THE REPUBLIC OF UGANDA
MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES (MAAIF)

THE PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN ATARI BASIN AREA
IN
THE REPUBLIC OF UGANDA

October 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Sanyu Consultants Inc.

The survey team held a series of discussions with the officials concerned of the Government of Uganda, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Uganda for their close cooperation extended to the survey team.

October, 2018

Kenichi Shishido

Director General
Rural Development Department
Japan International Cooperation Agency

Summary

1. Outline of Country

Agriculture sector in the Republic of Uganda (hereinafter referred to as “Uganda”) is the key industry, since it accounts for 24.5 % (source: the Central Intelligence Agency, the United State of America (hereinafter referred to as “CIA”, 2017), 46%(source: CIA, 2016) and 72%(source: CIA, 2013) of GDP, export and employment population, respectively. The potential irrigation area, however, is conservatively developed, namely 2.8% (1.4million ha as of 2010) only out of 50million ha of entire potential area due to the inadequate experience of irrigation development project. In recent years, rain-fed agricultural activities were significantly affected, due to the changes of rainfall pattern, seemingly by climate change. Accordingly, agricultural production activities in Uganda, which relies on rain-fed agriculture, have been forced to be unstable.

In this regards, GoU has defined agriculture and irrigation as one of the development sectors with the highest priority in the National Development Plan (2015/16 - 2019/20) (hereinafter referred to as “NDP II”). The Agricultural Sector Strategic Plan (2015/16 - 2019/20) (hereinafter referred to as “ASSP”) also emphasizes the necessity of irrigation development and sets a goal of implementation of "competitiveness, profitability and sustainability." Additionally, the development plan promotes to shift from subsistence agriculture to commercial agriculture through the promotion of collective rice production which is one of commercial crop in Uganda, and GoU has moved forward for the implementation.

2. Project Back Ground and Outline

As mentioned above, Japan International Cooperation Agency (hereinafter referred to as “JICA”) conducted the Feasibility Study (hereinafter referred to as “the FS”) named “The Project on Irrigation Scheme Development in Central and Eastern Uganda (2014-2016).” The Atari area was given the highest priority in 10 candidate sites by the FS, since it has rich water resources and comparative advantage in terms of costs for construction and operation and maintenance (hereinafter referred to as “O&M”). Based on the result of the FS, GoU officially requested the Government of Japan (hereinafter referred to as “GoJ”) to implement the Outline Design Study (hereinafter referred to as “the OD”) for “The Project for the Development of Irrigation System in Atari Basin Area (hereinafter referred to as “the Project”)” as the Japanese Grant Aid Project.

Through the Project, irrigation facilities will be constructed and O&M structure managed by mainly farmers will be established. It is expected to contribute to comprehensive middle or large-scale irrigation development which is dedicated in NDP II and Agricultural Sector Strategic Plan. In addition, Country Assistance Policy for Uganda documented by GoJ (July, 2017) states “increase of income through agricultural development” as one of major area and it aims at the income improvement of farmers through improvement of their productivity and effectiveness of post-harvesting for agricultural products.

From these aspects, the Project purpose and result based on the OD serve the stable irrigation water supply and the contribution to improvement of rural income with increasing in rice production.

Table-1. Project Outline Requested by Uganda

Items	Contents
Project site	Atari area (Left on Atri river: Bulambuli district, Right on Atari river: Kween District)
Project goal	To be Improved rice production through the construction of the irrigation facilities in the target area
Outputs	To be implemented the construction of the irrigation facilities in the target area
Contents of request letter	【Facilities】 Headworks (1set), Main canal (2.4km), Secondary canal (15.1km), Main farm itch

Items	Contents
	(10.0km), Sub-farm ditch (38.2km), Protection dyke (10.0km), Drainage canal (25.5km),Tail end facilities, O&M road (27.7km), Training facilities, Dry yard, Storage, Grain storage 【Equipment】 Agricultural machine (Tractor: 2sets、Hand tractor: 4sets), Machine for post-harvest treatment (Rice mill machine: 2sets, Drying machine, Packaging machine, Forklift: (4sets)) 【Consulting service】 Detailed design, Tender assistance, Supervision for construction and procurement 【Soft components】 Enhancement of operation and maintenance on irrigation facilities
Related agency	【Line Ministry】 Ministry of Agriculture, Animal Industry and Fishery：MAAIF 【Implement agency】 Department of Agricultural Infrastructure, Mechanization and Water for Agricultural Production：DAIMWAP

Source: JICA OD Team

3. Outline of Survey and Project Contents

The contents of survey in OD is targeted as follows; 1) Outline design and necessary survey, discussion and data collection for reporting 2) Follow-up procedure of concurrence by National Environment Management Authority (hereinafter referred to as "NEMA") on EIA report drew up in the FS, 3) Supervision and technical assistance on Resettlement Action Plan (hereinafter referred to as "RAP") drew by MAAIF, 4) Participate in stakeholder meeting for discussion and explanation on the Project components, 5) Discussion with, explanation to and basic consensus with the related agency and persons on the Draft final Report of preparatory survey, and 6) Interview to related agency and experts concerning Agricultural Chemicals Management Plan (hereinafter referred to as "ACMP") and birds monitoring method.

The OD was conducted the survey, based on the purpose above, with Ministry of Agriculture, Animal Industries, and Fisheries (hereinafter referred to as "MAAIF") as line Ministry of the Project, and was scheduled as follows;

Table2. Survey Schedule

Mission	Period	Purpose	Minutes of discussion (M/D)
1st mission	Jun.'17~ Sep.'17	Same as "1)" in description above	Discussion in JICA mission (July 30th in 2017) − Consensus with Uganda and Japan on the preparatory survey. − Discussion on project purpose, implementation agency, schedule on preparatory survey, category of social and environmental considerations, and the others. 5th JTC meeting (August 29th in 2017) − Confirmation on implementation of land re-organization. − Confirmation on Protected Zone of locating at 30m distance away from hypothetical river center. − Request for the speeding up documentation of RAP due to the delay. − Confirmation on budgeting and implementing of EIA done by Uganda side.
2nd mission	Sep.'17~Oct.'17	Same as "2) and 3)" in description above	Discussion in JICA mission (September 29th in 2017). − Supervising delay RAP progress and confirmation on request of support to RAP consultant by the OD Team. − Confirmation on necessity of compensation and livelihood support for the Project Affected Persons (hereinafter referred to as "PAPs")

Mission	Period	Purpose	Minutes of discussion (M/D)
			based on draft RAP. − Confirmation on inconsistency matters between MD signed with CAOs in Bulambuli and Kween on 24th May in 2016, and related domestic law in Uganda. − Confirmation on concept of land re-organization , consensus with PAPs and schedule and the others.
3rd mission	Oct.'17~Dec.'17	Same as "2) and 3)" in description above	ditto
4th mission	Jan.'18~Feb.'18	Same as "4)" in description above	MAAIF and OD Team discussion (February 7th in 2017). − Confirmation on targeted land re-organization of 12ha out of 680ha in total of beneficiary area. − Confirmation on implementation of land re-demarcation by recipient country. − Confirmation on obligation by MAAIF concerning the conditional certificate by NEMA issued on 2nd August 2017. − Confirmation on schedule of 2nd stakeholder meeting in mid-March and approval by Cheif Government Value (hereinafter referred to as CGV) in mid-April, and the others.
5th mission	Jun.'18	Same as "5)" in description above	Discussion in JICA mission (June 14th in 2018). − Agreed on contents of Draft final Report − Confirmation on Environmental Management Plan(hereinafter referred to as EMP) and Environmental Monitoring Plan (hereinafter referred to as EMoP) in social and environmental considerations. − Confirmation on the necessity of releasement on the WEB site about EIA approved by NEMA prior to 120 days from the conduction of E/N and G/A. − Confirmation on the necessity of releasement on the WEB site about RAP approved by CGV, and the others.
6th mission	Aug.'18	Same as "6)" in description above	− Interview and confirmation to related agency in Uganda concerning ACMP and birds monitoring.

Source：JICA ODTeam

JICA OD Team examined the survey and the outline design for the Project components together with the consideration of relevancy and urgency as Grant Aid Project about the request from Uganda. These data and results were consolidated in the Draft final Report of the preparatory survey, and explained and discussed with Uganda side about the report in the 5th mission. The Project components agreed with the both side are shown as follows;

Table-3. Outline of Facilities

Project components		Facilities	Qty.	Note
Construction of facilities	Irrigation and drainage	Headworks	1 set	Movable gate weir type including two intakes
		Main canal	2.3 km	Concrete lining
		Secondary canal	15.0 km	Concrete lining
		Tertiary canal	23.5 km	Earth canal
		Drainage	18.3 km	Earth canal
	River dyke	River dyke	5.1 km	Dyke height 1.4m (both banks)
	O&M road	O&M road	7.7 km	Soil pavement
	Land re-organization	Leveling	12.0 ha	Model site each 6ha in both district
Soft components	-	-	1 set	Operation and maintenance

Project components		Facilities	Qty.	Note
				on facilities, and water management

Source：JICA OD Team

4. Project Schedule

Based on the contents, the scale of facilities, site conditions in rainy season, cropping schedule of rice and the others, the entire project period is planned as follows;

- ✓ Detailed design: Eight(8) months
- ✓ Preparing tender document and, bidding and contract: five(5) months
- ✓ Procurement and construction: 31 months

The Project schedule is outlined as follows;

Table-4. Draft Project Schedule

year	'18	2019												2020												2021												2022						
month	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Detailed design																																													
Tender document / Bidding and Contract																																													
Procurement and Construction																																													

5. Project Evaluation

The nation of people below poverty line in Uganda is assumed to be 6.7million as of 2012/13, which account for 19.7% of gross population reported by Statistical Abstract, 2017, Uganda Bureau of Statistic. Comparing this statistical vale between in rural and urban areas, those are 7.8 million (22.8%) and 3.2 million (9.3%) respectively. It is appeared that the rural poor reaches about 2.5 times higher than the urban area of that. Furthermore the eastern area where the project is targeted is seen 24.5% of poor ratio in rural area, which is in excess of 22.8% of national average in rural area. Direct beneficial households in the Project are approximately 530 and indirect beneficial persons are approximately 6,530, therefore, the Project contributes poverty reduction through the increasing the rice production and the famers income.

NDRS undertaken in Uganda as the member of CARD plans to increase rice production in 680,000ton, which is three times relative to 2008. To increase in the rice production by the Project leads to realize an income improvement of farmers, hence, the Project serves the stable civilian life and the improvement of living conditions. Accordingly, the Project implementation is required with high urgency.

Agriculture in Uganda regards as the one of primary sector in the national development plan, in particular, it addresses to enhance modernization and productivity of agriculture. Agricultural Sector Development Strategy and Investment Plan 2010-2014 (hereinafter referred to as “DSIP”) in MAAIF puts the priority on improvement of productivity, hence, the Project policy is conformity with the national development plan and agriculture sector plan in Uganda. Furthermore, according to ODA policy for Uganda in July 2017, improving the rural income through the rural development project regards as the one of priority filed and the development project and aims at an enhancement of income of rural poverty with improving agricultural productivity and yielding. Hence the Project is in

conformity with these policy as well.

Expected quantitative effectiveness in the Project is 1) Increasing in the irrigation area, 2) Increasing in the paddy area, and 3) Increasing in the rice production, and the values of effectiveness in the table below are targeted in three years after the completion of the Project.

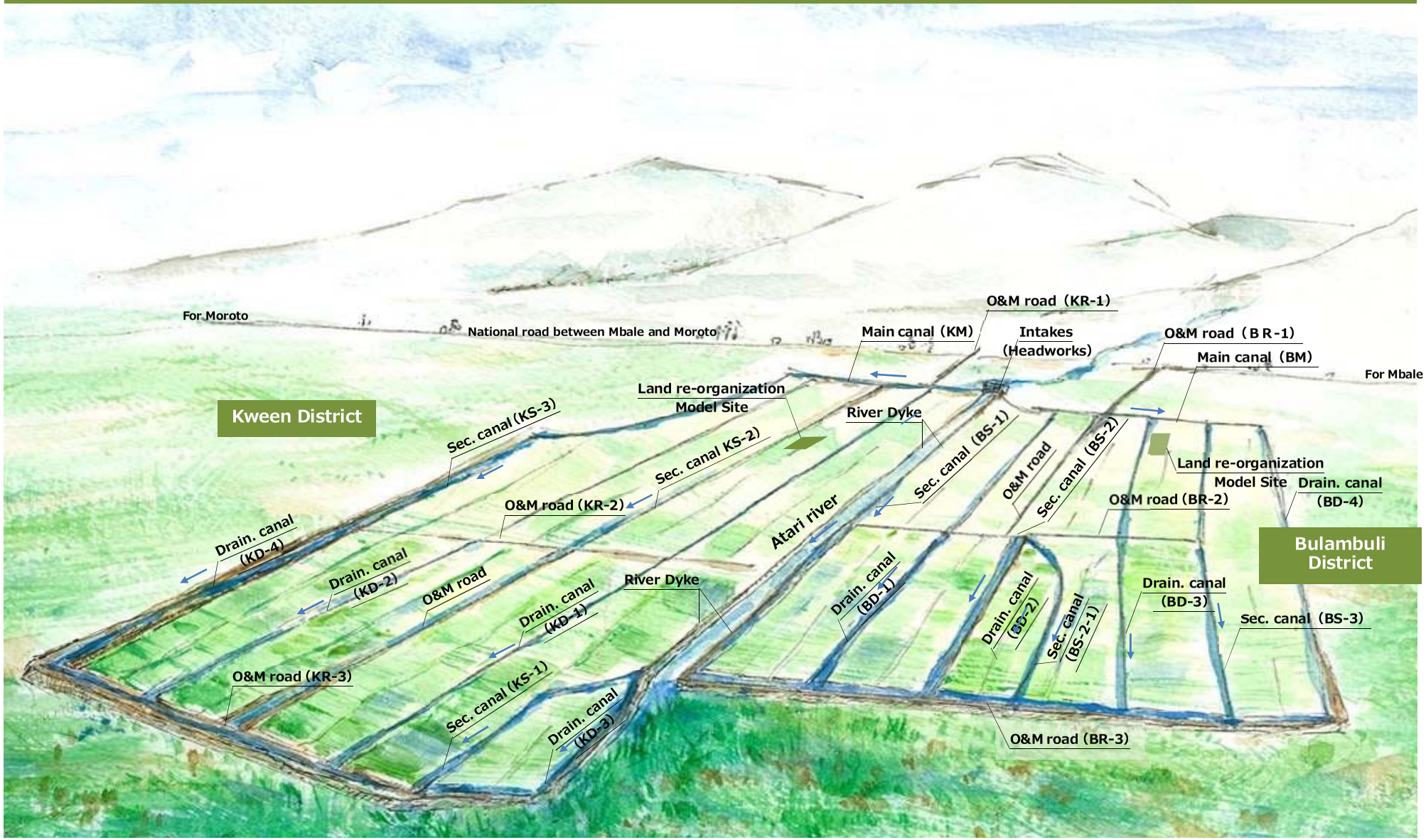
Table-5. Base and Target Value of Quantitative Effectiveness

Items	Base（2014）	Target（2025）
Irrigation area（ha）	330 ha	680 ha
Rice field（ha）	264 ha	570 ha
Rice production（ton／ha）	3.0 ton／ha	5.0 ton／ha

Source：JICA ODTeam

Qualitative effectiveness in the Project is expected as follows; 1) The Project becomes the model of irrigation development project in Uganda, furthermore, the activities in the Project are broaden and developed to other irrigation scheme, 2) Increasing in the rice production in the Project in conjunction with technical assistance project targeted improvement and extension of irrigation rice agriculture technics, 3) The construction of the river dyke expects to impact on disaster prevention in the beneficial area and the qualified facilities secured contribute to the increasing in rice production and improvement of farmers' income, and 4) The soft components in the Project serve acquisition of technics on the O&M for the facilities to the related persons in the Project, and realize the sustainable irrigation agriculture, etc.

