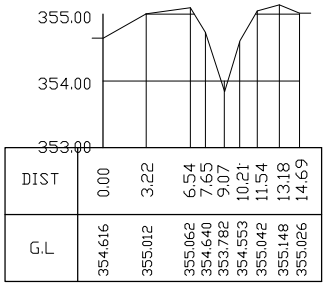


DIST	0.00	1.81	4.00	4.31	5.93	8.01	8.83	10.48	13.65
G.L	353.828	354.372	354.604	353.683	353.812	354.201	354.638	354.442	354.133

Minor Canal +1000 - Cross Section At The End

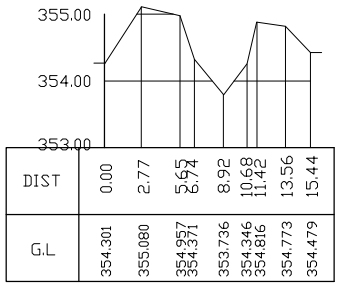
A6-80

Minor Canal+1670



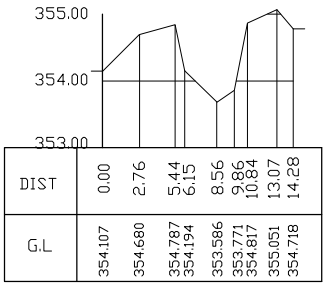
DIST	0.00	3.22	6.54	7.65	9.07	10.21	11.54	13.18	14.69
G.L	354.616	355.012	355.062	354.640	353.782	354.553	355.042	355.148	355.026

Minor Canal +1670 - Cross Section At The Beginning



DIST	0.00	2.77	5.65	6.74	8.92	10.68	11.42	13.56	15.44
G.L	354.301	355.080	354.357	354.371	353.736	354.346	354.816	354.773	354.479

Minor Canal +1670 - Cross Section At The Middle



DIST	0.00	2.76	5.44	6.15	8.56	9.86	10.84	13.07	14.28
G.L	354.107	354.680	354.787	354.194	353.586	353.771	354.817	355.051	354.718

Minor Canal +1670 - Cross Section At The End

0 20m

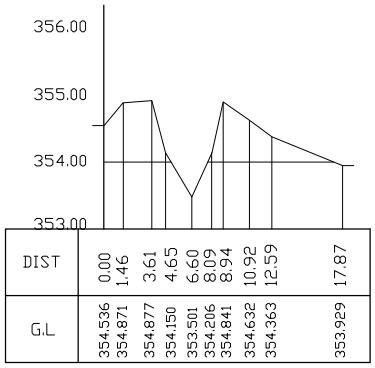
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-2	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Minor Canal +2500

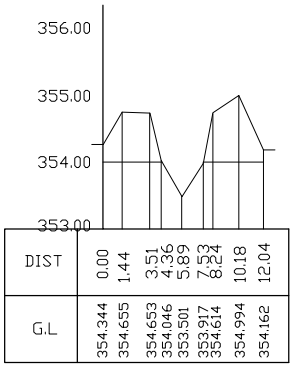
Kitiab Scheme Irrigation Project
Minor Canal Cross Section(3/7)

SCALE H=1:400, V=1:80



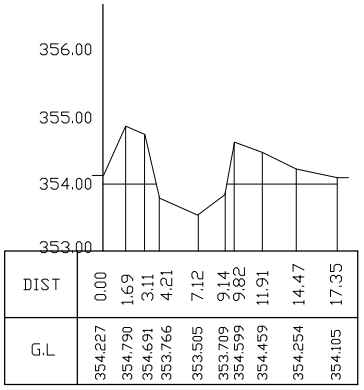
DIST	0.00	1.46	3.61	4.65	6.60	8.09	8.94	10.92	12.59	17.87
G.L	354.536	354.871	354.877	354.150	353.501	354.206	354.841	354.632	354.363	353.929

Minor Canal +2500 - Cross Section At The Beginning



DIST	0.00	1.44	3.51	4.36	5.89	7.53	8.24	10.18	12.04
G.L	354.344	354.655	354.653	354.046	353.501	353.917	354.614	354.994	354.162

Minor Canal +2500 - Cross Section At The Middle

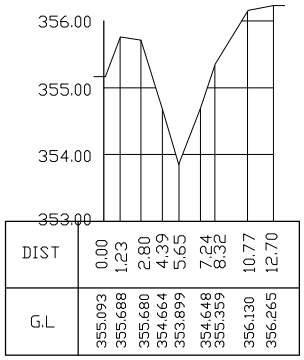


DIST	0.00	1.69	3.11	4.21	7.12	9.14	9.82	11.91	14.47	17.35
G.L	354.227	354.790	354.691	353.766	353.505	353.709	354.599	354.459	354.254	354.105

Minor Canal +2500 - Cross Section At The End

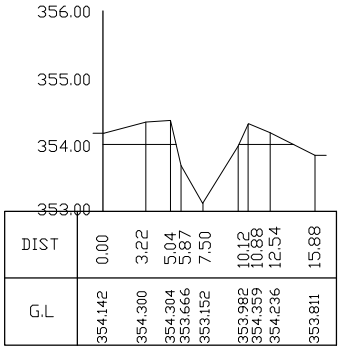
A6-81

Minor Canal +3740



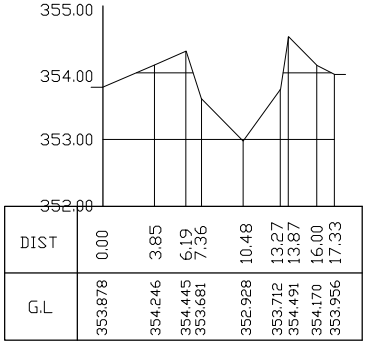
DIST	0.00	1.23	2.80	4.39	5.65	7.24	8.32	10.77	12.70
G.L	355.093	355.688	355.680	354.664	353.899	354.648	355.359	356.130	356.265

Minor Canal +3740 - Cross Section At The Beginning



DIST	0.00	3.22	5.04	5.87	7.50	10.12	10.88	12.54	15.88
G.L	354.142	354.300	354.304	353.666	353.152	353.982	354.359	354.236	353.811

Minor Canal +3740 - Cross Section At The Middle



DIST	0.00	3.85	6.19	7.36	10.48	13.27	13.87	16.00	17.33
G.L	353.878	354.246	354.445	353.681	352.928	353.712	354.491	354.170	353.956

Minor Canal +3740 - Cross Section At The End

0 20m

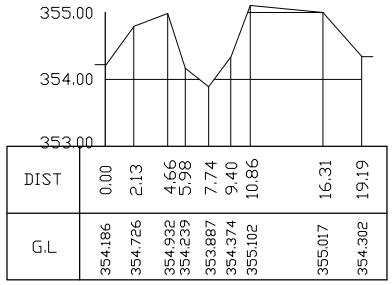
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-3	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Minor Canal +5300

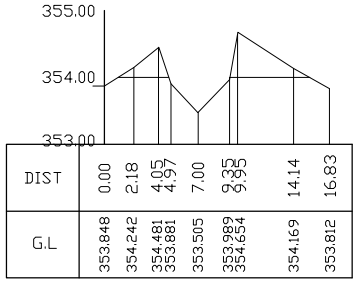
Kitiab Scheme Irrigation Project
Minor Canal Cross Section(4/7)

SCALE H=1:400, V=1:80



DIST	0.00	2.13	4.66	5.98	7.74	9.40	10.86	16.31	19.19
G.L	354.186	354.726	354.932	354.239	353.887	354.374	355.102	355.017	354.302

Minor Canal +5300 - Cross Section At The Beginning

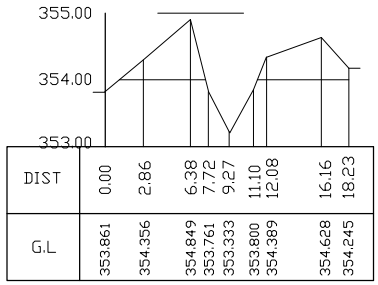


DIST	0.00	2.18	4.05	4.97	7.00	9.35	9.95	14.14	16.83
G.L	353.848	354.242	354.481	353.881	353.505	353.989	354.654	354.169	353.812

Minor Canal +5300 - Cross Section At The End

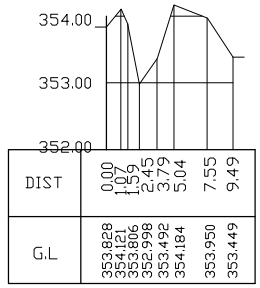
A6-82

Minor Canal +5460



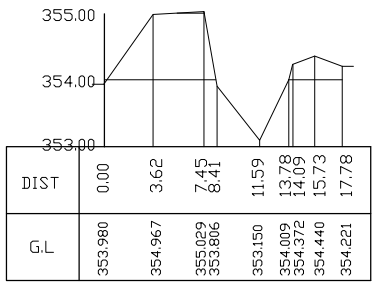
DIST	0.00	2.86	6.38	7.72	9.27	11.10	12.08	16.16	18.23
G.L	353.861	354.356	354.849	353.761	353.333	353.800	354.389	354.628	354.245

Minor Canal +5460 - Cross Section At The Beginning



DIST	0.00	1.07	1.59	2.45	3.79	5.04	7.55	9.49
G.L	353.828	354.121	353.806	352.998	353.492	354.184	353.950	353.449

Minor Canal +5460 - Cross Section At The Middle



DIST	0.00	3.62	7.45	8.41	11.59	13.78	14.09	15.73	17.78
G.L	353.980	354.967	355.029	353.806	353.150	354.009	354.372	354.440	354.221

Minor Canal +5460 - Cross Section At The End

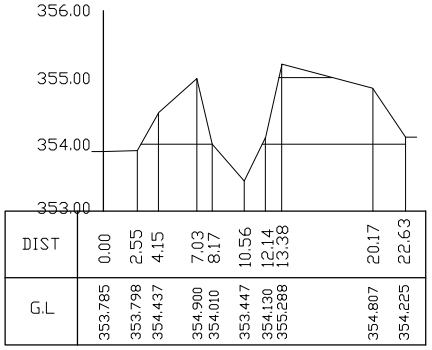
0 20m
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-4	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

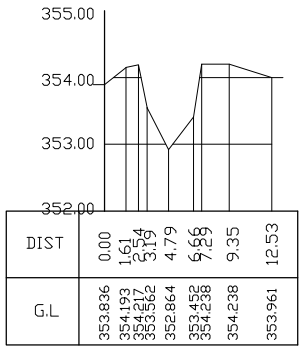
Minor Canal +7280

Kitiab Scheme Irrigation Project
Minor Canal Cross Section(5/7)

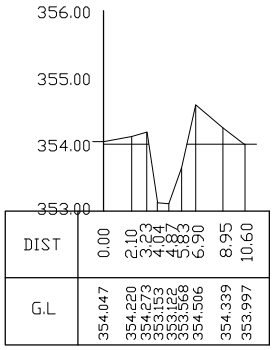
SCALE H=1:400, V=1:80



Minor Canal +7280 - Cross Section At The Beginning



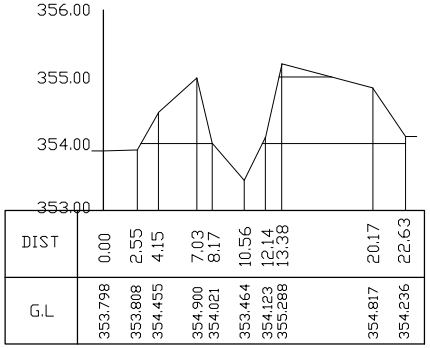
Minor Canal +7280 - Cross Section At The Middle



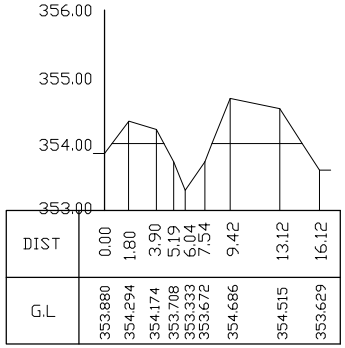
Minor Canal +7280 - Cross Section At The End

A6-83

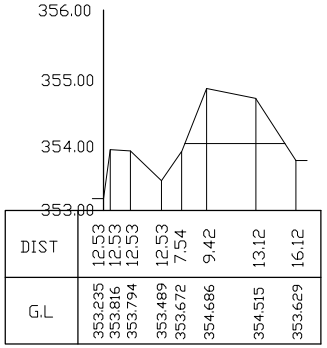
Minor Canal +8000



Minor Canal +8000 - Cross Section At The Beginning



Minor Canal +8000 - Cross Section At The Middle



Minor Canal +8000 - Cross Section At The End

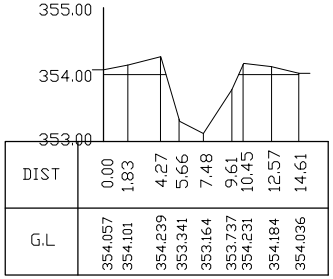
0 20m
SCALE : 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-5	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Kitiab Scheme Irrigation Project
Minor Canal Cross Section(6/7)

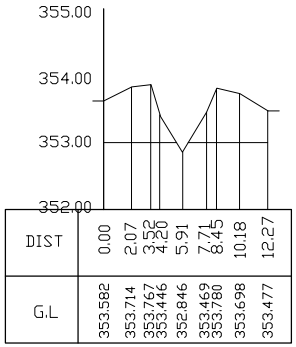
SCALE H=1:400, V=1:80

Minor Canal +9440



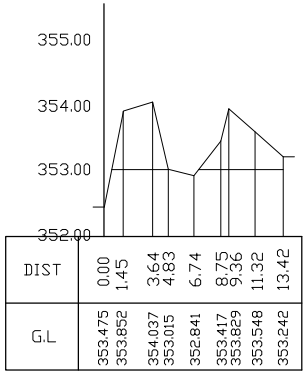
DIST	0.00	1.83	4.27	5.66	7.48	9.61	10.45	12.57	14.61
G.L	354.057	354.101	354.239	353.341	353.164	353.737	354.231	354.184	354.036

Minor Canal +9440 - Cross Section At The Beginning



DIST	0.00	2.07	3.52	4.20	5.91	7.71	8.45	10.18	12.27
G.L	353.582	353.714	353.767	353.446	352.846	353.469	353.780	353.698	353.477

