カメルーン国
農業・農村開発省

カメルーン国

農業振興インフラ整備事業準備調査

ファイナルレポート
（添付資料）

平成 29 年 2 月
（2017 年）

独立行政法人
国際協力機構（JICA）

NTC インターナショナル株式会社
株式会社アースアンドヒューマンコーポレーション

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List of Annex

1. List of the persons to be interviewd

No	Name	Position	Contact No.	Mail Address
MINADER				
	MVONDO NNA Patrick	MINADER-Direction des Etudes des Programes et de la Coopération		
	FALAINA	MINADER-Direction du Génie Rural et de l'Amélioration du Cadre de Vie en Milieu Rural		
	ONDOA MANGA Tobie	MINADER-Cellule des Projets & Programmes		
	Louisette Clémence Bamzok	MINADER-Cellule des Projets & Programmes		
	ZUE MINTSA OFFRE	MINADER-Direction du Génie Rural et de l'Amélioration du Cadre de Vie en Milieu Rural		
	TETKA JULES	Centre National d'Etudes et d'Experimentation du Machinisme Agricole		
	Ernest Roland ELA EVINA	Centre National d'Etudes et d'Experimentation du Machinisme Agricole		
	CHIN Richard	UNVDA		
	Francis FONAYI WAINDIM	UNVDA-Direction du Génie Rural		
	DJAKOU Dagobert	MINADER-Direction des Organisations Professionnelles Agricoles et de l'Appui aux Exploitations Agricoles(DOPA)		
	Emmanuel BODO	MINADER-Direction des Enquêtes et Statistiques Agricoles		
	BILLE Elise	MINADER-Direction Resouce Humaine		
MINTP				
	Guy Daniel Abune Zoa	MINTP-Direction Générale des etudes techniques		
	Mathurin Zanga	MINTP-Direction Générale des Travaux d'infrastructures Cellule Bad-Banque Mondiale		
	OLINGA O.Vitalis	MINTP Direction Générale des Travaux d'infrastructures Cellule Bad-Banque Mondiale		
	NIWA LONG OTHON	Parc National de Matèriel de Génie Civil		
	ZAMBO Simon Crépin	Parc National de Matèriel de Génie Civil		
	NDZANA I. Firmin	Parc National de Matèriel de Génie Civil		
	TANDONG VICTOR NJOH	Parc National de Matèriel de Génie Civil Agence Régionale du Sud		
	AMOUGUI AHANDA Timothée	Parc National de Matèriel de Génie Civil Agence Régionale du Sud		
	NGOULMA Josaphat René	Parc National de Matèriel de Génie Civil Agence Régionale du Sud		
	TANG AHANDA Barnabé	MINTP-Division de la Planification, de la Programmation et des Normes		
	Ndilassi Innocent	MINTP-Direction Générale des travaux d'infrastructures Direction des Routes Rurales		
MINT				
	Alexis Christian EWOLO	MINT- Direction de Metro		
	MPELE ONANA Serge	MINT-Service de la Climatologie et de la Banque des Données		
MINEPDED				
	KAMGUEM DIEUDONNE	MINEPDED-Direction de la Promotion du Développement Durable		
MINEPAT				
	MISSI Augustine Annette	MINEPAT-General Department of Cooperation and Regional Integration		
	Mme NOAH Epouse OBAMA Albertine Liliane	MINEPAT-Direction Générale de la Cooperation		
	Nekemé Issac	PNDP(MINEPAT)		
	NBOLO Rostan	PNDP(MINEPAT)		
MINEPIA				
	Ekeme née Ndome Lobe Esther Désirée	ACEFA(MINADER+MINEPIA)		
他ドナー				
	Luc NDIMI	World Bank(PIDMA)-Unité de Coodination du Projet		
	André MBAIRANODJI	World Bank(PIDMA)-Unité de Coodination du Projet		
	François KWONGANG	EU-Section Développement Rural, Environnement et Société Civile		
	AMADOU Fotouogboun Kou	Islamic Development Bank(MINADER)		
	Justinius	Grassfield Project(BAD)		
PRODERiP				
	SOKEI Yoshimi	PRODERiP		
	SASAGE Teruhiko	PRODERiP		
	KURIHARA Kazutoshi	PRODERiP		
	SHIINA Suguru	PRODERiP		
	MATSUMOTO Shunsuke	PRODERiP		

2. Minutes of Meeting (Inception Report)

MINUTES OF MEETING ON THE INCEPTION REPORT
FOR
THE PREPARATORY SURVEY
ON
RURAL INFRASTRUCTURE IMPROVEMENT PROJECT
IN
THE REPUBLIC OF CAMEROON

Yaoundé, FEBRUARY 23, 2016

Mr. Mvondo Nna Patrick
Director of DEPC, Ministry of Agriculture and Rural Development (MINADER)

Dr. Takashi KOTEGAWA
Sub-Team Leader, JICA Study Team

Le Directeur des Etudes des Programmes et de la Coopération
Mvondo Nna Patrick
Ingénieur Agro-Economiste

The Study Team for the Preparatory Survey on Rural Infrastructure Improvement Project in Cameroon (hereinafter referred to as "the Study Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Dr. Akira IWAMOTO as Team Leader, and the Ministry of Agriculture and Rural Development (hereinafter referred to as "MINADER") headed by Mr. Mvondo Nna Patrick as Director of MINADER, held a kick-off meeting and discussed on the Inception Report explained by the Study Team.

The list of participants is attached in Annex.

1. Submission of the Inception Report

The MINADER received 10 copies of the Inception Report submitted by the Study Team on February 23, 2016.

2. Kick-off Meeting

A kick-off meeting was held between the Study Team and the MINADER at the Conference room of the MINADER in Cameroon on February 23, 2016 to discuss on the Inception Report.

3. Presentation

The JICA explained the direction of cooperation of MINADER-JICA which is consisted of the technical cooperation named as Upland Rice Development of the Tropical Forest Zone in Cameroon (hereinafter referred to as "PRODERiP" and the Project for the Development of Irrigated and Rainfed Rice Cultivation (hereinafter referred to as "PRODELIP") and the loan project named as Rural Infrastructure Improvement Project in Cameroon. Moreover, the Study Team explained to the MINADER the Inception Report that contains the objectives, approaches and methodologies of the Preparatory Survey on Rural Infrastructure Improvement Project in Cameroon.

4. Discussion

Based on the discussion, the MINADER and the Study Team confirmed their agreement on the contents of the Inception Report. Meanwhile, the following matters were discussed between both the parties.

(a) MINADER and the Study Team agreed that the coordination mechanism with PRODERiP and PRODERIP would become a key for the success of the project.

(b) MINADER and the Study Team agreed that the MINADER would nominate Counter Parts for each expert of the Study Team in order to conduct the survey smoothly.

Annex : LIST OF ATTENDANTS

Cameroon		JAPAN	
Name	**Title**	**Name**	**Title**
Henri Eyebe Ayissi	Minister / MINADER	Shinji Umemoto	Reperesentitive / JICA
EKO'O A. Jean Claude	Secretary General / MINADER	Yuumi Ushiro	Country Officer / JICA
Mvondo Nna Patrick	DEPC / MINADER	Ryosuke Moritaki	Senior Advisor / JICA
Mveng Pauline	Inspector General / MINADER	Takayuki Muraoka	Sub-representitive / JICA
Nka Charles Noël	CT2 / MINADER	Gaston Galamo	Program Officer /JICA
Voundi Jacquinot	I1/IGDR / MINADER	Sokei Yoshimi	Expert / PRODERiP
Bedoung Gisele	I2/IGDR / MINADER	Akira IWAMOTO	Leader of Consultant
Mbili Oloume Jean Pierre	DDA / MINADER	Takashi Kotegawa	Sub-leader of Consultant
Mohamadou Saoudi	DRFP/ MINADER	Shigeru Takagi	Consultant
FALAINA	DGRCV / MINADER	Yusuke NAKAYAMA	Consultant
Ondoa Manga Tobie	CCPP/DEPC / MINADER	Hiroshi ISHII	Consultant
Vundi Fidele Magloire	Cadre Technique / MINADER	Hiroyuki KURONUMA	Consultant
Chin Richard	DG / UNVDA	Ayako MORISHIMA	Consultant
Francis Fonayi Waindim	DGR / UNVDA	**Donors**	
Mathias Mawo Lon	DAP / UNVDA	**Name**	**Title**
Olinga O.Vitalis	IP/ Cellule RAD/BM / MINTP	CADILLA FALCO JORDI	Gestion de Programmes Infrastructures / EU
Obama Albertine Liliane	IE/DNS / MINEPAT	FERNANDEZ OSUMA juan	Gestion de Programmes Infrastructures / EU
Monono Absalom Woloa	Secretary General / North West Governor's office	Ndimi Luc	Secretary General / PIDMA
Keyantio Augustin	Inspector General / East Governor's office		

3. Minutes of Meeting (Interim Report)

MINUTES OF MEETING ON THE INTERIM REPORT
FOR
THE PREPARATORY SURVEY
ON
RURAL INFRASTRUCTURE IMPROVEMENT PROJECT
IN
THE REPUBLIC OF CAMEROON

Yaoundé, JUNE 22, 2016

Mr. Mvondo Nna Patrick
Director of DEPC, Ministry of Agriculture and Rural Development (MINADER)

Dr. Akira IWAMOTO
Team Leader, JICA Study Team

Mr. Shinji UMEMOTO
Representative, JICA Cameroon Office

The Study Team for the Preparatory Survey on Rural Infrastructure Improvement Project in Cameroon (hereinafter referred to as "the Study Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Dr. Akira IWAMOTO as Team Leader, and the Ministry of Agriculture and Rural Development (hereinafter referred to as "MINADER") headed by Mr. Mvondo Nna Patrick as Director of MINADER, held a meeting and discussed on the Interim Report explained by the Study Team.

The list of participants is attached in Annex.

1. Meeting

A Meeting was held between the Study Team and the MINADER at the Conference room of the MINADER in Cameroon on JUNE 22, 2016 to discuss on the Interim Report.

2. Presentation

Dr.Kotegawa from the Study Team made a presentation for the contents stated below.

A. The following topics were introduced:

1. Overall objectives of the need to increase rice production in the country
2. Objectives and zones of the studies

B. The various components of the project was elaborated as follows :

1. Component of Irrigation Development
   - Explanation of the identified problems and the proposed solutions.
   - Explanation of the 4 options proposed and the costs.
2. Component of Road Access Improvement
   - Explanation of the basic criteria for the selection of the candidate roads.
   - Explanation of the methodology of the road selection.
   - Presentation of the selection list in terms of prioritization and the site located maps.
   - Explanation of advantages of using a stabilizer to reinforce groundworks compared to conventional methods used locally.
   - Proposition of road dimensions.
   - Presentation of 2 costing options for selected road list.
3. Component of Installation of Agricultural Machinery and Equipment
   - Presentation of the concerned machines.
   - Explanation of the identified problems and the proposed solutions.

- Presentation of the Japanese fabricated machinery and its rice-polishing potentiality to improve the quality of rice.
- Explanation of the Proposed Installation Site.
- Presentation of the 3 costing options for the type and number of machines to be acquired.

4. For Soft Component
   - Explanation of how training programs can be organized for the various components.

C. Explanation for the most advantageous option combination amongst the components and its costs
D. Presentation of the special terms and conditions for applying the STEP scheme to the Japanese Loan Projects.
E. Presentation of the Preparatory Study Calendar
F. Invitation of the attendees to a question-comment session.

3. Discussion

Comment 1:

Mr Mvondo expresses his appreciation for the Study Team who has always carried out the studies in a participative manner. He reminds the attendees that the Study Team has always worked closely with the various members of MINADER and UNVDA in the last months.

Comment 2 :

Mr Falaina's first question

1. For the road component, he wonders if it is necessary to use the stabilizer to upgrade the inland farm roads. He thinks that if the existing laterite would be compacted on site the results should be good enough for such roads.

Reply from Mr Sato from the Study Team

The stabilization machine is only applicable to roads with heavy traffic and the on-site laterite will be combined with cement to strengthen its base capacity. This method will not be used on internal farm roads.

Mr Falaina's second question

2. As for the promotion of fully polished rice production, he wonders if this would not deprive the consumers from its nutritive value as it is often considered as less nutritional than brown rice.

Reply from Mr Nagaoka from the Study Team

Basically, the milling machine to be used is adaptable to the needs of the markets. Should the market require less polished rice, the degree of the polishing process can be adjusted as per the demand requires.

Mr Chin of UNVDA adds that the most important factor in the rice-polishing process lies in the rice seed that is to be planted. The actual problem why the rice polishing process has been unsuccessful is because various rice originating from different seeds have been combined together during the process. As a result, the whiteness of the rice reacts differently after the process. Thanks to the technical team (PRODERIP), this problem will be solved basically with the plantation of a single rice seed at the origin.

Comment 3 :

Mrs Bamzok is very impressed by findings of the Study Team and thinks that the propositions made by the Study Team are very reasonable. She would like to know though for the STEP scheme how the 30% of the tied loan works; that is, if Cameroonian candidate companies would have to go to Japan to obtain Japanese products.

Replies from Dr Kotegawa and Mr Umemoto

Basically, more than 30% of the project costs will be allocated to Japanese companies for the supply of Japanese products. Nevertheless, the rest of the project costs will be used on locally obtainable products and services.

Mrs Bamzok finds this tied loan is very reasonable compared to loan projects offered by other donors.

Comment 4 :

Mr Mvondo asks if the maintenance of the concerned roads after rehabilitation has been taken into consideration. Will the construction machines be left to the disposal of the local authorities?

Reply from Dr Iwamoto of the Study Team

Dr Iwamoto explains that this is where the importance of the Soft Component comes in place. Training will be provided to the various staff for not only maintaining the roads, but also the construction and agricultural machines.

Reply from Mr Umemoto

Mr Umemoto stresses that Japan is 'together' with Cameroon on this project. Hence, if the training is judged not sufficient when the time comes, other solutions may be proposed should the need arise.

Mr Mvondo shares two news:

- The UNVDA Development Plan now figures as part of the Triennial Urgency Development Plan thanks to the Cameroonian Prime Minister.
- The candidate road list has been approved by the Minister of MINADER.

Mr Mvondo concludes that all attendees appreciates the good works proposed by the Study Team and confirms that the propositions made are acceptable and reasonable.

On this note, Mr Mvondo thanks all the attendees for their presence and ends the meeting session.

Annex : LIST OF ATTENDANTS

Cameroon		JAPAN	
Name	**Title**	**Name**	**Title**
Mvondo Nna Patrick	DEPC / MINADER	Shinji Umemoto	Reperesentative / JICA
FALAINA	DGRCV / MINADER	Takayuki Muraoka	Sub-representative / JICA
Mbili Oloume Jean Pierre	DDA / MINADER	AGNES OKODOMBE	Chargée Programmes Agriculture, Pêche et Environement /JICA
Bamzok Louisette	DEPC/CPP	Akira IWAMOTO	Leader of the Study Team
MBALLA ONANA Maigueite	CEAA/CPP	Takashi Kotegawa	Sub-leader of the Study Team
Mbock Clestin	Cellule de Suivi des MINADER	Shigeru Takagi	Member of the Study Team
Chin Richard	DG / UNVDA	Fusashige Sato	Member of the Study Team
Francis Fonayi Waindim	DGR / UNVDA	Akihiro Fukuda	Member of the Study Team
Mathias Mawo Lon	DAP / UNVDA	Hirokazu Nagaoka	Member of the Study Team
Olinga O.Vitalis	IP/ Cellule RAD/BM / MINTP	Hiroyuki KURONUMA	Member of the Study Team
Ngou Tamdem Gilbete	Chef Service de la Coopération Bilatérale /SDC	Ayako MORISHIMA	Member of the Study Team
MEYOMESSE ENGOLO Calvin	Consultant	Polly Le MOIGNE	Coordinator of the Study Team
		SOPTCHOM Victor	Civil Engineer of the Study Team
		NOAH Taustin	Interpreter of the Study Team

4. Minutes of Meeting (Japan Visit)

MINUTES OF MEETING ON THE JAPAN VISIT

FOR

THE PREPARATORY SURVEY

ON

RURAL INFRASTRUCTURE IMPROVEMENT PROJECT

IN

THE REPUBLIC OF CAMEROON

Tokyo, JULY 17, 2016

H.E. Mr. Eyebe Ayissi Henri
Minister, Ministry of Agriculture and
Rural Development (MINADER)

Dr. Akira IWAMOTO
Team Leader, JICA Study Team

The Study Team for the Preparatory Survey on Rural Infrastructure Improvement Project in Cameroon (hereinafter referred to as "the Study Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Dr. Akira IWAMOTO as Team Leader held the visit program in Japan for Ministry of Agriculture and Rural Development (hereinafter referred to as "MINADER"). The three delegations, H.E. Mr. Eyebe Ayissi Henri, Minister of MINADER, Mr. MVONDO NNA Patrick, Director of Department of Studies, Programmes, Cooperation and Mr. VOUNDI Jacquinot, Inspector general, Rural Development came to Japan. They visited the Japanese companies which can provide the proposed machines such as tractors, rice milling machine, country elevator, etc. Through the visit they discussed on the Preparatory Survey which is being carried out by the Study Team.

The executed schedule of program is following;

No	Date	Time	Activity
1	7/10 (sun)		21:05 Dept. from Yaoundé (AF909)
2	7/11 (mon)	AM	07:10 Arrival at Paris
		PM	13:55 Dept. from Paris (AF276)
3	7/12 (tue)	AM	8:30 Arrival at Tokyo (Narita airport)
		PM	14:30-16:30 Visit KUBOTA factory (Tractor and etc.) at Tsukuba city, Ibaraki Pref.
4	7/13 (wed)	AM	10:00 -11:00 Courtesy call to Cameroon Embassy 11:30 -12:30 Courtesy call to JICA HQ
		PM	13:30-14:30 Courtesy call to Ministry of Agriculture, Forestry and Fisheries 17:25 Dep. from Haneda airport 18:45 Arrival at Hiroshima airport
5	7/14 (thu)	AM	10:00-11:30 Visit SATAKE HQ at Higashi Hiroshima City
		PM	13:00 Dep. from Hiroshima airport 14:35 Arrival at Haneda airport 18:00-18:30 Courtesy call to Ministry of Foreign Affairs
6	7/15 (fri)	AM	10:00-11:30 Visit Country Elevator of JA Utsunomiya at Utsunomiya city, Tochigi Pref.
		PM	15:00-16:30 Visit rice milling plant of ITAMI SANGYO at Tsurugashima city, Saitama Pref.
7	7/16 (sat)		Off Day
8	7/17 (sun)	PM	22:55 Dept. from Tokyo (AF293)
9	7/18 (mon)	AM	04:30 Arrival at Paris
		PM	14:15Dept. from Paris (AF900) 19:40 Arrival at Yaoundé

Contents of the visit

A. Courtesy calls:
   1. JICA Head Quarters
   2. Cameroon Embassy
   3. Ministry of Agriculture, Forestry and Fisheries
   4. Ministry of Foreign Affairs

B. The tours at the factories and the facilities of Agricultural Machinery:

1. Kubota
   - Observation of the assemblage at tractors factory
   - Explanation of the advantage of Japanese tractor compared with other country's one
2. Satake
   - Explanation of Satake products
   - Demonstration of Optical Sorter
3. Country Elevator
   - Explanation and observation of the facility
4. Rice Milling Plant
   - Explanation and observation of the plant

During the program, the following points have been discussed:

i. The Cameroonian side requests to introduce the Agricultural Machinery which meets meteorological and geological condition in Cameroon.
ii. Japan will continue to support Cameroon for the agriculture development especially for rice farming sector as the one of most important countries for the development in Central Africa area.
iii. The Cameroonian side requests to increase the loan volume for the project being prepared by the Study Team.