Perspective Drawing
The Project for the Development of Irrigation System in Atari Basin Area



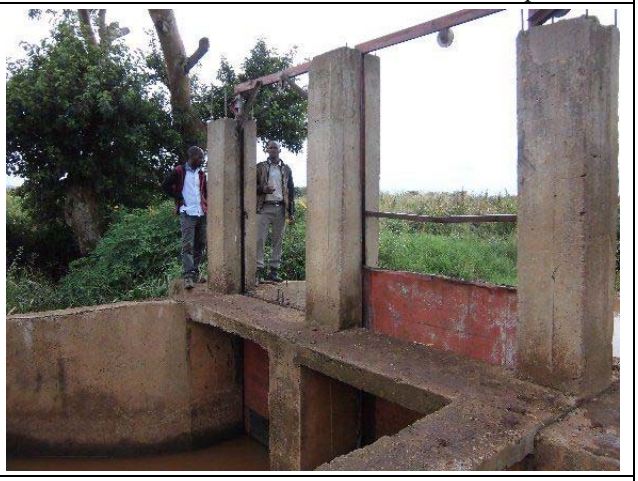
Pictures(1/2)

Picture 1. Landscape of Atari Area

This is a view from Kween side to the Project site surrounded with red dot line and blue line shows the Atari river. The target area at Kween side at the bottom of the picture and the Bulambuli side is widen at the corner of picture

Picture 2. Atari River

This is the status of the Atari river targeted water resource for the Project.



Picture 3. Existing Headwork

The headworks was constructed in 2006 by NGO, but proper operation is impossible due to the malfunction of gates hoist.

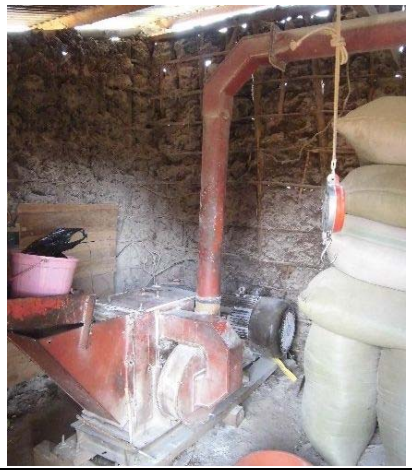
Picture 4. Paddy in the Target Area

This is the paddy in the target area. The farmers organize the earth canal from the Atari river and partly irrigate in the area.

Picture 5. Rice Planting in the Target Area

This is the status of the rice planting in the Kween area. The farmers are planting by means of manual works

Pictures(2/2)



Picture 6. Post-Harvest Treatment

This is the mill in the Atari area. The mill machine seems to be low quality and large milling yield.

Picture 7. Doho Irrigation Scheme

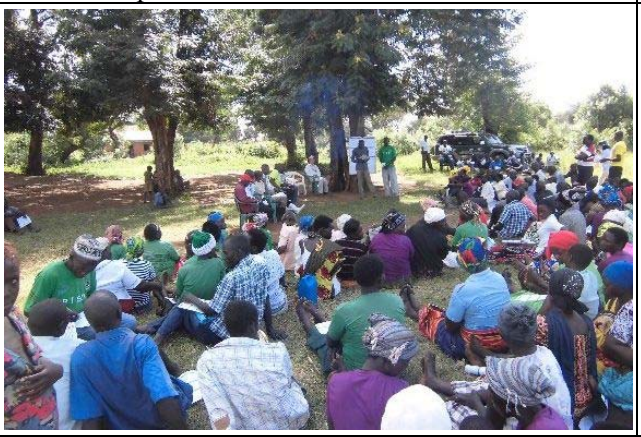
This is the Doho irrigation scheme as advanced irrigation relative to the Atari. Land re-organization has been implemented, and organized canal and farm ditch.

Picture 8. Boring Survey

This is the Boring survey to check strength of foundation for Dyke and O&M road. The survey was done at 18 points in total in the area.

Picture 9. Sand Back Test

This is the sand back test to check the strength of them filled with Black Cotton Soil



Picture 10. Stakeholder Meeting

This is the stakeholder meeting targeted all villagers in the area and the Project plan, issues of construction works were explained.

Picture 11. Minutes of Meeting

This is the minutes of meeting in the branch office of MAAIF in Kampala.

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List of Abbreviation

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AfDB	African Development Bank
ALC	Area Land Committee
AMU	Agricultural Mechanization Unit
A/P	Authorization to Pay
ARAP	Abbreviated Resettlement Action Plan
ASSP	Agriculture Sector Strategy Plan
B/A	Bank Arrangement
BCS	Black Cotton Soil
CAO	Chief Administrative Officer
CAS	Community Access Road
CbWMP	Community-based Wetland Management Plan
CDO	Community Development Officer
CGV	Chief Government Valuer
CIA	Central Intelligence Agency
C/P	Counterpart
DAIMWAP	Department of Agricultural Infrastructure, Mechanization and Water for Agricultural Production
DAO	District Agriculture Officer
DD	Detailed Design
DLO	District Land Officer
DNR	District Natural Resources
DP	District Planner
DPC	District Police Commander
DPO	District Production Officer
DWO	District Water Officer
EIA	Environmental Impact Assessment
EMA	Environmental Management Agent
EMP	Environmental Management Plan
EMoP	Environmental Monitoring Plan
EN	Exchange of Note

ESIA	Environmental and Social Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FR	Final Report
FS	Feasibility Study
GA	Grant Aid
GDP	Gross Domestic Product
GNI	Gross National Income
GoJ	Government of Japan
GoU	Government of Uganda
HH	Household
IBA	Important Bird Area
IMA	Internal Monitoring Agent
IUCN	International Union for Conservation of Nature and Natural Resources
ISO	International Organization for Standardization
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JICA Guidelines	JICA Guidelines for Environmental and Social Considerations
JIS	Japanese Industrial Standards
JTC	Joint Technical Committee
MAAIF	Ministry of Agriculture, Animal Industries, and Fisheries
MWE	Ministry of Water and Environment
MoGLSD	Ministry of Gender, Labor and Social Development
MoLHUD	Ministry of Lands, Housing and Urban Development
NaCRRI	National Crop Research Institute
NARO	National Agricultural Research Organization
NDP	National Development Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
OD	Outline Design
OP	Operation Manual
PACC	Project Area Coordination Committee
PAH	Project Affected Household
PAPs	Project Affected Persons
PDCC	Project District Coordination Committee
PIU	Project Implementation Unit
PPP	Public-Private-Partnership

PRiDe	Promotion of Rice Development Project
QS	Quality Seeds
RAP	Resettlement Action Plan
RCMU	Resettlement and Compensation Management Unit
SACCO	Savings and Credit Cooperatives Organization
SAE	Senior Agricultural Engineer
TOR	Terms of Reference
UGX	Uganda shilling
UNRA	Uganda National Road Authority
URA	Uganda Revenue Authority
VAT	Value Added Tax
WB	World Bank
WUA	Water User Association
ZARDI	Zonal Agricultural Research of Development Institute

List of Unit

1 UGX = 0.0311 Yen

1 USD = 112.05Yen

1 ha = 10,000m^2

kg = 1,000 g

km = 1,000 m

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Introduction

Agriculture sector in the Republic of Uganda (hereinafter referred to as “Uganda”) is the key industry, since it accounts for 24.5 % (source: the Central Intelligence Agency, the United State of America (hereinafter referred to as “CIA”), 2017), 46%(source: CIA, 2016) and 72%(source: CIA, 2013) of GDP, export and employment population, respectively. The potential irrigation area, however, is conservatively developed, namely 2.8% (1.4million ha as of 2010) only out of 50 million ha of entire potential area due to the inadequate experience of irrigation development project. Because stable rain fall twice in a year is major climate trend in Uganda and serves adequate agricultural productions by the rain-fed agriculture, in addition to that, the fact that the population is relatively small and the problem of food shortage has not emerged obviously.

In recent years, however, rain-fed agricultural activities were significantly affected, due to changes of rainfall pattern, seemingly by climate change. While the Government of Uganda (hereinafter referred to as “GoU”) aims the continuous development of irrigation facilities project, it is not promoted effectively due to the limit of human resources of the Government and farmers’ technical skill. Furthermore, the population increase rate with 3.2% makes pressure a limiting factor for the development (2017: 43 million people, 2050: 106 million people estimated; Source United Nations (2017). World Population Prospects: The 2017 Revision).

GoU has defined agriculture and irrigation as one of the development sectors with the highest priority in the National Development Plan (2015/16 - 2019/20) (hereinafter referred to as “NDP II”). The Agricultural Sector Strategic Plan (2015/16 - 2019/20) (hereinafter referred to as “ASSP”) also emphasizes the necessity of irrigation development and sets a goal of implementation of "competitiveness, profitability and sustainability." Additionally, the development plan promotes to shift from subsistence agriculture to commercial agriculture through the promotion of rice production which is one of commercial crop in Uganda.

1-2 Background and Outline of Grant Aid Project

From the view point of the development plan prioritized agriculture, the conversion from subsistence agriculture to commercial agriculture and the promotion of collective rice cultivation for the commercial agriculture together with background on the requirement of irrigation development, Japan International Cooperation Agency (hereinafter referred to as “JICA”) conducted the Feasibility Study (hereinafter referred to as “the FS”) named “The Project on Irrigation Scheme Development in Central and Eastern Uganda (2014-2016).”the Atari area was given the highest priority in 10 candidate sites by the FS, since it has rich water resources and comparative advantage in terms of costs for construction and operation and maintenance (hereinafter referred to as “O&M”). Based on the result of the FS, GoU officially requested the Government of Japan (hereinafter referred to as “GoJ”) to implement the Outline Design Study (hereinafter referred to as “the OD”) for the Project for the Development of Irrigation System in Atari Basin Area (hereinafter referred to as “the Project”) as the Japanese Grant Aid Project.

Through the Project, irrigation facilities will be constructed and O&M structure managed by mainly farmers will be established. It is expected to contribute to comprehensive middle or large-scale irrigation development which is dedicated in NDP II and Agricultural Sector Strategic Plan. In addition, Country Assistance Policy for Uganda documented by GoJ (July, 2017) states “increase of income through agricultural development” as one of major area and it aims at the income improvement of farmers through improvement of their productivity and effectiveness of post-harvesting for agricultural products. From this aspect, the Project can be said that it is in conformity with that policy.

Based on findings and results of the OD in response to the request from Uganda and a series of discussion, which aim at the development of new irrigation system and the contribution to increase in rice production, the Project components are formulated as follows;

Table 1-1. Outline of the Project

Facilities	Specification	Japanese side	Ugandans side	Remarks
Headworks	1	○	－	Movable weir, Two of intakes
Main canal	L=2.3 km	○	－	Concrete lining
Secondary canal	L=15.0 km	○	－	Concrete lining
Tertiary canal	L=23.5 km	Canal and division works	Farm dich	Earth canal
Drainage canal	L=18.3 km	○	－	Earth canal
River dyke	L=5.1 km	○	－	
Maintenance road	L=7.7 km	○	－	Earth pavement
Drainage canal at outside of Bulambuli	-	－	○	Design would be in D/D
Land re-organization	A=12 ha	Model site A=12 ha	Not model site	
Agricultural machine	－	－	○	
Value chain facilities	－	－	○	

Source：JICA OD Team

Site survey schedule in Uganda is shown as follows;

Table 1-2. Schedule on Site Survey

Mission	Term	Main works and activities
1st	Jun. 2017 ～Sep. 2017	Kick-off meeting on the preparatory survey Collection of data for the outline design
2nd	Sep. 2017 ～Oct. 2017	Follow-up the procedure on the EIA certification by NEMA Supervision of RAP and support of national consultant for RAP
3rd	Oct. 2017 ～Dec. 2017	Ditto
4th	Jan. 2018 ～Feb. 2018	Discussion of the Project components 1st stakeholder meeting
5th	Jun. 2018	Discussion of DfR 2nd stakeholder meeting
6th	Aug. 2018 ～Sep. 2018	Interviews on Methods of Bird Monitoring and Preparation of Agricultural Chemicals Management Plan

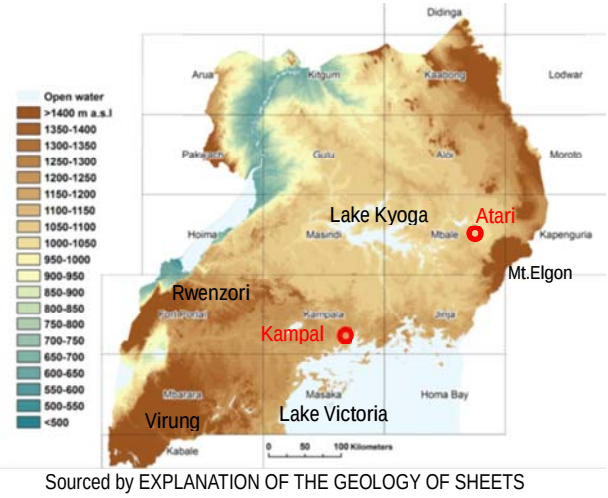
Source：JICA OD Team

1-3 Natural conditions

1-3-1 Topography and the geology

(1) Topography

The Atari area is located in the eastern part of Uganda, near the Uganda-Kenya border, and approximately 300km northeast from the capital city, Kampala. This area has various topographic features from the volcanic mountains of the East Rift, the vast plain area which is composed of the East African Plateau, lower wetland areas and finally to the surface water area such as Lake Kyoga, Lake Visina, and Lake Opeta. The volcanic mountain range comprising Mt. Elgon (4,321m), Mt. Kadam (3,068m), Mt. Napak (2,537m), and Mt. Moroto



Sourced by EXPLANATION OF THE GEOLOGY OF SHEETS NA-36-11 AND NA-36-12 (Mbale and Kapenguria 1:250 000)

Fig. 1-3-1. Topography in Uganda

(3,084m) forms steep terrain, which makes a lot of waterfalls and cliffs on the mountains.

The plain area has dominantly gentle slope with some sparse residual hills, which results in meandering rivers and wetland zones. Lake Kyoga has only 6m in depth but 1,720km^2, and wetland areas around the lake are designated by the Ramsar Convention. The main rivers in the eastern part, namely the Namatara River, Shironko River, Sipi River, Atari River and Ngenge River, flow the volcanic mountainous area to Lake Kyoga through the vast plateau.

This OD survey area is located on the northwest side of the foot of Mt. Elgon, which has 1,065m to 1,078m in altitude. It has relatively flat with slope of 1/200 as the result of sedimentation by pyroclastic material which the Atari river erodes and transports. The Atari River has its source in Mt. Elgon, and has 103km^2 in watershed area including the OD survey area and approximately 42km in length. The average river slope in the OD survey area is about 1/250, which make the river meandering and flow into Lake Opeta which has 8,412km^2 in basin area.

(2) Geology

Uganda is one of the countries where the oldest geological feature in the world is distributed. Precambrian rock (3,000Ma - 600Ma) occupies approximately 80% of the country. Those rocks receive metamorphism by the orogenic movement that happened from the Precambrian to Cambrian period (500Ma), and most are gneiss and granite.