Minor Canal +9440 - Cross Section At The Middle

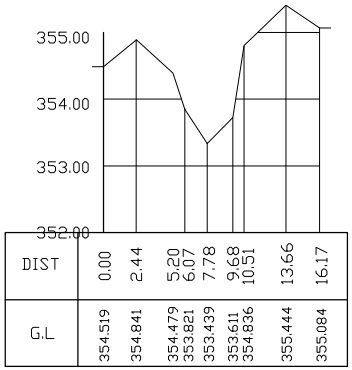


DIST	0.00	1.45	3.64	4.83	6.74	8.75	9.36	11.32	13.42
G.L	353.475	353.852	354.037	353.015	352.841	353.417	353.829	353.548	353.242

Minor Canal +9440 - Cross Section At The End

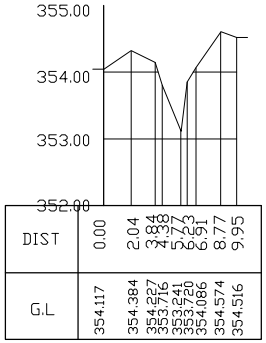
A6-84

Minor Canal +9480



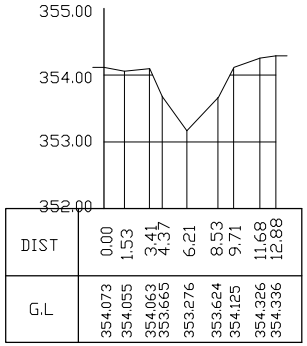
DIST	0.00	2.44	5.20	6.07	7.78	9.68	10.51	13.66	16.17
G.L	354.519	354.841	354.479	353.821	353.439	353.611	354.836	355.444	355.084

Minor Canal +9480 - Cross Section At The Beginning



DIST	0.00	2.04	3.84	4.38	5.77	6.51	8.77	9.95
G.L	354.117	354.384	354.227	353.716	353.241	353.220	354.086	354.574	354.516

Minor Canal +9480 - Cross Section At The Middle



DIST	0.00	1.53	3.41	4.37	6.21	8.53	9.71	11.68	12.88
G.L	354.073	354.055	354.063	353.665	353.276	353.624	354.125	354.326	354.336

Minor Canal +9480 - Cross Section At The End

0 20m

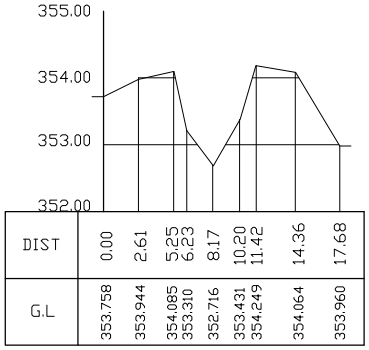
SCALE: 1:400

PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-6	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Minor Canal +10510

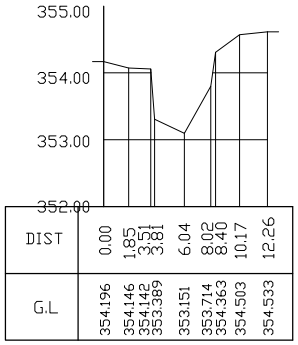
Kitiab Scheme Irrigation Project
Minor Canal Cross Section(7/7)

SCALE H=1:400, V=1:80



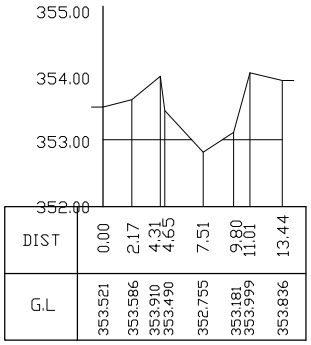
DIST	0.00	2.61	5.25	6.23	8.17	10.20	11.42	14.36	17.68
G.L	353.758	353.944	354.085	353.310	352.716	353.431	354.249	354.064	353.960

Minor Canal +10510 - Cross Section At The Beginning



DIST	0.00	1.85	3.51	3.81	6.04	8.02	8.40	10.17	12.26
G.L	354.196	354.146	354.142	353.389	353.151	353.714	354.363	354.503	354.533

Minor Canal +10510 - Cross Section At The Middle

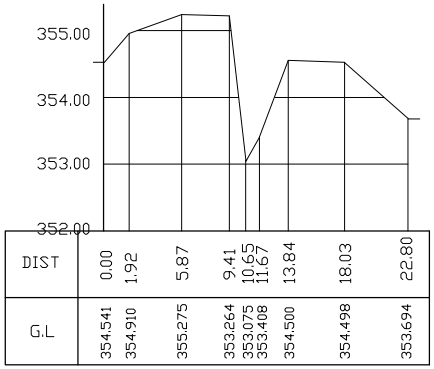


DIST	0.00	2.17	4.31	4.65	7.51	9.80	11.01	13.44
G.L	353.521	353.586	353.910	353.490	352.755	353.181	353.999	353.836

Minor Canal +10510 - Cross Section At The End

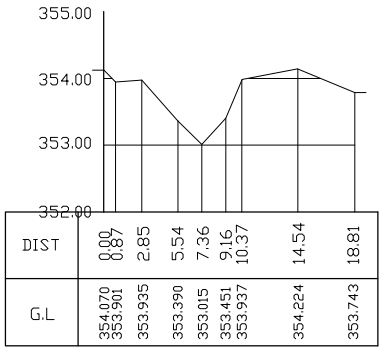
A6-85

Minor Canal +11640



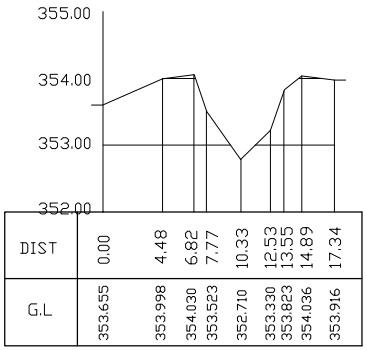
DIST	0.00	1.92	5.87	9.41	10.65	11.67	13.84	18.03	22.80
G.L	354.541	354.910	355.275	353.264	353.075	353.408	354.500	354.498	353.694

Minor Canal +11640 - Cross Section At The Beginning



DIST	0.00	0.87	2.85	5.54	7.36	9.16	10.37	14.54	18.81
G.L	354.070	353.901	353.935	353.390	353.015	353.451	353.937	354.224	353.743

Minor Canal +11640 - Cross Section At The Middle



DIST	0.00	4.48	6.82	7.77	10.33	12.53	13.55	14.89	17.34
G.L	353.655	353.998	354.030	353.523	352.710	353.330	353.823	354.036	353.916

Minor Canal +11640 - Cross Section At The End

0 20m

SCALE: 1:400

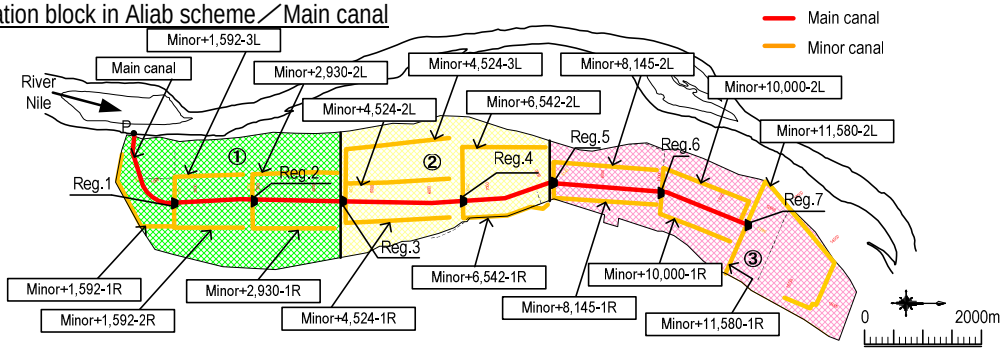
PROJECT: Kitiab Scheme Irrigation Project						
UNIT TITLE: Minor Canal Cross Section(1/7)						
PROJECT:						
PROJECT: 05-7	SCALE H=1:400 V=1:80	UNIT	SIZE	SHEET	PROJ.No.	REV.

Appendix -6.12 Calculation of canal capacity for target area

Appendix -6.12-1 Calculation of canal capacity for Aliab

The caluculation of the hydralic capacity of the cross section in Aliab scheme

Iriigation block in Aliab scheme／Main canal



Irrigation area of each block (ha)

Bolck	Block①	Block②	Block③						Total
Area	823.7	653.5	727.8						2205.0

Iriigation area of each canal (ha)

Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
Area	2205.0	1381.3	727.8						

Required irrigation water of each canal (m^3/s)

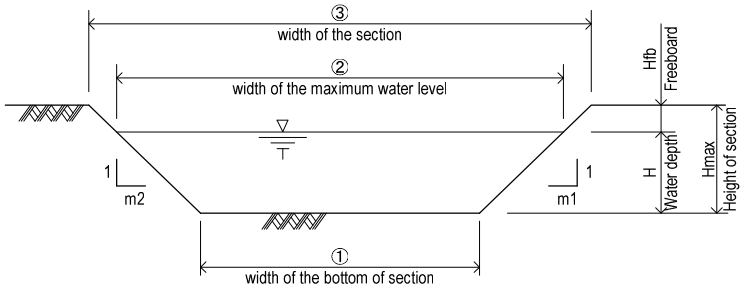
Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
Required Water:Qr	3.58	*) 3.58	*) 3.58						

Remarks : In the examination the capacity of canal section can be 3.58m3/s of Maximum discharge for the rotation irrigation

Required capacity of each canal section

1) Estimation of the existing canal section

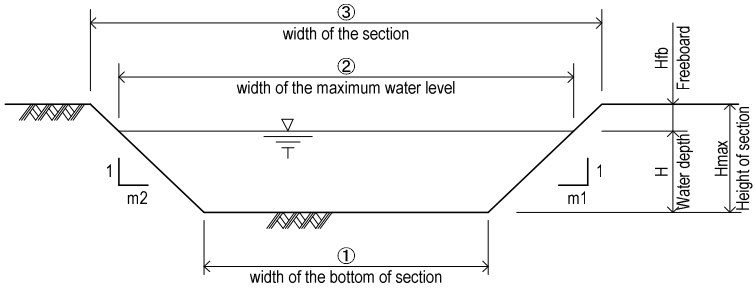
1-1) Dimention of the existing canal (m)



Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
m1	3.8	1.7	1.6						
m2	3.8	5.0	1.6						
Hfb-r	0.26 Min. Clearance by Jp. Formula	0.00 Too low canal height	0.24 Min. Clearance by Jp. Formula						
Hfb	0.26	0.00	0.53						
H	0.64	0.35	0.67						
Hmax	0.90	0.35	1.20						
①	5.50	6.10	4.70						
②	10.36	8.45	6.83						
③	12.34	8.45	8.54						
1-2) Estimation of the capasity of the existing canal section									
A (m2)	5.076	2.545	3.835						
P(m)	10.530	8.575	7.210						
R = A/P	0.482	0.297	0.532						
n	0.022	0.022	0.022						
I	1/7,900	1/7,900	1/7,900						
v (m/s)	0.314	0.228	0.336						
Qm (m^3/s)	1.60	0.58	1.29						
Qr (m^3/s)	3.58	3.58	3.58						
Judge Qm > Qr	NG	NG	NG						

2) Estimation of the improvement on the canal section

2-1) Dimention of the improvement on the canal section (m)



Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
m1	2.0	2.0	2.0						
m2	2.0	2.0	2.0						
Hfb-r	0.26 Min. Clearance by Jp. Formula	0.25 Min. Clearance by Jp. Formula	0.24 Min. Clearance by Jp. Formula						
Hfb	0.43	0.43	0.43						
H	1.07	1.07	1.07						
Hmax	1.50	1.50	1.50						
①	5.50	5.50	5.50						
②	9.78	9.78	9.78						
③	11.50	11.50	11.50						
2-2) Capacity of the improvement on the canal section									
A (m2)	8.163	8.163	8.163						
P(m)	10.280	10.280	10.280						
R = A/P	0.794	0.794	0.794						
n	0.022	0.022	0.022						
I	1/7,900	1/7,900	1/7,900						
v (m/s)	0.439	0.439	0.439						
Qm (m^3/s)	3.58	3.58	3.58						
Qr (m^3/s)	3.58	3.58	3.58						
Judge Qm > Qr	OK	OK	OK						
Judge Hfb > Hfbr	OK	OK	OK						

Iriigation block in Aliab scheme／Minor canal

The examination of minor canal of the capacity execute for most minimum cross section at each block.

As the condtion of canal slope when the examination, it apply most shelving of value for the safe of risk.

The target cross section and canal slope of the minimum cross section at Minor canal at each block is as follows;

Block①: No. 2,930-2L I= 1/ 4,400

Block②: No. 6,542-2L I= 1/ 3,500

Block③-1: No. 8,145-1R I= 1/ 4,500 No.11,580-2L is executed as having twice irrigation area, because this canal is twice length comaparing other canal.

Block③-2: No.11,580-2L I= 1/ 4,500 No.11,580-2L is executed as having twice irrigation area, because this canal is twice length comaparing other canal.