Future Programs are shown below:

- The presentation of Draft Final Report (The beginning of October)
- The fact finding mission of JICA (The beginning of October)
- The Submission of Final Report (December)

After the submission of Final Report, JICA will execute the following events:

- The appraisal mission
- The signing Exchange of Note
- The signing Loan Agreement

H.E. Mr. Henri Eyebe Ayissi expresses his appreciation for the Study Team who organized this visit program in Japan. He reminds all members that the Study Team and MINADER will continue to work together to finalize the Preparatory Survey and realize the Yen Loan project.

5. Minutes of Meeting (Draft Final Report)

MINUTES OF MEETING ON THE PRESENTATION OF DRAFT FINAL REPORT

FOR

THE PREPARATORY SURVEY

ON

RURAL INFRASTRUCTURE IMPROVEMENT PROJECT

IN

THE REPUBLIC OF CAMEROON

Yaoundé, December 14, 2016

Mr Mvondo Nna Patrick
Director of DEPC, Ministry of Agriculture and Rural Development (MINADER)

Le Directeur des Etudes des Programmes et de la Coopération
Mvondo Nna Patrick
Ingénieur Agro-Economiste

Mr Shinji UMEMOTO
Representative, JICA Cameroon Office

JAPAN INTERNATIONAL COOPERATION AGENCY
JICA
Cameroon Office

Dr Akira IWAMOTO
Team Leader, JICA Study Team

The Study Team for the Preparatory Survey on Rural Infrastructure Improvement Project in Cameroon (hereinafter referred to as "the Study Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Dr Akira IWAMOTO as Team Leader, and the Ministry of Agriculture and Rural Development (hereinafter referred to as "MINADER") headed by Mr Mvondo Nna Patrick as Director of MINADER, held a meeting and discussed on the Draft Final Report explained by the Study Team.

The list of participants is attached in Annex.

Minutes of Presentation-Meeting on 14 December 2016

15H35 Opening Speech by Mr. Mvondo (Director of DEPC) welcoming and thanking everyone's presence at the meeting

15H40 Introduction Speech by Mr Umemoto (Director of JICA Cameroon) thanking all the Cameroonian parties' support to the study team and asking for continued support to the Japanese Team for the realization of the Project. He emphasized that all questions and comments, if any, should be made this meeting as this is the last occasion to do so.

He also introduced Mr Furukawa (First Secretary of Japan Embassy in Cameroon) who just arrived in Cameroon recently.

15H50 Presentation of the Draft Final Report by the study team: Mr Iwamoto, Mr Sato and Mr Fukuda

Contents of the Presentation

A. The following topics were introduced:
1. Significance of the project implementation for Cameroon and Japan
2. Progress of the preparatory survey
3. Objectives and target area for the project

B. The following components of the project were elaborated :
1. For Irrigation Component
   - Explanation of the identified problems and the proposed solutions
2. For Access Road Component
   - Explanation of procedures for target road selection
   - Presentation of summary of selected target roads
   - Explanation of the identified problems and the proposed solutions

3. For Agricultural Machinery Component
   - Explanation of the identified problems and the proposed solutions
   - Presentation of the Japanese fabricated machinery and its rice-polishing potentiality to improve rice production capacity
   - Presentation of drawings relating to the country elevator and the transformation unit
4. Explanation of how training programs (soft component) can be organized for the various components (Irrigation, Access Road, Agricultural Machinery and Marketing)

C. Explanation of the Overall Concept of the Project
D. Explanation of the Project Implementation Schedule and Organization
E. Explanation of the procurement system
F. Invitation of the attendees to a question-comment session.

16h35 Opening of the Question-Comment Session

Comments and answers

Question 1 :

During the Fact Finding Mission, the request to modify the name of the project was made and was approved. Mr Mvondo wondered why this change has not been taken into account in the draft final report.

Answer from the study team :

Dr Iwamoto explained that the draft final report is based on the contract made between the study team and JICA office in Japan since the beginning of the year. Hence, the team has to abide to this project name for the submission of all the output documents related to this contract.

Question 2 :

Mr Mvondo would also like to know why the costs of the project are not mentioned at all in the presentation.

Answer from the study team :

Dr Iwamoto explained that the study team has been contracted by JICA to formulate the technical aspect of the project. As far as the costs of the project are concerned, the details were discussed between the Cameroonian authorities and the Fact Finding Mission dispatched by JICA headquarters in October 2016 and a consensus was reached between both parties.

Mr Ondoa also thinks that the Ministry of Commerce should be included in the steering committee as the rice produced will have to be sold on a national basis.

Answers:

1. Mr Iwamoto explained that the annual harvest of 15 000 t is not only based on the paddy rice to be collected from the 918 ha of the selected site but also includes the 3000 ha actually owned by UNVDA.

As for annual double rice crop production, Mr Iwamoto thinks it may be socially and economically difficult for farmers to plant only rice and not other crops which they may need for personal consumption or economic purposes as well.

As for the steering committee, the organization of the steering and implementation committees was clearly agreed upon during the Fact Finding Mission by both Cameroonian and Japanese sides. The study team suggests that MINADER discuss this matter directly with the JICA Appraisal Mission next year.

2. Mr Chin explained that in the past, rice crops were produced twice a year but it is no longer the case especially with the existence of cattle farming. The Ndop valley is a grazing area for the cattle and until there is another option, there is a need to respect this.

Mr Chin also reminded everyone that the NDOP valley is often known for its rice but in reality, the other crops like tomatoes and corns produced in the zone are also very important sources of income for the farmers.

As for the need to install a levy system to be paid by the farmers, Mr Chin thinks that it is an important issue to be discussed internally. Many years ago, the levy system existed but it was abolished due to the economic crisis.

3. Mr Mvondo agrees that this levy issue concerns basically the Cameroonian side and needs to be discussed internally in the near future.

17h00 Mr Mvondo thanked all the attendees for their presence and ended the meeting session.

After the presentation, MINADER received 10 copies of the Draft Final Report submitted by the study team.

MINADER has been requested to submit all comments, if any, concerning the draft final report before 20th December 2016. No comments will be taken into account after the mentioned-date.

Annex : LIST OF ATTENDANTS

Cameroon		JICA	
Name	**Title**	**Name**	**Title**
Mvondo Nna Patrick	DEPC / MINADER	Shinji Umemoto	Reperesentitive / JICA
Chin Richard	DG / UNVDA	Takayuki Muraoka	Sub-representitive / JICA
Francis FONAYI Waindim	DGR / UNVDA	OKODOMBE Agnes	Program Officer /JICA
FALAINA	DGRCV / MINADER	**Japan Embassy**	
ONDOA Tobie	CCPP/DEPC / MINADER	Hiroshi FURUKAWA	First Secretary
VESSAH Daouda	SDMA/ MINADER	**JICA Study Team**	
MESSIA MESSIA Georges Cheistien	CS / MINADER	Akira IWAMOTO	Leader of consultant
Mme Ngou Tamdem G.A	CS/ MINADER	Fusashige SATO	Consultant
TSANGUE poul yves	Cardre MINADER	Akihiro FUKUDA	Consultant
ZUE	CS/DGRCV/MINADER	Hiroyuki KURONUMA	Consultant
EONE NSOGA OSCAR	Cadre/MINEPAT	Ayako MORISHIMA	Consultant
DJAKOU Dagobert	DOPA/MINADER	Polly Le MOIGNE	Local Staff
		SOPTCHOM T. Victor	Local Staff
		ZAMBOU Djibril	Local Consultant

6. Annex of Irrigation Component

Result of Soil Profile Survey (1)

Upper Site of Upper Bumenda

Date of Soil Survey：14th/Mar/2016
Surveyor：Takashi KOTEGAWA
Location： 5°58'38.30"N、10°24'37.99"E
Altitude：1,179 m
Soil Classification：
Remarks：The soil pit is located in the rice seed producing farmland managed by the UNVDA. Since the farmland belongs to UNVDA, the cultivation activities are rarely conducted in dry season. The farmland was reclaimed approximately 40 years ago. The clear horizons are observed between each layer. The soil texture is assumed to be high in clay contents in the soil. Moreover, the viscosity, plasticity and compactness are also high indicating that the amount of vertical drainage of the water would be low, while the soil could retail the soil nutrients for the favourable growth of rice. The mottles of iron are observed from the upper layer to lower layer though its abundance is different depending on the layers.

Horizon	Range(cm)	Profile
Ap	0-14/16	【Horizon】：Smooth, Abrupt、【Color (Wet)】：5YR 3/4、【Mottles】： Irregular, Few、【Soil Texture】：Light Clay、【Gravel】： Fine gravel, Sub-angular, Few、【Structure】：Week, Fine, Sub-angular blocky、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Medium (20-24mm)、【Hardness】：Slightly Hard、【 Plant roots】：Fine, Common、
Ad	14/16-30	【Horizon】：Smooth, Clear、【Color (Wet)】：5YR 3/4、【Mottles】： Irregular, Few、【Soil Texture】：Clay Loam、【Gravel】： Fine gravel, Sub-angular, Few、【Structure】：Week, Fine, Sub-angular blocky、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Compact (25-28mm)、【Hardness】：Hard、【 Plant roots】：Fine, Very few、
B	30-45/50	【Horizon】：Smooth, Clear 、【Color (Wet)】：5YR2/3、【Mottles】：Irregular, Common、【Soil Texture】：Clay Loam、【Gravel】： Fine gravel, Sub-angular, Few、【Structure】：Massive、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Very compact (>29)、【Hardness】：Hard、【 Plant roots】： Fine, Very few
C1	45/50-68	【Horizon】：Smooth, Clear 、【Color (Wet)】：5YR3/3、【Mottles】： Irregular, Common、【Soil Texture】：Light Clay、【Gravel】：None 、【Structure】：Massive 、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Very compact (>29)、【Hardness】：Hard、【 Plant roots】：None
C2	68-85+	【Color (Wet)】：5YR4/4、【Mottles】： Irregular, Common 、【Soil Texture】：Clay Loam、【Gravel】：None 、【Structure】： Massive 、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Very compact (>29)、【Hardness】：Very Hard、【 Plant roots】：None

Result of Soil Profile Survey (2)

Middle Site of Upper Bumenda

Date of Soil Survey：14th/Mar/2016
Surveyor：Takashi KOTEGAWA
Location： 5°58'17.39"N、10°25'2.84"E
Altitude：1,170 m
Soil Classification：
Remarks：The soil pit is located in the farmland managed by the local farmer. The farmland is cultivated for maize, beans etc. in dry season while paddy cultivation is conducted in rainy season. The farmland was reclaimed approximately 40 years ago. The soil clay contents are assumed to be high in the soil of each layer. The mottles of iron in the lower soil layer are more abundant than that of Upper site. Moreover, the accumulation of iron is observed in the B horizon indicating that the permeability of surface layer could be low and the reduced condition of the soil in the lower layer might be affected by the ground water.

Horizon	Range(cm)	Profile
Ap	0-15/18	【Horizon】: Wavy, Claer、【Color (Wet)】: 5YR 3/1、【Mottles】: Irregular, Few、【Soil Texture】: Clay Loam、【Gravel】: Fine gravel, Sub-angular, Few、【Structure】: Week, Fine, Sub-angular blocky、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Medium (20-24mm)、【Hardness】: Slightly Hard、【 Plant roots】: Fine, Common、
Bdgir	15/18-20/22	【Horizon】: Wavy, Clear、【Color (Wet)】: 5YR 4/4、【Mottles】: Irregular, Common、【Soil Texture】: Light Clay、【Gravel】: Fine gravel, Sub-angular, Few、【Structure】: Massive 、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Slightly Hard、【Plant roots】: Fine, Very few
Cg1	20/22-50	【Horizon】: Smooth, Clear 、【Color (Wet)】: 5YR 5/1、【Mottles】: Irregular, Abundant、【Soil Texture】: Clay Loam、【Gravel】: None 、【Structure】: Massive、【Viscosity】: Sticky、【Plasticity】: Plastic、【Compactness】: Very compact (>29)、【Hardness】: Very Hard、【Plant roots】: Fine, Very few
Cg2	50-80+	【Color (Wet)】: 5YR 6/1、【Mottles】: Irregular, Abundant 、【Soil Texture】: Light Clay、【Gravel】: None 、【Structure】: Massive 、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Very Hard、【 Plant roots】: None

Result of Soil Profile Survey (3)

Lower Site (1) of Upper Bumenda

Date of Soil Survey：14th/Mar/2016
Surveyor：Takashi KOTEGAWA
Location： 5°58'22.02"N、10°25'51.79"E
Altitude：1,161 m
Soil Classification：
Remarks：The soil pit is located in the farmland managed by the local farmer. The farmland is cultivated for maize, beans etc. in dry season while paddy cultivation is conducted in rainy season. The farmland was reclaimed approximately 40 years ago. The soil clay contents are assumed to be high in the soil of each layer. The ground water are observed in this soil pit. The height of ground water is around 60 cm from the surface. The mottles of iron are found in the lower layer, but most of soil colors in this pit are greyish, indicating the strongly reduced condition of the soil.

Horizon	Range(cm)	Profile
Ap	0-15/22	【Horizon】: Irregular, Clear、【Color (Wet)】: 5YR 3/1、【Mottles】: None、【Soil Texture】: Light Clay、【Gravel】: Fine gravel, Sub-angular, Few、【Structure】: Week, Fine, Sub-angular blocky、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Slightly Hard、【Plant roots】: Fine, Common
BC	15/22-42/45	【Horizon】: Wavy, Diffuse、【Color (Wet)】: 5YR 3/2、【Mottles】: Irregular, Few、【Soil Texture】: Heavy Clay、【Gravel】: Fine gravel, Sub-angular, Few、【Structure】: Massive、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Slightly Hard、【 Plant roots】: None
Cg1	42/45-68/70	【Horizon】: Wavy, Diffuse、【Color (Wet)】: 5YR 6/1、【Mottles】: Irregular, Common、【Soil Texture】: Light Clay、【Gravel】: None 、【Structure】: Massive、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Hard、【 Plant roots】: None
Cgir2	68/70-85+	【Color (Wet)】: 7.5YR 6/6 、【Mottles】: Irregular, Common、【Soil Texture】: Heavy Clay、【Gravel】: None 、【Structure】: Massive 、【Viscosity】: Sticky、【Plasticity】: Very Plastic、【Compactness】: Compact (25-28mm)、【Hardness】: Hard、【 Plant roots】: None

Result of Soil Profile Survey (4)

Lower Site of Upper Bumenda 2

Date of Soil Survey：15th/Mar/2016
Surveyor：Takashi KOTEGAWA
Location： 5°58'10.84"N、10°26'50.50"E
Altitude：1,161 m
Soil Classification：
Remarks：The soil pit is located in the farmland managed by the local farmer. The farmland is cultivated for maize, beans etc. in dry season while paddy cultivation is conducted in rainy season. The farmland was reclaimed approximately 7 years ago, which is different from the other soil pits. The agricultural machines such as tractor are not utilized in this area since the suitable internal road for the machines are not well constructed. The ground water are observed in this soil pit. The height of ground water is around 90 cm from the surface. The mottles of the iron are observed in B horizon, indicating the low water permeability.

Horizon	Range(cm)	Profile
Ap	0-10/15	【Horizon】：Wavy, Diffuse、【Color (Wet)】：5YR 3/1、【Mottles】：Root-like, Few、【Soil Texture】：Clay Loam、【Gravel】： Fine gravel, Sub-angular, Few、【Structure】：Week, Fine, Sub-angular blocky、【Viscosity】：Sticky、【Plasticity】：Plastic、【Compactness】：Medium (20-24mm)、【Hardness】：Slightly Hard、【Plant roots】：Fine, Common
AB	10-15/20-25	【Horizon】：Irregular, Diffuse、【Color (Wet)】：5YR 3/1、【Mottles】：Root-like, Few 、【Soil Texture】： Light Clay、【Gravel】： Fine gravel, Sub-angular, Few、【Structure】：Week, Fine, Sub-angular blocky、【Viscosity】： Sticky、【Plasticity】：Plastic、【Compactness】： Compact (25-28mm)、【Hardness】：Hard、【 Plant roots】：Fine Few、
Bg	20-25/45-53	【Horizon】：Wavy, Clear 、【Color (Wet)】：7.5YR 5/1、【Mottles】：Root-like & Irregular, Common、【Soil Texture】：Heavy Clay、【Gravel】：None 、【Structure】：Massive、【Viscosity】：Sticky、【Plasticity】：Very Plastic、【Compactness】：Compact (25-28mm)、【Hardness】：Hard、【 Plant roots】：Fine, Very few、
C1	45-53/70	【Horizon】：Smooth, Clear 、【Color (Wet)】：5YR 5/1、【Mottles】： Irregular, Common、【Soil Texture】：Heavy Clay、【Gravel】： None、【Structure】：Massive 、【Viscosity】：Sticky、【Plasticity】：Very Plastic、【Compactness】： Compact (25-28mm)、【Hardness】：Hard、【 Plant roots】：None
C2	70-85+	【Color (Wet)】：7.5YR 4/1、【Mottles】： Irregular, Few 、【Soil Texture】：Heavy Clay、【Gravel】：None、【Structure】：Massive 、【Viscosity】：Sticky、【Plasticity】：Very Plastic、【Compactness】：Compact (25-28mm)、【Hardness】：Hard、【 Plant roots】：None

Results of the calculation of Irrigation Requirement

1.ETc&Irrigation Requirement

Beneficiary area: 918 ha

Description	Unit		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
ETo on Modified Penman	(mm/month)		125.70	129.62	140.07	125.74	121.78	105.20	99.58	99.72	101.58	111.67	116.24
↓													
Selected Eto	(mm/month)		125.70	129.62	140.07	125.74	121.78	105.20	99.58	99.72	101.58	111.67	116.24
ETC=ETO*Kc*Area													
Dry Season (Mar. to End of May)	Crop Area (ha)												
1. Maize	597	Kc			0.55	0.85	0.88	0.28					
		ETC	0	0	45,992	63,809	63,979	17,585	0	0	0	0	0
2. Beans	31	Kc			0.56	0.83	1.00	0.63					
		ETC	0	0	1,826	2,562	3,091	1,984	0	0	0	0	0
3. Poteto	31	Kc			0.57	0.91	0.82						
		ETC	0	0	1,859	2,809	2,535	0	0	0	0	0	0
4. Tomato	30	Kc			0.45	0.75	1.15	0.80					
		ETC	0	0	1,420	2,240	3,440	2,438	0	0	0	0	0
Rainy Season (Jun. to End of Dec.)													
1. Paddy	459	Kc							1.10	1.10	1.05	1.00	0.18
		ETC	0	0	0	0	0	0	50,277	50,346	48,955	51,255	9,604
Adding for pre sowing (Special needs)													
Total consumptive use in the month			0	0	51,097	71,421	73,045	22,006	50,277	50,346	48,955	51,255	9,604
Net Irrigated area (ha)			0	0	665	665	665	665	568	568	568	537	475
Net Irrigation reqd. mm/ha			0	0	77	107	110	33	89	89	86	95	20
Effective Rainfall in mm (Koundja)			0	0	62	105	122	129	226	242	237	182	22
Net Irri. Required per month			0	0	15	2	-12	-96	-137	-153	-151	-87	-2
Net Irri Required in cum			0	0	148	24	-122	-959	-1,375	-1,534	-1,508	-866	-18
Net Irri Required per day			0	0	5	1	-4	-32	-46	-51	-50	-29	-1
Gross Irri Reqd. inclusive losses			0	0	11	2	-9	-68	-98	-109	-107	-62	-1
Irrigation required for whole area			0	0	7,028	1,137	-5,758	-45,426	-55,621	-62,044	-61,012	-33,104	-603
Design discharge lps/day			0	0	81	13	-67	-526	-644	-718	-706	-383	-7

PEAK WATER REQUIREMENT **81 lps**

2. Kc per Growth Stage

DURATION OF GROWTH STAGE FOR FIELD CROP

Approximate Duration of Growth Stages for Various Field Crops

Crops	Initial Stage	Crop Developme nt Stage	Mid Season Stage	Late Season Stage	Total	Remarks
Maize (grain)	20	30	30	25	105	*UNVDA hearing
Beans	20	30	50	20	120	*UNVDA hearing
Paddy	30	30	45	30	135	*UNVDA hearing
Poteto	20	25	25	20	90	*UNVDA hearing
Tomato	30	30	40	20	120	*UNVDA hearing
JamJam	N.A.	N.A	N.A.	N.A	N.A.	