Bedrock of the Atari district comprises the alkali basaltic lava and its clastic rocks from the Cenozoic stratovolcano, Mt. Elgon. It forms a horizontal multilayer structure of lava and tuff breccia caused by the intermittent lava flow, pyroclastic flow, mudflow and volcanic ash. Because the tuff is more subject to weathering compared to the lava, tuff surface is eroded selectively, which forms structural terraces on the upstream of the Atari area.

Sourced by EXPLANATION OF THE GEOLOGY OF SHEETS NA-36-11 AND NA-36-12 (Mbale and Kapenguria 1:250 000)

Fig. 1-3-2. Geological Map around the Atari

Table 1-3-1- Stratigraphic Table around the Atari Area

Geological age		Ma	Compl	Group	Formati	Sign	Geological feature
Phanerozoic	Quortanaly	2.58-	Sedimentary, Metamorphic Complexes			QHu	Alluvium, swamp, lacustrine
						QHl	Laterite
	Neogene	23-2.58	Elgon	Bugishu	Wagagai	NeEag	Volcanic mudflow , agglomerate,
				-	Ngenge	NeEnl	Nephelinite lava, olivine basalt
Proterozoi	Neoproterozo	1,000-541	-	West-Karam	Naparar	P3WK	Banded granulite and
Archeozoi	Neoarcheozo	2,800-2,50	Plutonic Rocks and Dykes			A3Ubg	Banded granite gneiss and

Ma: million years ago
Source: JICA OD Team

Regarding the latest sediments in the OD survey area, alluvial plain composed of the river and wetland sediments are distributed, and Luvisols and Vertisols (BCS) covers those sediments as the surface soil.

The BCS has high plant productivity from its chemical and agricultural aspects, and is appropriate for the production of cotton. However, from the civil engineering aspect, it requires special consideration

for the design of structures because the BCS includes clay materials such as smectite and montmorillonite. That type of soil shows swelling behavior when it contains water, which makes the soil very soft. On the other hand, it also shows dry shrinkage which makes the soil stiff and many cracks. Therefore, the BCS is generally regarded inappropriate as the material for civil engineering. Because the Atari district is covered by the BCS, it is one of the most important matter to consider the BCS's behavior even though the low swelling pressure was confirmed by swelling pressure test at site.

In addition, laterite (Murram) which is appropriate as the embankment material is distributed at the borrow pit of Cheptelere located approximately 9km northeast from the OD survey area.

1-3-2 Climate

Uganda is in tropical climate, which is characterize by much annual precipitation through all the seasons. The climatic zones of the survey area is categorized into Aw[1] (savanna climate) by Koeppen Geiger system. The climate conditions in the Atari district is as follows.

(1) Temperature

Figure 1-3-3 shows the temperature of Buginyanya located 27km southeast from the Atari district. The temperature is warm and stable throughout the year, showing 20-24℃ as the monthly mean temperature. As for the seasonal change in temperature, it becomes slightly lower from May to September (Lowest in July), and higher from January to March (highest in February). The annual average daylight hours is 6.8 hours (longest January and shortest in April). The humidity becomes lowest in February, and higher from May through October.

(2) Precipitation

The annual precipitation reaches 1,500mm. The characteristic of the precipitation trend is the length of the wet season. It is from the end of March to November, recording 125~250mm/month. During the wet season, there are two small peaks at May and August. The period from December to the middle of March is classified in the dry seasons. Because the annual evaporation amount reaches 1,700mm (biggest in February), the balance of precipitation and evaporation becomes negative.

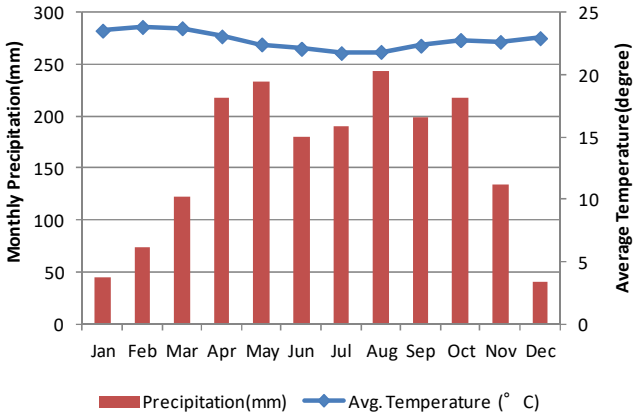


Fig. 1-3-3. Mean Temperature and Precipitation (Buginyanya)

1-3-3 Geological survey

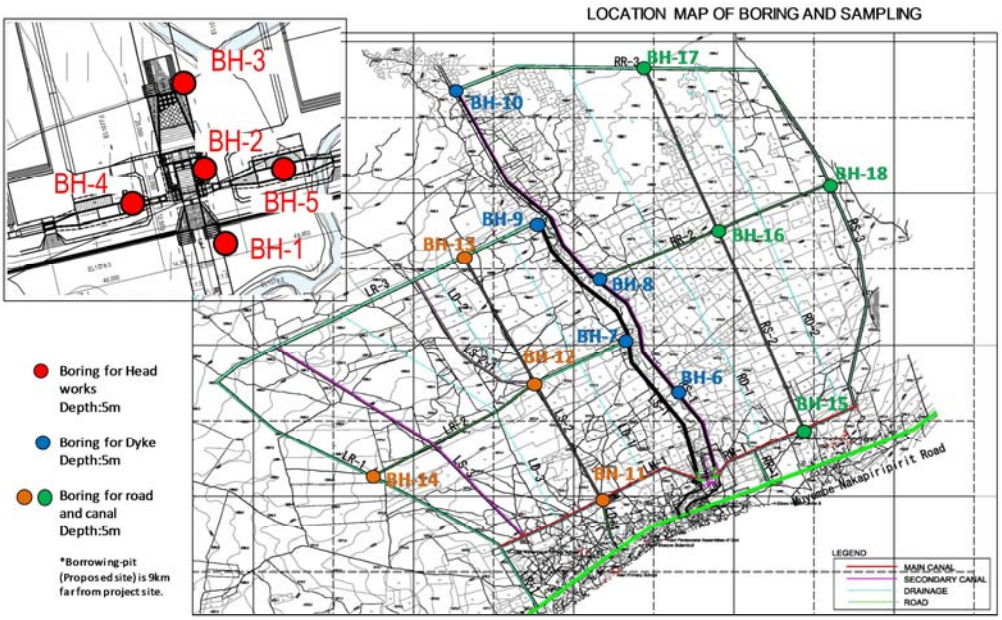
(1) Survey Contents

The geotechnical survey was carried to confirm geological features and the quality of soil on the main structures (head work, dike and road) and the proposed borrow pit.

[1] A (the tropical zone): The most wintry moon is w more than 18 degrees Celsius (I can grow a palm), w: wintertrocken (winter dries)

Table 1-3-2. Contents of the Geotechnical Survey

Location	Survey item		Amount
Head works	In situ test	Boring survey (BH-1 - 5)	5 places × 5 m / place = 25 m
		Standard Penetration Test	5 places × 5 times / place = 25 times
	laboratory test	Grain size analysis, Specific gravity, Natural water contents, Attarberg limit	5 places ×1 sample＝5 samples
Dykes	In situ test	Boring survey (BH-6 – 10)	5 places × 5 m / place = 25 m
		Standard Penetration Test	5 places × 5 times / place = 25 times
	laboratory test	Grain size analysis, Specific gravity, Natural water contents, Attarberg limit	5 places ×1 sample＝5 samples
Roads and Canals	In situ test	Boring survey (BH-11 - 18)	8 places × 5 m / place = 40 m
		Standard Penetration Test	8 places × 5 times / place = 40 times
		Portable Cone Penetration Test	52 places
		Filed demonstration of Do-nou	1 set
	laboratory test	Grain size analysis	8 places ×1 sample＝8 samples
		Swelling pressure test	5 places ×1 sample＝5 samples
Borrow pit	laboratory test	Grain size analysis, Specific gravity, Natural water contents, Attarberg limit, Compaction test	10 places ×1 sample＝10 samples



Source: JICA OD Team

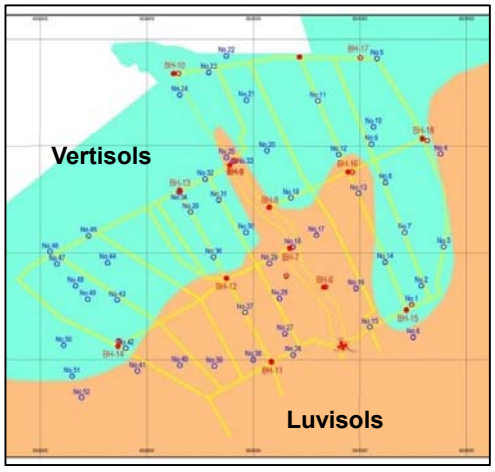
Fig. 1-3-4. Location Map of Geotechnical Survey

(2) Soil distribution and its property

- Vertisols (BCS)

This type of soil was found on the 70% of the survey area, covering the northern and eastern area as the result of the survey. The maximum thickness of this soil layer is 2.0m according to the borehole logs.

In the survey, BCS is categorized into two types depending on its property. BCS1 is defined as the general BCS, black clay which was formed by repetitive wet and dry on the ground surface. BCS2 is defined as blackish gray - light gray clay (indicating the



Note: ○ shows location of the Portable Cone Penetration Test.
Source: JICA OD Team

Fig. 1-3-5. Soil Distribution Map

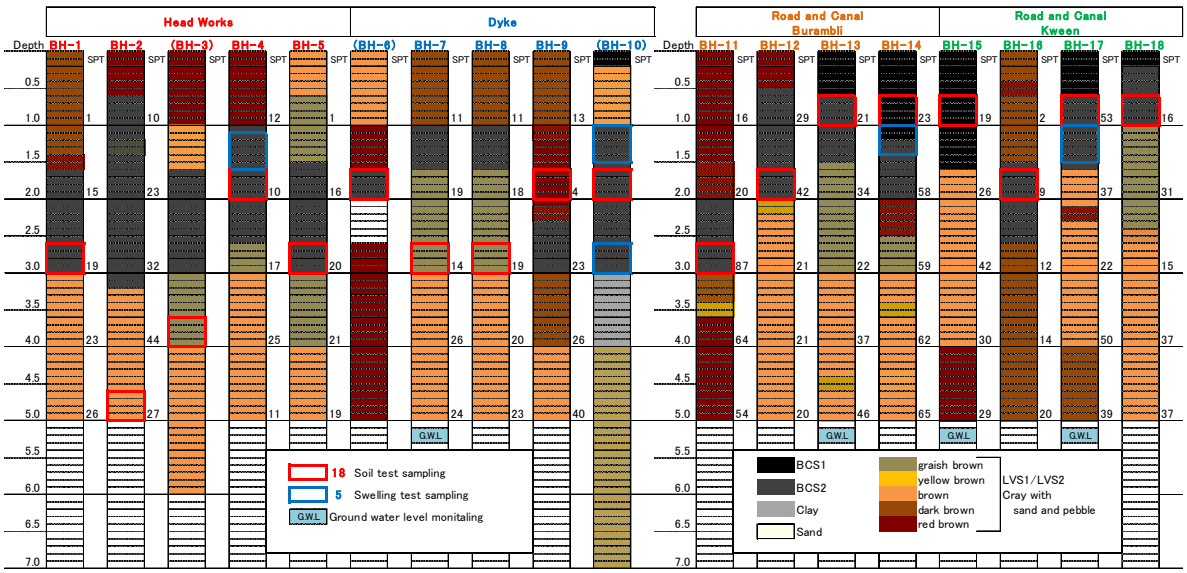
close property of Gleysols[2] on the downstream wetland) which has strong cohesive property. BCS1 and BCS2 are in the same startum, but it comprises a transition layer from BCS2 which covers Luvisols to BCS1 which is exposed to the surface of the ground. Therefore the boundary of those BCS is unclear.

- Luvisols (LVS)

This type of soil was found on the Atari River and southern to eastern part of the survey area as the result of the survey. LVS also has two types depending on its property (LVS1 and LVS2), which layer has 2m and 3m in thickness respectively. LVS1 is defined as the dark reddish-brown clay which contains gravel with weathered condition on the top layer. LVS2 is defined as dark brown – yellow brown clay with gravel. It is stiff and N value generally shows more than 20. Both of them contain scoria breccia with maximum 1cm in diameter and the gravel laminae which are considered to be old river deposit.

- Laterite (Murrum)

It exists until 5m in depth from the ground surface in the borrow pit of Cheptelere, and is easily excavated and exploited by the open-pit mining with backhoe. Although the distribution of laterite is irregular from the large scale view, the potential amount of the laterite is copious, and therefore it is utilized as embankment material for the national highway. Laterite with a lot of quarts veins as fragment which are originated from intrusive rock of granite is distributed on the plain around the Mt. Elgon as the result of eluviation due to the climate of the savanna.



Source: JICA OD Team

Fig. 1-3-6. Comparison Columnar section

[2] Gleysols ; This soil type can be seen on the wetland where the groundwater level is high and much amount of water can be accumulated. It has blue gray - green gray colored soil, and because it contains little oxygen, root rot often occurs and decomposition does not occur on the other hand. Therefore, this soil type is not suitable for cultivation.

1-4 Environmental and Social Considerations

1-4-1 Environmental Impact Assessment

As the Project site is in neighbor with the Ramsar Convention registered wetland, it is categorized as "Category A", which is "the Sensitive Areas" in accordance with JICA Guideline. Thus, Environmental and Social Impact Assessment, hereinafter referred to as "EIA," and Resettlement Action Plan (hereinafter referred to as "RAP"), were prepared when the FS was conducted (refer to Annex 6). Both EIA and RAP reports was submitted to NEMA, the authorization agency for EIA reports in Uganda, in February 2017.

JICA OD Team made a close follow-up of the submitted EIA report to NEMA for its approval, and further survey was conducted so that appropriate EIA could take place. Regarding RAP report, JICA OD Team also had provided continuous support to GoU to finalize RAP report which is complementary to JICA guideline. The detail of the consideration regarding RAP is presented in "1-4-2 Land Acquisition and Resettlement."