Irrigation area of each block (ha)

Block	Block① 2930-2L	Block② 2930-2L	Block③-1 8145-1R	Block③-2 11580-2L					
Area	164.7	130.7	104.0	235.3					

Iriigation area of each canal (ha)

Canal	Block① 2930-2L	Block② 2930-2L	Block③-1 8145-1R	Block③-2 11580-2L					
Area	164.7	130.7	104.0	235.3					

Required irrigation water of each canal (m^3/s)

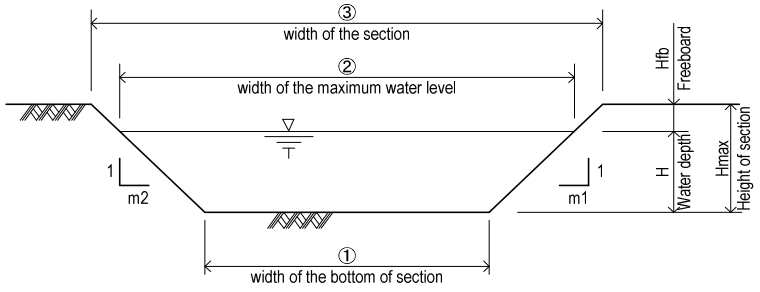
Canal	Block① 2930-2L	Block② 2930-2L	Block③-1 8145-1R	Block③-2 11580-2L					
Required Water:Qr	0.27	0.21	0.17	0.38					

Remarks : In the examination the capacity of canal section can be 3.58m3/s of Maximum discharge for the rotation manner

Required capacity of each canal section

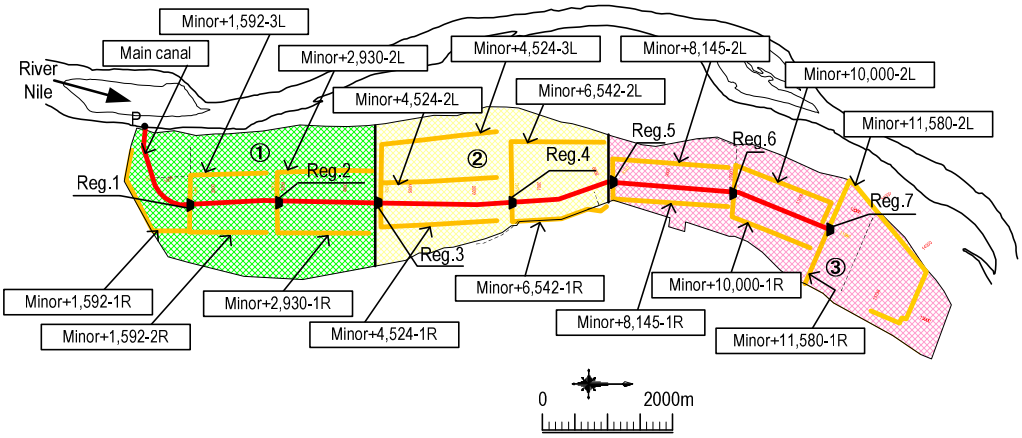
1) Estimation of the existing canal section

1-1) Dimention of the existing canal (m)

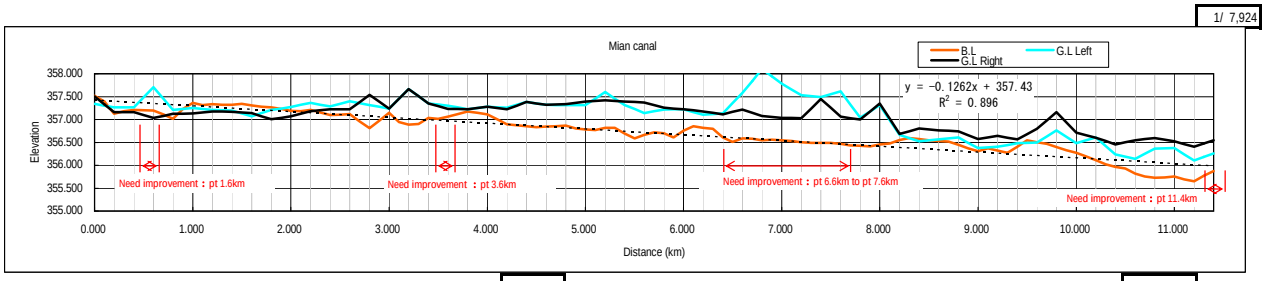


Canal	Block① 2930-2L	Block② 2930-2L	Block③-1 8145-1R	Block③-2 11580-2L					
m1	1.0	1.5	1.0	2.0					
m2	0.5	1.5	1.0	2.0					
Hfb	0.28	0.29	0.42	0.28					
H	0.52	0.21	0.38	0.52					
Hmax	0.80	0.50	0.80	0.80					
①	1.20	3.80	1.20	1.20					
②	1.98	4.42	1.97	3.29					
③	2.40	5.30	2.80	4.40					
1-2) Estimation of the capasity of the existing canal section									
A (m2)	0.828	0.842	0.608	1.172					
P(m)	2.518	4.539	2.285	3.536					
R = A/P	0.329	0.186	0.266	0.332					
n	0.022	0.022	0.022	0.022					
I	1/4,400	1/3,500	1/4,500	1/4,500					
v (m/s)	0.326	0.250	0.280	0.325					
Qm (m^3/s)	0.27	0.21	0.17	0.38					
Qr (m^3/s)	0.27	0.21	0.17	0.38					
Judge Qm > Qr	OK	OK	OK	OK					

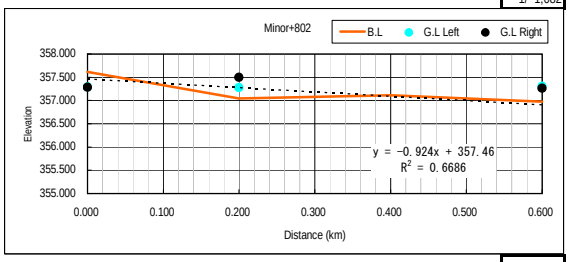
Aliab scheme : Examination of the canal slope



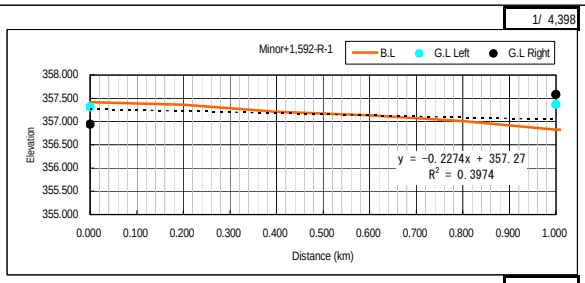
1/ 7,924



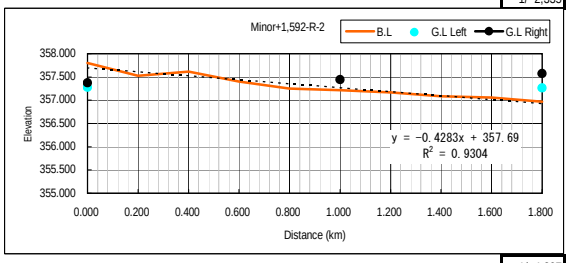
1/ 1,082



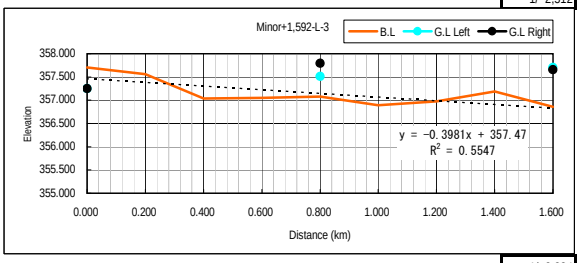
1/ 4,398



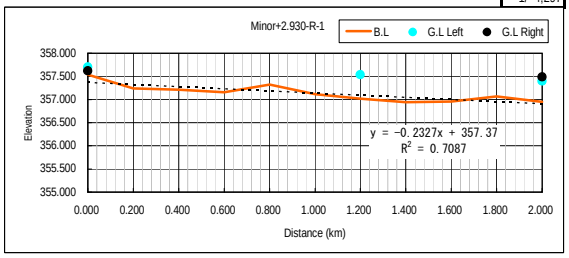
1/ 2,335



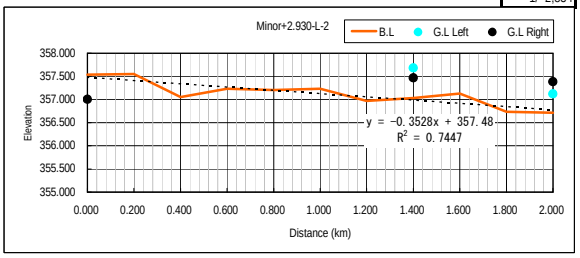
1/ 2,512



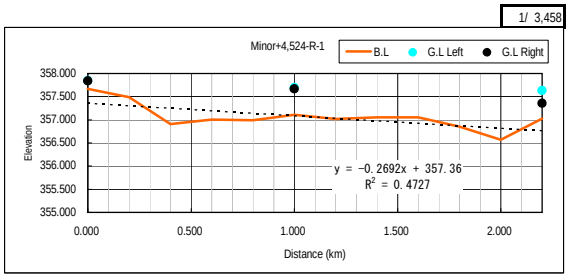
1/ 4,297



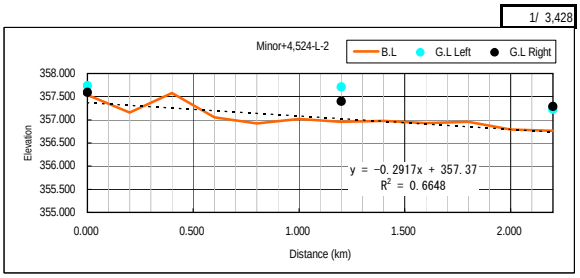
1/ 2,834



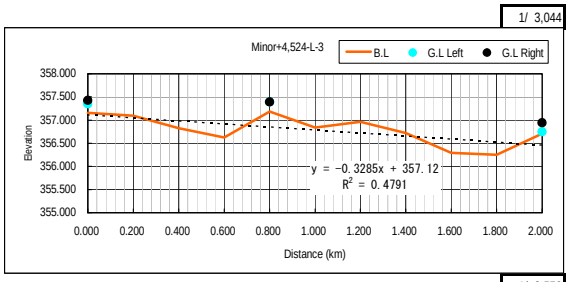
1/ 3,458



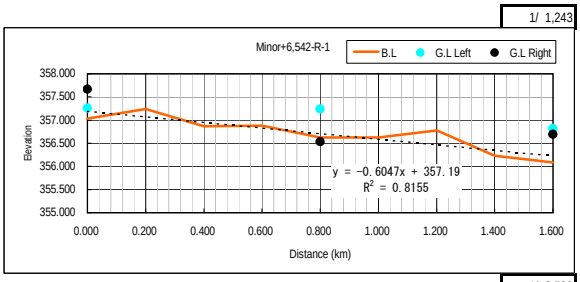
1/ 3,428



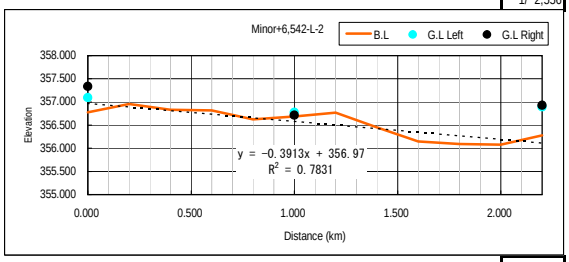
1/ 3,044



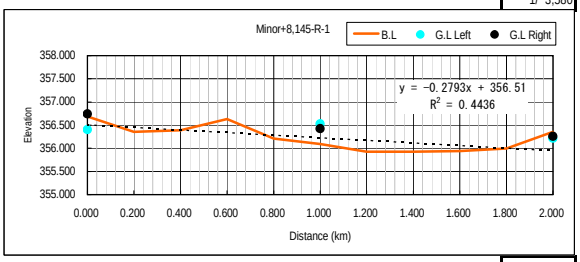
1/ 1,243



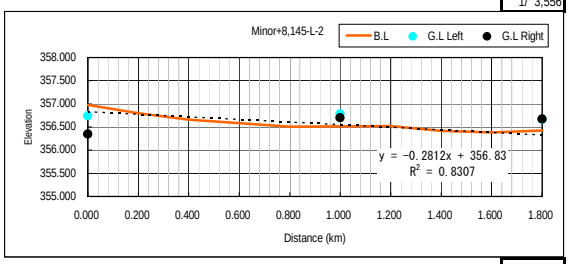
1/ 2,556



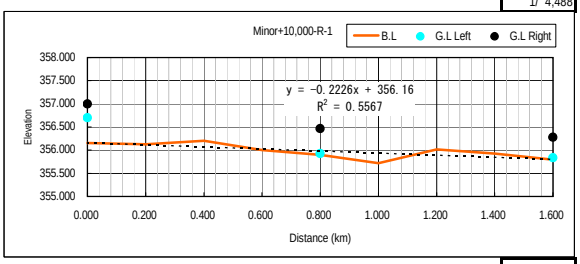
1/ 3,580



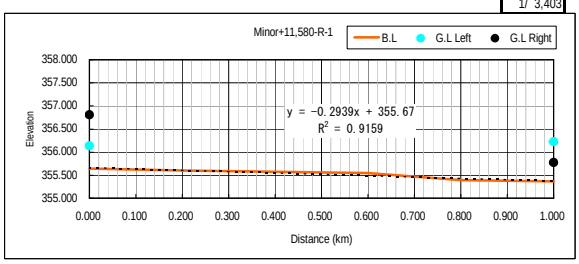
1/ 3,556



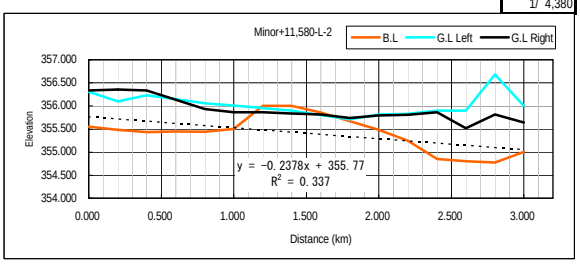
1/ 4,488



1/ 3,403



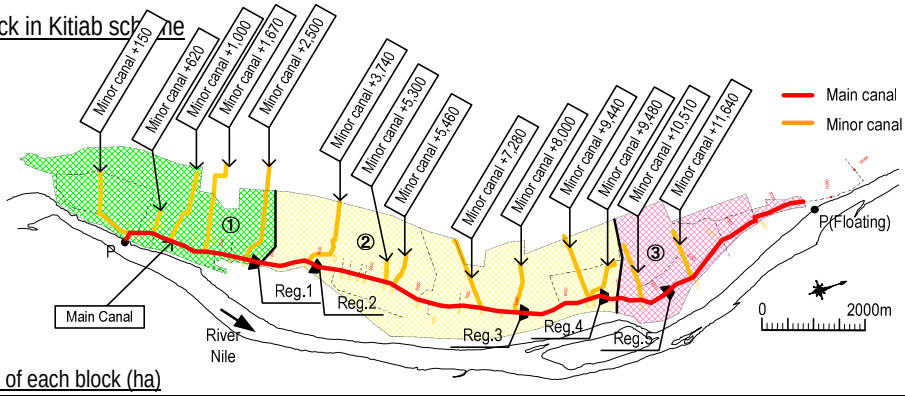
1/ 4,380



Appendix -6.12-2 Calculation of canal capacity for Kitiab

The caluculation of the hydralic capacity of the cross section in Kitiab scheme

Iriigation block in Kitiab scheme



Irrigation area of each block (ha)