Source : FAO Irrigation and Drainage Paper No.24, 56, "Crop evapotranspiration", published 1998

Crop Factor (Kc)

Values of the Crop Factor (Kc) for Various Crops and Growth Stages

Crops	Initial Stage	Crop Developme nt Stage	Mid Season Stage	Late Season Stage	Remarks
Maize (grain)	0.45	0.75	1.05	0.55	*FAO24 p.60, 61
Beans	0.47	0.74	1.00	0.45	*FAO24 p.60, 62
Paddy	1.10	1.10	1.05	0.95	*FAO24 p.71。但し、Late season 後半は0.95から大幅に減少し、0.35と仮定した。
Poteto	0.47	0.76	1.05	0.70	*FAO24 p.60, 61
Tomato	0.47	0.76	1.05	0.60	*FAO24 p.60, 62
JamJam	0.47	0.74	1.00	0.45	同期間に育成可能で、必要水量の少ないBeansと同等とみなした。

3. Kc per month

Maize

Month	1st Month						2nd Month						3rd Month						4th Month						5th Month					
Groth Stage	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30
Groth Duration	20				30						30						25													
Kc per Groth stage	0.45				0.75						1.05						0.55													
Calculation Ⅰ	20/30*0.45 a				10/30*0.75 b		20/30*0.75 a				10/30*1.05 b		20/30*1.05 a				10/30*0.55 b		15/30*0.55 a											
Calculation Ⅱ	(20/30*0.45+10/30*0.75)						(20/30*0.75+10/30*1.05)						(20/30*1.05+10/30*0.55)						(15/30*0.55)											
Kc per month (a+b)	0.55						0.85						0.88						0.28											

Paddy

Month	1st Month						2nd Month						3rd Month						4th Month						5th Month					
Groth Stage	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30
Groth Duration	30						30						45						15						15					
Kc per Groth stage	1.1						1.1						1.05						0.95						0.35					
Calculation Ⅰ	30/30*1.1 a						30/30*1.1 a						30/30*1.05 a						15/30*1.05 a				15/30*0.95 b		15/30*0.35 a					
Calculation Ⅱ	(30/30*1.1)						(30/30*1.1)						(30/30*1.05)						(15/30*1.05+15/30*0.95)						(15/30*0.35)					
Kc per month (a+b)	1.1						1.1						1.05						1.00						0.18					

Beans (Redbeans/Blackbeans)

Month	1st Month						2nd Month						3rd Month						4th Month						5th Month					
Groth Stage	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30
Groth Duration	20				30						50								20											
Kc per Groth stage	0.47				0.74						1.00								0.45											
Calculation Ⅰ	20/30*0.47 a				10/30*0.74 b		20/30*0.74 a				10/30*1.00 b		30/30*1.00 a						10/30*1.00 a				20/30*0.45 b							
Calculation Ⅱ	(20/30*0.47+10/30*0.74)						(20/30*0.74+10/30*1.00)						(30/30*1.00)						(10/30*1.00+20/30*0.45)											
Kc per month (a+b)	0.56						0.83						1.00						0.63											

Poteto

Month	1st Month						2nd Month						3rd Month						4th Month						5th Month					
Groth Stage	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30
Groth Duration	20				25						25						20													
Kc per Groth stage	0.47				0.76						1.05						0.7													
Calculation Ⅰ	20/30*0.47 a				10/30*0.76 b		15/30*0.76 a				15/30*1.05 b		10/30*1.05 a				20/30*0.7 b													
Calculation Ⅱ	(20/30*047+10/30*0.76)						(15/30*0.76+15/30*1.05)						(10/30*1.05+20/30*0.7)																	
Kc per month (a+b)	0.57						0.91						0.82																	

Tomato

Month	1st Month						2nd Month						3rd Month						4th Month						5th Month					
Groth Stage	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30	5	10	15	20	25	30
Groth Duration	30						30						40						20											
Kc per Groth stage	0.45						0.75						1.15						0.8											
Calculation Ⅰ	30/30*0.45 a						30/30*0.75 a						30/30*1.15 a						10/30*1.15 a				20/30*0.8 b							
Calculation Ⅱ	(30/30*0.45)						(30/30*0.75)						(30/30*1.15)						(10/30*1.15+20/30*0.8)											
Kc per month (a+b)	0.45						0.75						1.15						0.92											

4. Irrigation efficiency

Irrigation efficiency (Ep) = Ea*Eb*Ec=0.32*0.8*0.9= 0.2304

a. Conveyance Efficiency (Ec)			
Continuous supply with no substantial change in flow			0.9
Rotational supply in projects of 3000 - 7000 ha and rotation areas of 70 - 300 ha, with effective management			0.8
Rotational supply in large schemes (> 10000 ha) and small schemes (< 1000ha) with respective	based on predetermined schedule		0.7
	based on advance request		0.65
b. Field Canal Efficiency (Eb)			
Bkocks larger than 20 ha:	unlined		0.8
	lined or piped		0.9
Blocks up to 20 ha:	unlined		0.7
	lined or piped		0.8
c. Distribution Efficiency (Ed = Ec * Eb)			
Average for rotational supply with management and communicaition	adequate		0.65
	sufficient		0.55
	insufficient		0.4
	poor		0.3
d. Field Application Efficiency (Ea)			
Surface methods	light soils		0.55
	medium soils		0.7
	heavy soils		0.6
	graded border	0.60 - 0.75	0.53
	basin and level border	0.60 - 0.80	0.58
	contour ditch	0.50 - 0.55	-
	furrow	0.55 - 0.70	0.57
	corrugation	0.50 - 0.70	-
Subsurface		up to 0.80	-
Sprinkler	hot dry climate	0.6	-
	moderate climate	0.7	0.67
	humid and cool	0.8	-
Rice			0.32

Reference: FAO Irrigation and Drainage Paper 24 (Revised 1977) Crop Water Requirements

5. Eto Penman Montieth

Table Crop Evapotranspiration

Method: Penman-Montieth equation
Place: Ndop

Longitude: 10 E°
Latitude : 6 N°
Altitude : 1,160 m above sea level

Data and elements		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
			1	2	3	4	5	6	7	8	9	10	11	12	
1. Monthly average daily maximum temprature	Tmax	°C	29.2	30.5	29.6	28.0	26.7	25.7	24.7	24.8	25.2	25.9	27.2	28.4	
2. Monthly average daily minimum temprature	Tmin	°C	14.7	15.9	17.2	17.5	17.0	16.4	16.2	16.7	16.0	16.2	15.3	14.3	
3. Wind speed	u_z	m/sec	1.30	1.60	1.60	1.40	1.20	1.10	1.10	1.00	1.10	1.20	1.30	1.20	
4. Mean relative humidity	RHmean	%	61.0	60.0	64.0	70.0	71.0	73.0	74.0	74.0	74.0	72.0	68.0	63.0	
5. Sunshine hour	n	hour	7.8	8.0	6.8	6.5	6.8	5.8	4.5	4.3	4.6	5.8	7.5	8.2	
Parameters															
Mean monthly temprature	Tmean	°C	22.0	23.2	23.4	22.8	21.9	21.1	20.5	20.8	20.6	21.1	21.3	21.4	
Slope of saturation vapour pressure curve	Δ	kPa/° C	0.16	0.17	0.17	0.17	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.16	Δ=4098*(0.6108*EXP((17.27*T)/(T+237.3)))/(T+237.3)2
Altitude [atmospheric pressure]	P	kPa	88.3												P=101.3*((293-0.0065z)/293)$^{5.26}$
Latitude [radian]	φ	rad	0.1												
Psychrometric constant	γ	kPa/° C	0.059												γ=0.665/1000*P
Hight of wind speed measurement	z	m	10												
Windspeed at 2 m above ground surface	u_2	ms^{-1}	0.97	1.20	1.20	1.05	0.90	0.82	0.82	0.75	0.82	0.90	0.97	0.90	u2=uz*4.87/ln(67.8z-5.42)
$1+0.34u_2$			1.33	1.41	1.41	1.36	1.31	1.28	1.28	1.25	1.28	1.31	1.33	1.31	
$Δ/(Δ+γ*(1+0.34*u_2))$			0.67	0.68	0.68	0.68	0.68	0.67	0.66	0.67	0.67	0.67	0.66	0.67	
$γ/(Δ+γ*(1+0.34*u_2))$			0.25	0.23	0.23	0.24	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.25	
$(900/(Tmean+273)*u_2$			2.97	3.64	3.63	3.19	2.74	2.52	2.52	2.29	2.52	2.75	2.97	2.74	
Vapour pressure deficit															
Saturation vapour pressure for Tmax	e°(Tmax)	kPa	4.05	4.37	4.15	3.78	3.50	3.30	3.11	3.13	3.21	3.34	3.61	3.87	e°(T)=0.6108*EXP((17.27*T)/(T+237.3))
Saturation vapour pressure for Tmin	e°(Tmin)	kPa	1.67	1.81	1.96	2.00	1.94	1.87	1.84	1.90	1.82	1.84	1.74	1.63	
Saturation vapour pressure	es	kPa	2.86	3.09	3.05	2.89	2.72	2.58	2.48	2.52	2.51	2.59	2.67	2.75	es=(e°(Tmax)+e°(Tmin))/2
Actual vapour pressure	ea	kPa	1.24	1.32	1.49	1.63	1.59	1.57	1.55	1.59	1.55	1.53	1.40	1.24	ea=Rhmean/(30/e°(Tmax)+70/e°(Tmin))
Vapour pressure deficit	es-ea	kPa	1.62	1.77	1.56	1.26	1.13	1.02	0.92	0.92	0.97	1.06	1.27	1.51	
Radiation															
Number of the day in the year	J	days	15	45	76	106	137	167	197	228	258	289	319	349	J=INT(30.4*Month,i-15)
Inverse relative distance Earth-Sun	dr	rad	1.032	1.024	1.009	0.992	0.977	0.968	0.968	0.977	0.991	1.009	1.023	1.032	dr=1+0.033*COS(2*PI()*J/365)
Solar declination	δ	rad	-0.37	-0.24	-0.03	0.17	0.34	0.41	0.37	0.23	0.04	-0.18	-0.33	-0.41	δ=0.409*SIN(2*PI()*J/365-1.39)
Sunset hour angle	ωs	rad	1.530	1.546	1.567	1.589	1.608	1.616	1.612	1.596	1.575	1.552	1.534	1.525	ωs=ACOS((-TAN(φ)*TAN(δ)))
sin(φ)sin(δ)			-0.038	-0.024	-0.003	0.018	0.035	0.041	0.038	0.024	0.004	-0.018	-0.034	-0.041	
cos(φ)cos(δ)			0.927	0.967	0.994	0.980	0.939	0.913	0.927	0.968	0.994	0.979	0.939	0.913	
Extraterrestial radiation	Ra	MJm^{-2}day^{-1}	33.7	35.7	37.5	37.6	36.5	35.6	35.9	36.9	37.3	36.0	34.1	32.9	Ra=24*60/π*Gsc*dr*(ωs*sin(ψ)sin(δ)+cos(ψ)cos(δ)sin())
Maximum possible duration of daylight hours	N	hours	11.7	11.8	12.0	12.1	12.3	12.3	12.3	12.2	12.0	11.9	11.7	11.7	
Solar radiation	Rs	MJm^{-2}day^{-1}	19.66	21.04	20.01	19.45	19.21	17.28	15.54	15.74	16.43	17.83	19.42	19.82	Rs=(0.25+0.5*n/N)*Ra
Clear-sky solar radiation	Rso	MJm^{-2}day^{-1}	26.05	27.63	28.97	29.05	28.20	27.55	27.77	28.55	28.80	27.87	26.34	25.46	Rso=(0.75+2*(Altitude)/100000)*Ra
Net solar radiation	Rns	MJm^{-2}day^{-1}	15.14	16.20	15.41	14.98	14.79	13.30	11.97	12.12	12.65	13.73	14.95	15.26	Rns=(1-0.23)*Rs
Monthly average daily maximum temprature	Tmax	K	302.4	303.7	302.8	301.2	299.9	298.9	297.9	298.0	298.4	299.1	300.4	301.6	Tmax(K)=Tmax(° C)+273.16
Monthly average daily minimum temprature	Tmin	K	287.9	289.1	290.4	290.7	290.2	289.6	289.4	289.9	289.2	289.4	288.5	287.5	Tmin(K)=Tmin(° C)+273.16
$σTmax,K^2$		MJm^{-2}day^{-1}	41.0	41.7	41.2	40.3	39.6	39.1	38.6	38.6	38.9	39.2	39.9	40.5	
$σTmin,K^2$		MJm^{-2}day^{-1}	33.7	34.2	34.9	35.0	34.8	34.5	34.4	34.6	34.3	34.4	33.9	33.5	
(σTmax,K4+σTmin,K4)/2			37.3	38.0	38.0	37.7	37.2	36.8	36.5	36.6	36.6	36.8	36.9	37.0	
0.34-0.14*√ea			0.18	0.18	0.17	0.16	0.16	0.16	0.17	0.16	0.17	0.17	0.17	0.18	
1.35*Rs/Rso-0.33			0.67	0.68	0.58	0.55	0.57	0.50	0.41	0.39	0.42	0.51	0.65	0.70	
Net longwave radiation	Rnl	MJm^{-2}day^{-1}	4.6	4.6	3.7	3.4	3.5	3.0	2.4	2.4	2.5	3.1	4.2	4.8	Rnl=σ(Tmax,'K4+Tmin,'K4)/2*(0.34-0.14*√ea)(1.35*Rs/Rso-0.35)
Net radiation	Rn	MJm^{-2}day^{-1}	10.5	11.6	11.7	11.6	11.3	10.3	9.5	9.8	10.1	10.6	10.8	10.5	Rn=Rns-Rnl
Soil heat flux	G	MJm^{-2}day^{-1}	0.08	0.18	0.03	-0.09	-0.13	-0.11	-0.08	0.04	-0.02	0.06	0.03	0.01	Gmonth,i=0.014*(Tmonth,i-Tmonth,i-1)
Rn-G		MJm^{-2}day^{-1}	10.46	11.41	11.64	11.71	11.45	10.40	9.60	9.72	10.13	10.51	10.77	10.47	
0.408*(Rn-G)		mm/day	4.27	4.65	4.75	4.78	4.67	4.24	3.92	3.97	4.13	4.29	4.39	4.27	*0.408
$(Δ/(Δ+γ*(1+0.34u_2)))*(0.408(Rn-G))$			2.87	3.14	3.22	3.24	3.16	2.85	2.60	2.66	2.75	2.86	2.92	2.86	
$(γ/(Δ+γ*(1+0.34u_2)))*(900/(T+273))*u_2(es-ea)$			1.18	1.49	1.30	0.95	0.77	0.66	0.61	0.55	0.64	0.74	0.95	1.05	
Grass reference evapotranspiration	ETo	mm/day	4.05	4.63	4.52	4.19	3.93	3.51	3.21	3.22	3.39	3.60	3.87	3.91	
		mm/month	126	130	140	126	122	105	100	100	102	112	116	121	

Source : FAO Irrigation and Drainage Paper No.56, "Crop evapotranspiration", published 1998

mm/year 1398.07

7. List of Drawings (Irrigation Component)

Title	Nos	Page
General Plan	1	A-30
Drainage Canal and Farm Road	1	A-31
Main Drainage Plan and Profile	9	A-32, 33, 34, 35, 36, 37, 38, 39,40
Tractor Passage	1	A-41
Farm Road Crossing	2	A-42, 43
Irrigation Canal	1	A-44
Bridge	2	A-45, 46, 47, 48

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE GENERAL PLAN	SCALE	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					

Drainage Canal and Farm Road

Farm Road TypeA

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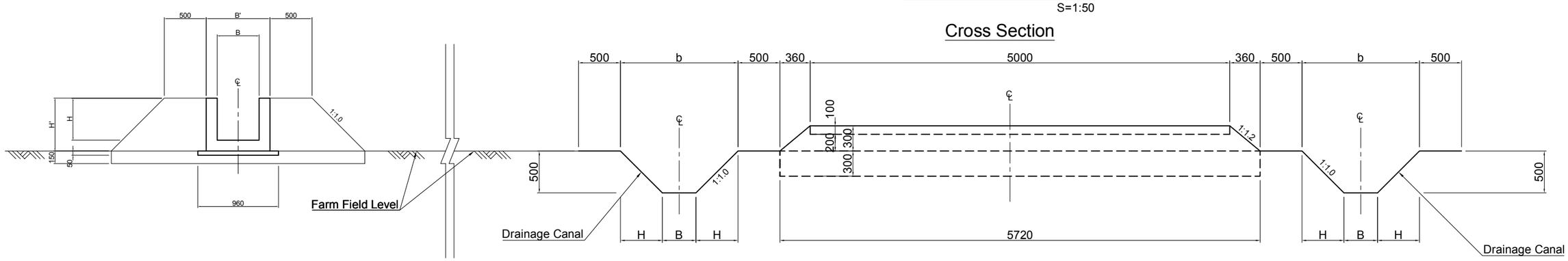
Cross Section