Table 1-4-1-1. Additional Study during the OD

No.	Content of ESIA	Summary of Additional Study
1	Environmental and Social Situation as the Basis	Especially, situation of the surrounding area of the Project Site
2	Results of Environmental and Social Survey	Especially, rare/ threatened species of the surrounding area of the Project Site
3	Environmental Impact Study and Mitigation	- Regarding excavated soil and agricultural residues, the treatment measures during construction and mitigation of soil pollution during operation - Mitigation for the impacts to the Ramsar Convention registered wetlands - Mitigation for avoiding free behaviors of fishes in the Atari River - Mitigation for use of agricultural chemicals in future
4	Monitoring	- Item of water sampling for monitoring the impacts to the Ramsar Convention registered wetlands which locate the downstream of the Project Site - Item of birds for monitoring methods and revisions of the form - Item on the gender issue (described in "6-2.Land Acquisition and Resettlement")

Source: JICA OD Team

The specific contents of additional survey during the OD are as follows:

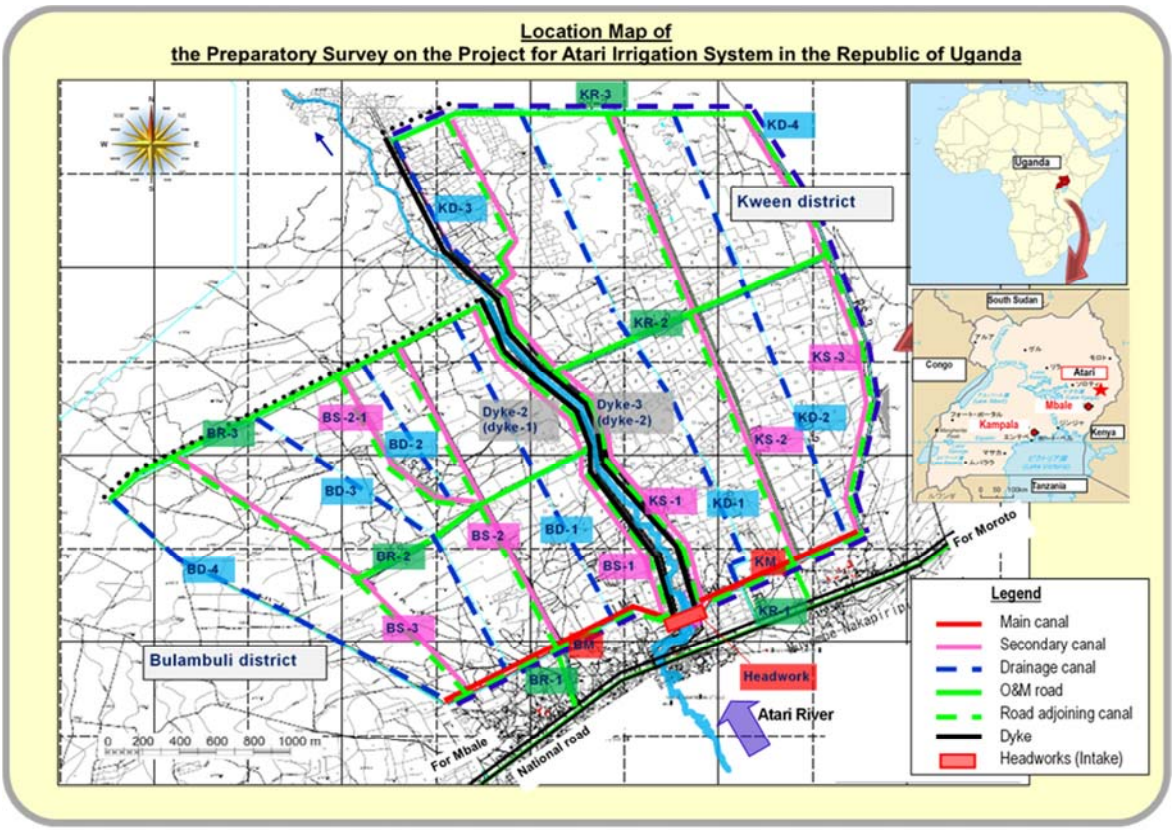
1-4-1-1 Outline of Project Component to Anticipated impact on Environmental and Social Aspects

As the result of the OD, it was decided to include the Land Re-organization in the Project component. Table 1-4-1-2 and Figure 1-4-1-1 show the designed main facilities of the Project.

Table 1-4-1-2. Irrigation Facilities of the Project

Component	Specification	Quantity
Headworks	Movable weir type, Intake, De-silting basin	Complete set
Main canal	Concrete lining	Length = 2.3 km
Secondary canal	Concrete lining	Length = 15.0 km
Tertiary canal	Earth canal	Length = 23.5 km
Drainage canal	Earth canal	Length = 18.3 km
O&M road	Soil paving	Length = 7.7km
Dyke	Earth dyke	Length = 5.1 km
Land reorganization	Including a land leveling	Area = 12 ha

Source: JICA OD Team



Source: JICA OD Team

Fig. 1-4-1-1. Irrigation Facilities of the Project

1-4-1-2 Environmental and Social Situation as Basis

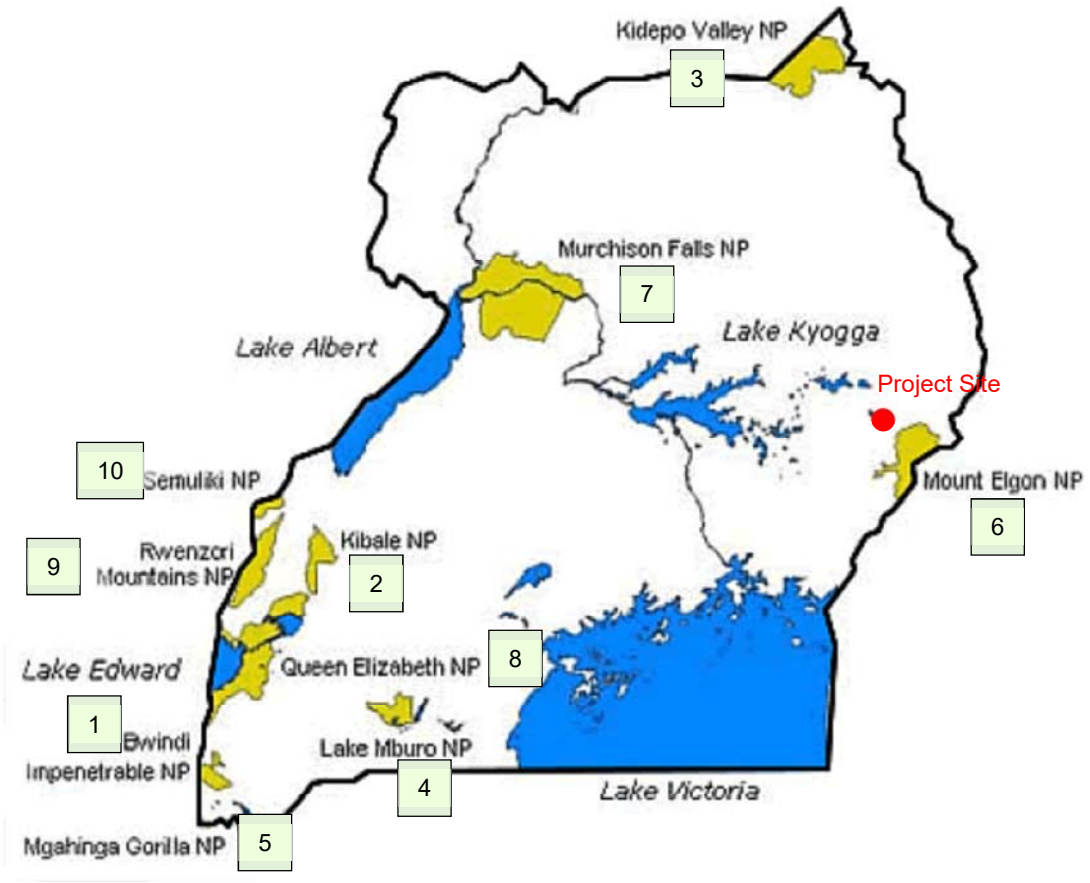
The Project Site is located in the eastern region of Uganda, which has unique environmental varieties; on one side, steep mountains such as Mt. Ergon and Mt. Kadam reaching to an altitude of 4,321 meters with volcanic activities, and on the other hand, terrain changes to lowland wetlands including Lake Bisina and Lake Opeta. The Project site is located in the alluvial plain, which spreads at the foot of Mt. Ergon of which altitude is 1,065 meter to 1,078 meter. The depositional plain was eroded by sediment transported from Atari River, and has geographical features of 1/250 mild slope. Atari River is recognized as the natural and administrative boundary between Bulambuli District and Kween District.

There are ten (10) national parks in Uganda, and Mt. Ergon, which is located in the upstream of the Project sited, is designated as National Park.

Table 1-4-1-3. List of National Parks in Uganda

No.	Name of Park	Size	Remark
1	Bwindi Impenetrable National Park	321km^2	World Heritage Site (Biodiversity)
2	Kibale National Park	795 km^2	Forest area of middle elevation and diverse primates
3	Kidepo Valley National Park	1,442 km^2	Diverse megafauna and flora
4	Lake Mburo National Park	370 km^2	Habitat for Impala
5	Mghaninga Gorilla National Park	33.7 km^2	Habitat for Gorilla
6	Mount Elgon National Park	1,121 km^2	Important catchment area and forest area
7	Murchison Falls National Park	3,840 km^2	Uganda's largest and oldest conservation area, hosting 76 species of mammals and 451 birds.
8	Queen Elizabeth National Park	1,978 km^2	Conservation area of “Man and Biosphere”
9	Rwenzori Mountains National Park	N/A	World Heritage Site (Biodiversity)
10	Semuliki National Park	220km²	Typical species in the Central and Eastern Africa

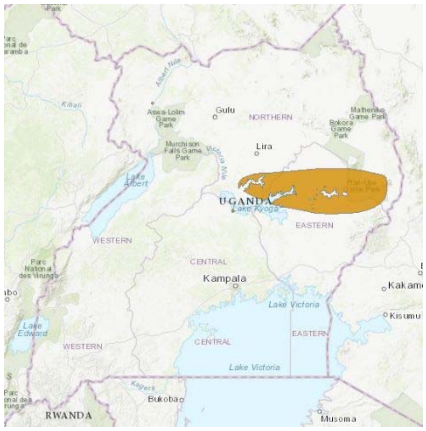
Source: Official Website of Uganda Wildlife Authority (http://www.gou.go.ug/content/national-parks, (June, 2018)



Note: The numbers in the figure addressed Table 1-4-1-3.
Source: "National Wetlands Management Project in the Republic of Uganda (2012)", red added by OD Team

Fig. 1-4-1-2. Location of the Project Site and National Parks in Uganda

According to "Wetland Sector Strategic Plan (2001-2010, MWE)", wetland in Uganda occupies 13% of the national territory which is around 29,000km^2. Uganda ratified Ramsar Convention on 4 June 1988 and there are 12 wetlands which have been registered under this convention so far. Lake Bisina, which is located downstream of the Project Site, is registered in 2006 to protect fishes of the lake, as it has been utilized as the source for drinking and cattle. For Lake Opeta, it was also registered at the same time with Lake Bisina as it is the habitat area for Fox's Weaver (*Ploceus spekeoides*[3]), the Ugandan endemic species. International Union for Conservation of Nature (IUCN) specifies the habitat of fox weaver as presented in Figure 1-4-1-3.



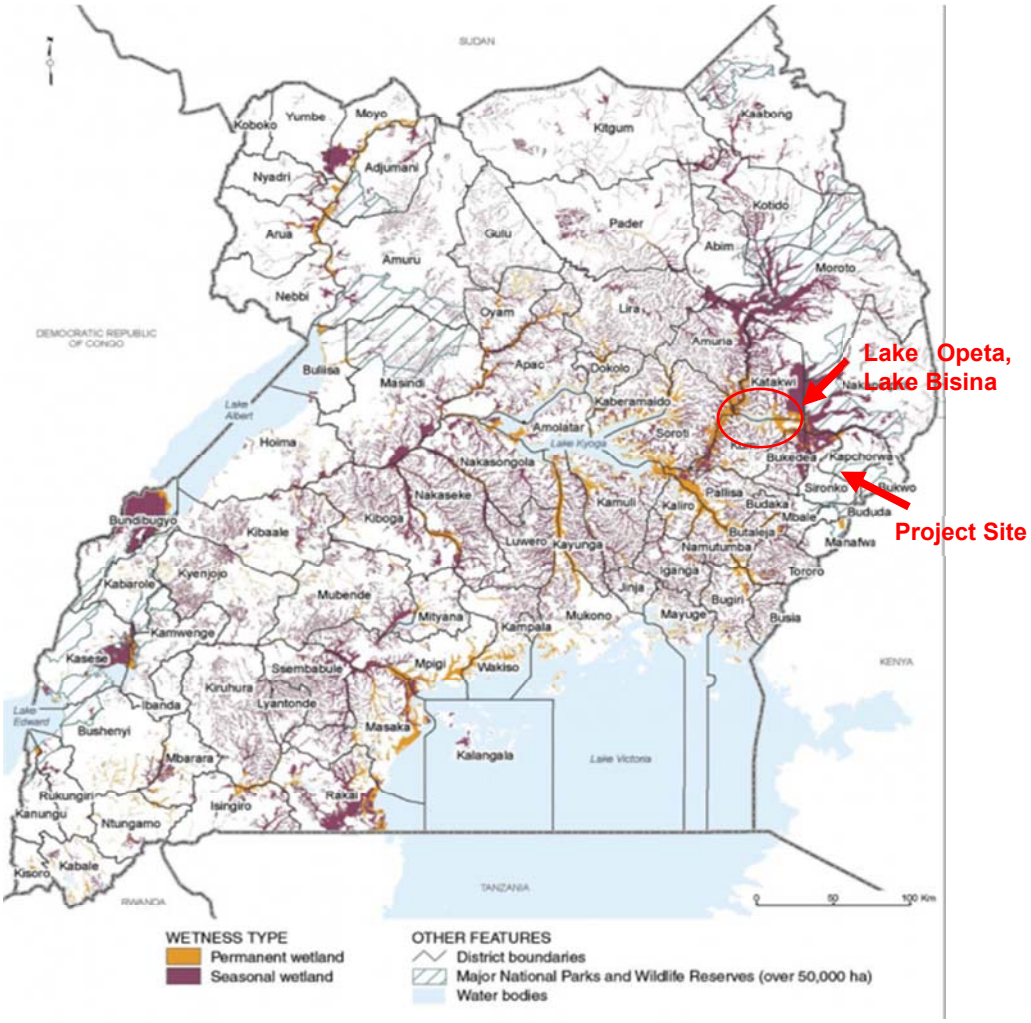
Source: IUCN

Fig. 1-4-1-3. Habitat of Fox's Weaver

To note, "wetland" in Uganda is stated as "the location which floods either permanently or seasonally,

[3] The name of the species is "T. Spekeii" and is categorized as Least Concern (LC) in IUCN Red List.

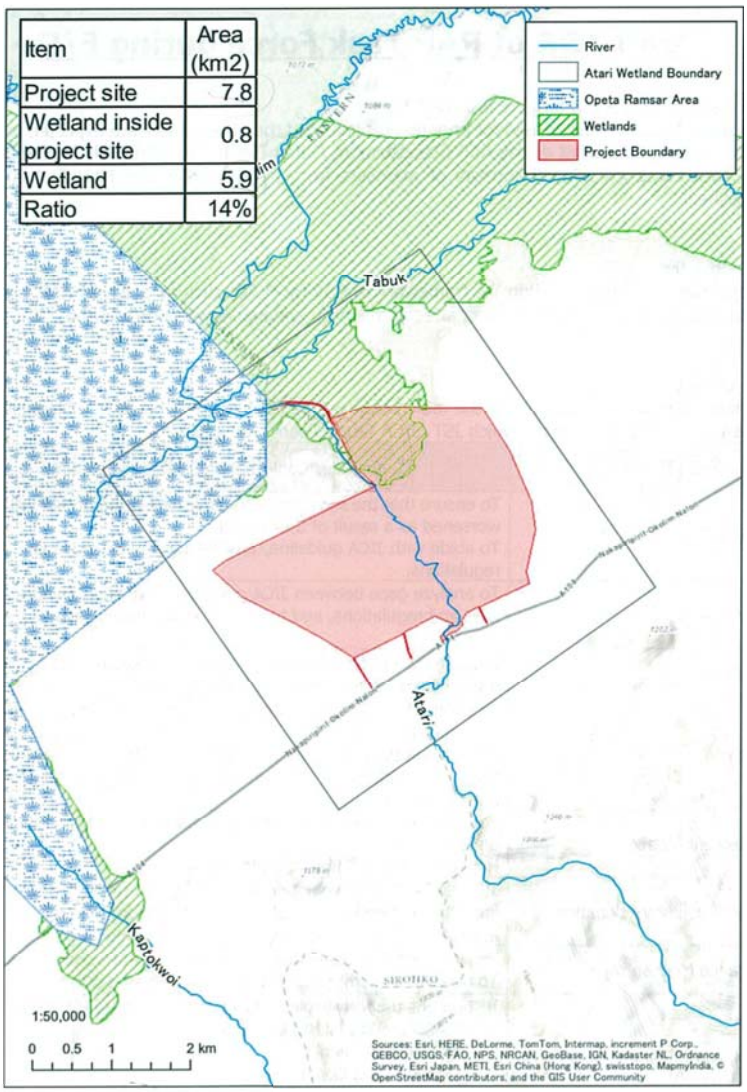
which flora and fishes could be adopted" according to the National Regulation, "The National Environment (Wetlands, River Banks And Lake Shores Management) Regulations (2000)". Though the wetland is categorized either permanent wetland or seasonal wetland, there are no difference in the degree of protection between these 2 categories.