Bolck	Block①	Block②	Block③						Total
Area	671.6	1250.0	472.4						2394.0

Iriigation area of each canal (ha)

Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
Area	2394.0	1722.4	472.4						

Required irrigation water of each canal (m^3/s)

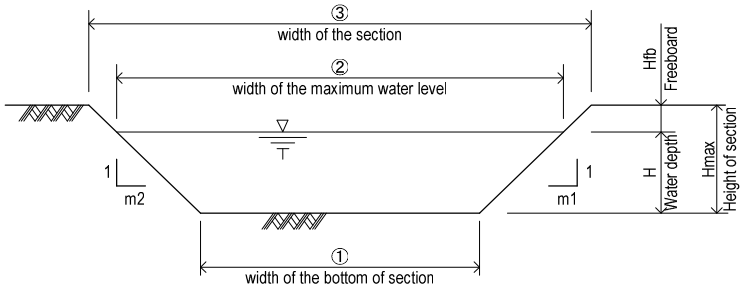
Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
Required Water:Qr	3.93	*) 3.93	*) 3.93						

Remarks : In the examination the capacity of canal section can be 3.93m3/s of Maximum discharge for the rotation irrigation

Required capacity of each canal section

1) Estimation of the existing canal section

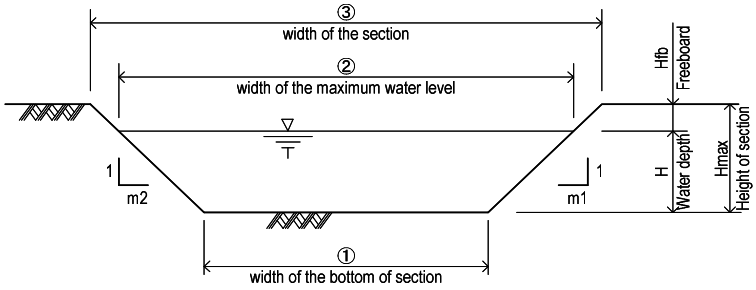
1-1) Dimention of the existing canal (m)



Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
m1	1.5	1.5	1.5						
m2	1.5	1.5	1.5						
Hfb-r	0.26 clearance by Jp formula	0.45 clearance by Jp formula	0.26 clearance by Jp formula						
Hfb	0.26	0.45	0.26						
H	1.24	1.05	1.24						
Hmax	1.50	1.50	1.50						
①	4.00	4.00	4.00						
②	7.72	7.15	7.72						
③	8.50	8.50	8.50						
1-2) Estimation of the capasity of the existing canal section									
A (m2)	7.266	5.854	7.266						
P(m)	8.471	7.786	8.471						
R = A/P	0.858	0.752	0.858						
n	0.022	0.022	0.022						
I	1/9,700	1/9,700	1/9,700						
v (m/s)	0.417	0.382	0.417						
Qm (m^3/s)	3.03	2.23	3.03						
Qr (m^3/s)	3.93	3.93	3.93						
Judge Qm > Qr	NG	NG	NG						

2) Estimation of the improvement on the canal section

2-1) Dimention of the improvement on the canal section (m)



Canal	Block① Main canal	Block② Main canal	Block③ Main canal						
m1	1.5	1.5	1.5						
m2	1.5	1.5	1.5						
Hfb-r	0.26 clearance by Jp formula	0.45 clearance by Jp formula	0.26 clearance by Jp formula						
Hfb	0.51	0.51	0.51						
H	1.29	1.29	1.29						
Hmax	1.80	1.80	1.80						
①	5.00	5.00	5.00						
②	8.87	8.87	8.87						
③	10.40	10.40	10.40						
2-2) Capacity of the improvement on the canal section									
A (m2)	8.954	8.954	8.955						
P(m)	9.654	9.654	9.655						
R = A/P	0.927	0.927	0.928						
n	0.022	0.022	0.022						
I	1/9,700	1/9,700	1/9,700						
v (m/s)	0.439	0.439	0.439						
Qm (m^3/s)	3.93	3.93	3.93						
Qr (m^3/s)	3.93	3.93	3.93						
Judge Qm > Qr	OK	OK	OK						

検討結果

Iriigation block in Kitiab scheme／Minor canal

The examination of minor canal of the capacity execute for most minimum cross section at each block.

As the condtion of canal slope when the examination, it apply most shelving of value for the safe of risk.

The target cross section and canal slope of the minimum cross section at Minor canal at each block is as follows;

Block①: Minor 1,670	I=	1/ 1,300	The target each area make proportional distribution depending on the canal length. (1.4km/6.62km)
Block②: Minor 5,300	I=	1/ 1,500	The target each area make proportional distribution depending on the canal length. (0.45km/7.55km)
Block③: Minor 11,640	I=	1/ 2,200	The target each area make proportional distribution depending on the canal length. (0.78km/2.18km)

※(‥km/‥km)=(the lengh of target Minor canal/the total lengh of target Minor canal at target block)

Irrigation area of each block (ha)

Block	Block① 1, 670	Block② 5, 300	Block③ 11, 640						
Area	142.0	74.5	169.0						

Iriigation area of each canal (ha)

Canal	Block① 1,670	Block② 5,300	Block③ 11,640						
Area	142.0	74.5	169.0						

Required irrigation water of each canal (m^3/s)

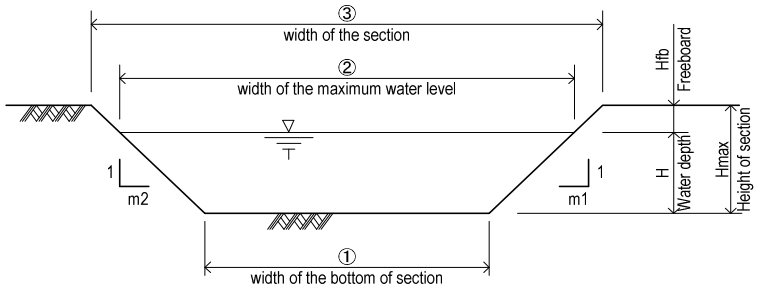
Canal	Block① 1,670	Block② 5,300	Block③ 11,640						
Required Water:Qr	0.23	0.12	0.28						

Remarks : In the examination the capacity of canal section can be 3.93m3/s of Maximum discharge for the rotation irrigation

Required capacity of each canal section

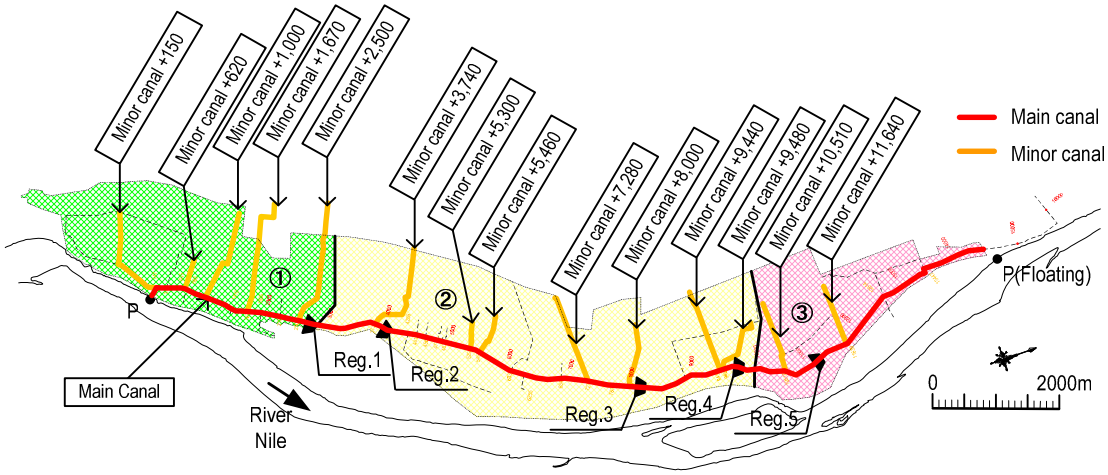
1) Estimation of the existing canal section

1-1) Dimention of the existing canal (m)

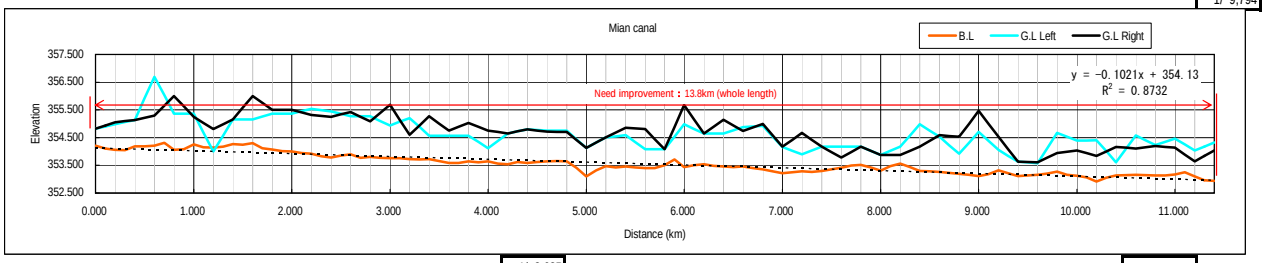


Canal	Block① 1,670	Block② 5,300	Block③ 11,640						
m1	1.0	1.0	1.0						
m2	2.0	2.0	2.0						
	clearance by Jp formula	clearance by Jp formula	clearance by Jp formula						
Hfb	0.05	0.05	0.05						
H	0.57	0.46	0.68						
Hmax	1.25	1.00	1.00						
①	0.00	0.00	0.00						
②	1.70	1.38	2.04						
③	1.85	1.53	2.19						
1-2) Estimation of the capasity of the existing canal section									
A (m2)	0.482	0.317	0.694						
P(m)	2.070	1.679	2.482						
R = A/P	0.233	0.189	0.279						
n	0.022	0.022	0.022						
I	1/1,300	1/1,500	1/2,200						
v (m/s)	0.477	0.387	0.414						
Qm (m^3/s)	0.23	0.12	0.29						
Qr (m^3/s)	0.23	0.12	0.28						
Judge Qm > Qr	OK	OK	OK						

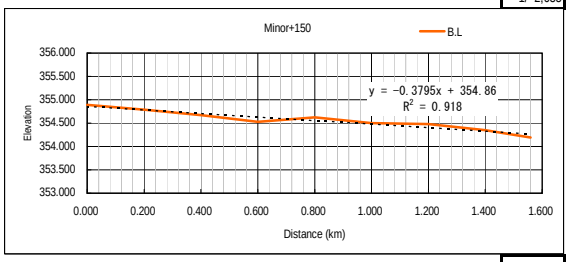
Kitiab scheme : Examination of the canal slope