Farm Road TypeB

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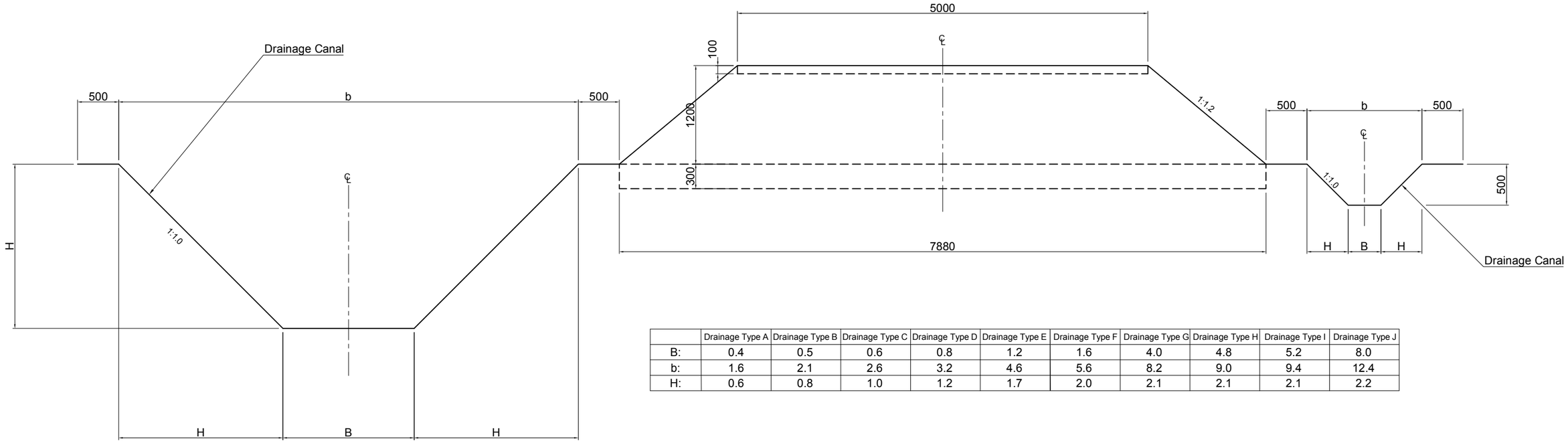
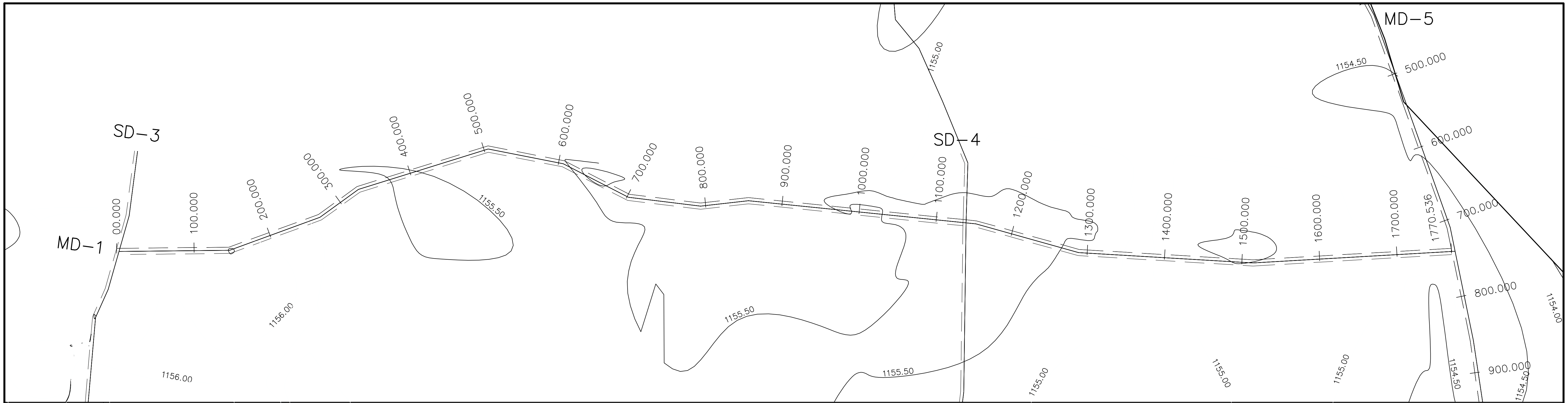
Cross Section

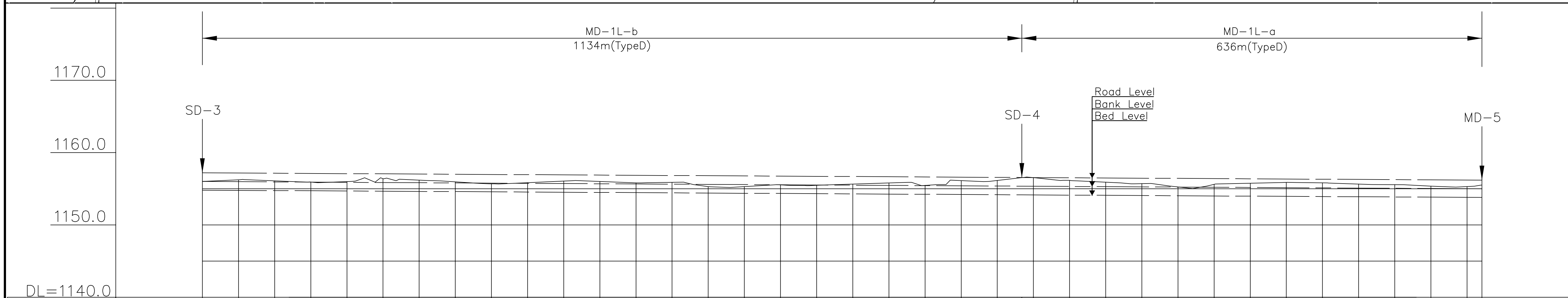


	Drainage Type A	Drainage Type B	Drainage Type C	Drainage Type D	Drainage Type E	Drainage Type F	Drainage Type G	Drainage Type H	Drainage Type I	Drainage Type J
B:	0.4	0.5	0.6	0.8	1.2	1.6	4.0	4.8	5.2	8.0
b:	1.6	2.1	2.6	3.2	4.6	5.6	8.2	9.0	9.4	12.4
H:	0.6	0.8	1.0	1.2	1.7	2.0	2.1	2.1	2.1	2.2

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE: DRAINAGE CANAL AND FARM ROAD	SCALE: 1:50	APPROVED BY	SERIAL NO.

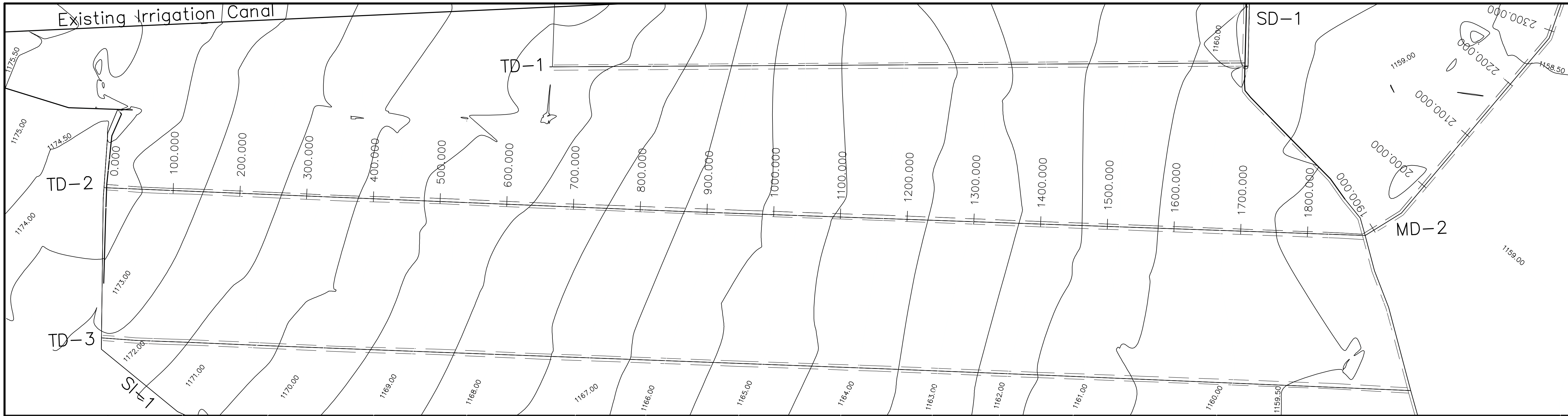
A-31

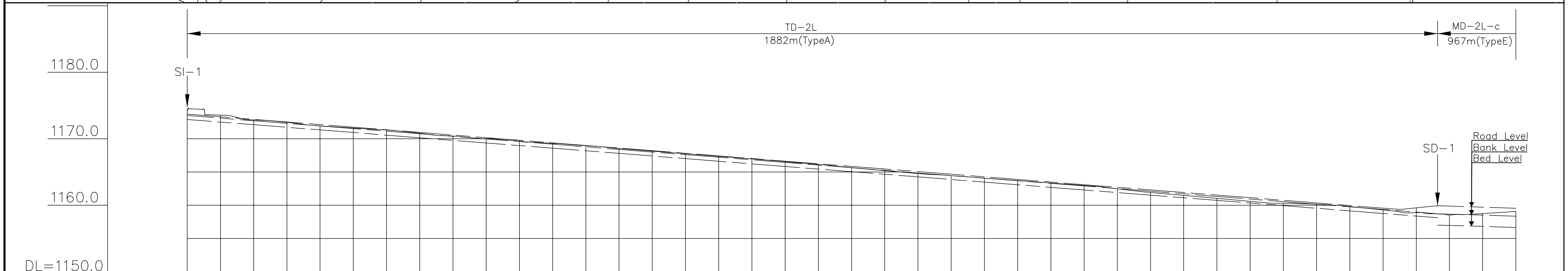




ACCUMULATED DISTANCE	DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL
0.000		1157.210	1156.010	1154.810	1156.010
50.000	50.000	1157.181	1155.981	1154.781	1156.241
100.000	50.000	1157.153	1155.953	1154.753	1156.107
150.000	50.000	1157.124	1155.924	1154.724	1155.941
200.000	50.000	1157.096	1155.896	1154.696	1155.989
250.000	50.000	1157.067	1155.867	1154.667	1156.385
300.000	50.000	1157.039	1155.839	1154.639	1156.188
350.000	50.000	1157.010	1155.810	1154.610	1155.956
400.000	50.000	1156.981	1155.781	1154.581	1155.688
450.000	50.000	1156.953	1155.753	1154.553	1155.855
500.000	50.000	1156.924	1155.724	1154.524	1156.079
550.000	50.000	1156.896	1155.696	1154.496	1156.014
600.000	50.000	1156.867	1155.667	1154.467	1155.827
650.000	50.000	1156.839	1155.639	1154.439	1155.895
700.000	50.000	1156.810	1155.610	1154.410	1155.292
750.000	50.000	1156.781	1155.581	1154.381	1155.305
800.000	50.000	1156.753	1155.553	1154.353	1155.557
850.000	50.000	1156.724	1155.524	1154.324	1155.481
900.000	50.000	1156.696	1155.496	1154.296	1155.652
950.000	50.000	1156.667	1155.467	1154.267	1155.813
1000.000	50.000	1156.639	1155.439	1154.239	1155.474
1050.000	50.000	1156.610	1155.410	1154.210	1156.129
1100.000	50.000	1156.581	1155.381	1154.181	1156.160
		1156.562	1155.362	1154.162	
1150.000	50.000	1156.553	1155.353	1154.153	1156.543
1200.000	50.000	1156.524	1155.324	1154.124	1156.157
1250.000	50.000	1156.496	1155.296	1154.096	1155.906
1300.000	50.000	1156.468	1155.268	1154.068	1155.711
1350.000	50.000	1156.439	1155.239	1154.039	1155.256
1400.000	50.000	1156.411	1155.211	1154.011	1155.620
1450.000	50.000	1156.382	1155.182	1153.982	1155.764
1500.000	50.000	1156.354	1155.154	1153.954	1155.898
1550.000	50.000	1156.325	1155.125	1153.925	1155.816
1600.000	50.000	1156.297	1155.097	1153.897	1155.657
1650.000	50.000	1156.269	1155.069	1153.869	1155.575
1700.000	50.000	1156.240	1155.040	1153.840	1155.356
1750.000	50.000	1156.212	1155.012	1153.812	1155.312
1770.536	20.536	1156.200	1155.000	1153.800	1155.501

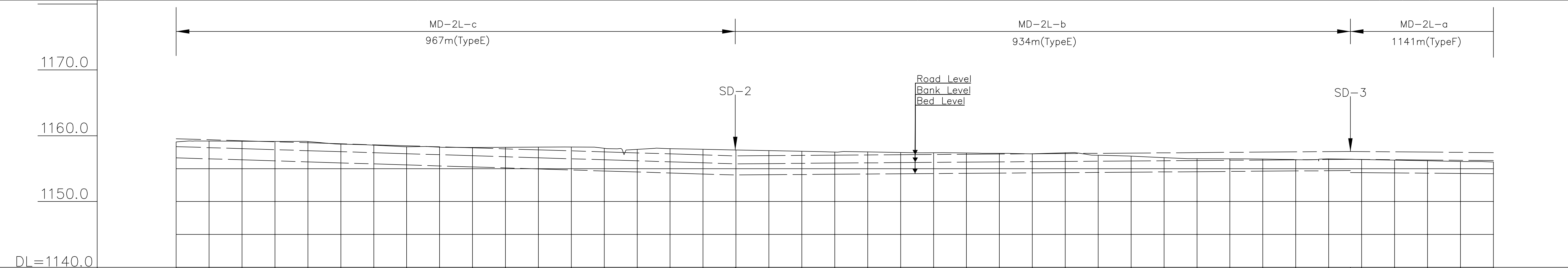
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE: RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO. MD1- 1
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE: MAIN DRAINAGE 1 PLAN AND PROFILE 0.000~1770.536	SCALE 1:6000	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					





ACCUMULATED DISTANCE	DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL
0.000		1173.700	1173.500	1172.900	1174.430
50.000	50.000	1173.307	1173.107	1172.507	1173.549
100.000	50.000	1172.914	1172.714	1172.114	1172.819
150.000	50.000	1172.521	1172.321	1171.721	1172.479
200.000	50.000	1172.128	1171.928	1171.328	1171.932
250.000	50.000	1171.735	1171.535	1170.935	1171.601
300.000	50.000	1171.342	1171.142	1170.542	1171.300
350.000	50.000	1170.949	1170.749	1170.149	1170.822
400.000	50.000	1170.556	1170.356	1169.756	1170.403
450.000	50.000	1170.163	1169.963	1169.363	1170.015
500.000	50.000	1169.770	1169.570	1168.970	1169.734
550.000	50.000	1169.377	1169.177	1168.577	1169.301
600.000	50.000	1168.984	1168.784	1168.184	1168.960
650.000	50.000	1168.591	1168.391	1167.791	1168.527
700.000	50.000	1168.198	1167.998	1167.398	1168.133
750.000	50.000	1167.805	1167.605	1167.005	1167.742
800.000	50.000	1167.412	1167.212	1166.612	1167.353
850.000	50.000	1167.019	1166.819	1166.219	1166.963
900.000	50.000	1166.626	1166.426	1165.826	1166.561
950.000	50.000	1166.233	1166.033	1165.433	1166.135
1000.000	50.000	1165.840	1165.640	1165.040	1165.652
1050.000	50.000	1165.447	1165.247	1164.647	1165.207
1100.000	50.000	1165.054	1164.854	1164.254	1164.768
1150.000	50.000	1164.661	1164.461	1163.861	1164.437
1200.000	50.000	1164.268	1164.068	1163.468	1164.062
1250.000	50.000	1163.875	1163.675	1163.075	1163.694
1300.000	50.000	1163.482	1163.282	1162.682	1163.327
1350.000	50.000	1163.089	1162.889	1162.289	1162.959
1400.000	50.000	1162.696	1162.496	1161.896	1162.469
1450.000	50.000	1162.303	1162.103	1161.503	1161.919
1500.000	50.000	1161.910	1161.710	1161.110	1161.472
1550.000	50.000	1161.517	1161.317	1160.717	1161.025
1600.000	50.000	1161.124	1160.924	1160.324	1160.579
1650.000	50.000	1160.731	1160.531	1159.931	1160.285
1700.000	50.000	1160.338	1160.138	1159.538	1160.146
1750.000	50.000	1159.945	1159.745	1159.145	1159.789
1800.000	50.000	1159.552	1159.352	1158.752	1159.285
1850.000	50.000	1160.864	1158.959	1158.359	1158.884
		1159.907	1158.707	1158.107 / 1157.007	
1900.000	50.000	1159.852	1158.652	1156.952	1158.528
1950.000	50.000	1159.698	1158.498	1156.798	1158.741
2000.000	50.000	1159.544	1158.344	1156.644	1159.059

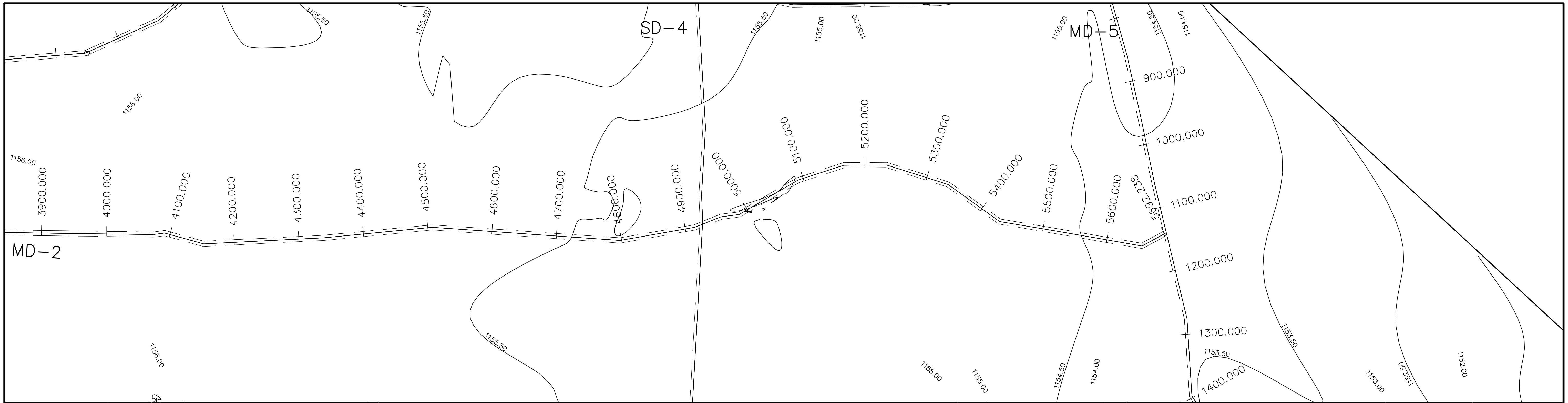
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO. MD2- 1
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE MAIN DRAINAGE 2 PLAN AND PROFILE 0.000~2000.000	SCALE 1:6000	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					