Source: "Uganda: Distribution of Permanent and Seasonal Wetlands, 1996", red added by OD Study Team

Fig. 1-4-1-4. Distribution of Wetland in Uganda

According to the result of the measurement conducted in FS, there is wetland on the downstream side of the Kween District which consists of 14% of the Project site but is not the Ramsar Convention registered wetland. The area is flooded throughout the year due to water discharge from the surrounding farming area and backwater from the downstream of the Project Site. Those crops which are resilient to flood, such as yam, are being widely produced.



Source: "FS Report"

Fig. 1-4-1-5. Proportion of Wetland in Atari

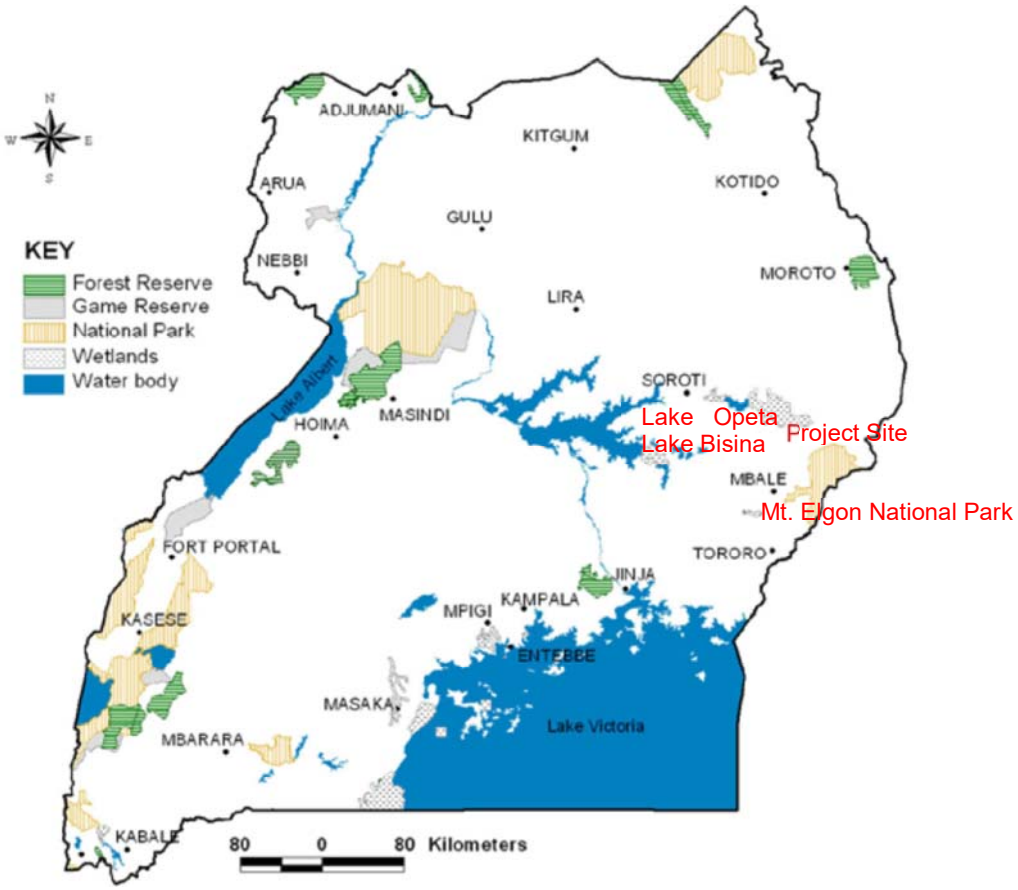
There are total of thirty-three (33) areas which are designated as "Important Bird Areas (IBA)" according to "Important Bird Areas in Uganda, Status and Trends 2009". Lake Opeta, Lake Bisina and Mt. Elgon National Park, which are located nearby the Project site, are designated areas in IBA, but the Project site is not included in IBA.

Table 1-4-1-4. IBA in Uganda

IBA Code	Name of IBA	Status
UG001	Migahinga Gollira National Park	Stable
UG002	Echuya Forest Reserve	Small decline
UG003	Nyamuriro	Unchanged (UF)
UG004	Bwindi Impenetrable National Park	Stable
UG005	Rwenzori Mountains National Park	Stable
UG006	Kibale National Park	Unchanged (NF)
UG007	Queen Elizabeth National Park	Unchanged (NF)
UG008	Kyambura Wildlife Reserve	Small improvement
UG009	Semliki National Park	Unchanged (NF)
UG010	Semliki Reserves	Unchanged (UF)
UG011	Lake Mburo National Park	Unchanged (NF)
UG012	Mabira Forest Reserve	Unchanged (NF)
UG013	Sango Bay Area	Stable
UG014	Musambwa Islands	Stable
UG015	Lutoboka Point	Not assessed
UG016	Nabugabo Wetland	Small decline

IBA Code	Name of IBA	Status
UG017	Mabamba Bay	Stable
UG018	Lutembe Bay	Small decline
UG019	Budongo Forest Reserve	Small decline
UG020	Murchison Falls National Park	Unchanged (NF)
UG021	Ajai Wildlife Reserve	Unchanged (NF)
UG022	Mount Kei Forest Reserve	Small decline
UG023	Mount Otzi Forest Reserve	Small decline
UG024	Doho Rice scheme	Unchanged (NF)
UG025	Lake Nakuwa	Not assessed
UG026	Lake Bisina	Small improvement
UG027	Lake Opeta	Unchanged (NF)
UG028	Mount Elgon National Park	Unchanged (NF)
UG029	Mount Moroto Forest Reserve	Small decline
UG030	Kidepo Valley National Park	Unchanged (NF)
UG031	Nabajjuzi Wetland	Small improvement
UG032	Kasyoha – Kitomi Forest Reserve	Unchanged (NF)
UG033	Bugoma Forest Reserve	Small improvement

Source: "Important Bird Areas in Uganda Status and Trends (2009)"



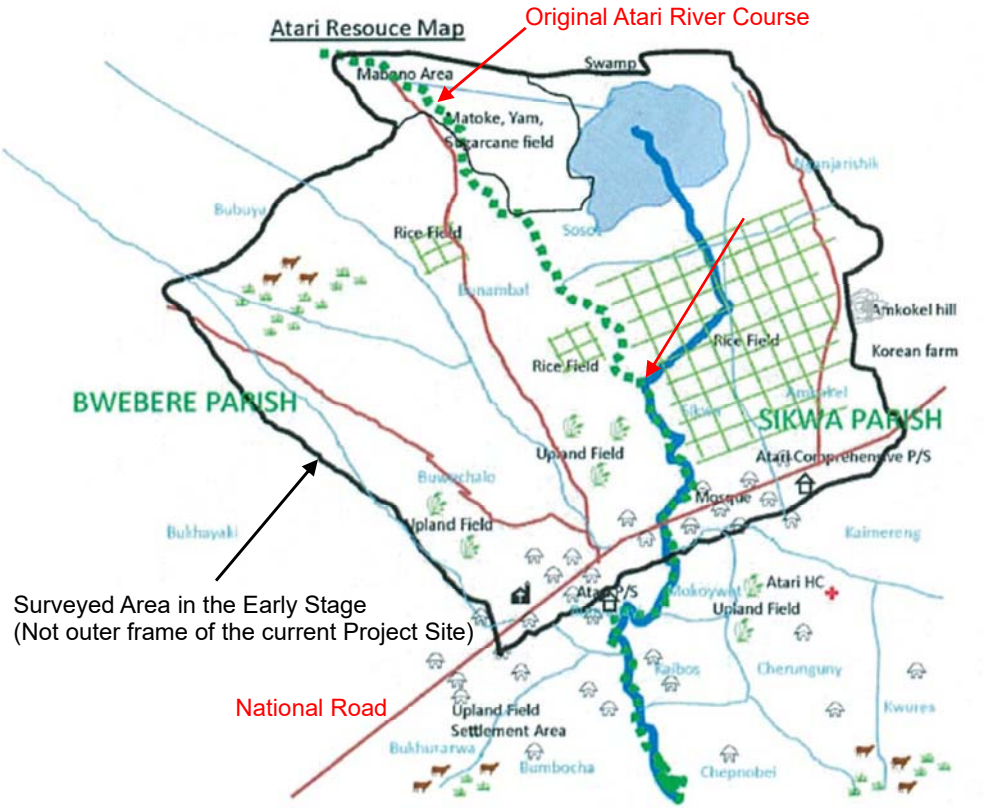
Source: "Important Bird Areas in Uganda Status and Trends 2009", red added by OD Team

Fig. 1-4-1-6. IBA in Uganda

As mentioned above, the Project site is not the area of National Park, registered wetland under Ramsar Convention, nor IBA. In addition, there are no picturesque place, nor historically/ cultural heritage close to the Project site. However, environmental consideration, such as no farming activities within the Protected Zone along the Atari River, are required as stated in the Ugandan national regulation "The National Environmental (Wetlands, River Banks and Lake Shores Management) Regulations (2000)" (see, "2-2-3 Plan for Protected Zone"). Regarding the principle for the establishment of Protected Zone, NEMA agreed the proposed contents (see, Appendix-8).

As Figure 1-4-1-7 presents, the majority of the Project site is utilized for farming activities. Bulambuli District is more in favor with upland farming, and paddy is more in favor in Kween District side.

Residential areas of those farmers are concentrated further in the upland of the national road, which crosses out of the Project site.



Source: FS Report, red added by OD Team

Fig. 1-4-1-7. Current Land Use of the Project Site

1-4-1-3 Regulation and Organization of Uganda

(1) Status of the EIA

The submitted EIA report, which was prepared during the FS, was approved by NEMA on 2nd August 2017 with several consideration. MAAIF paid the approval fee to NEMA in December 2017, and received the Certificate of Approval in January 2018 (see, Appendix-7). For those issues which were raised as "consideration" were agreed to be dealt by MAAIF with an appropriate manner on 7th February 2018 (see, Appendix-5).

To note, "Land Reorganization" is an additional component planned during the OD, and is not included in ESIA report which was submitted and approved by NEMA. However, it has been confirmed by NEMA that there are no need to resubmit nor submit the additional information on this additional work.

The Project is schedule to enter into EN and GA around October 2018. As the Project is categorized as "Category A", approved EIA report has to be discolored before120 days from the date of EN and GA conclusions. In regards this, the EIA report was disclosed at JICA's website on 26th June 2018.

(2) Other Approval which are Necessary for the Project Implementation

Beside the Certificate of Approval of EIA report, the Project is required to receive approval on Water Permit and Construction Permit for its implementation, according to Certification of Approval issued

by NEMA.

These rights are regulated under "The Water (Water Resources) Regulation (1997)", which is the regulation for utilization, protection and management of water resources, expansion of provision of water, and sewage improvement, and MWE is assigned as supervisory agency. The Project has to apply for Water Permit with Form A of Appendix I, to draw water from surface water of Atari River to the Project Site, and it is required to receive the Water Permit before the water intake starts. The Water Permit is usually valid for 2 to 5 years[4], and is required to renew as long as it continues to intake the water. The Water Permit Fee depends on the amount of the water intake. Regarding Construction Permit, it shall be applied with Form F1 in Annex VI. The Construction Permit is valid for 1 year, thus, the Project has to renew during the construction period.

Table 1-4-1-5. Cost related to Water Permit and Construction Permit

Fees	Amount (UGX)
For processing an application for:	
a) registration of existing works or use	100,000
b) water permit	450,000
c) renewal of a water permit	50,000
d) an easement	100,000
e) a drilling permit	500,000
f) a construction permit	500,000
g) renewing a drilling permit	500,000
h) renewing a construction permit	500,000
Annual charges	**Amount (UGX)**
1. For taking and using water under a water permit:	
a) up to 400 cubic meters per day	200,000
b) more than 400 cubic meters per day but less than 1,000 cubic meters per day	1,000,000
c) 1,000 cubic meters per day or more	3,000,000
2. For operating any works which impound water for no consumptive uses e.g., for hydropower of	
a) 10-50 megawatts	1,000,000
b) 50- 100 megawatts	5,000,000
c) Over 100 megawatts	20,000,000

Source: Appendix II of "The Water (Water Resources) Regulations."

1-4-1-4 Comparison of Alternatives

In the FS, comparison of alternatives was considered focusing on 1) Flood control, 2) Environmental Impact and 3) Social Impact. In addition, the option when the Project is not implemented on Protected Zone was considered and the concept of "30m from hypothetical center line Atari River" for Protected Zone was applied (for more details on alternatives, see Appendix-6).

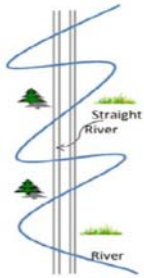
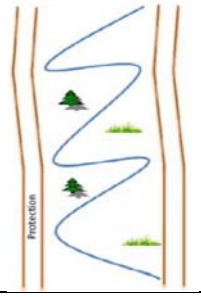
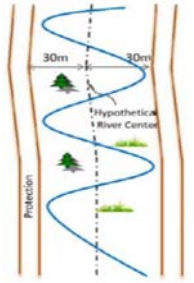
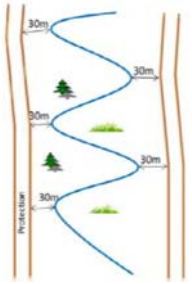
[4] Newly applied water permit is usually valid for 2~3 years, and more than 4 years are valid in case of renewal of water permit..