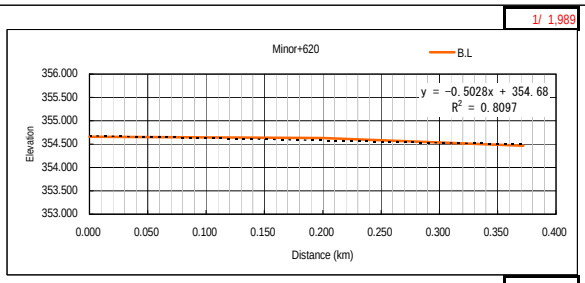
1/ 9,794



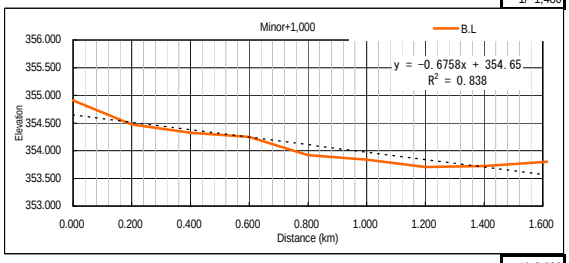
1/ 2,635



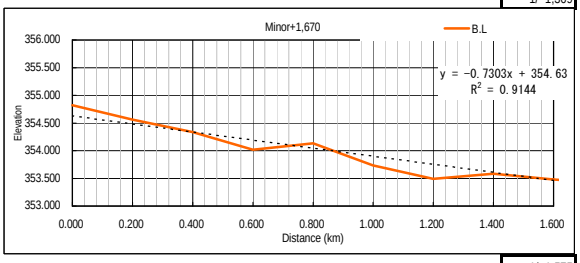
1/ 1,989



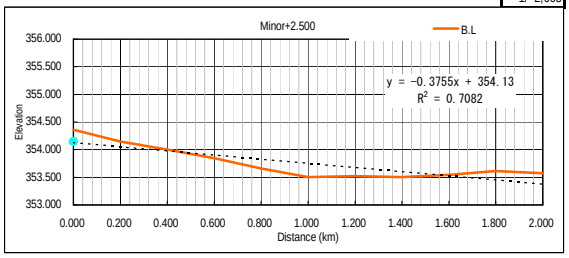
1/ 1,480



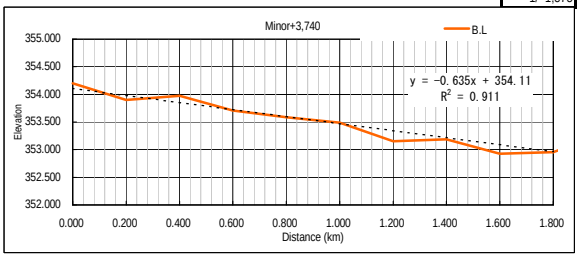
1/ 1,369



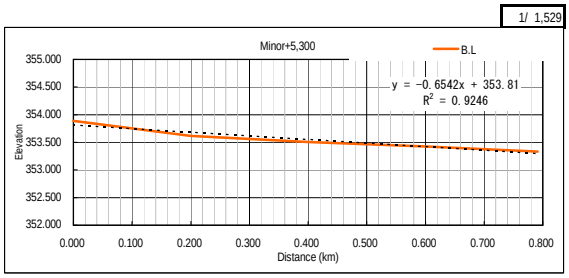
1/ 2,663



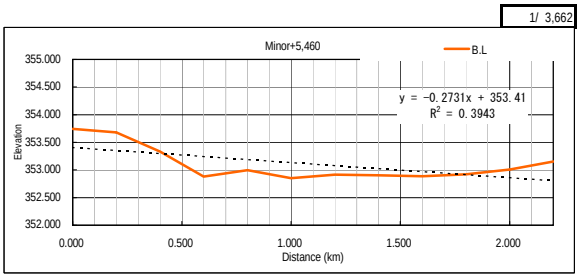
1/ 1,575



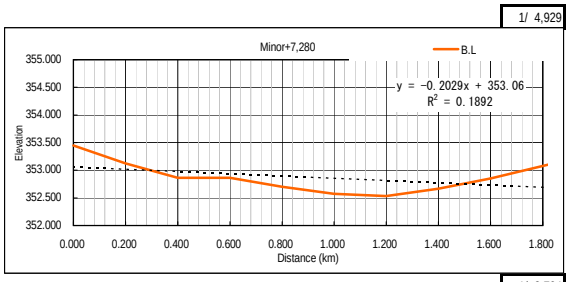
1/ 1,529



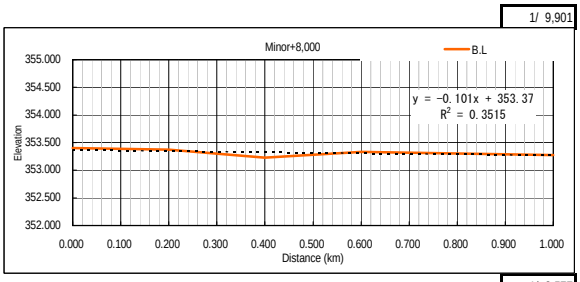
1/ 3,662



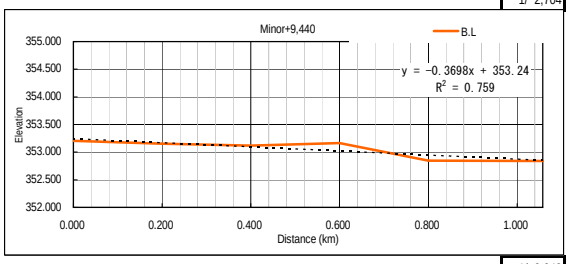
1/ 4,929



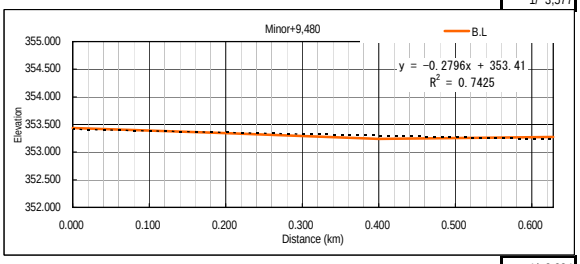
1/ 9,901



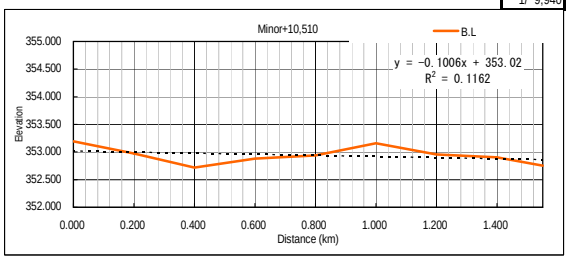
1/ 2,704



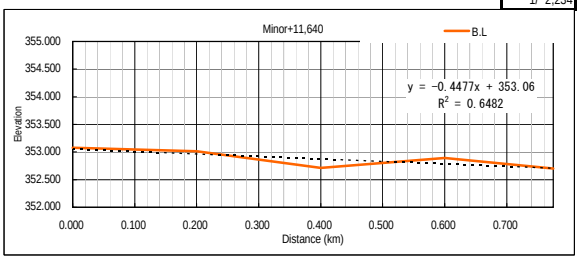
1/ 3,577



1/ 9,940



1/ 2,234

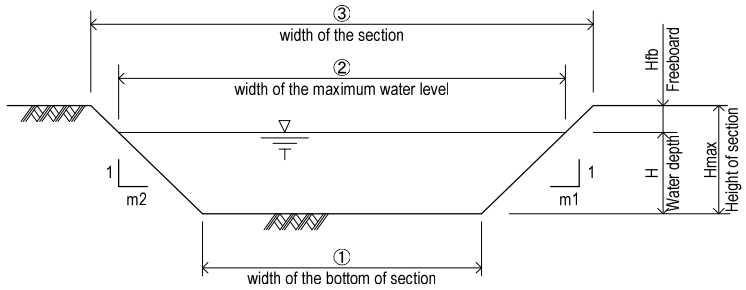


Appendix -6.12-3 : Calculation of canal capacity for New Halfa

Capacity of the canal in New Halfa

1) Estimation of the existing canal section

1-1) Dimention of the existing canal (m)



水路	Major canal	Major canal							
m1	2.0	2.0							
m2	2.0	2.0							
Hfb	0.75	0.77							
H	1.50	1.73							
hmax	2.25	2.50							
①	8.00	8.00							
②	14.00	14.92							
③	17.00	18.00							
1-2) Estimation of the capasity of the existing canal section									
A (m2)	16.500	19.809							
P(m)	14.708	15.732							
R = A/P	1.122	1.259							
n	0.025	0.022							
I	1/10,000	1/10,000							
v (m/s)	0.424	0.530							
Qm (m^3/s)	7.00	10.50							

Appendix-6.13 Result of natural condition survey

●Topographic survey

The target area for the survey is Kadabas, Aliab and Kitiab scheme. The survey items are shown as follows;

Survey Point	Survey Item	Quantity
Kadabas scheme	TBM shall be set in the target area	1 L.S
	Longitudinal survey for the Main canal by 100 meter interval	17km
	Cross section survey for the Main canal	3.4km
	Longitudinal survey for the Minor canal by 100 meter interval	21km
	Cross section survey for the Minor canal	30pt
	Plane survey around the existing pump station	0.04km2
Aliab scheme	TBM shall be set in the target area	1 L.S
	Longitudinal survey for the Main canal by 100 meter interval	16km
	Cross section survey for the Main canal	3.2km
	Longitudinal survey for the Minor canal by 100 meter interval	35km
	Cross section survey for the Minor canal	30 p.t
	Plane survey around the existing pump station	0.04km
Kitiab scheme	TBM shall be set in the target area	1 L.S
	Longitudinal survey for the Main canal by 100 meter interval	16km
	Cross section survey for the Main canal	3.2km
	Longitudinal survey for the Minor canal by 100 meter interval	34km
	Cross section survey for the Minor canal	30 p.t
	Plane survey around the existing pump station	0.04km
Reporting（drawings、coordinates）		1 L.S

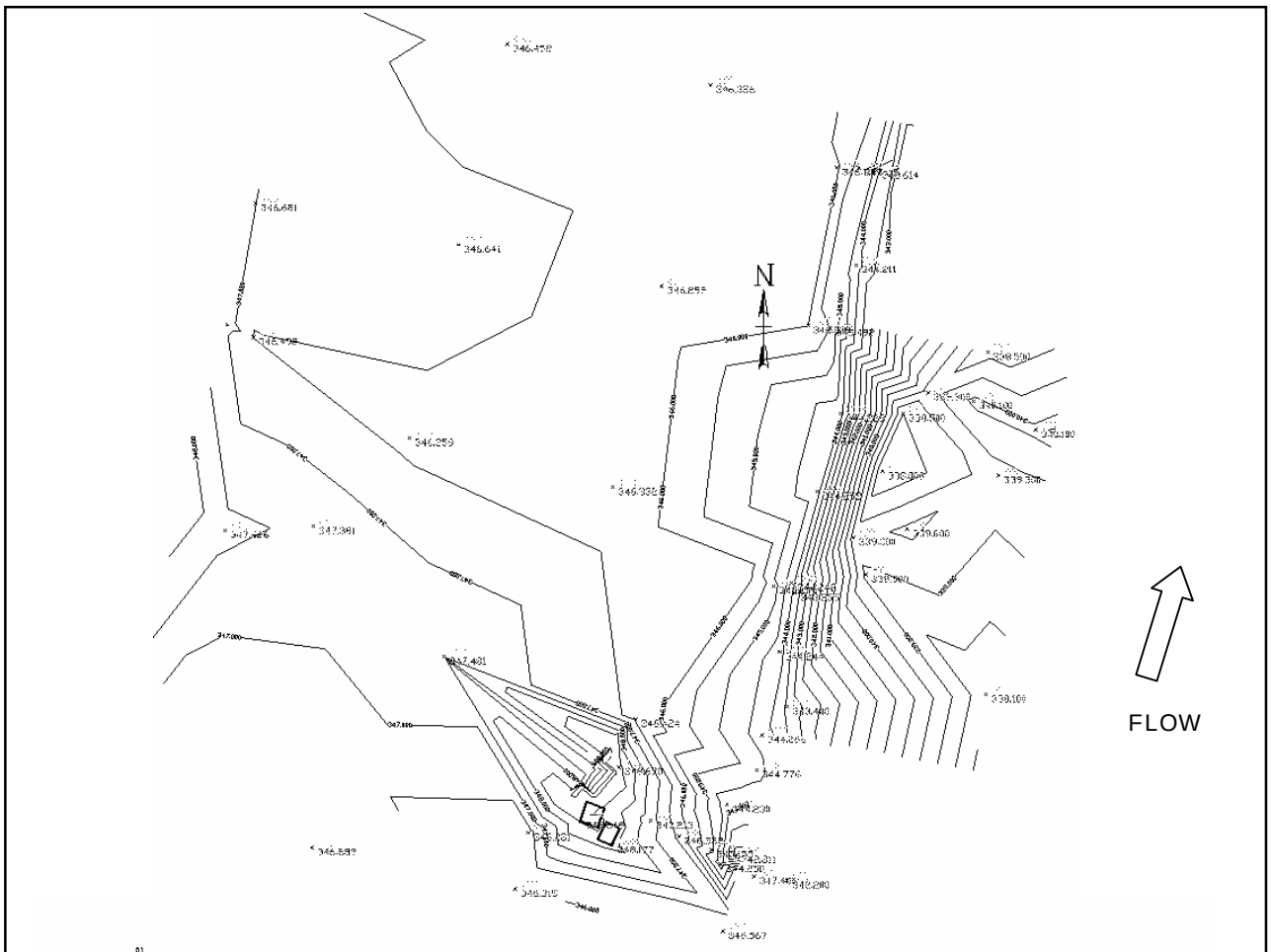
●Geographical survey and soil investigation

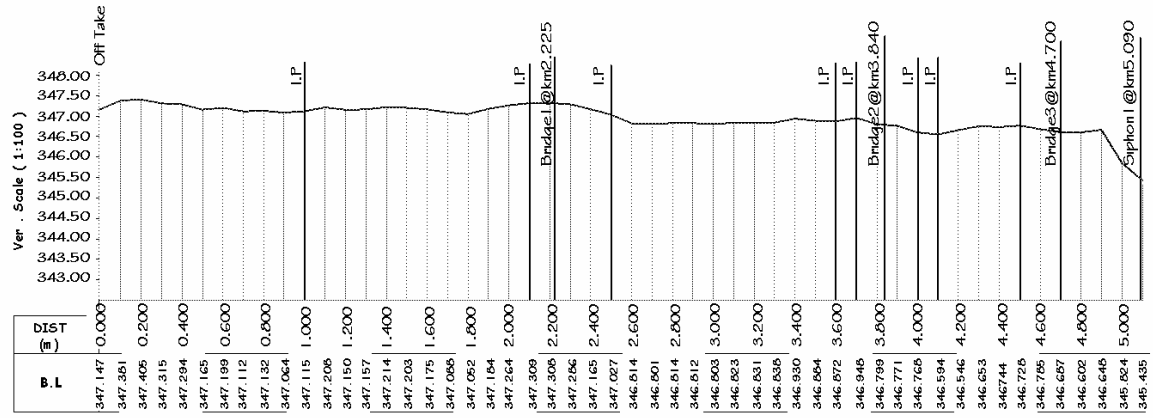
The target area for the survey is Kadabas, Aliab and Kitiab scheme. The survey items are shown as follows;

Survey Point	Survey Item	Quantity
Kadabas scheme	Bore hole drilling（two holes x 30m）	60m
	Standard penetration test（29pc/hole x two bore hole）	58pc
	Sampling（more than one sample at the changing point of the layer feature）	more than 6pt
	Grain size analysis（conduct to the sampling core）	more than 6pt
Aliab scheme	Bore hole drilling（two holes x 30m）	60m
	Standard penetration test（29pc/hole x two bore hole）	58pc
	Sampling（more than one sample at the changing point of the layer feature）	more than 6pt
	Grain size analysis（conduct to the sampling core）	more than 6pt
Kitiab scheme	Bore hole drilling（two holes x 30m）	60m
	Standard penetration test（29pc/hole x two bore hole）	58pc
	Sampling（more than one sample at the changing point of the layer feature）	more than 6pt
	Grain size analysis（conduct to the sampling core）	more than 6pt
Reporting（Core log hole, laboratory test etc.）		1 L.S

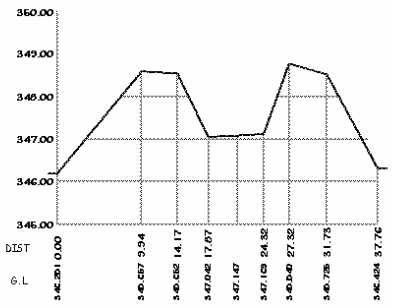
The main report of the survey is shown as follows;

Kadabas scheme : Plane, Longitudinal, Cross section on the main canal

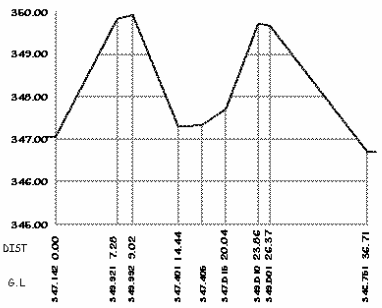




Longitudinal Section Main Canal No(1)
Hor scale (1:16000)