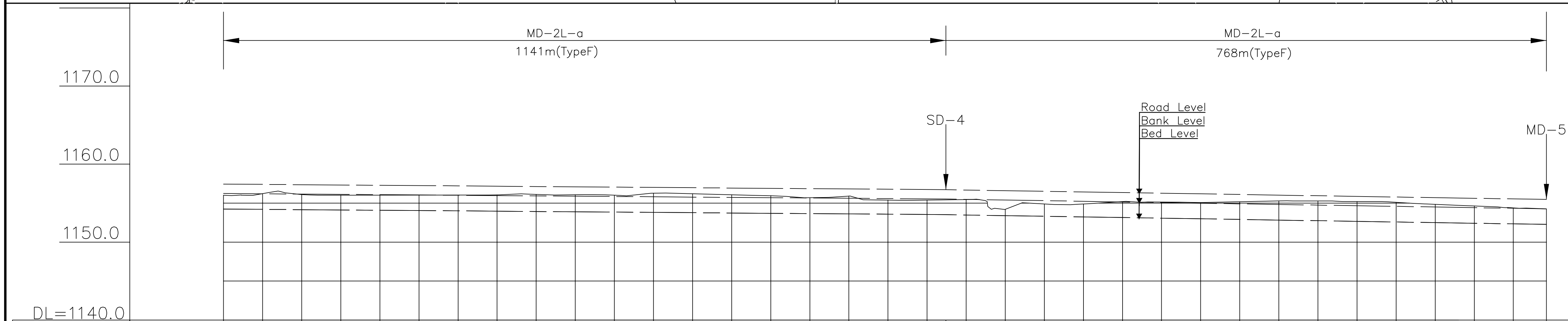


ACCUMULATED DISTANCE	DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL
2000.000		1159.544	1158.344	1156.644	1159.059
2050.000	50.000	1159.390	1158.190	1156.490	1159.183
2100.000	50.000	1159.237	1158.037	1156.337	1159.153
2150.000	50.000	1159.083	1157.883	1156.183	1159.123
2200.000	50.000	1158.929	1157.729	1156.029	1159.123
2250.000	50.000	1158.776	1157.576	1155.876	1158.719
2300.000	50.000	1158.622	1157.422	1155.722	1158.562
2350.000	50.000	1158.468	1157.268	1155.568	1158.311
2400.000	50.000	1158.314	1157.114	1155.414	1158.268
2450.000	50.000	1158.161	1156.961	1155.261	1158.224
2500.000	50.000	1158.007	1156.807	1155.107	1158.245
2550.000	50.000	1157.853	1156.653	1154.953	1158.266
2600.000	50.000	1157.700	1156.500	1154.800	1158.282
2650.000	50.000	1157.546	1156.346	1154.646	1158.095
2700.000	50.000	1157.392	1156.192	1154.492	1157.918
2750.000	50.000	1157.238	1156.038	1154.338	1158.042
2800.000	50.000	1157.085	1155.885	1154.185	1157.945
2850.000	50.000	1156.934 1156.935	1155.734 1155.735	1154.034 1154.035	1157.844
2900.000	50.000	1156.971	1155.771	1154.071	1157.743
2950.000	50.000	1157.006	1155.806	1154.106	1157.646
3000.000	50.000	1157.042	1155.842	1154.142	1157.518
3050.000	50.000	1157.078	1155.878	1154.178	1157.549
3100.000	50.000	1157.114	1155.914	1154.214	1157.463
3150.000	50.000	1157.150	1155.950	1154.250	1157.414
3200.000	50.000	1157.186	1155.986	1154.286	1157.375
3250.000	50.000	1157.222	1156.022	1154.322	1157.333
3300.000	50.000	1157.258	1156.058	1154.358	1157.263
3350.000	50.000	1157.293	1156.093	1154.393	1157.416
3400.000	50.000	1157.329	1156.129	1154.429	1157.033
3450.000	50.000	1157.365	1156.165	1154.465	1156.890
3500.000	50.000	1157.401	1156.201	1154.501	1156.675
3550.000	50.000	1157.437	1156.237	1154.537	1156.511
3600.000	50.000	1157.473	1156.273	1154.573	1156.485
3650.000	50.000	1157.509	1156.309	1154.609	1156.455
3700.000	50.000	1157.544	1156.344	1154.644	1156.369
3750.000	50.000	1157.580	1156.380	1154.680	1156.489
		1157.604	1156.404	1154.704 1154.404	
3800.000	50.000	1157.591	1156.391	1154.391	1156.394
3850.000	50.000	1157.552	1156.352	1154.352	1156.299
3900.000	50.000	1157.513	1156.313	1154.313	1156.204
3950.000	50.000	1157.474	1156.274	1154.274	1156.089
4000.000	50.000	1157.435	1156.235	1154.235	1155.997

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
JAPAN INTERNATIONAL COOPERATION AGENCY
NTC INTERNATIONAL CO., LTD.

REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
	RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			MD2- 2
	DWG. TITLE	SCALE	APPROVED BY	SERIAL NO.
	MAIN DRAINAGE 2 PLAN AND PROFILE 2000.000~4000.000	1:6000		



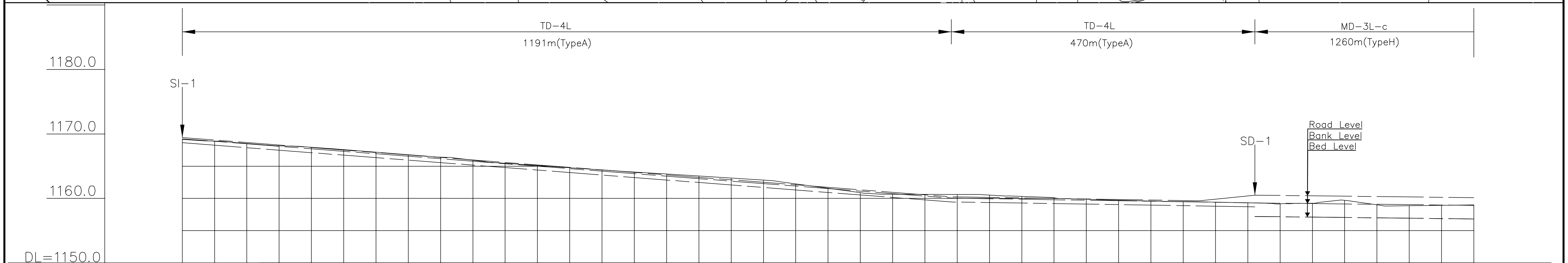


ROAD LEVEL	1157.435	1157.396	1157.357	1157.318	1157.279	1157.240	1157.201	1157.162	1157.123	1157.084	1157.045	1157.006
BANK LEVEL	1156.235	1156.196	1156.157	1156.118	1156.079	1156.040	1156.001	1155.962	1155.923	1155.884	1155.845	1155.806
BED LEVEL	1154.235	1154.196	1154.157	1154.118	1154.079	1154.040	1154.001	1153.962	1153.923	1153.884	1153.845	1153.806
ORIGINAL GROUND LEVEL	1155.997	1156.213	1156.078	1156.002	1156.013	1156.024	1156.035	1156.047	1156.107	1156.071	1156.015	1156.272
ACCUMULATED DISTANCE	4000.000	4050.000	4100.000	4150.000	4200.000	4250.000	4300.000	4350.000	4400.000	4450.000	4500.000	4550.000
DISTANCE		50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000

ROAD LEVEL	1156.967	1156.928	1156.889	1156.850	1156.811	1156.772	1156.734	1156.715	1156.673	1156.591	1156.510	1156.428
BANK LEVEL	1155.767	1155.728	1155.689	1155.650	1155.611	1155.572	1155.534	1155.515	1155.473	1155.391	1155.310	1155.228
BED LEVEL	1153.767	1153.728	1153.689	1153.650	1153.611	1153.572	1153.534	1153.515	1153.473	1153.391	1153.310	1153.228
ORIGINAL GROUND LEVEL	1156.200	1156.059	1155.948	1155.689	1155.897	1155.389	1155.385		1155.462	1154.208	1154.888	1154.881
ACCUMULATED DISTANCE	4600.000	4650.000	4700.000	4750.000	4800.000	4850.000	4900.000		4950.000	5000.000	5050.000	5100.000
DISTANCE	50.000	50.000	50.000	50.000	50.000	50.000	50.000		50.000	50.000	50.000	50.000

ROAD LEVEL	1156.347	1156.266	1156.184	1156.103	1156.022	1155.940	1155.859	1155.778	1155.696	1155.615	1155.534	1155.465
BANK LEVEL	1155.147	1155.066	1154.984	1154.903	1154.822	1154.740	1154.659	1154.578	1154.496	1154.415	1154.334	1154.265
BED LEVEL	1153.147	1153.066	1152.984	1152.903	1152.822	1152.740	1152.659	1152.578	1152.496	1152.415	1152.334	1152.265
ORIGINAL GROUND LEVEL	1155.192	1155.132	1155.071	1155.180	1155.276	1155.269	1155.199	1155.098	1154.832	1154.634	1154.389	1154.265
ACCUMULATED DISTANCE	5150.000	5200.000	5250.000	5300.000	5350.000	5400.000	5450.000	5500.000	5550.000	5600.000	5650.000	5692.238
DISTANCE	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	42.238

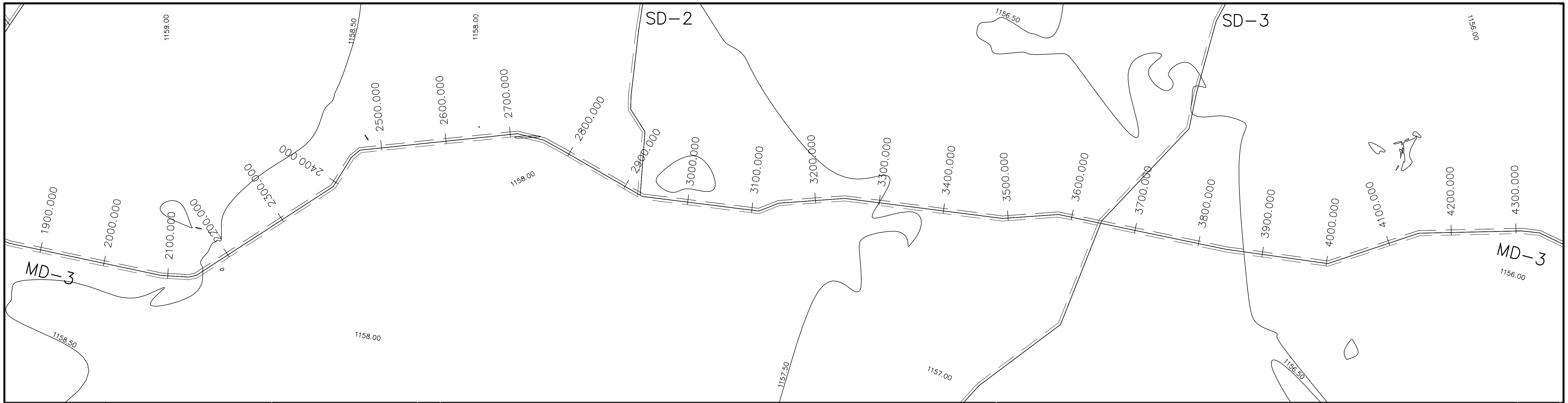
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT JAPAN INTERNATIONAL COOPERATION AGENCY NTC INTERNATIONAL CO., LTD.	REVISION	PROJECT TITLE: RURAL INFRASTRUCTURE IMPROVEMENT PROJECT DWG. TITLE: MAIN DRAINAGE 2 PLAN AND PROFILE 4000.000~5692.238	DATE SCALE 1:6000	DESIGNED BY APPROVED BY
			DWG NO. MD2- 3	SERIAL NO.

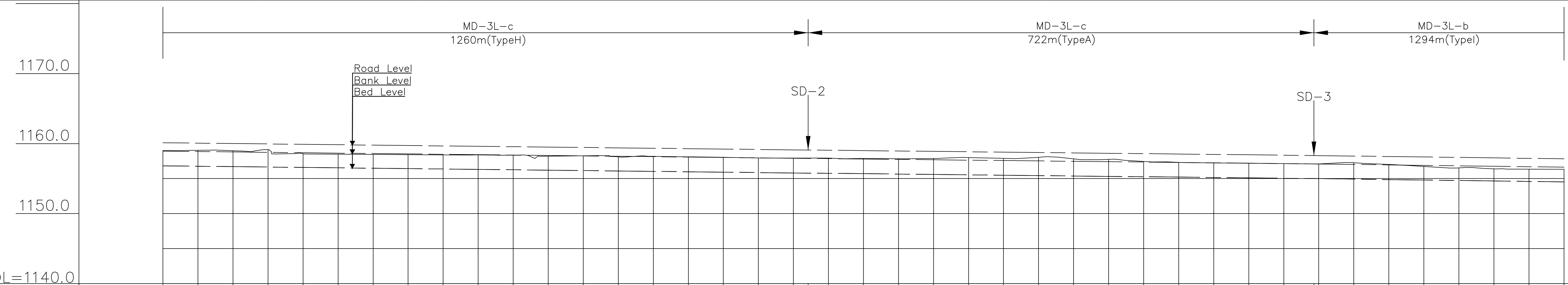


ACCUMULATED DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL	DISTANCE
0.000	1169.441	1169.241	1168.641	1169.152	
50.000	1169.055	1168.855	1168.255	1168.888	50.000
100.000	1168.669	1168.469	1167.869	1168.521	50.000
150.000	1168.283	1168.083	1167.483	1168.155	50.000
200.000	1167.898	1167.698	1167.098	1167.920	50.000
250.000	1167.512	1167.312	1166.712	1167.574	50.000
300.000	1167.126	1166.926	1166.326	1167.176	50.000
350.000	1166.740	1166.540	1165.940	1166.777	50.000
400.000	1166.354	1166.154	1165.554	1166.407	50.000
450.000	1165.968	1165.768	1165.168	1165.928	50.000
500.000	1165.582	1165.382	1164.782	1165.453	50.000
550.000	1165.197	1164.997	1164.397	1165.104	50.000
600.000	1164.811	1164.611	1164.011	1164.759	50.000
650.000	1164.425	1164.225	1163.625	1164.414	50.000
700.000	1164.039	1163.839	1163.239	1164.083	50.000
750.000	1163.653	1163.453	1162.853	1163.783	50.000
800.000	1163.267	1163.067	1162.467	1163.482	50.000
850.000	1162.882	1162.682	1162.082	1163.167	50.000
900.000	1162.496	1162.296	1161.696	1162.844	50.000
950.000	1162.110	1161.910	1161.310	1162.251	50.000
1000.000	1161.724	1161.524	1160.924	1161.572	50.000
1050.000	1161.338	1161.138	1160.538	1160.893	50.000
1100.000	1160.952	1160.752	1160.152	1160.635	50.000
1150.000	1160.566	1160.366	1159.766	1160.630	50.000
1200.000	1160.250 / 1160.236	1160.050 / 1160.036	1159.450 / 1159.436	1160.625	50.000
1250.000	1160.156	1159.956	1159.356	1160.512	50.000
1300.000	1160.076	1159.876	1159.276	1160.312	50.000
1350.000	1159.997	1159.797	1159.197	1160.101	50.000
1400.000	1159.917	1159.717	1159.117	1159.879	50.000
1450.000	1159.837	1159.637	1159.037	1159.718	50.000
1500.000	1159.758	1159.558	1158.958	1159.594	50.000
1550.000	1159.678	1159.478	1158.878	1159.504	50.000
1600.000	1159.891	1159.398	1158.798	1159.418	50.000
1650.000	1160.387 / 1160.501	1159.319 / 1159.301	1158.719 / 1158.701 / 1157.201	1159.325	50.000
1700.000	1160.457	1159.257	1157.157	1159.160	50.000
1750.000	1160.401	1159.201	1157.101	1159.252	50.000
1800.000	1160.345	1159.145	1157.045	1159.696	50.000
1850.000	1160.289	1159.089	1156.989	1159.012	50.000
1900.000	1160.232	1159.032	1156.932	1158.873	50.000
1950.000	1160.176	1158.976	1156.876	1158.933	50.000
2000.000	1160.120	1158.920	1156.820	1158.992	50.000

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
JAPAN INTERNATIONAL COOPERATION AGENCY
NTC INTERNATIONAL CO., LTD.

REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
	RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			MD3- 1
	DWG. TITLE	SCALE	APPROVED BY	SERIAL NO.
	MAIN DRAINAGE 3 PLAN AND PROFILE 0.000~2000.000	1:6000		

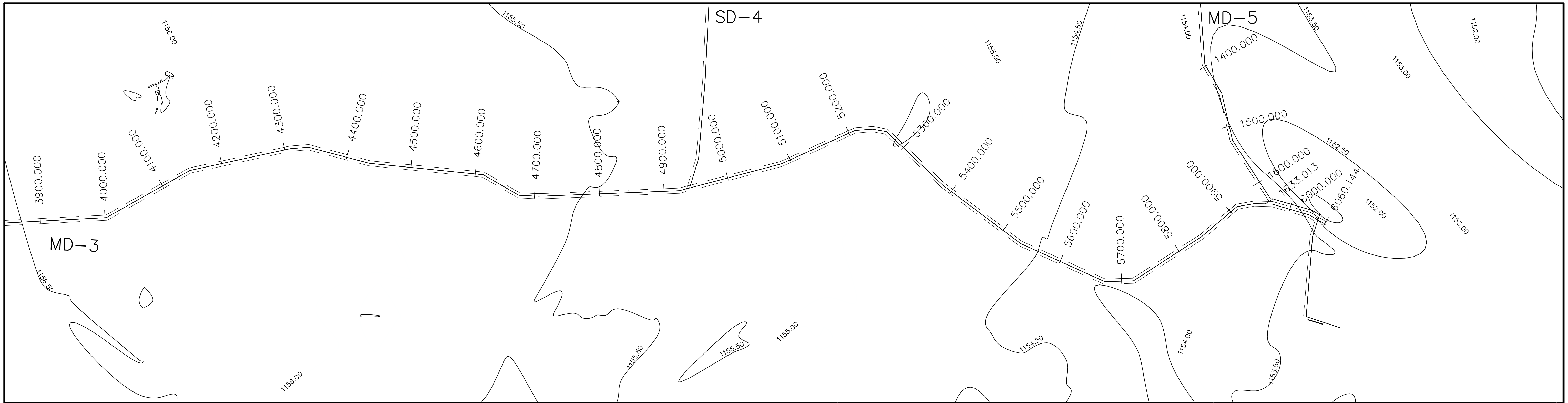


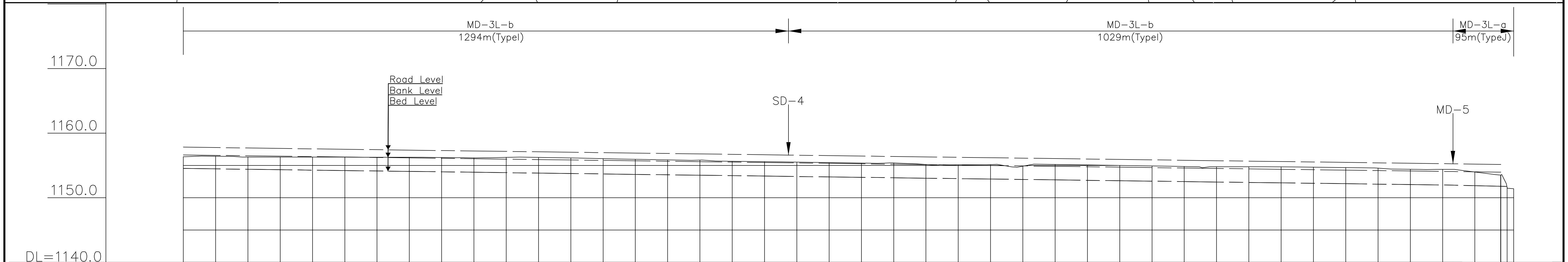


ACCUMULATED DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL	DISTANCE
2000.000	1160.120	1158.920	1156.820	1158.992	
2050.000	1160.064	1158.864	1156.764	1159.046	50.000
2100.000	1160.008	1158.808	1156.708	1158.983	50.000
2150.000	1159.951	1158.751	1156.651	1159.145	50.000
2200.000	1159.895	1158.695	1156.595	1158.563	50.000
2250.000	1159.839	1158.639	1156.539	1158.478	50.000
2300.000	1159.783	1158.583	1156.483	1158.446	50.000
2350.000	1159.727	1158.527	1156.427	1158.414	50.000
2400.000	1159.671	1158.471	1156.371	1158.385	50.000
2450.000	1159.614	1158.414	1156.314	1158.381	50.000
2500.000	1159.558	1158.358	1156.258	1158.353	50.000
2550.000	1159.502	1158.302	1156.202	1158.205	50.000
2600.000	1159.446	1158.246	1156.146	1158.268	50.000
2650.000	1159.390	1158.190	1156.090	1158.097	50.000
2700.000	1159.333	1158.133	1156.033	1158.196	50.000
2750.000	1159.277	1158.077	1155.977	1158.119	50.000
2800.000	1159.221	1158.021	1155.921	1158.040	50.000
2850.000	1159.165	1157.965	1155.865	1157.956	50.000
2900.000	1159.109	1157.909	1155.809	1157.927	50.000
	1159.085	1157.885	1155.785		
2950.000	1159.053	1157.853	1155.753	1157.921	50.000
3000.000	1158.999	1157.799	1155.699	1157.871	50.000
3050.000	1158.945	1157.745	1155.645	1157.844	50.000
3100.000	1158.890	1157.690	1155.590	1157.878	50.000
3150.000	1158.836	1157.636	1155.536	1157.998	50.000
3200.000	1158.781	1157.581	1155.482	1157.883	50.000
3250.000	1158.727	1157.527	1155.427	1158.036	50.000
3300.000	1158.672	1157.472	1155.373	1157.825	50.000
3350.000	1158.618	1157.418	1155.319	1157.751	50.000
3400.000	1158.564	1157.364	1155.264	1157.458	50.000
3450.000	1158.509	1157.309	1155.210	1157.307	50.000
3500.000	1158.455	1157.255	1155.155	1157.244	50.000
3550.000	1158.400	1157.200	1155.101	1157.193	50.000
3600.000	1158.346	1157.146	1155.047	1157.144	50.000
	[illegible]	[illegible]	1155.000		
3650.000	1158.290	1157.090	1154.991	1157.100	50.000
3700.000	1158.224	1157.024	1154.925	1157.262	50.000
3750.000	1158.159	1156.959	1154.860	1157.031	50.000
3800.000	1158.093	1156.893	1154.794	1156.740	50.000
3850.000	1158.027	1156.827	1154.728	1156.523	50.000
3900.000	1157.962	1156.762	1154.663	1156.406	50.000
3950.000	1157.896	1156.696	1154.597	1156.346	50.000
4000.000	1157.831	1156.631	1154.531	1156.345	50.000

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
JAPAN INTERNATIONAL COOPERATION AGENCY
NTC INTERNATIONAL CO., LTD.