Table 1-4-1-6. Comparison of Alternative Plan for Water Course of Atari River

Alternative	ALT-L1	ALT-L2	When the Project is not implemented
Layout			
Outline of the Plan	This alternative has installation of River Dyke along the original waterway which is also the boundary of Kween and Bulambuli Districts. Protected zone shall be established at 30m from hypothetical center line of original waterway to preserve buffer zone for purification of water and preserve existing natural forest along river course. Downstream part of original river shall be restored by excavating about 30cm from existing river bed to maintain the waterway and flow the same capacity of discharge with upstream.	This alternative has installation of River Dyke along the existing river course which was a canal constructed to irrigate the right side of Atari River. Protection zone shall be set with 30m from center line of irrigation canal to preserve buffer zone for purification of water.	Nothing to be changed from the current condition. No regulation and wise-use of wetland become impossible. It is expected that planned Community-Based Wetland Management Plan (hereinafter referred to as "CbWMP") will be implemented by the community together with related District and to realize wise-use of wetland.
Irrigation Area	680ha	680 ha	450 ha
Evaluation	○	△	×

Source: "FS Report"

Table 1-4-1-7. Comparison of Alignment of Protection Dyke and Protection Area

Alternative	ALT-P1	ALT-P2	ALT-P3	ALT-P4	When the Project is not implemented
Layout					
Outline of the Plan	Rive improvement by straight line with bank protection and no River Dyke against flood. Therefore more land resource can be available for development.	To install River Dyke along the current river curvature to prevent the flood flow. Even in this case, more space is needed for Protected Zone more than the width of 5 to 20m which is agreed on CbWMP.	To install River Dyke leaving 30m wide area from hypothetical river center. The alignment and necessary space is almost the same as ALT-P2.	To install River Dyke leaving 30m wide area from river curvature. The National Environment Regulation (2000) suggests taking 30m from river bank.	Nothing to be changed, so no River Dyke and no Protected Zone.
Flood Control	2	5	5	5	1

Alternative	ALT-P1	ALT-P2	ALT-P3	ALT-P4	When the Project is not implemented
Environmental Impact	1	3	3	3	2
Biodiversity	1	3	3	3	2
Water quality and purification	1	3	4	4	3
Environmental condition within protection zone	2	4	4	4	2
Affect to the downstream	1	3	3	3	2
Social Impact	2	3	3	3	2
Land acquisition and its impact	5	2	2	1	3
Involuntary resettlement within Protected Zone	3	3	3	3	2
Impact to Local economy	5	4	4	4	1
Benefit, Cost and Environmental impact	1	3	4	2	5
Total Point	**24**	**36**	**38**	**35**	**25**
Evaluation	Very Bad	Good	Very Good	Fair	Bad

Source: "FS Report"

1-4-1-5 Scoping

The scoping in the FS was examined thirty one (31) items fixed at the JICA Advisory Committee for Environmental and Social Considerations held on 22nd June 2015. For more details on the scoping, see Appendix-6.

1-4-1-6 Terms of Reference for ESIA Study

Thirty one (31) items of scoping were considered for Terms of Reference (hereinafter referred to as "TOR") of ESIA Study in the FS. For more details on TOR, see Appendix-6.

1-4-1-7 Result of Investigation of Environmental and Social Considerations

(1) Result of Environmental and Social Considerations Study

Outline of the result of the ESIA of the Project Site during the FS is as follows (Apprndix-6 for detail result):

1) Items on Pollution

Baseline survey data for all item related to pollution, such as air pollution, water pollution, and noise and vibration, are within the referable value.

2) Fauna

The following 2 bird species were identified.

Table 1-4-1-8. Birds identified at FS and Categories under IUCN Red List and Ugandan Regulation

Common Name In English	Scientific Name	IUCN Red List Category	Ugandan Regulation*	
			Category in Uganda	Habitat and Ecology
Grey Crowned-crane	Balearica regulorum	Endangered (EN)	EN A2b	Widely distributed at moisture non-forestry area
Pallid Harrier	Circus macrourus	Near Threatened (NT)	CR C1+2a(i)	Queen Elizabeth National Park, Lake Mburu National Park, Lake Victori, West Nile region, Murchison Falls National Park, Kidepo Valley National Park, Karamajo sub-region

Note: Other birds which were observed were categorized as "Least Concern (LC)".

3) Land Acquisition and Resettlement

The Resettlement was not expected. Additionally, 264 household which the population is 2,556 were estimated to be affected by the Project*.

Note: Since the contents came from results during FS, it is differ from the contents described RAP which was approved by CGV. The latest information is available at Appendix-10 or "1-4-2 Land Acquisition and resettlement."

Source: "FS Report," and "Nationally Threatened Species for Uganda (Wild Conservation Society, 2016)"

(2) Impact for Farmland Ecosystem

Farmland ecosystem is considered from those areas such as paddy field, upland farming, canal/ reservoir/ pond, woodland/trees, and grassland for grazing and meadows. The following changes in agricultural environment are expected to affect the ecosystem (detail in Appendix 6).

1) Development of agricultural lands is assumed to cause of the reformation of wetlands into well-drained paddy field, increase in size of a plot, decrease of ridge areas, and concrete construction of waterways
2) Use of pesticides and herbicides is presumed to cause water pollution.
3) Use of chemical fertilizer is assumed to cause eutrophication of waters.
4) Change of O&M methods is presumed to lead to mechanization, chemicalization, labor saving of farming activities, and careless O&M.
5) Increase of deserted cultivated lands is assumed to cause devastation of cultivated lands and water utilization facilities, and decrease of paddy areas.

The Project plans to increase agricultural productivity, especially paddy, through construction of irrigation facility and utilization of farmland with appropriate management. Currently, the area of paddy is dependent on rain-fed, and would enable the farmland to be filled with water in a stable and planned manner by introducing irrigation system for paddy. In addition, farmers would be trained on the wise-use of the wetland, and application of organic farming and instruction on suitable amount for use of fertilizer to mitigate serious impact to the agricultural ecological system. Continuous monitoring on biological and water quality are expected to be conducted, which could be one of the ways to mitigate the negative impact.

Source: "FS Report"

(3) Evaluation of Environmental Impact to the Lake Opeta

By implementation of the Project, one of the concern related to natural environment is the effect to those wetland registered in Ramsar Convention, which include wetland system of Lake Opeta-Bisina

located downstream of the Project Site. During FS study, it has been assessed that there would be no such serious impact mainly from the following points;

1) The volume of water supply from the Atari River to the Opeta-Bisina lakes wetland system is estimated quite small. The catchment areas of the Project is 103 km^2 and 1.2% of that of Lake Opeta, 8,412 km^2;

2) The concentration of ammonia nitrogen (NH4-N) in the Opeta-Bisina lakes system is already high since livestock farming is run around the system;

3) Although fertilizers are assumed to be used for the irrigation farming, the level of fertilizers in the backflow water from the irrigation area to the Atari River is estimated low compared to the level of fertilizers flows into the Opeta-Bisina lakes wetland system from the entire watershed are of the said system;

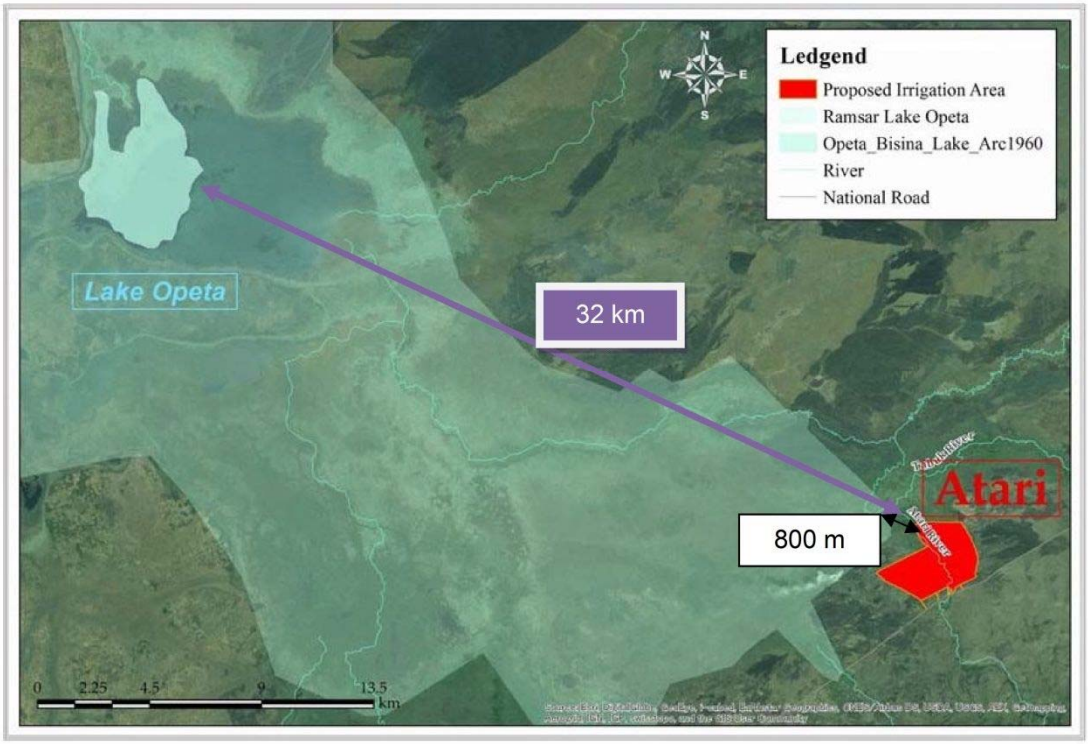
4) Also, in the case of the fertilizer flowing into the system, the high level of NH4-N at the mouth of the Lake Opeta would not be affected to increase the level;

5) It is feasible to avoid excessive use of fertilizers and ban the use of agrichemicals by employing sufficient farming management and such management is a part of the project menu;

6) Since the proposed irrigation area is located at 500 m of the shortest distance from the Ramsar Convention wetland area (800 m through the Atari River), impacts to the farmers and fisher folks are not anticipated because of no direct touches to the wetland (e.g. encroachment or farming in the Ramsar wetland); and

7) The Opeta-Bisina lakes wetland system is rich in the ecosystem and designated as a bird conservation area, however serious impacts are not anticipated on aspects of water volume and quality and human-induced action from the reasons of above-mentioned.

Source: "FS Report"



Source: ""FS Report"

Fig. 1-4-1-8. Distance between Atari River, Ramsar Convention Wetland Area and Lake Opeta

To note, as it does not mean that the downstream area of the Project site is with no effect, alternative

measures are proposed by JICA OD Team based on the survey (see, "1-4-1-9 Mitigation Measures"). Instruction to the farmers on farm management and monitoring by the implementing agency would be conducted based on the measures pointed out in section 1-4-1-9.

(4) Results of the Baseline Survey

Results of the baseline survey for major items done in the FS are shown in Table 1-4-1-9.

Table 1-4-1-9. Summary of Impact Examination Result

Item	Description
1. Physical Environment	
1-1 Topography	A flat area of Sikwa Parish and its environs, with the undulating Kapchorwa hills overlooking it, makes it suitable for the irrigation project. The Atari River is running from Kapchorwa hills all the way down into the proposed the Atari irrigation project area.
1-2 Geology	The cover deposits mainly consist of Tertiary sediments, including those from volcanos from the highland areas of the Mountain Elgon ranges where the Atari River originates. As a result of erosion and continuous deposition in the floodplain, the lithology of the Atari Project site is mainly comprised of volcanic rocks and associated sediments. Much as the rocks belong to ancient rock systems, volcanic intrusions that occurred leading to material flows forming sediments in floodplains.
1-3 Soils	The predominant types of soil are luvisols and vertisols. Luvisols are strongly influenced by water and thus are usually in floodplains, alluvial plains, river fans, valleys and tidal marshes. They have high base status and high-activity clay. Vertisols are characterized by a clay-size-particle content of 30 percent or more by mass in all layers of the upper half-meter of the soil profile.
1-4 Sediment	Major textural class of sediment is loamy sand and with 2 mm -250 um of particle size.
1-5 Air quality	Baseline air quality at measurement locations indicated no detectable levels of NH3, NO, NO2, CO, H2S, SO2 and combustible gases. These measurements indicate a generally pristine environment with respect to air quality. At all these locations the detected levels of the measured parameters were below the limits of the Draft National Air Quality Standards.
1-6 Water quality	Low Dissolved Oxygen (DO) levels were recorded in the Mabono area for both the spring and drainage i.e. 2.4 and 1.8 mg/l respectively in the First dry season. The low DO levels in the drainage can be attributed to the runoff of fertilizer from the fields; as at the time of carrying out measurements, several farmers were spraying fertilizers and pesticides in their vegetable gardens adjacent to the drainage.
1-7 Climate change	The amount of annual GHG emission (CO2 equivalent) caused by rice growing is estimated about 2,800 tons of CO2 equivalent. According to the threshold value proposed by IFC[5] per project (25,000 tons of CO2 equivalent per year), the estimated amount is quite lower thus a critical impact by the Project is not anticipated.
2. Biological Environment	
2-1 Flora	The site lies within the flood plains of Mt Elgon; it contains modified habitats, natural sites and agricultural fields. The natural sites are mainly composed of Typha-Cyperus- Echinochloa permanent wetland, Typha-Cyperus-Phoenix-Acacia swamp with scattered trees, patches of seasonally flooded Acacia-Echinochloa-Imperata open wooded grassland, Acacia-Harissonia-Capparis-Setaria open woodland with light thicket, Harissonia-Acacia-Setaria seasonally flooded lightly bushed grassland, Andropogon-Panicum-Setaria seasonally flooded open grassland and Setaria-Harissonia-Acacia open grassland with thicket.
2-2 Fauna	**Fish** A total of two hundred and sixty-two (262) fish specimens belonging four (4) families and five (5) species were recorded. Those species which were mainly identified during the wet season were those which tends to grow big (>100g). On the other hand, the majority of those samples caught in dry season samples were small in size. Labeobarbus bynni (*Barbus bynni*[6]) was the major species for both wet season and dry season. Dark Stonebasher (*Pollimyrus nigricans*[7]), which is the small species fish, was captured most during dry season survey. So far, there is no report on either rare or endangered fish species. **Aquatic Insect:** Ninety-two (92) specimens which belongs to four (4) families and three (3) species were identified. All of the species showed middle level resistance toward disturbance and pollution. So far, no rare species nor endangered species are reported. **Amphibia:**

[5] Sister organization of the World Bank and member of the World Bank Group

[6] Categorized as LC (Least Concerned) on IUCN Red List.

[7] Categorized as LC on IUCN Red List.

Item	Description
	Twelve (12) species were identified during FS. All of the identified species are categorized as LC on IUCN Red List, and there are no rare or endangered species reported so far. **Reptile:** Twelve (12) species of reptiles were acknowledged during FS. All of those species are categorized as LC on IUCN Red List, and rare species or endangered species are yet being reported. **Mammals** Four (4) specimens representing three (3) species (Lophuromys aquilus, Crocidura olivieri and Crocidura nigrofusca) of small mammals were collected from permanent wetland. In addition, three (3) specimens of mammals were visually identified from the hill of the land owned by the Pakistani (Korean at that time), which is located next to the Project site. Those species which were identified were Striped Ground Squirrel (*Xerus erythropus*), Bush Duiker (*Sylvicapra grimmia*), and Bush pigs (*Potamochoerus larvatus*), and are categorized as LC on IUCN Red List. **Birds** Ninety (90) species were recorded during FS, which all of them are categorized as LC. Two (2) endangered species were identified; Gray-crowned Crane (*Balearica regulorum*) and Pallid Harrier (*Circus macrourus*). For aquatic bird, thirty-one (31) species were identified along Atari River and its surroundings, but so far, no endangered species are yet being reported.