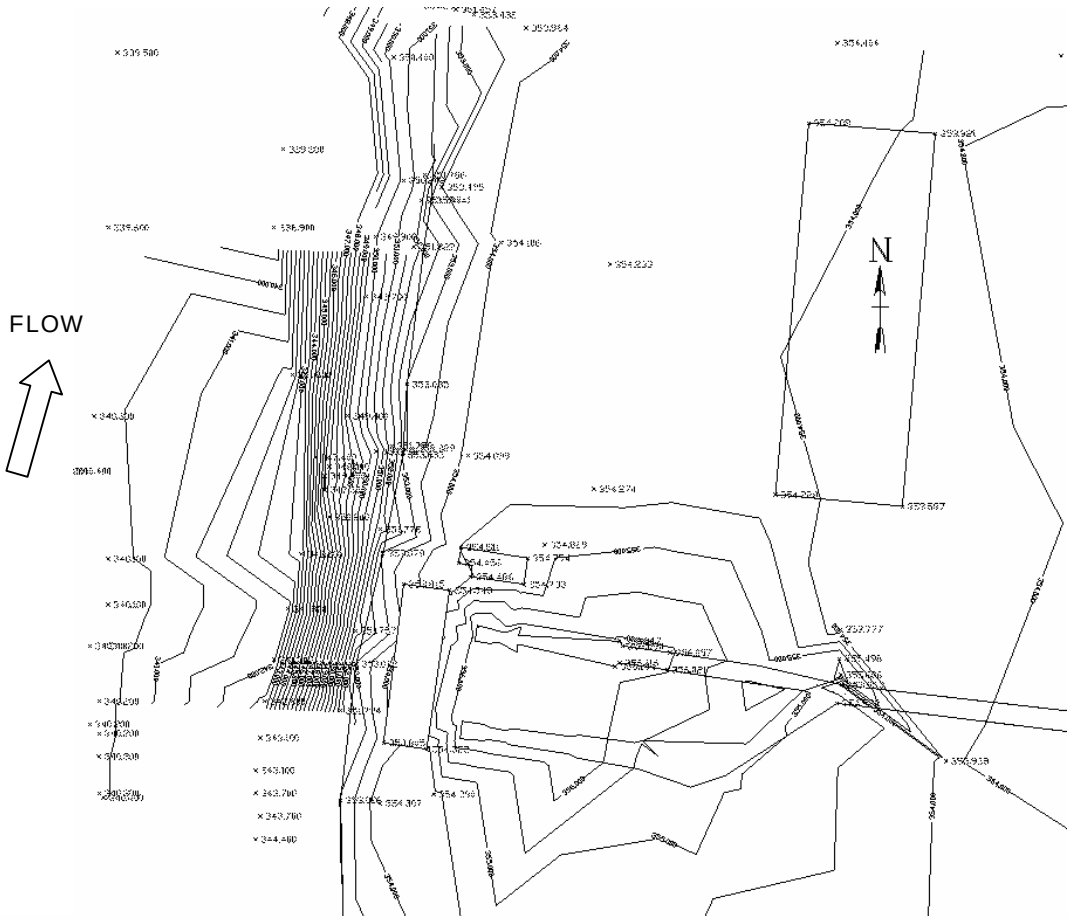


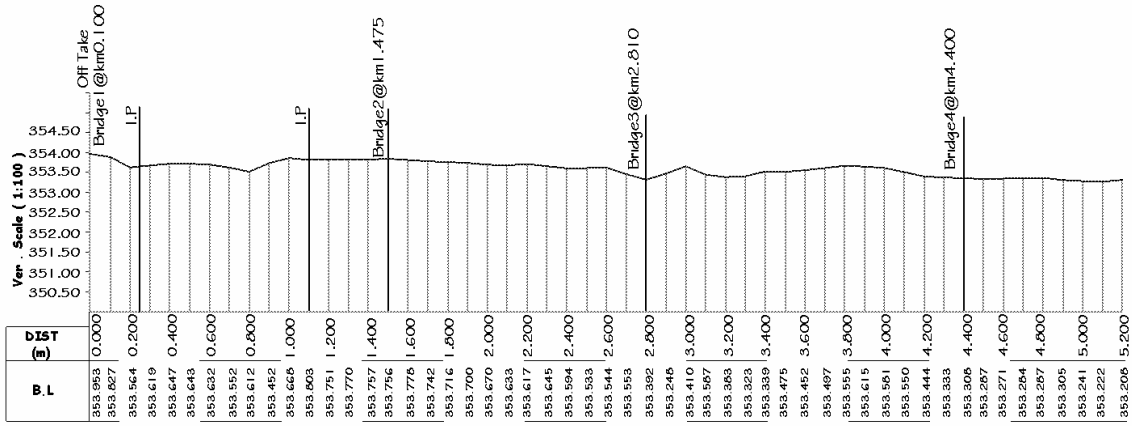
Main Canal - Cross Section at Ch 0.00km



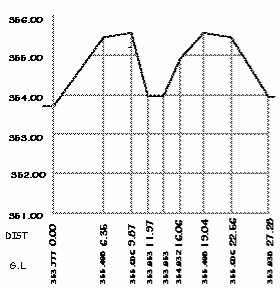
Main Canal - Cross Section at Ch 0.20km

Aliab scheme : Plane, Longitudinal, Cross section on the main canal

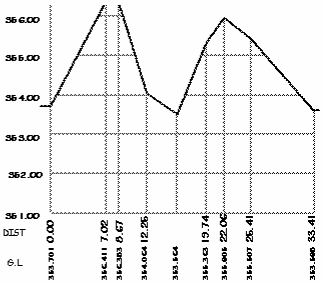




Longitudinal Section Main Canal
Hor scale (1:16000)

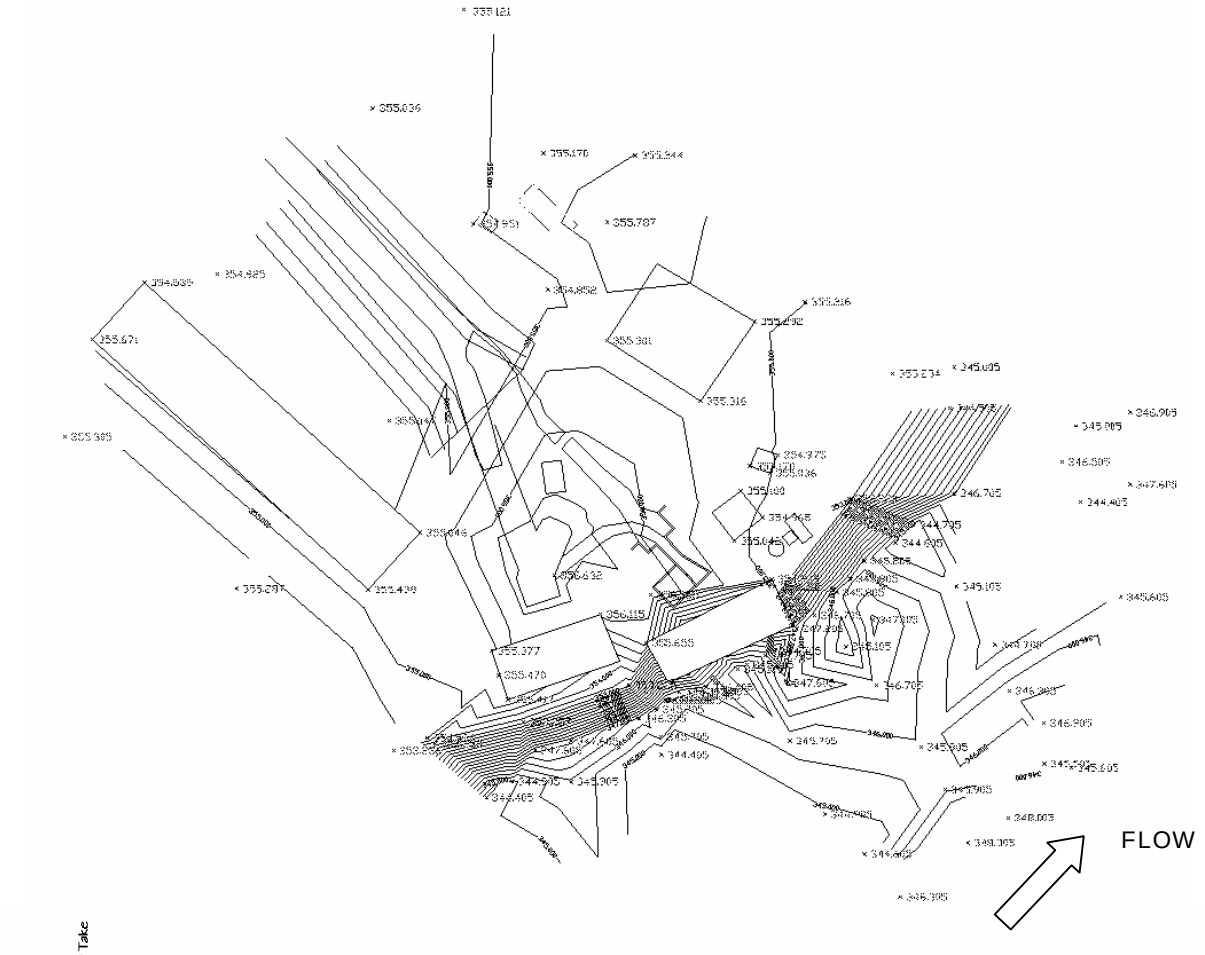


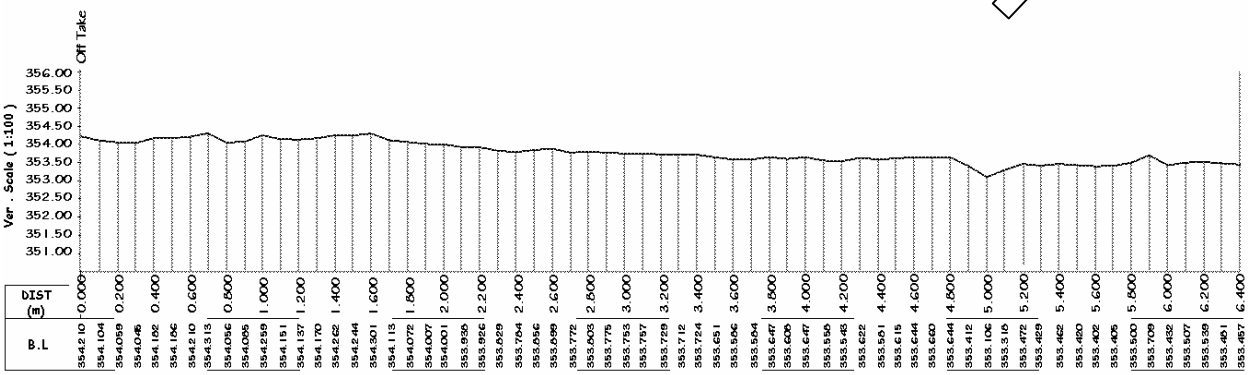
Main Canal - Cross Section at Ch 0.00km



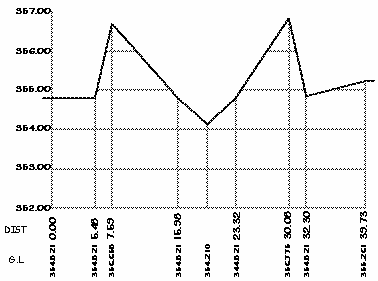
Main Canal - Cross Section at Ch 0.20km

Kitiab scheme : Plane, Longitudinal, Cross section on the main canal

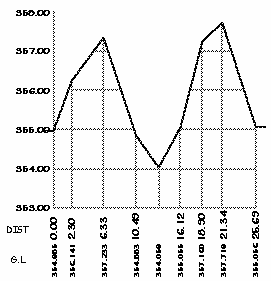




Longitudinal Section Main Canal
Hor scale (1:16000)