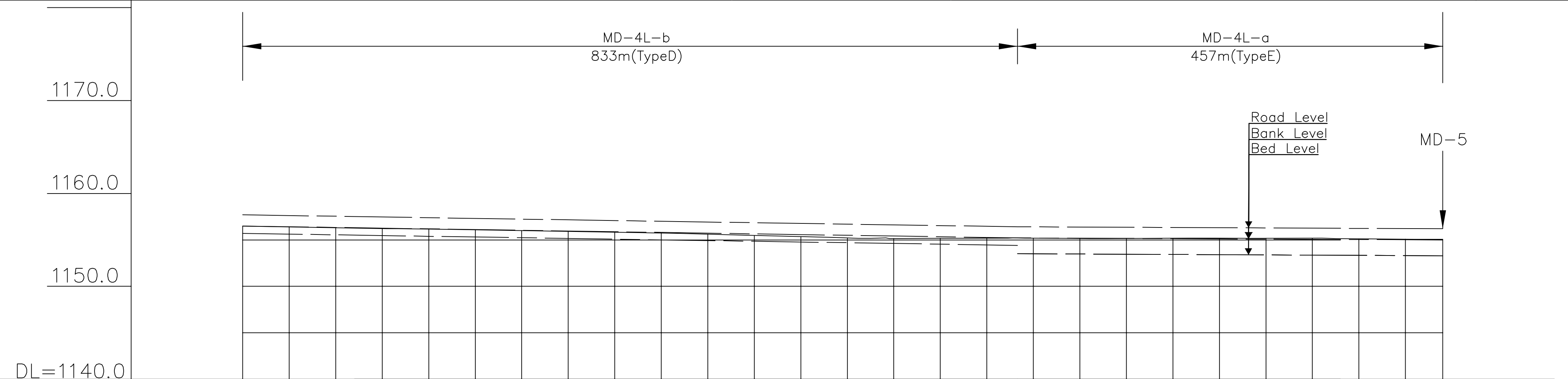
REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
	RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			MD3- 2
	DWG. TITLE	SCALE	APPROVED BY	SERIAL NO.
	MAIN DRAINAGE 3 PLAN AND PROFILE 2000.000~4000.000	1:6000		





ACCUMULATED DISTANCE	ROAD LEVEL	BANK LEVEL	BED LEVEL	ORIGINAL GROUND LEVEL	DISTANCE
4000.000	1157.831	1156.631	1154.531	1156.345	
4050.000	1157.765	1156.565	1154.466	1156.420	50.000
4100.000	1157.699	1156.499	1154.400	1156.290	50.000
4150.000	1157.634	1156.434	1154.334	1156.281	50.000
4200.000	1157.568	1156.368	1154.268	1156.281	50.000
4250.000	1157.502	1156.302	1154.202	1156.279	50.000
4300.000	1157.437	1156.237	1154.137	1156.274	50.000
4350.000	1157.371	1156.171	1154.071	1156.270	50.000
4400.000	1157.306	1156.106	1154.006	1156.224	50.000
4450.000	1157.240	1156.040	1153.940	1156.164	50.000
4500.000	1157.174	1155.974	1153.874	1156.253	50.000
4550.000	1157.109	1155.909	1153.809	1156.246	50.000
4600.000	1157.043	1155.843	1153.743	1156.154	50.000
4650.000	1156.978	1155.778	1153.678	1156.048	50.000
4700.000	1156.912	1155.712	1153.612	1155.947	50.000
4750.000	1156.846	1155.646	1153.546	1155.864	50.000
4800.000	1156.781	1155.581	1153.481	1155.818	50.000
4850.000	1156.715	1155.515	1153.415	1155.640	50.000
4900.000	1156.650	1155.450	1153.350	1155.580	50.000
	1156.601	1155.401	1153.301		
4950.000	1156.584	1155.384	1153.284	1155.512	50.000
5000.000	1156.518	1155.318	1153.218	1155.437	50.000
5050.000	1156.453	1155.253	1153.153	1155.363	50.000
5100.000	1156.387	1155.187	1153.087	1155.381	50.000
5150.000	1156.321	1155.121	1153.021	1155.139	50.000
5200.000	1156.256	1155.056	1152.956	1155.086	50.000
5250.000	1156.190	1154.990	1152.890	1155.127	50.000
5300.000	1156.124	1154.924	1152.824	1154.879	50.000
5350.000	1156.059	1154.859	1152.759	1155.150	50.000
5400.000	1155.993	1154.793	1152.693	1155.073	50.000
5450.000	1155.927	1154.727	1152.627	1154.994	50.000
5500.000	1155.862	1154.662	1152.562	1154.915	50.000
5550.000	1155.796	1154.596	1152.496	1154.834	50.000
5600.000	1155.731	1154.531	1152.431	1154.799	50.000
5650.000	1155.665	1154.465	1152.365	1154.802	50.000
5700.000	1155.599	1154.399	1152.299	1154.789	50.000
5750.000	1155.534	1154.334	1152.234	1154.738	50.000
5800.000	1155.468	1154.268	1152.168	1154.677	50.000
5850.000	1155.402	1154.202	1152.102	1154.581	50.000
5900.000	1155.337	1154.137	1152.037	1154.402	50.000
5950.000	1155.271	1154.071	1151.971	1154.384	50.000
	1155.250	1154.050	1151.950		
6000.000	1155.204	1154.004	1151.858	1153.982	50.000
6040.000	1155.150	1153.950	1151.750	1153.505	40.000
6050.000		1151.568	1151.724	1151.568	10.000
6060.144				1151.383	10.144

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE: RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO.: MD3- 3
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE: MAIN DRAINAGE 3 PLAN AND PROFILE 4000.000~6060.144	SCALE: 1:6000	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					



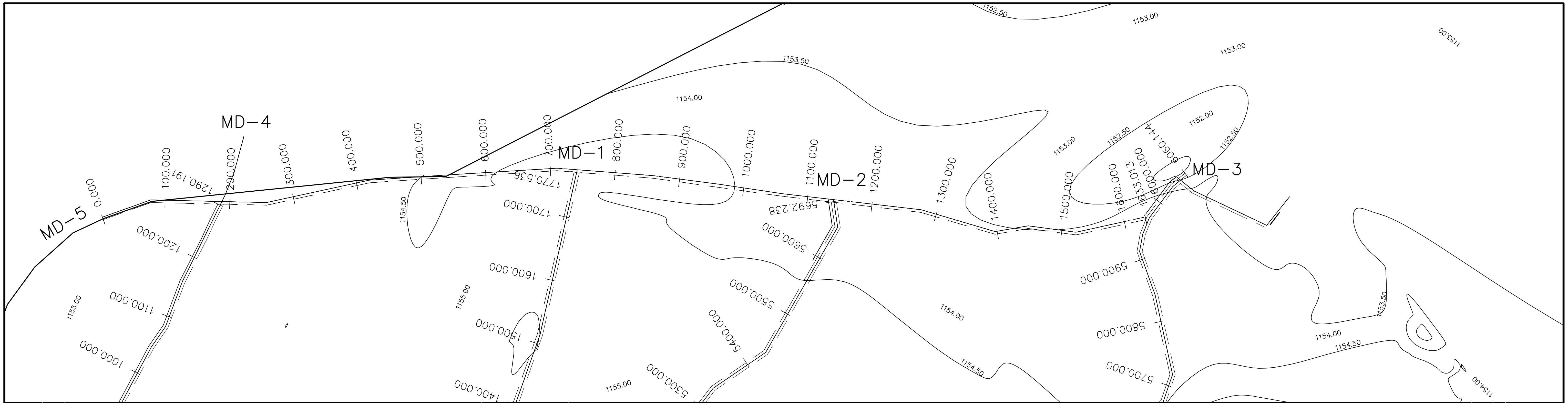
ROAD LEVEL	1157.700	1157.623	1157.546	1157.469	1157.392	1157.315	1157.238	1157.161	1157.083	1157.006	1156.929	1156.852	1156.775	1156.698
BANK LEVEL	1156.500	1156.423	1156.346	1156.269	1156.192	1156.115	1156.038	1155.961	1155.883	1155.806	1155.729	1155.652	1155.575	1155.498
BED LEVEL	1155.700	1155.623	1155.546	1155.469	1155.392	1155.315	1155.238	1155.161	1155.083	1155.006	1154.929	1154.852	1154.775	1154.698
ORIGINAL GROUND LEVEL	1156.500	1156.407	1156.315	1156.222	1156.163	1156.086	1156.001	1155.916	1155.832	1155.747	1155.621	1155.477	1155.350	1155.215
ACCUMULATED DISTANCE	0.000	50.000	100.000	150.000	200.000	250.000	300.000	350.000	400.000	450.000	500.000	550.000	600.000	650.000
DISTANCE		50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000

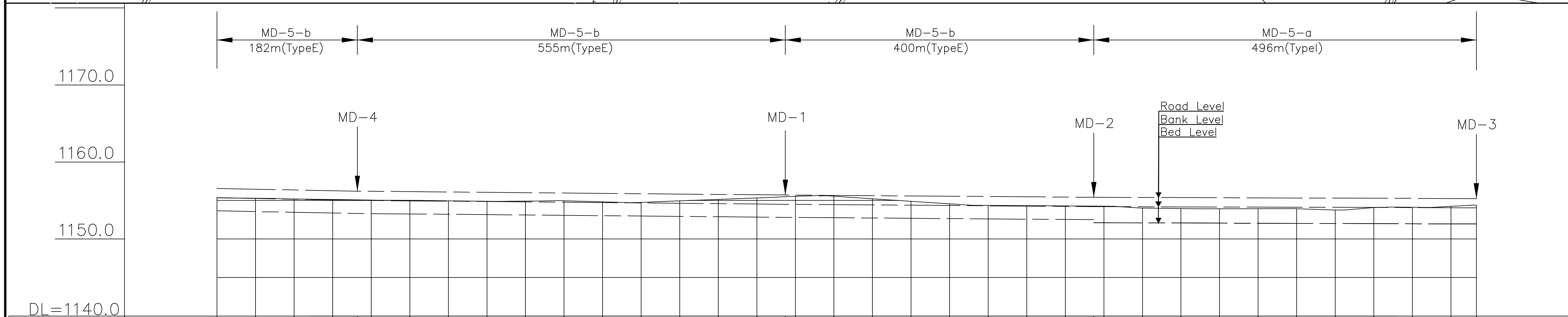
ROAD LEVEL	1156.621	1156.544	1156.467	1156.416	1156.408	1156.384	1156.361	1156.337	1156.313	1156.290	1156.266	1156.243	1156.219	1156.200
BANK LEVEL	1155.421	1155.344	1155.267	1155.216	1155.208	1155.184	1155.161	1155.137	1155.113	1155.090	1155.066	1155.043	1155.019	1155.000
BED LEVEL	1154.621	1154.544	1154.467	1154.416 1153.516	1153.508	1153.484	1153.461	1153.437	1153.413	1153.390	1153.366	1153.343	1153.319	1153.300
ORIGINAL GROUND LEVEL	1155.146	1155.167	1155.194		1155.199	1155.155	1155.160	1155.181	1155.182	1155.169	1155.180	1155.121	1155.086	1155.078
ACCUMULATED DISTANCE	700.000	750.000	800.000		850.000	900.000	950.000	1000.000	1050.000	1100.000	1150.000	1200.000	1250.000	1290.191
DISTANCE	50.000	50.000	50.000		50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	40.191

A-39

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO. MD4- 1
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE MAIN DRAINAGE 4 PLAN AND PROFILE 0.000~1290.191	SCALE 1:6000	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					

A-40





ROAD LEVEL	1156.556	1156.461	1156.366	1156.272	1156.211	1156.195	1156.150	1156.104	1156.059	1156.014
BANK LEVEL	1155.356	1155.261	1155.166	1155.072	1155.011	1154.995	1154.950	1154.904	1154.859	1154.814
BED LEVEL	1153.656	1153.561	1153.466	1153.372	1153.311	1153.295	1153.250	1153.204	1153.159	1153.114
ORIGINAL GROUND LEVEL	1155.340	1155.287	1155.188	1155.121		1155.053	1155.014	1154.957	1154.903	1154.925
ACCUMULATED DISTANCE	0.000	50.000	100.000	150.000		200.000	250.000	300.000	350.000	400.000
DISTANCE		50.000	50.000	50.000		50.000	50.000	50.000	50.000	50.000

ROAD LEVEL	1155.969	1155.924	1155.879	1155.834	1155.789	1155.743	1155.710	1155.700	1155.663	1155.625	1155.588	1155.550	1155.513	1155.475	1155.438
BANK LEVEL	1154.769	1154.724	1154.679	1154.634	1154.589	1154.543	1154.510	1154.500	1154.463	1154.425	1154.388	1154.350	1154.313	1154.275	1154.238
BED LEVEL	1153.069	1153.024	1152.979	1152.934	1152.889	1152.843	1152.810	1152.800	1152.763	1152.725	1152.688	1152.650	1152.613	1152.575	1152.538
ORIGINAL GROUND LEVEL	1154.960	1154.817	1154.744	1154.960	1155.149	1155.337		1155.559	1155.550	1155.227	1154.897	1154.565	1154.358	1154.327	1154.292
ACCUMULATED DISTANCE	450.000	500.000	550.000	600.000	650.000	700.000		750.000	800.000	850.000	900.000	950.000	1000.000	1050.000	1100.000
DISTANCE	50.000	50.000	50.000	50.000	50.000	50.000		50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000

ROAD LEVEL	1155.410	1155.406	1155.390	1155.374	1155.357	1155.341	1155.325	1155.309	1155.293	1155.277	1155.261	1155.250
BANK LEVEL	1154.210	1154.206	1154.190	1154.174	1154.157	1154.141	1154.125	1154.109	1154.093	1154.077	1154.061	1154.050
BED LEVEL	1152.510 / 1152.110	1152.106	1152.090	1152.074	1152.057	1152.041	1152.025	1152.009	1151.993	1151.977	1151.961	1151.950
ORIGINAL GROUND LEVEL		1154.256	1154.017	1153.958	1153.931	1153.937	1153.930	1153.771	1154.085	1154.126	1154.241	1154.387
ACCUMULATED DISTANCE		1150.000	1200.000	1250.000	1300.000	1350.000	1400.000	1450.000	1500.000	1550.000	1600.000	1633.013
DISTANCE		50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	33.013

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
JAPAN INTERNATIONAL COOPERATION AGENCY
NTC INTERNATIONAL CO., LTD.

REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
	RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			MD5- 1
	DWG. TITLE	SCALE	APPROVED BY	SERIAL NO.
	SECONDARY DRAINAGE 5 PLAN AND PROFILE 0.000~1633.013	1:6000		

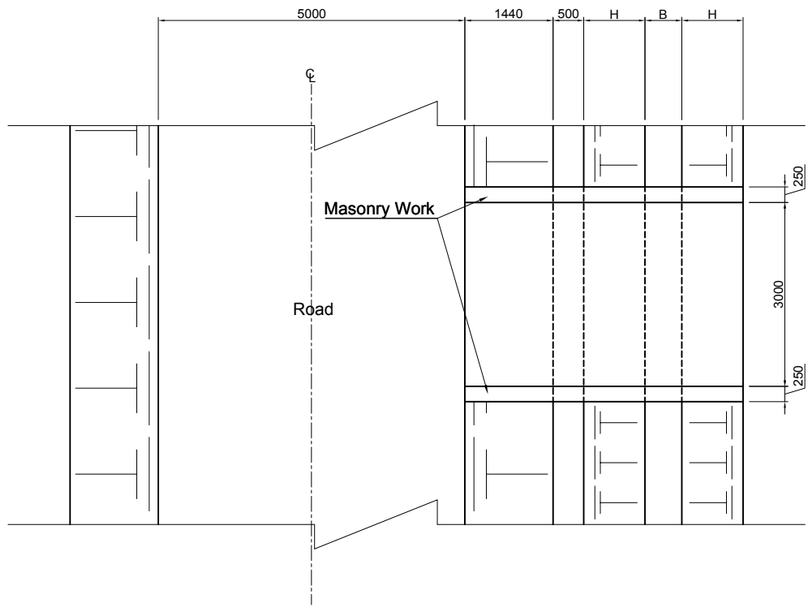
Tractor Passage

Tractor Passage TypeA~E

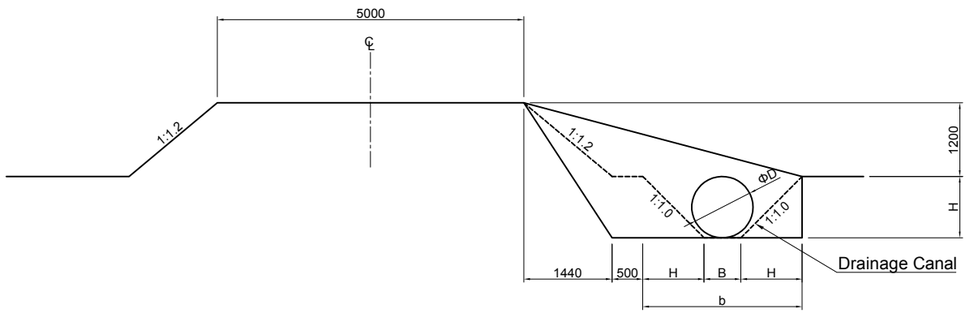
S=1:100

NOTE: Construction of Tractor Passage Type A~E @120m along Farm Road in Middle and downstream area.