Source: "FS Report"

The brief overview of these endangered bird species identified at the time of FS is as shown in Table 1-4-1-10. Additionally, MAAIF Counterparts mentioned that endangered birds such as Shoebill (*Balaeniceps rex*)[8] and Fox's Weaver (*Ploceus spekeoides*) are observed around Lake Opeta which is located at downstream of the Project Site. However, it is conceivable effect on the birds that inhabit the Lake Opeta, the Project is not separately carried out the investigation because it has carried out the birds survey of Lake Opeta by Nature Uganda[9] .(Refer to Appendix-9)

Table 1-4-1-10. Endangered Birds Observed in the FS

Item		No. 1	No. 2
Picture		 © Jean-Christophe Vie	 © Balaji Ventakesh Sivaramakrishnan
Common Name		Gray-crowned Crane	Pallid Harrier
Scientific Name		Balearica regulorum	Circus macrourus
IUCN Category		EN (Endangered)	NT (Near threated)
Ugandan Category		EN A2b	CR C1+2a(i)
1. Assessment Information	Red List Category & Criteria	Endangered A2acd+4acd ver 3.1	Near Threatened ver 3.1
	Year Published	2016	2017
	Date Assessed	01/10/2016	01/10/2017
2. Geographic Range	Range Description	Balearica regulorum occurs in eastern and southern Africa, with B. r. gibbericeps occurring from the Democratic Republic of the Congo, Rwanda, Uganda and Kenya south through Tanzania to Mozambique,	This species breeds primarily in the steppes of Asiatic Russia, Kazakhstan and north-west China. Small populations breed in Azerbaijan, Romania, Turkey and Ukraine. A minority winter in

[8] While Shoebill (*Balaeniceps rex*) is categorized as "EN D (Endangered (Used for very small or restricted populations)) by the national threaten status, it is categorized as "Vulnerable (VU)" by IUCN Red List.

[9] Uganda Branch Office of East Africa Natural History Society (NGO), a member of IUCN

Item		No. 1	No. 2
		and nominate race B. r. regulorum found from Mozambique south through Zimbabwe to South Africa and west in small numbers to Namibia and Angola. Populations in many areas including Kenya, Uganda, Zimbabwe and Namibia have experienced very rapid declines (Beilfuss et al. 2007, K. Morrison in litt. 2011, O. Mabhachi in litt. 2012, A. Scott in litt. 2012, National Biodiversity Data Bank in prep.), although the South African population appears to be stable or increasing (Beilfuss et al. 2007). The largest remaining populations are believed to be in Kenya (10,000-12,500 individuals in 2014), **Uganda (500-8,000 individuals)**, Zambia (2,000-2,500 individuals), and South Africa (6,500 birds) (Morrison in press).	south-east and central Europe, north Africa and the Middle East but most migrate to the Afrotropics and the Indian subcontinent (Thiollay 1994). The global population is estimated at 9,000-15,000 pairs (Galushin et al. 2003). Records in northern and western Europe have increased in recent years, with regular breeding now taking place in Finland and wintering records in several countries (eg Ollé et al. 2015). Assessment of the status of this species is complicated by the fact that on breeding territories numbers fluctuate in response to environmental conditions, probably numbers of small mammals. Thus, high or low numbers in any given year or two-year period may be indicative of change in demographics or they may be indicative of change in local environment (and birds may go elsewhere without their population size changing) (T. Katzner in litt. 2005). A 13-year data study in north-central Kazakhstan revealed that its numbers and reproductive success vary cyclically, peaking every c. 6 years, in response to interannual variation in local vole densities; these cycles were asynchronous between regions, suggesting a regional redistribution of birds between years (Terraube et al. 2012a). Reliable records from migration routes and wintering grounds are also difficult to obtain owing to the rarity of the species, its broad-front migration strategy, and difficulties in field identification, although important concentrations of birds have been identified in parts of India and Africa (Galushin et al. 2003).
	Countries occurrence	**Native:** Angola; Botswana; Burundi; Congo, The Democratic Republic of the; Kenya; Malawi; Mozambique; Namibia; Rwanda; South Africa; Tanzania, United Republic of; **Uganda**; Zambia; Zimbabwe **Vagrant:** Lesotho; Swaziland 	**Native:** Afghanistan; Albania; Algeria; Angola; Armenia; Austria; Azerbaijan; Bahrain; Bangladesh; Belarus; Benin; Botswana; Bulgaria; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; China; Congo, The Democratic Republic of the; Côte d'Ivoire; Croatia; Cyprus; Czech Republic; Djibouti; Egypt; Eritrea; Ethiopia; Gambia; Georgia; Ghana; Greece; Guinea; Guinea-Bissau; Hungary; India; Iran, Islamic Republic of; Iraq; Israel; Italy; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyzstan; Lebanon; Liberia; Libya; Macedonia, the former Yugoslav Republic of; Malawi; Maldives; Mali; Malta; Mauritania; Moldova; Mongolia; Montenegro; Mozambique; Myanmar; Namibia; Nepal; Niger;

Item		No. 1	No. 2
			Nigeria; Oman; Pakistan; Palestinian Territory, Occupied; Qatar; Romania; Russian Federation (Central Asian Russia, Eastern Asian Russia, European Russia); Rwanda; Saudi Arabia; Senegal; Serbia; Sierra Leone; Slovakia; Slovenia; Somalia; South Africa; South Sudan; Sri Lanka; Sudan; Syrian Arab Republic; Tajikistan; Tanzania, United Republic of; Togo; Tunisia; Turkey; Turkmenistan; **Uganda**; Ukraine; United Arab Emirates; Yemen; Zambia; Zimbabwe **Possibly extinct:** Uzbekistan **Vagrant:** Belgium; Denmark; Estonia; Finland; France; Germany; Gibraltar; Iceland; Japan; Lesotho; Liechtenstein; Luxembourg; Malaysia; Netherlands; Norway; Spain (Canary Is.); Sweden; Switzerland; United Kingdom **Present - origin uncertain:** Bhutan; Swaziland 
3. Population	Population	The current population size has recently been estimated at 26,500-33,500 (Morrison in press) and is placed in the 20,00-49,999 range. This roughly equates to 17,700-22,300 mature individuals.	The global population is estimated at 9,000-15,000 pairs (Galushin et al. 2003), equating to 18,000-30,000 mature individuals. The European population is estimated at 300-1,100 breeding females, which roughly equates to 600-2,300 mature individuals (BirdLife International 2015).
	Current Population Trend	Decreasing	Decreasing
4. Habitat and Ecology	Habitat and Ecology	**Habitat:** The species inhabits wetlands such as marshes, pans and dams with tall emergent vegetation (Hockey et al. 2005), riverbanks (Meine and Archibald 1996), open riverine woodland, shallowly flooded plains (Urban et al. 1986) and temporary pools (del Hoyo et al. 1996) with adjacent grasslands, open savannas, croplands (del Hoyo et al. 1996) (del Hoyo et al. 1996, Meine and Archibald 1996), pastures, fallow fields and irrigated areas (del Hoyo et al. 1996). It shows a preference for short to medium height open grasslands adjacent to wetlands for foraging (Meine and Archibald 1996), and breeds within or at the edges of wetlands (Meine and Archibald 1996) especially in marshes with water 1 m deep and with emergent vegetation 1 m above the water	It breeds in semi-desert, steppe and forest-stepe up to 2,000 m, where its favoured nesting sites are wet grasslands close to small rivers and lakes, and marshlands (Galushin et al. 2003, Snow and Perrins 1998). The species has also been found to breed in agricultural areas, at least when agriculture is non-intensive (Terraube et al. 2009). A small minority of the population breeds in the boreal forest and forest-tundra zones, north of its main breeding range (Kuznetsov 1994, Morozov in litt. 1999), where it nests in clearings and other open areas (Galushin et al. 2003). Semi-desert, scrub, savanna and wetlands are used in winter (J. Brouwer in litt.). The species is migratory, with most birds wintering in sub-Saharan Africa or south-east Asia. They leave their breeding grounds between August and November and return in March

Item		No. 1	No. 2
		(Urban et al. 1986). It roosts in water along rivers or in marshes, or perches on nearby trees (Urban et al. 1986, Meine and Archibald 1996). A Maxent-modelling study showed that while wetlands are important for the species in Uganda, temperature seasonality can also be important (Stabach et al. 2009). Diet The species is a generalist, its diet consisting of seed heads (e.g. of sedges Cyperus spp.), new tips of grasses (del Hoyo et al. 1996), agricultural pulses, nuts and grain (Meine and Archibald 1996), insects (Orthoptera, larval Lepidoptera), frogs, lizards and crabs Potamon spp. (del Hoyo et al. 1996). **Diet:** The species is a generalist, its diet consisting of seed heads (e.g. of sedges Cyperus spp.), new tips of grasses (del Hoyo et al. 1996), agricultural pulses, nuts and grain (Meine and Archibald 1996), insects (Orthoptera, larval Lepidoptera), frogs, lizards and crabs Potamon spp. (del Hoyo et al. 1996). **Breeding Site**: The nest is a circular platform of uprooted grasses and sedges (del Hoyo et al. 1996) concealed in tall emergent vegetation (greater than 1 m in height) (Urban et al. 1986, Meine and Archibald 1996) in or along the margins of wetlands such as marshes (del Hoyo et al. 1996) with water c.1 m deep (Urban et al. 1986). The species may also rarely nest in trees (del Hoyo et al. 1996).	and April (del Hoyo et al. 1994). Birds migrate on a broad front, with only minor concentrations at bottleneck sites (del Hoyo et al. 1994, Ferguson-Lees and Christie 2001). Although birds are most often seen singly, females and juveniles can form parties of 10-15 on migration (Snow and Perrins 1998, Ferguson-Lees and Christie 2001). Birds fly at c.1-9 m above the ground when hunting (del Hoyo et al. 1994, Snow and Perrins 1998); they fly generally higher on migration but tend to remain from c.1-15 m above the ground (Brown et al. 1982).
	Systems	Terrestrial: Freshwater	Terrestrial; Freshwater
	Generation length (years)	15.1	6
	Movement patterns	Not a Migrant	Full Migrant
	Congregatory	Congregatory (and dispersive)	Congregatory (and dispersive)

Source: The IUCN Red List of Threatened Species

IUCN, in cooperation with organizations such as Wetlands Management Department (WMD), the umbrella organization of MSE, Nature Uganda, and Uganda Wildlife Society[10], conducted 4 year project at eastern and western region of Ugadan[11]. Baseline survey was conducted in 2009 for Lake Opeta-Bisina, the registered wetland of Ramsar Convention, which is located at the downstream of the Project site in 2009 under the project, and the result of the survey is as follows:

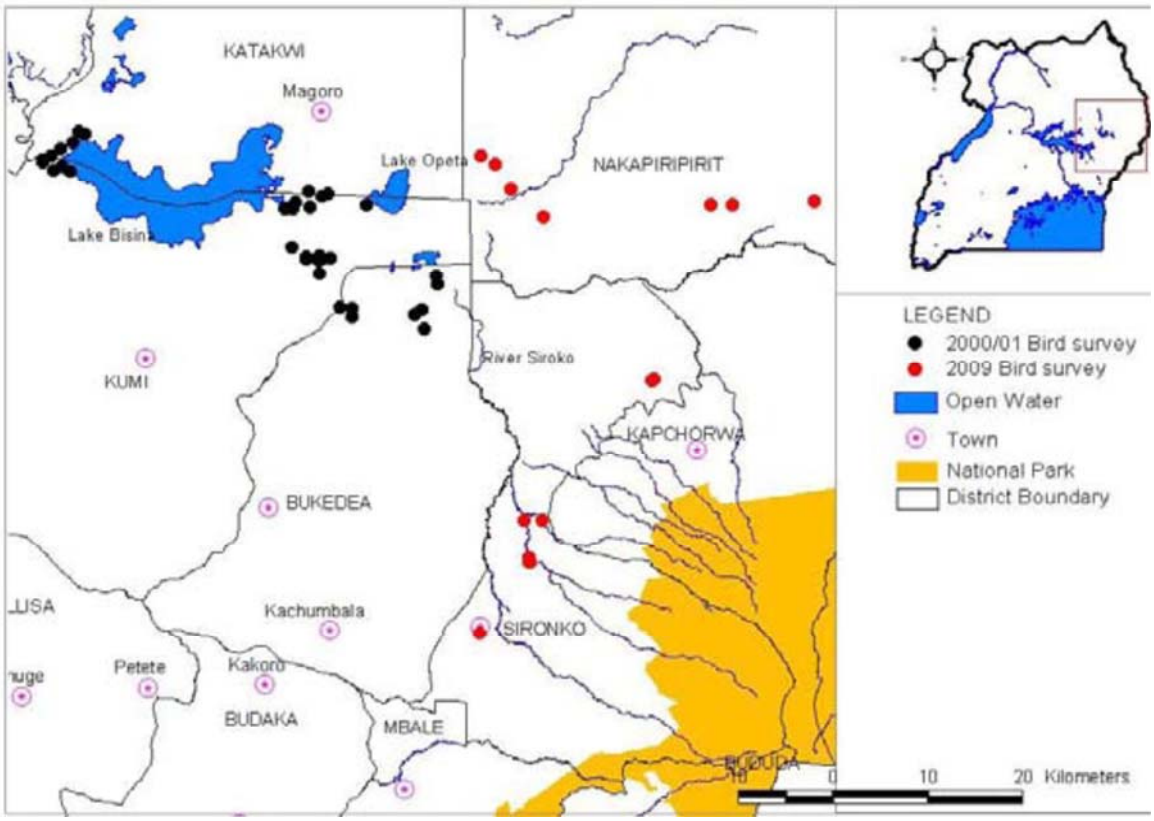
- Total wetland area of Lake Opeta-Bisina is 123,141ha and is one of the most important undeveloped wetland which are remaining in Uganda.

[10] NPO which started as Uganda Branch Office of East Africa Wildlife Conservation Association founded in 1951, and registered in1998 in Uganda

[11] The name of the Project is “Extending Wetland Protected areas through community conservation initiatives”.

- The wetland is known as where Hippo grass (Vossia cuspidate12), which is the aquatic weed bristles.
- Lake Opeta is the habitat of Fox's Weaver (Ploceus spekeoides), which is the Ugandan original species. Forty-seven (47) nesting sites were confirmed during 1996 survey.
- Part of Opeta-Bisina is included in in Pian-Upe Wildlife Reserve, and is functioned as habitat of animal fauna during the dry season.
- It consist from marsh and papyrus wetland.

One hundred and ninety-four (194) birds were identified at baseline survey, which includes fourty-one (41) migrant species and twenty-six (26) species which requires conservation. Beside Fox's Weaver (*ploceus spekeoides*) which was already mentioned, White backed Duck (*Thalassornins leuconotus*[13]) is included.