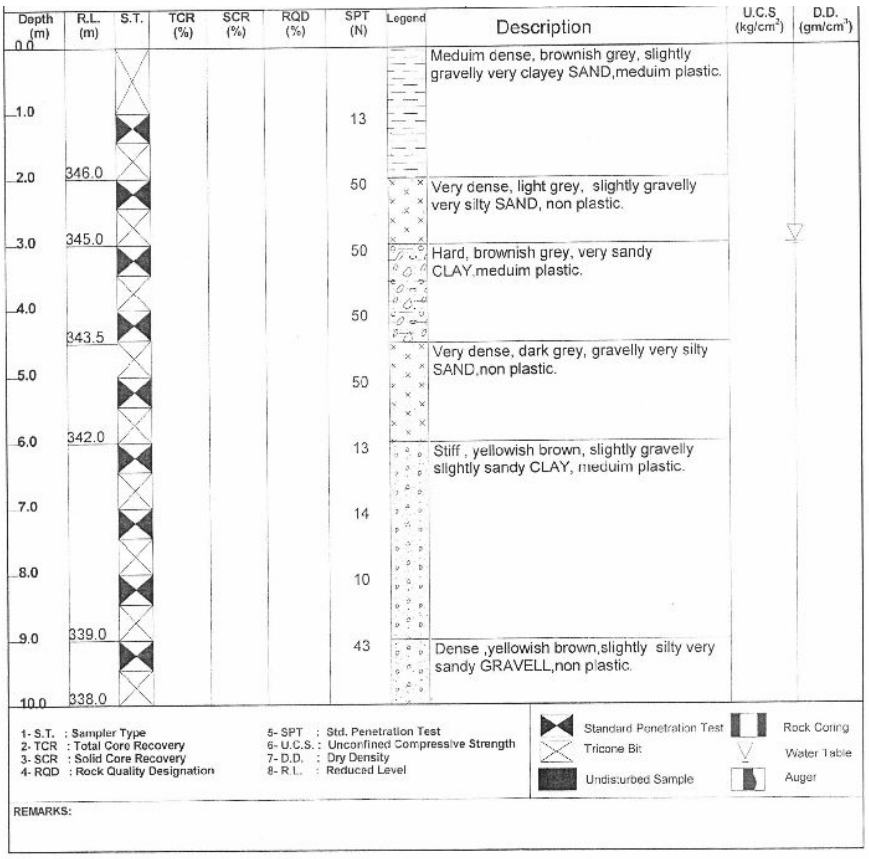
Main Canal - Cross Section at Ch 0.00km



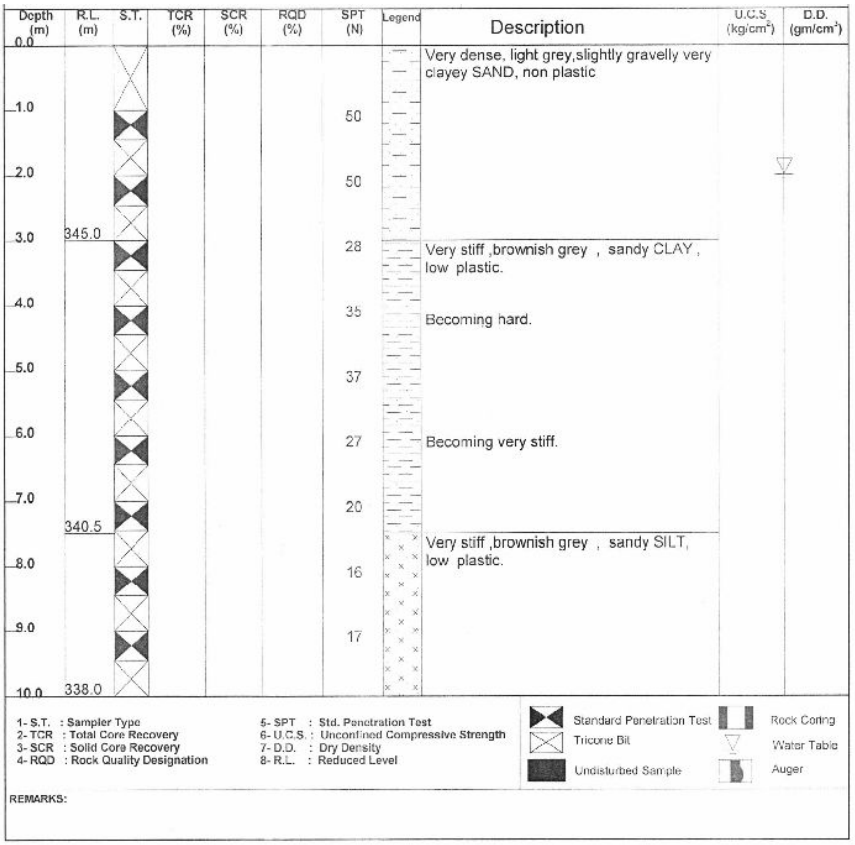
Main Canal - Cross Section at Ch 0.20km

Kadabas scheme : The log of the bore hole (The figure shows geological log of only 10m in depth from surface [around the foundation of the planning pump station] although 30m in total)

Bore hole No.1

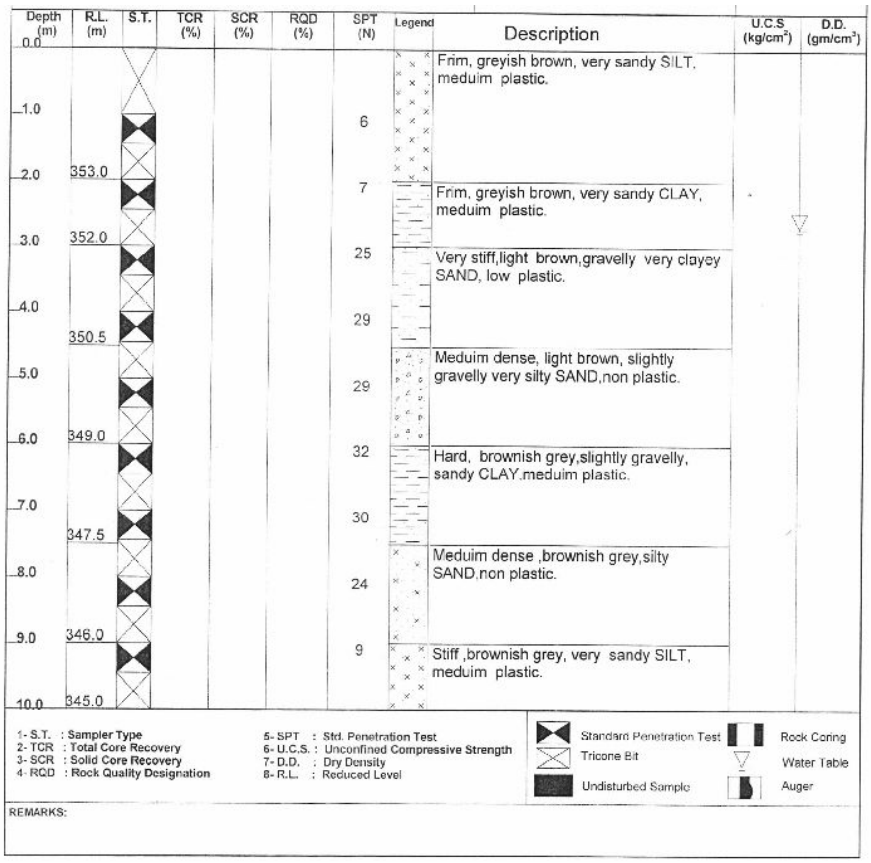


Bore hole No.2

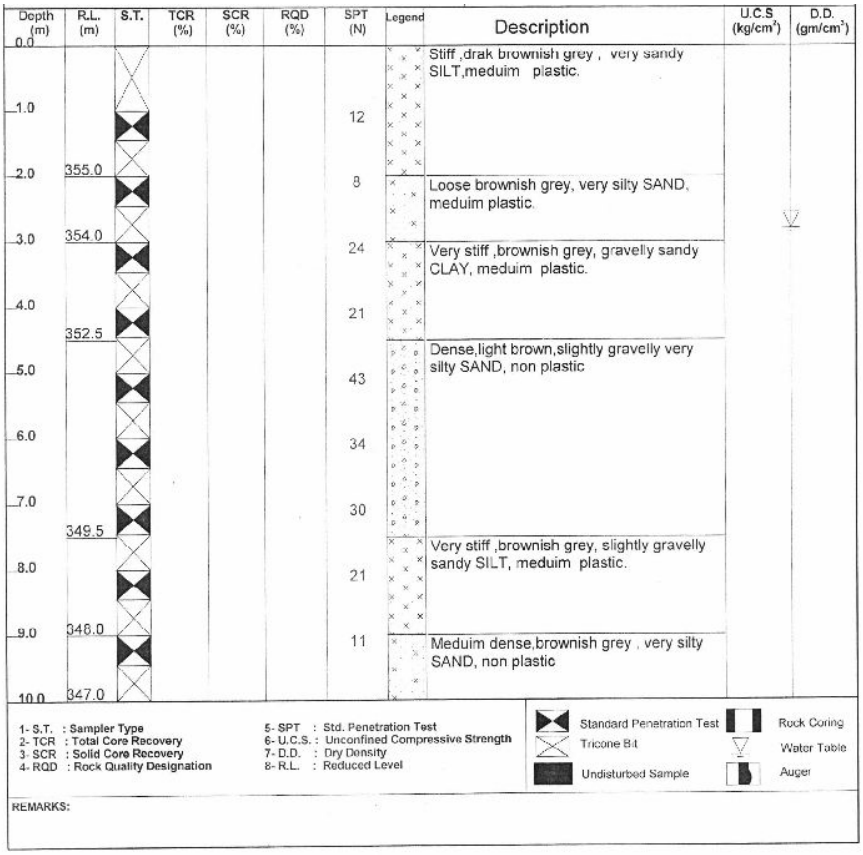


Aliab scheme : The log of the bore hole (The figure shows geological log of only 10m in depth from surface [around the foundation of the planning pump station] although 30m in total)

Bore hole No.1

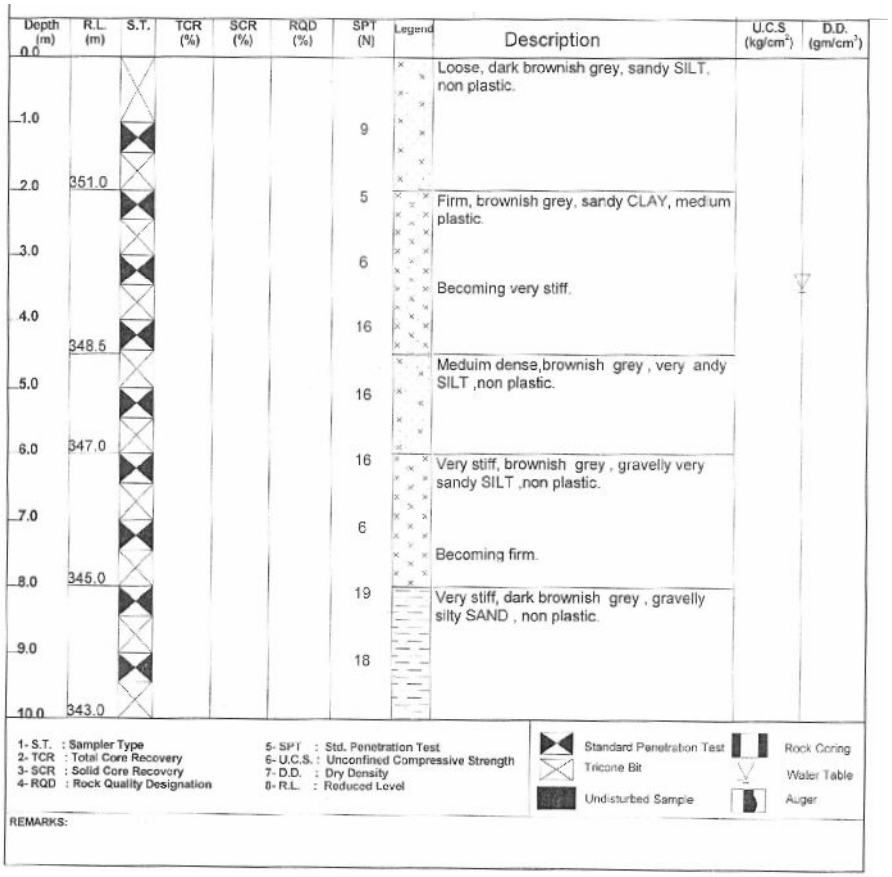


Bore hole No.2

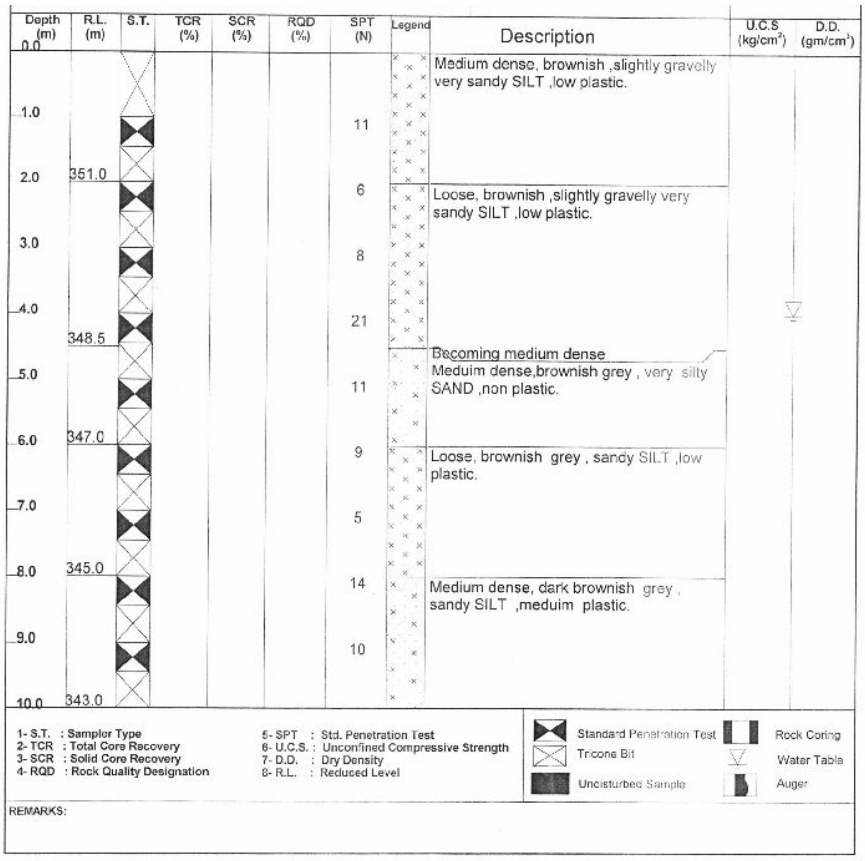


Kitiab scheme : The log of the bore hole (The figure shows geological log of only 10m in depth from surface [around the foundation of the planning pump station] although 30m in total)