Plan



Cross Section

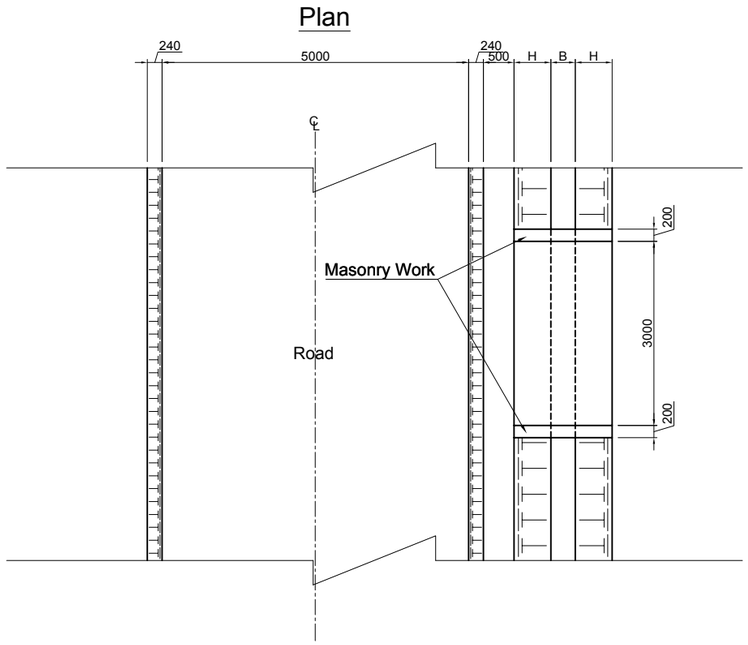


Tractor Passage TypeF

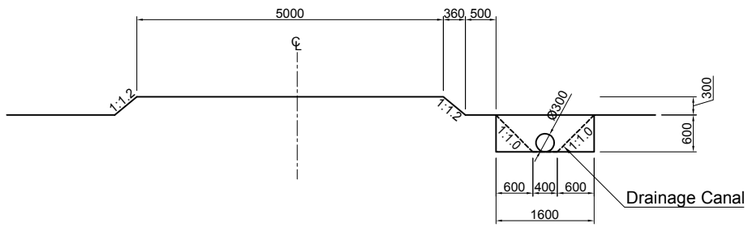
S=1:100

NOTE: Construction of Tractor Passage Type F @20m along Farm Road in upstream area.

Plan



Cross Section



	Drainage Type A			Drainage Type B			Drainage Type C			Drainage Type D			Drainage Type E		
	B:	b:	H:	B:	b:	H:	B:	b:	H:	B:	b:	H:	B:	b:	H:
	0.4	1.6	0.6	0.5	2.1	0.8	0.6	2.6	1.0	0.8	3.2	1.2	1.2	4.6	1.7
Tractor Passage TypeA D=Φ800	○			○			○								
Tractor Passage TypeB D=Φ1000							○			○			○		
Tractor Passage TypeC D=Φ1000x2							○			○			○		
Tractor Passage TypeD Box w1.5xh1.0													○		
Tractor Passage TypeE Box w2.0xh1.0										○					

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE: TRACTOR PASSAGE	SCALE: 1:100	APPROVED BY	SERIAL NO.

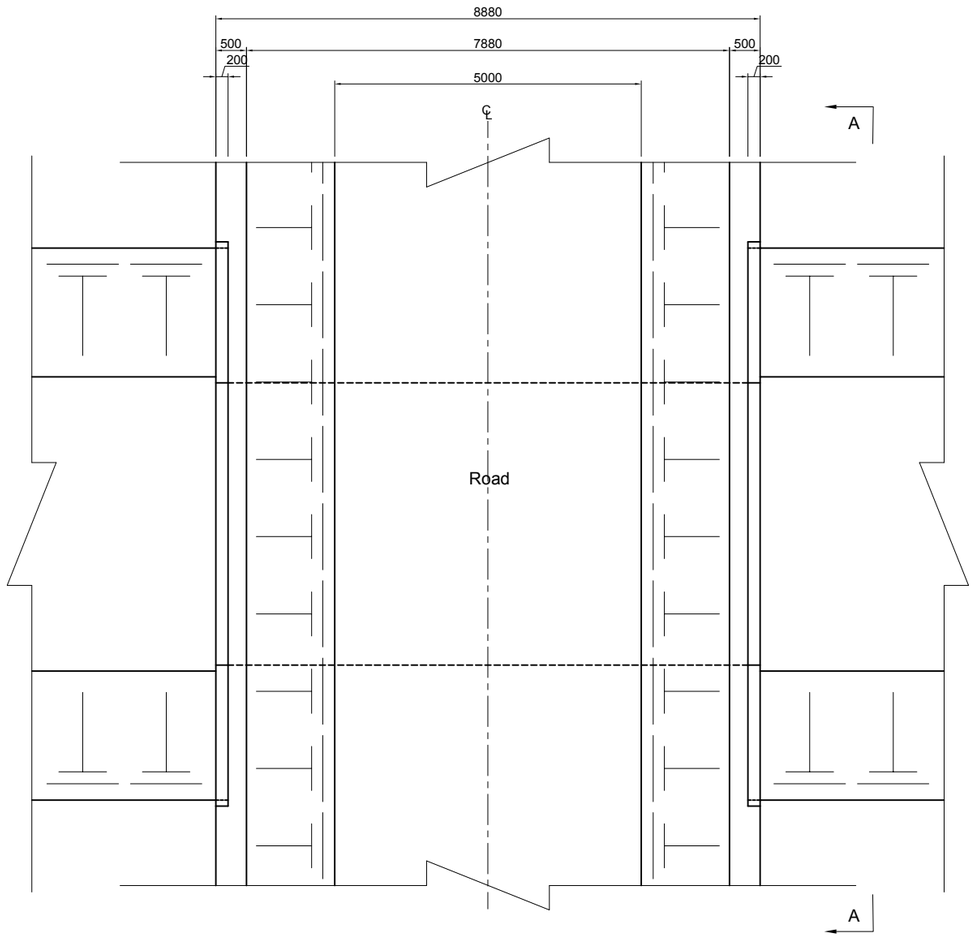
A-41

Farm Road Crossing

Road Crossing TypeA~G

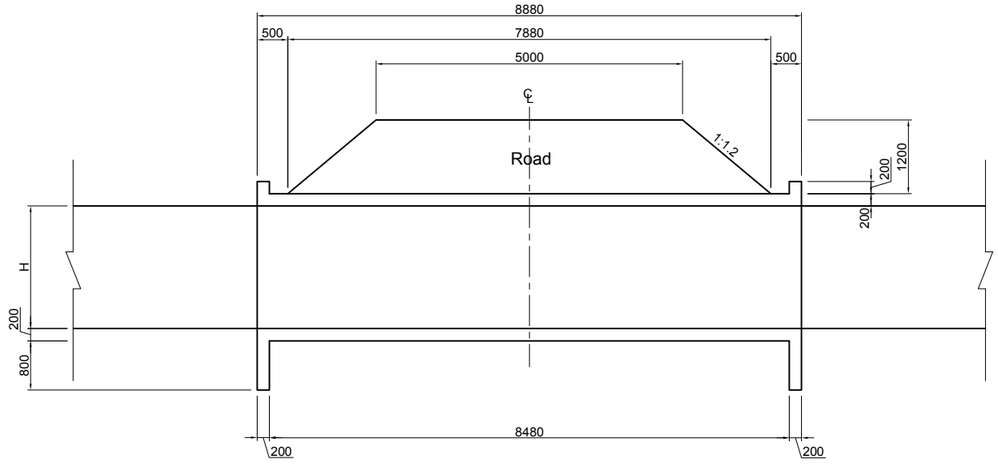
S=1:100

Plan

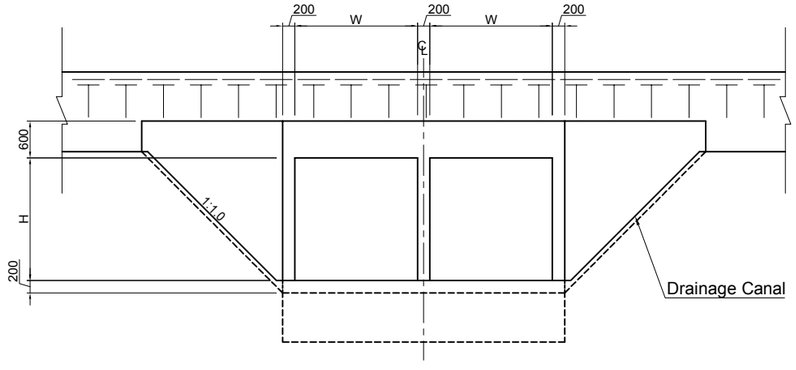


Farm Road Crossing Type A	Farm Road Crossing Type B	Farm Road Crossing Type C	Farm Road Crossing Type D	Farm Road Crossing Type E	Farm Road Crossing Type F	Farm Road Crossing Type G
W1.0xH1.5	W2.0xH1.0	W2.0xH1.5	W2.0xH2.0	W2.0xH2.0 (Double)	W2.5xH2.5 (Double)	W2.5xH2.5 (Triple)

Cross Section



Cross Section A-A



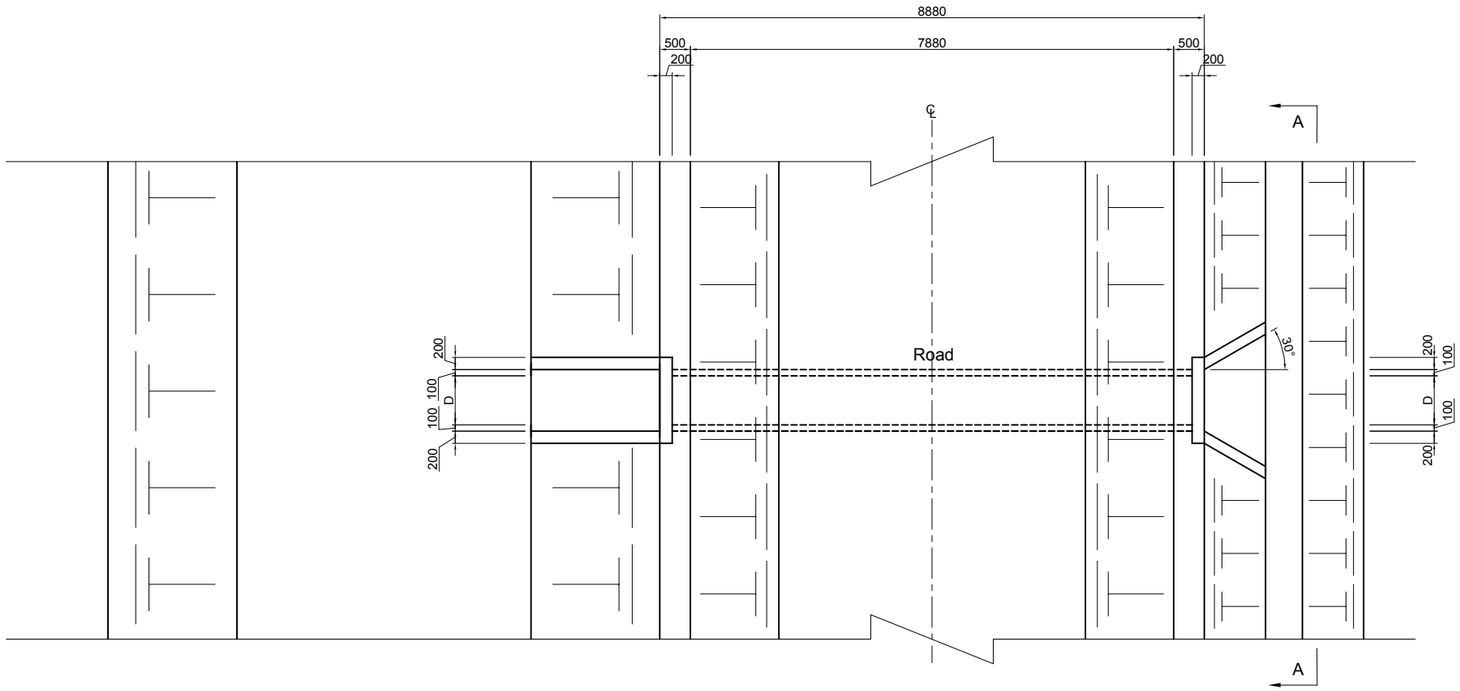
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE: RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE: Farm Road Crossing Type A~G	SCALE: 1:100	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					

Farm Road Crossing

Road Crossing TypeH~I

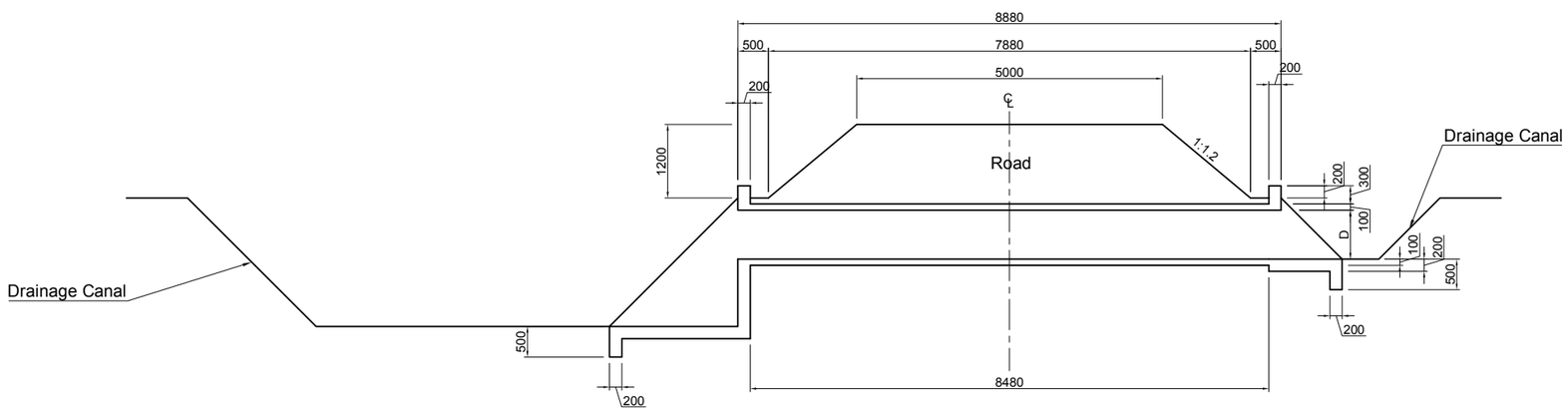
S=1:100

Plan

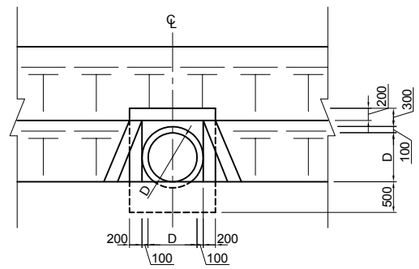


Farm Road Crossing Type H	Farm Road Crossing Type I
D800	D1000

Cross Section



Cross Section A-A

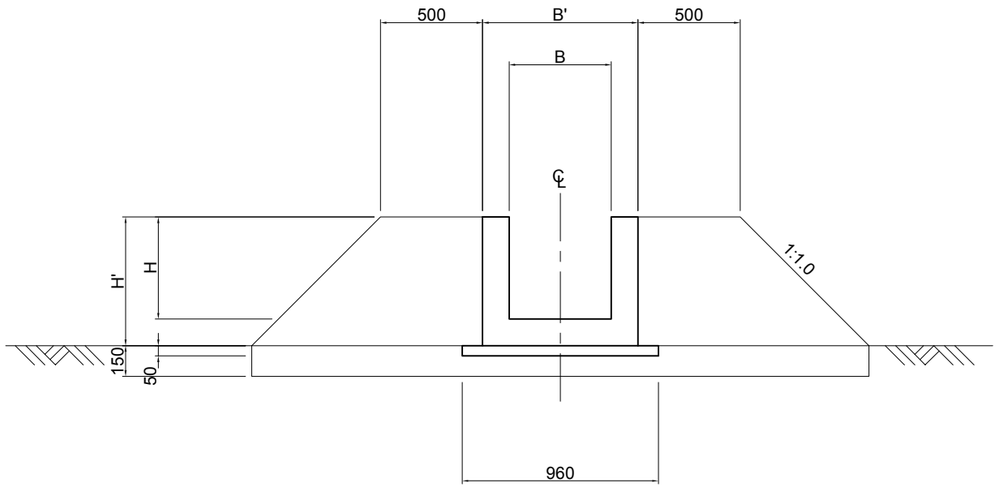


MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE: Farm Road Crossing Type H~I	SCALE: 1:100	APPROVED BY	SERIAL NO.

Irrigation Canal

Irrigation Canal
S=1:30

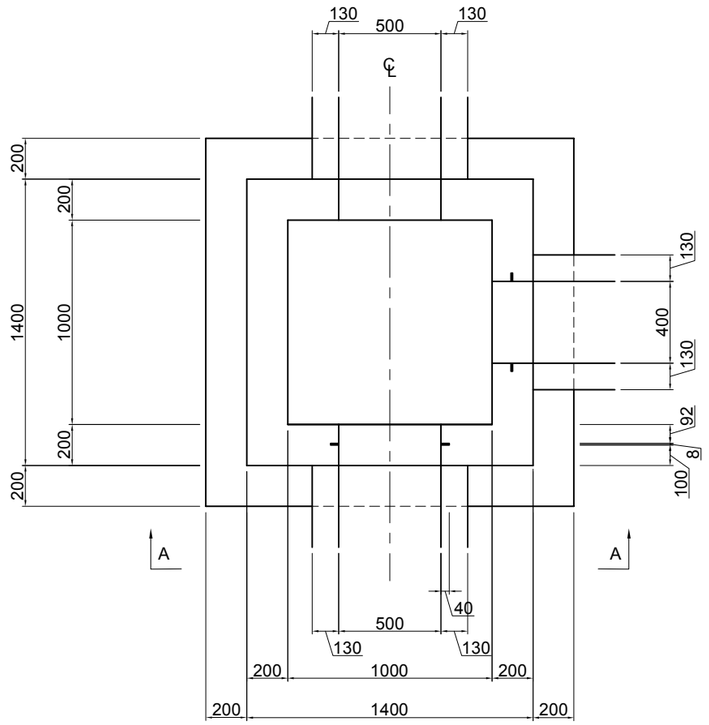
Cross Section



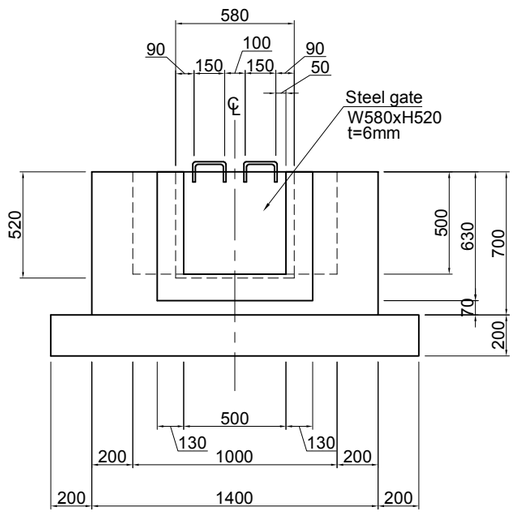
	Irrigation Type A	Irrigation Type B
B:	0.4	0.5
B':	0.66	0.76
H:	0.4	0.5
H':	0.53	0.63
b:	0.86	0.96

Division Box
S=1:30

Plan



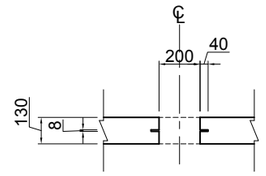
Cross Section A-A



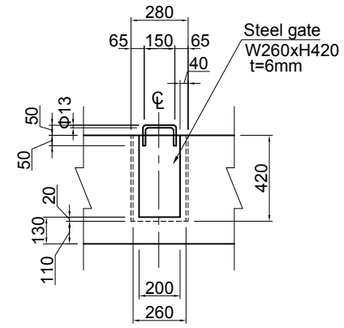
Inlet
S=1:30

NOTE: Construction of inlet @10m along Irrigation canal.

Plan

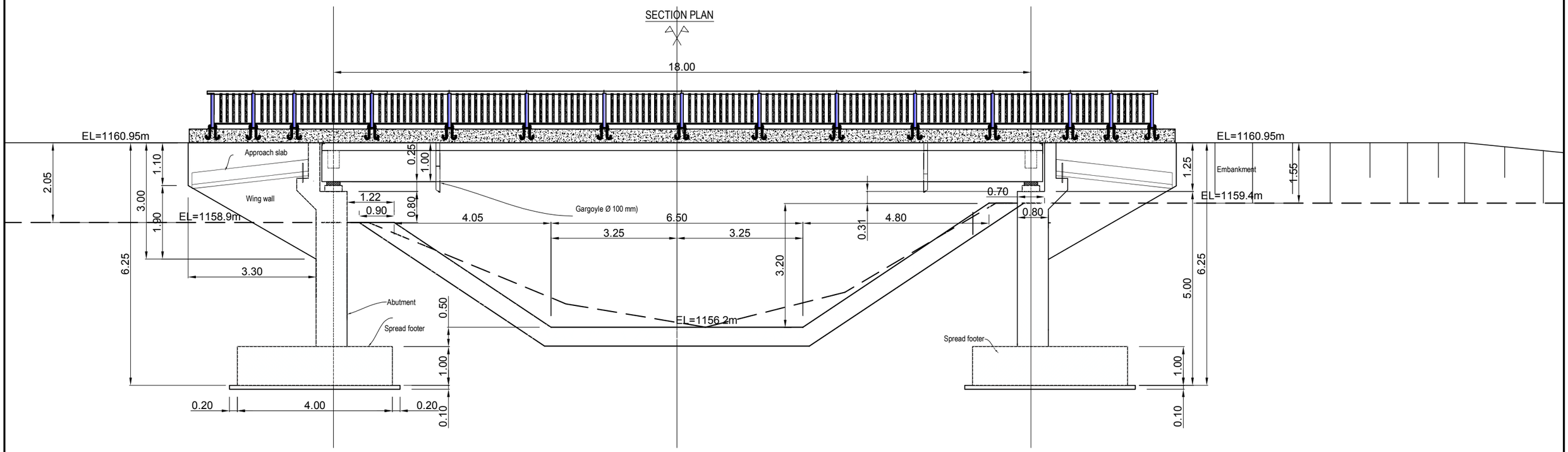


Cross Section

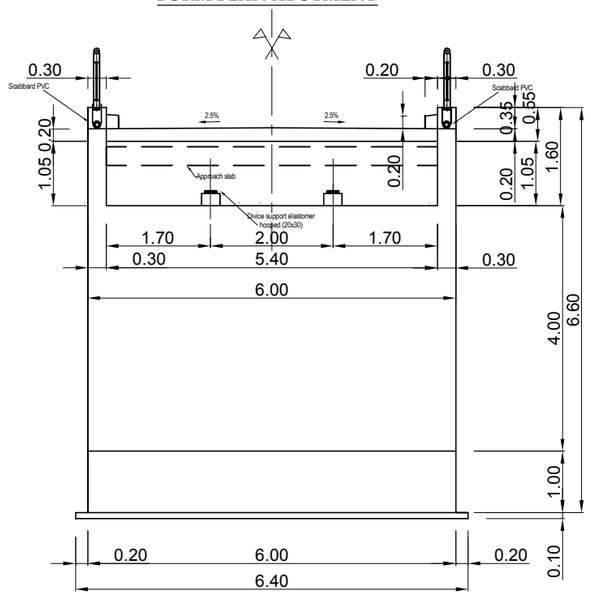


MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE: RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE: IRRIGATION CANAL	SCALE: 1:30	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					

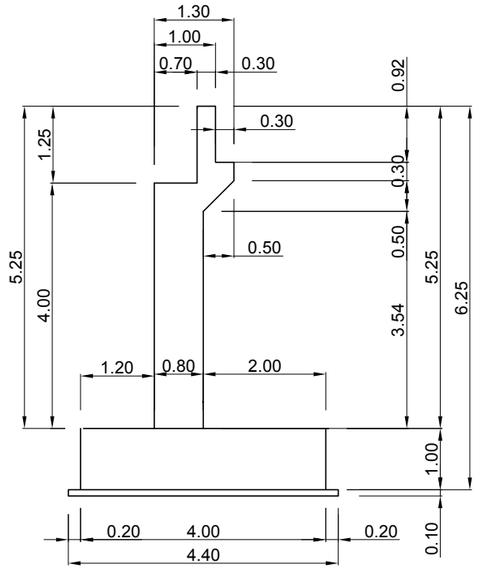
SECTION PLAN



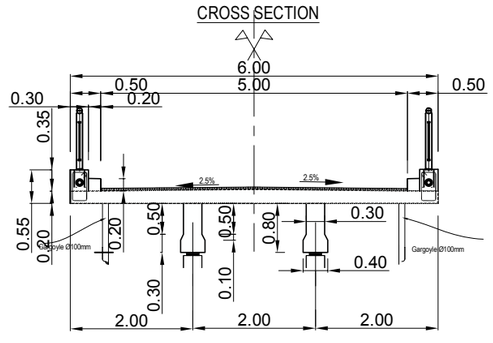
FORM PLAN ABUTMENT



ABUTMENT SECTION



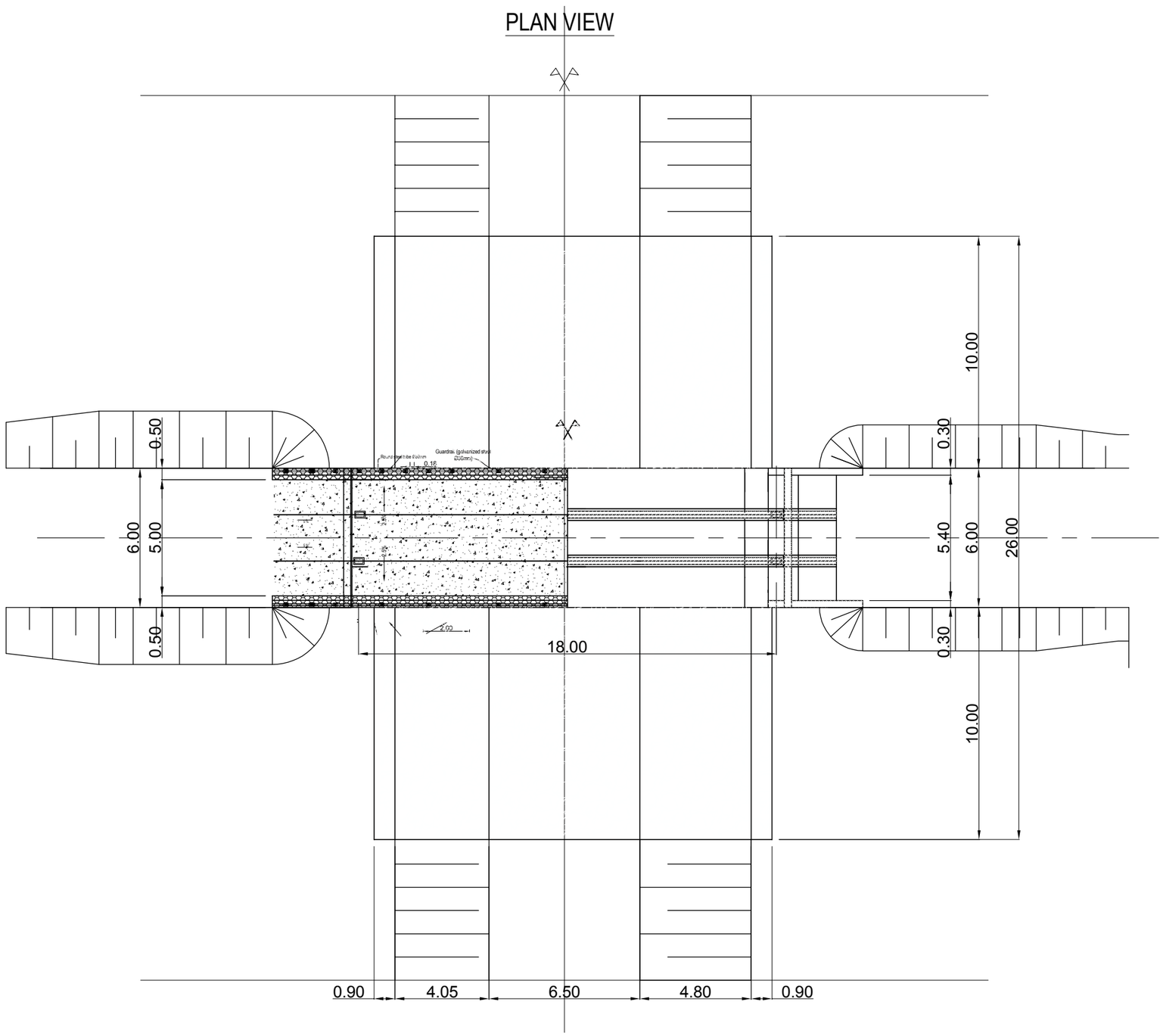
CROSS SECTION



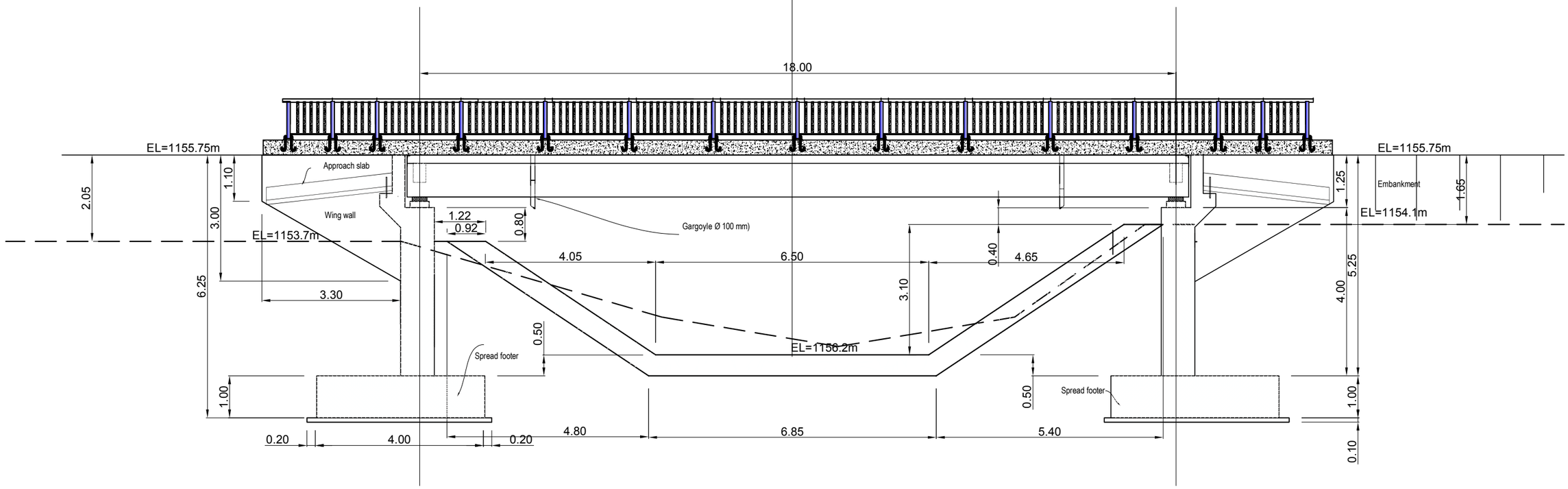
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE BRIDGE No.1 (1/2)	SCALE	APPROVED BY	SERIAL NO.

A-46

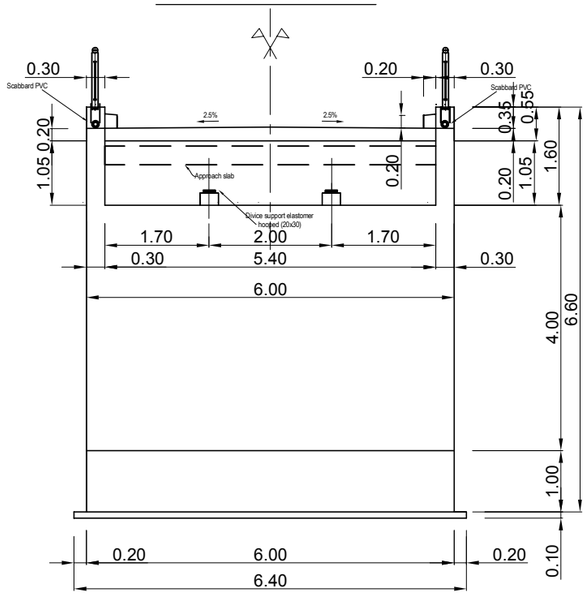
PLAN VIEW



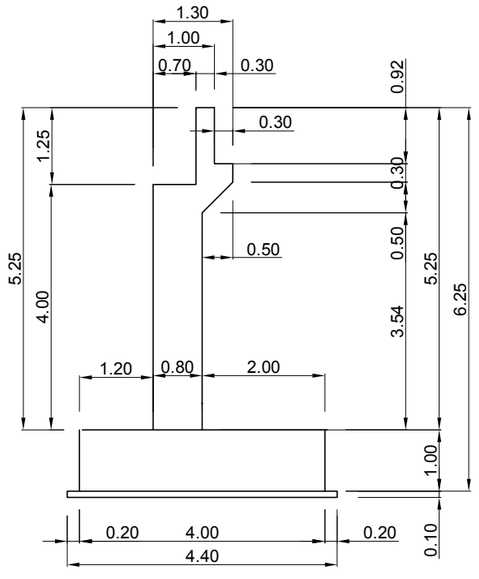
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE BRIDGE No.1 (2/2)	SCALE	APPROVED BY	SERIAL NO.



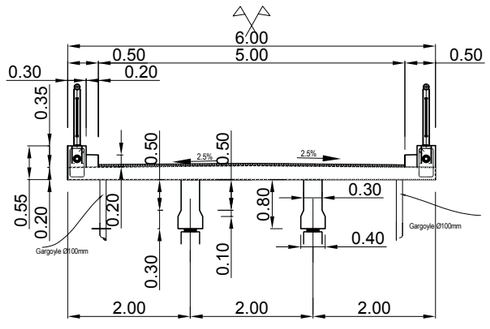
FORM PLAN ABUTMENT



ABUTMENT SECTION



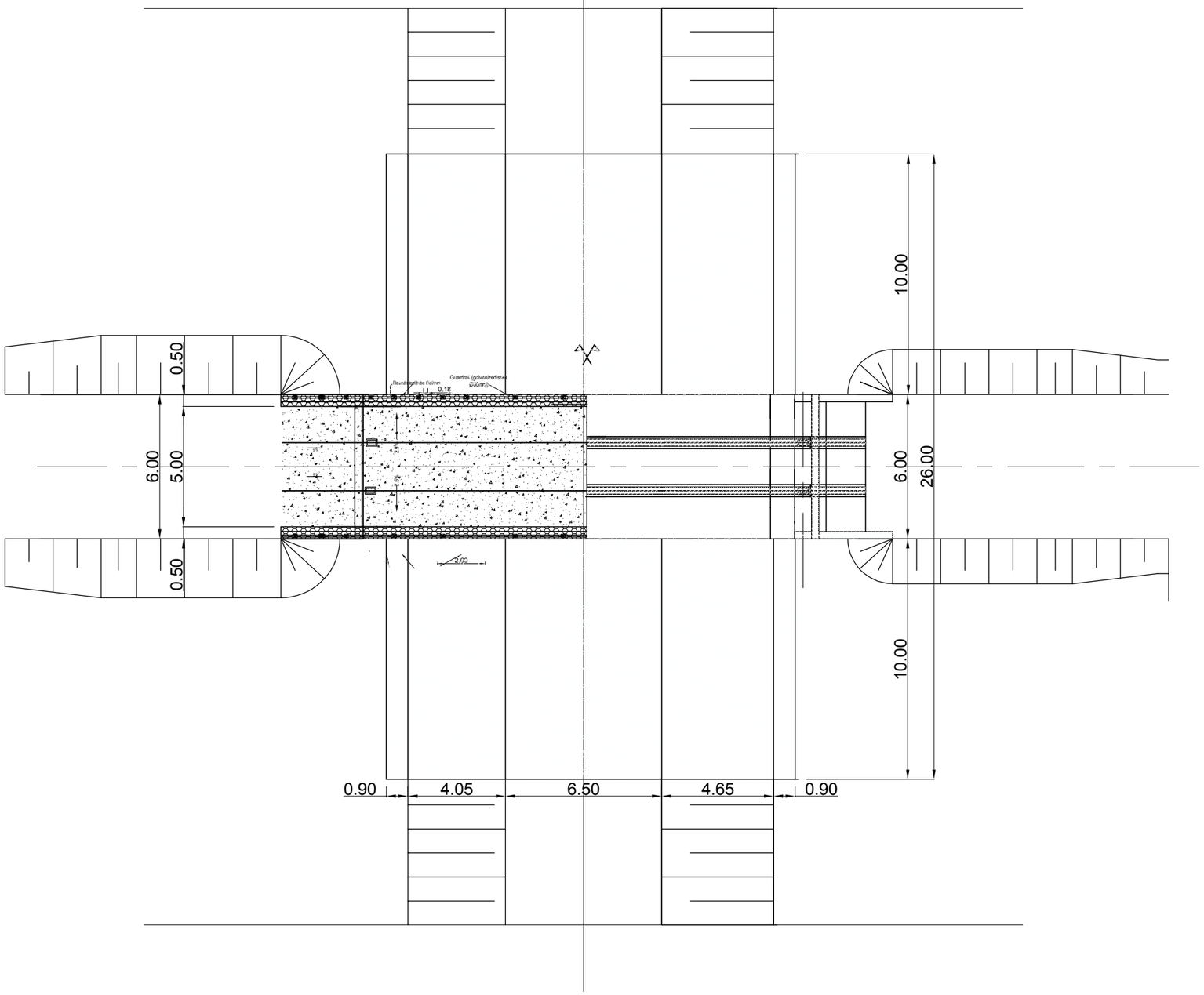
CROSS SECTION



MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		RURAL INFRASTRUCTURE IMPROVEMENT PROJECT			
NTC INTERNATIONAL CO., LTD.		DWG. TITLE BRIDGE No.2 (1/2)	SCALE	APPROVED BY	SERIAL NO.

A-47

PLAN VIEW



MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT	REVISION	PROJECT TITLE RURAL INFRASTRUCTURE IMPROVEMENT PROJECT	DATE	DESIGNED BY	DWG NO.
JAPAN INTERNATIONAL COOPERATION AGENCY		DWG. TITLE BRIDGE No.2 (2/2)	SCALE	APPROVED BY	SERIAL NO.
NTC INTERNATIONAL CO., LTD.					