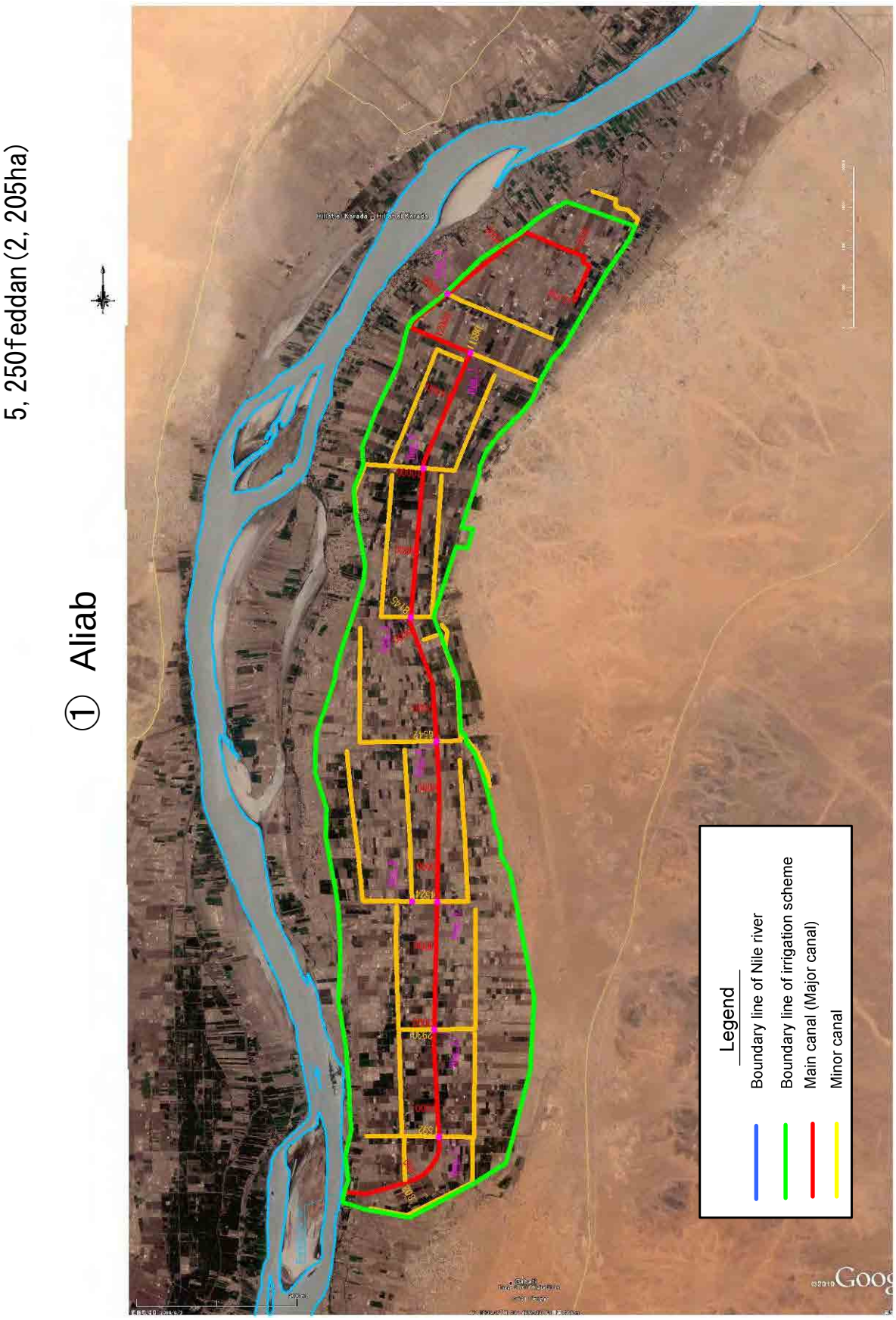
Bore hole No.1



Bore hole No.2

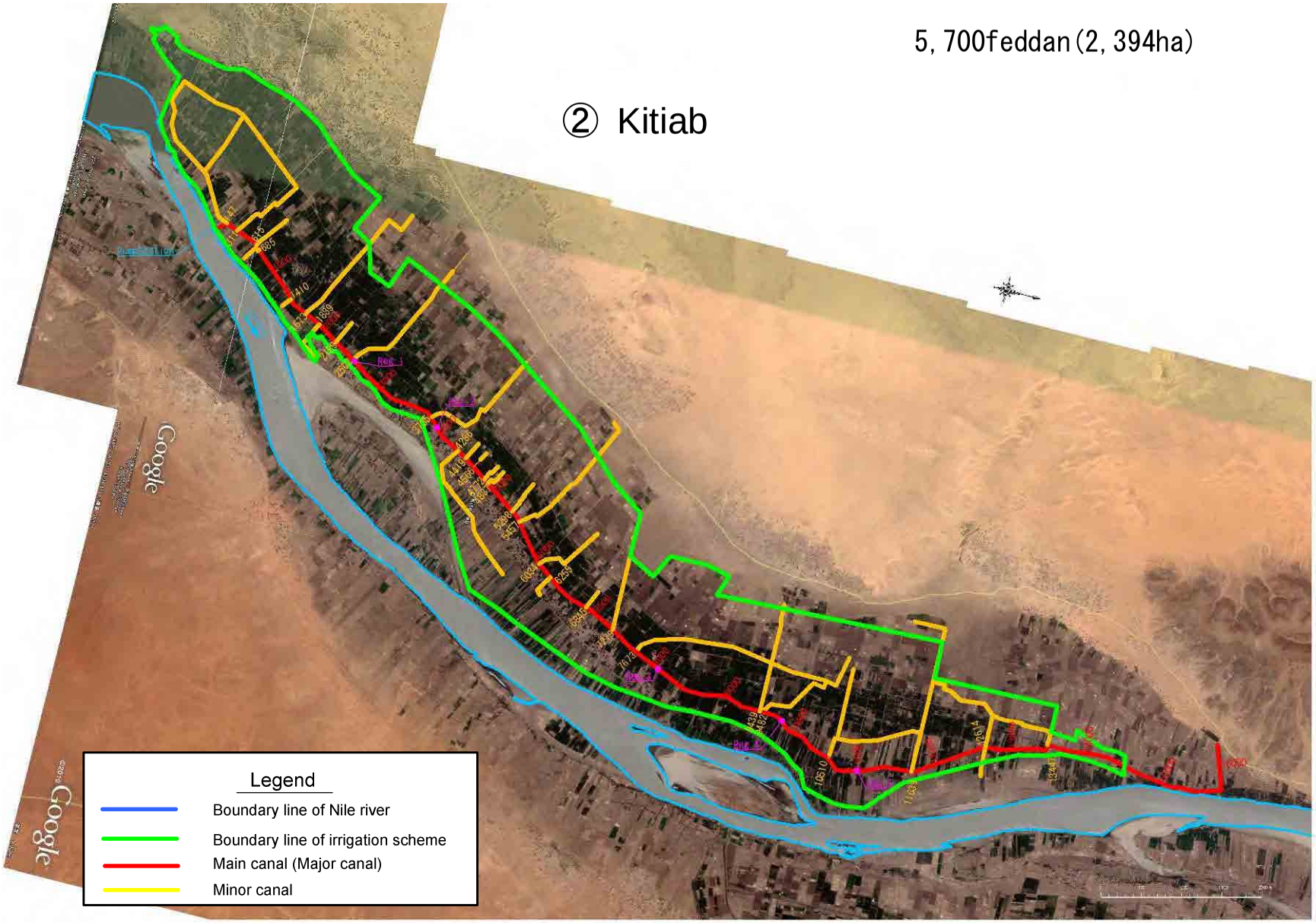


Appendix-6.14 General planned irrigation scheme

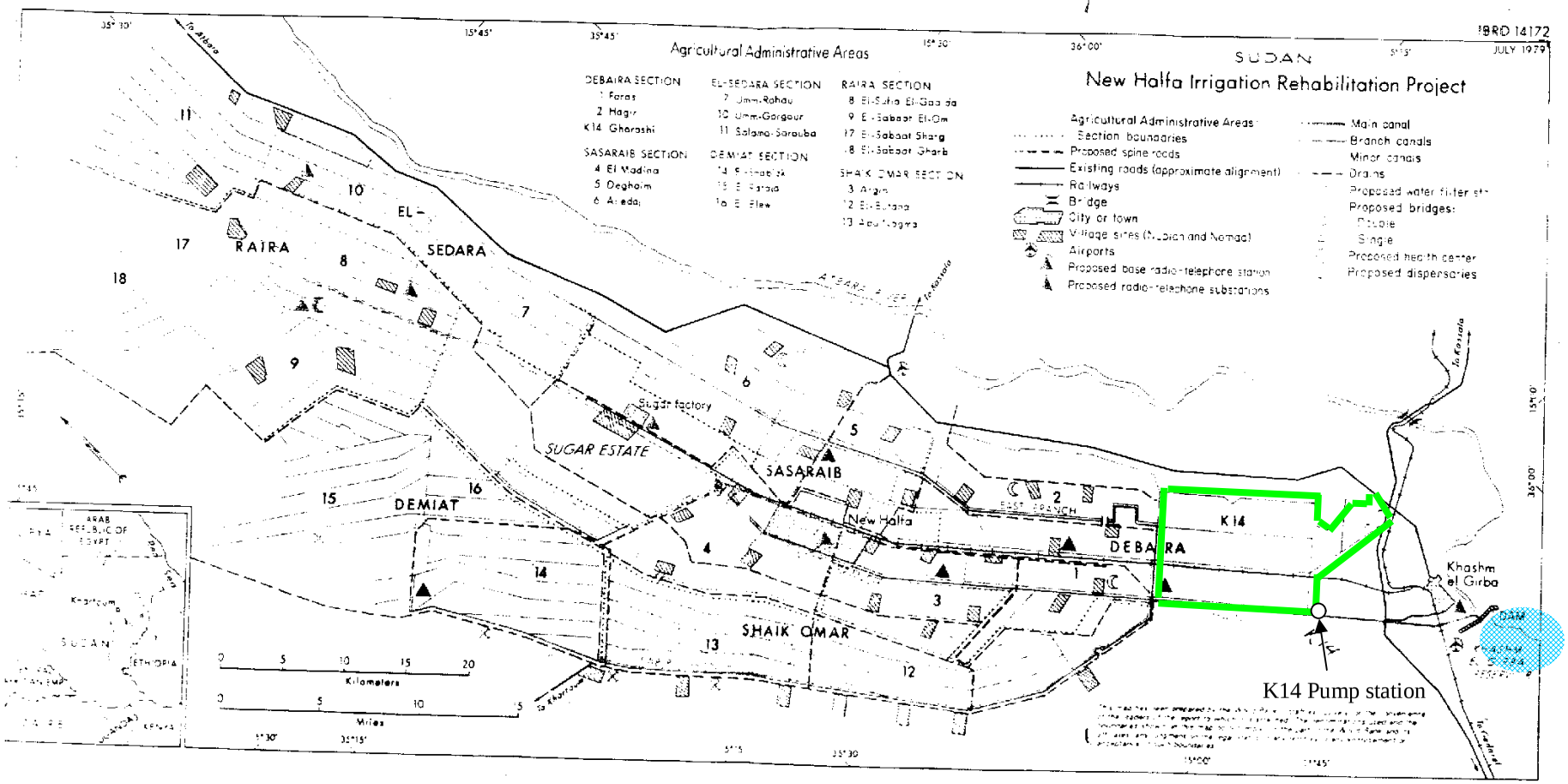


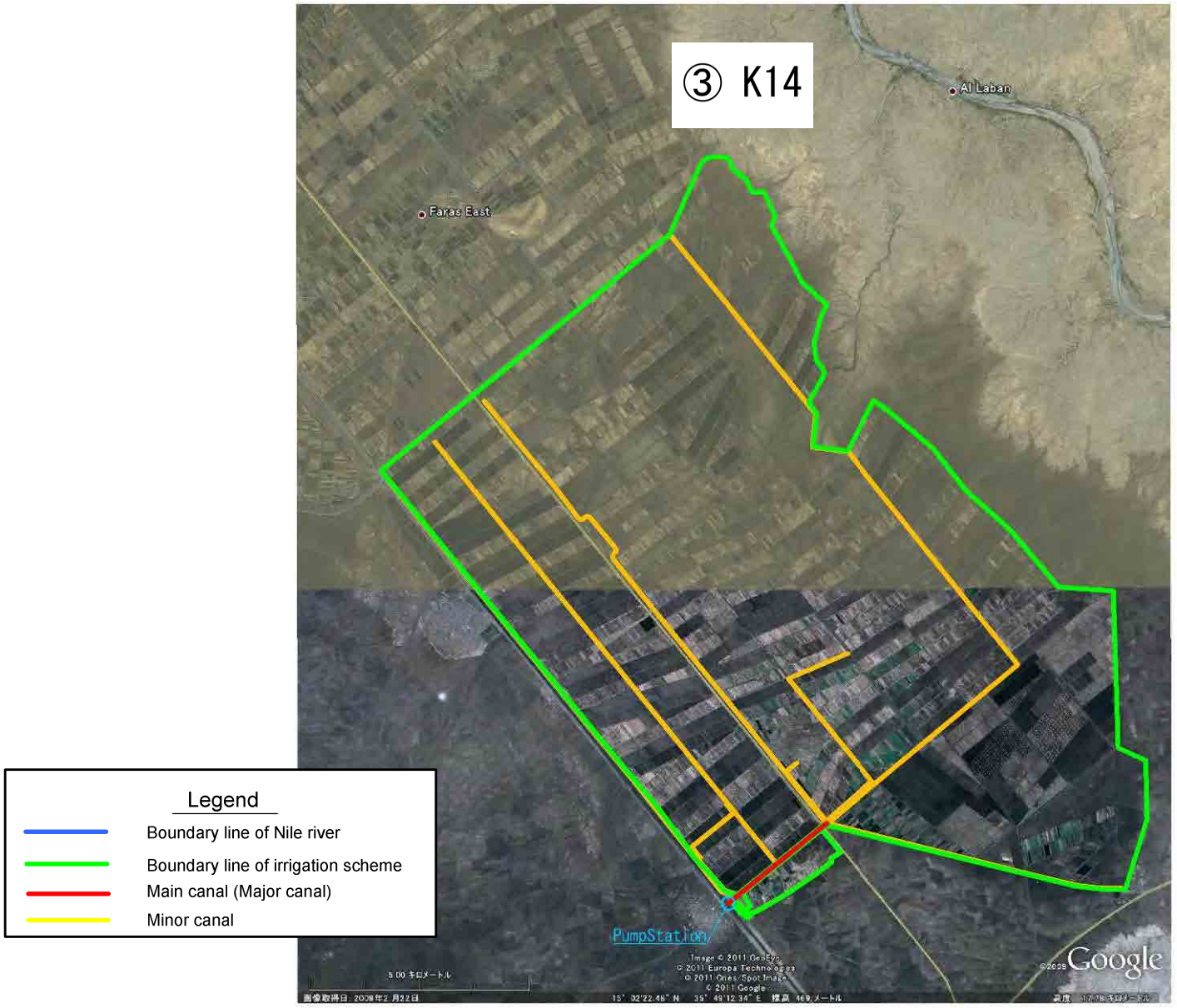
5, 700feddan (2, 394ha)

② Kitiab



New Halfa Irrigation Scheme





30,000feddan

(13,020ha)