Source: "Ecological Baseline Surveys of Lake Bisina – Lake Opeta Wetlands System, Lake Mburo – Nakivali Wetlands System (2009)"

Fig. 1-4-1-9. Bird Survey Point at Opeta-Bisina Wetland

12 Not rare species in IUCN Red List

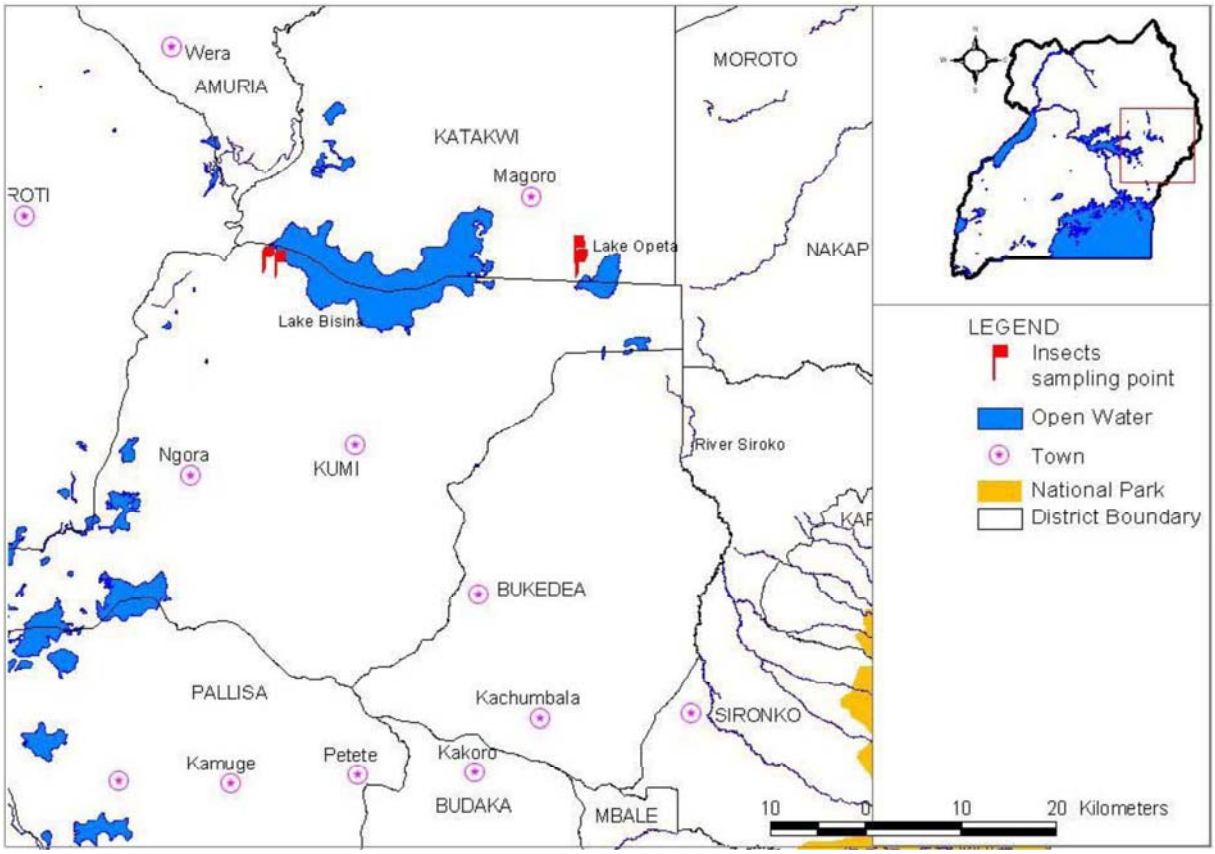
13 Categorized as LC in IUCN Red List

Table 1-4-1-11. Result of the Survey on Bird at Opeta-Bisina Wetland

Habitat	
Forest Specialists	1
Forest Generalists	8
Forest Visitors	22
Water Birds	79
Grassland Species	19
Migration	
Afro-tropical Migrants	9
Palearctic Migrants	31
PA (Afro-tropical Migrants and Palearctic Migrants)	1

Source: "Ecological Baseline Surveys of Lake Bisina – Lake Opeta Wetlands System, Lake Mburo – Nakivali Wetlands System (2009)"

- Twenty-three (23) species for Lake Opeta and forty-three (43) species for Lake Bisina were identified for insects (butterflies).
- Basically, majority of the identified butterflies are commonly observed butterflies, and no endangered species were observed. However, there were butterflies which are unique to wetland area. Acraea arhira and Borbo micans, which were identified, have to be taken with special care, as both are understood to receive impact of ecological change in wetland.



Source: "Ecological Baseline Surveys of Lake Bisina – Lake Opeta Wetlands System, Lake Mburo – Nakivali Wetlands System (2009)"

Fig. 1-4-1-10. Insect (Butterflies) Sampling Point Area at Opeta-Bisina Wetland

Table 1-4-1-12. Result of Survey on Insect (Butterflies) at Opeta-Bisina Wetland

Ecotype	Lake Opeta	Lake Bisina
Forest Dependent Species	0	0
Forest Edge/ Woodland species	0	1
Wetland Species	1	1
Open habitat species	5	11
Widespread Species	9	16
Open Habitat/ Migratory Species	4	8
Widespread/ Migratory Species	4	5
U	0	1
Total	23	43

Source: "Ecological Baseline Surveys of Lake Bisina – Lake Opeta Wetlands System, Lake Mburo – Nakivali Wetlands System (2009)"

- For fauna and flora, Lake Opeta is richer compared to Lake Bisina. Eighty-four (84) species were identified at Lake Opeta, and seventy (70) species for Lake Bisina. *Ottelia fischeri*[14] was identified at Lake Bisina, which is recognized as rare species in the region.
- For fishes, twenty-eight (28) species for Lake Opeta and thirty-four (34) Species for Lake Bisina were identified. Haplochromines (*O. Variabilis*), which was observed at both Lake Opeta and Lake Bisinais, is regarded as an important species from bio-diversity point of view though it is not registered on IUCN Red List.

Table 1-4-1-13. Result of Survey on Fishy at Opeta-Bisina Wetland

Family	Family Fish Species	Lake Opeta	Lake Bisina
Cichlidae	Chichlidae Astatoreochromis sp.	1	1
	Astatoilapia sp.	4	3
	Haplochromis lividus	1	1
	Haragachromis spp.	1	1
	Lipochromis spp.	1	3
	Marcusenius spp.	2	4
	Oreochromis spp.	3	
	Pedicel		3
	Prognathochromis spp.	2	1
	Psammochromis spp.	1	3
	Pyxichromis spp.		1
	Tilapia sp.	1	1
	Xystichromis sp.	1	1
Mormyridae	Gnathonemus spp.	2	1
	Mormyrus sp	1	
	Petrocephalus spp.	1	1
Ciprynidae	Bagrus spp.	2	2
Characidae	Brycinus sp.	1	1
Claridae	Clarias spp.	2	2
Lepidosirenidae	Protopterus sp.		1
Schibeidae	Schilbe sp.		1
Machokidae	Synodontis spp.	1	2
Total		34	28

Source: "Ecological Baseline Surveys of Lake Bisina – Lake Opeta Wetlands System, Lake Mburo – Nakivali Wetlands System (2009)"

1-4-1-8 Assessment of Environmental and Social Impact

Based on the above survey results, the environmental impact of the project was evaluated.
Table 1-4-1-14 shows the scooping and survey results.

[14] No registered on IUCN Red List.

Table 1-4-1-14. Scoping and Survey Results

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
Pollution	1	Air Pollution	B-	D	B-	N/A	[Design/construction phase] · There are two types of the sources of air pollution: 1) dust caused by operation of construction; and 2) vehicles and heavy machineries for construction. · They may put some impacts but their impacts on the existing air environment are limited. [Operation phase] · Considering the nature of the project, the source of pollution is not expected in operation.
	2	Water Pollution	B-	B-	B-	B-	[Design/construction phase] · The expected impacts by construction are soil and drained water inflow and increase of suspended solids from the waste of the construction sites, including workers' camp. · Considering the current situation of Atari River and the coverage of construction, the impacts of construction are considered limited. [Operation phase] · **It remains the concern of water pollution being caused by the use of agricultural chemicals in future. Training of farmers and agricultural extension officers will be conducted and periodic monitoring will be conducted.**
Pollution	3	Soil Contamination	B-	C	B-	B-	[Design/construction phase] · Soil contamination from heavy machineries and vehicles for construction is anticipated, but the impact is limited. [Operation phase] · Salt damage of farmlands may be anticipated but the level seems minor considering the current soil condition, but the following up will be needed because a new farming manner is introduced.
	4	Waste	B-	B-	B-	B-	[Design/construction phase] · Excavated soil needs to be treated appropriately (transport and emplacement). · Wastes from workers' camp are one of sources

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							during the construction as well. · It may be necessary to conduct EIA and obtain an appropriate environmental certificate if another treatment site is required. [Operation Phase] · In operation phase, residues from agricultural products (e.g. rice straw) will be the major waste generated and needed to treat. **However, such residues can be reused for soil improvement and increasing productivity. The proper measures of such reuse will be guided to farmers. Additionally, it can use for feedstuff of cattle, goat, etc.**
	5	Noise and Vibration	B-	D	B-	N/A	[Design/construction phase] · As heavy machineries are going to be used in construction, the impacts on the residents living within certain distance (e.g. 50m) are concerned. [Operation phase] · The level of noise increases only temporarily during construction, there are no activities expected to cause noise in operation.
	6	Ground Subsidence	D	D	N/A	N/A	[Design/construction phase], [Operation phase] · Ground subsidence is not anticipated during construction and in operation since the project will not plan to do activities causing the ground subsidence.
	7	Offensive Odor	D	D	N/A	N/A	[Design/construction phase] · The construction work itself is not anticipated to generate serious offensive odor since heavy operation of machines in a small area is not planned. Operation phase] · Impacts by offensive odor in operation are not anticipated because there are no sources of odor.
Natural Environment	8	Topography and Geographical Features	D	D	N/A	N/A	[Design/construction phase], [Operation phase] · The project will not give large-scaled modification in topography and geography of the area. No impacts are expected.
	9	Flora, Fauna and Biodiversity	B-	B-	B-	B-	[Design/construction phase] · The area has variety of faunal and floral species

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							and the construction work will give adverse impacts on the wetland ecosystem like loss of some plants and wild animal habitats. · Based on the EIA survey, a few animals (Gray-crowned crane etc.) to be treated carefully were observed. [Operation phase] · There remain fears that local people may vanish local resources without knowledge of the importance.
	10	Protected Areas	B-	B-	B-	B-	[Design/construction phase], [Operation phase] · Since a certain level of impacts to the Ramsar Convention wetland by the river water from the Project Site during construction and operation phases respectively is anticipated, careful management of river water is required in order to secure the preservation.
	11	Soil Erosion	B-	B+	B-	B+	[Design/construction phase] · Soil erosion is anticipated near a borrowing pit as being scoped. [Operation phase] · The project will contribute to land arrangement and prevent soil erosion because the introduced irrigation system will strengthen fragile basement of the land.
	12	Groundwater	D	B-	N/A	B-	[Design/construction phase] · The construction will not give impact on the groundwater ways since the construction applies shallow dredging manner. [Operation phase] · **It remains the concern of water pollution being caused by the use of agricultural chemicals in future. Training of farmers and agricultural extension officers will be conducted and periodic monitoring will be conducted.**
	13	Hydrological Situation	B-	B+/-	B-	B+/-	[Design/construction phase] · There is a temporal change of the river flow during construction (mainly in closing rivers). [Operation phase] · Water intake from Atari River can disturb the flow to an extent but the extent

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							of disturbance is limited. In contrast, the stable water distribution for irrigation contributes to the area development and gives benefits.
	14	Global Warming	D	D	N/A	N/A	[Design/construction phase] · Although the construction vehicles emit greenhouse gas, the extent and impact are expected minor. [Operation phase] · In operation, the project is not supposed to give an impact on global warming.
Social Environment	15	Involuntary Resettlement/Land Acquisition	B-	C	B-	D	[Design/construction phase] · Despite no involuntary resettlement, land acquisition caused by the implementation of the project shall be conducted according to laws and regulations of Uganda and JICA Guidelines. The affected residents are going to be compensated. · RAP is prepared to be prepared before the construction. [Operation phase] · The land issue will and shall be solved before operation, and then adverse impacts are not expected in operation phase.
	16	Local Economy such as Employment and Livelihood etc.	B-	B+/-	B+	B+/-	[Design/construction phase] · The construction work provided will generate additional employment in the area (positive impact). [Operation phase] · In operation, the crop productivity will grow and livelihood of farmers be improved. · On the other hand, fishing activity in existing ponds or papyrus harvesting may have an adverse impact.
	17	Landscape	B-	D	B-	N/A	[Design/construction phase] · The alignment of construction machines can be a source of landscape disturbance. [Operation phase] · In operation, the facilities to be installed are not anticipated to give adverse impacts.
	18	Land Use and Utilization of Local Resources	B-	B-	B-	B-	[Design/construction phase] · The construction work will disturb the current land use by farmer and need cares. [Operation phase] · Farmers will be restricted

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							activities inside the buffer zone by embankment installation. However the impact seems limited because the zone is managed by the community.
	19	Split Community	D	B+/-	N/A	B+/-	[Design/construction phase] · Community issues will be solved prior to the construction since the boundaries will be identified. [Operation phase] · The irrigation project gives effective water use for communities concerned, but some disturbances due to the project implementation such as less use of local resources may be a cause of community split.
Social Environment	20	Existing Social Infrastructures and Services	B-	D	B-	N/A	[Design/construction phase] · Construction vehicles will give an adverse impact to the local traffic condition. [Operation phase] · In operation phase, the adequate provision of public services is realized.
	21	The Poor, Indigenous and Ethnic People	B+	B+/-	B+	B+/-	[Design/construction phase] · Construction work will give employment to local people, especially for lower-earned class. [Operation phase] · The new irrigation will propose positive impacts on these people as well as adverse ones such as minor disturbance of local resource use.
	22	Misdistribution of Benefit and Damage	D	B-	D	B-	[Design/construction phase] · The affected people will be supported in accordance with RAP. [Operation phase] · Although the project does not intend to generate a gap between beneficiaries and non-beneficiaries, it shall be considered in case.
	23	Cultural Heritage	D	D	N/A	N/A	[Design/construction phase], [Operation phase] · The cultural heritage to be considered does not exist in the project area since no important heritage was observed.
	24	Local Conflict of Interest	C	B-	B-	B-	[Design/construction phase] · Some local people may show privately frustration about boundary determination even during the construction phase.

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							[Operation phase] · Although the project does not intend to generate a gap between beneficiaries and non-beneficiaries, it shall be considered in case.
	25	Water Usage or Water Rights and Rights of Commons	B-	B+/-	B-	B+/-	[Design/construction phase] · Usage of the downstream water will be impacted due to changed water flow during the construction. [Operation phase] · New irrigation system will realize effective and fair water use, but unbalanced water usage is anticipated in operation phase.
	26	Gender/Children's Rights	C	C	B-	B-	[Design/construction phase], · As children play a role to help their families, they may be involved in works. [Operation phase] · As a result of project, women's farming burden may be increased and women may lose their opportunity of participating in social activities and acquiring new farming skills.
Social Environment	27	Hazards (Risk), Infectious Diseases such as HIV/AIDS	C	C	B-	B-	[Design/construction phase] · Infectious diseases such as STD are possible to spread due to inflow of construction workers carrying them. · Crimes including sexual harassment toward women due to inflow of construction workers may occurred. [Operation phase] · A possibility remains the project would bring endemic diseases by an increase in water area.
	28	Working Conditions/ Accidents	B-	D	B-	N/A	[Design/construction phase] · Intensive measures to avoid accidents by the construction work shall be installed because some farmers do not wear shoes. Borrowing pit is still an accident source. [Operation phase] · Occurrence of accidents by the project will not expected since there are not construction works in operation phase.
Others	29	Accident	B-	B-	B-	B-	[Design/construction phase] · Due to an increase in traffic volume by construction vehicles, the possibility of traffic accident can be higher.

	No.	Item	Rating during Scoping		Re-Rating		Reasons for Re-Rating
			Construction	Operation	Construction	Operation	
							[Operation phase] · In operation, increased vehicles which drive for crop conveyance on the farm roads inside the irrigation area. Although attack by wild animals is expected minor, cautions will be still needed.
	30	Across-boarder problems	D	C	N/A	D	[Design/Construction phase], [Operation phase] · Since the water intake for the irrigation project during construction and operation phases is tiny compared to the Nile River basin, a cross-border problems are not anticipated.
	31	Monitoring System	B-	B-	B-	B-	[Design/Construction phase], [Operation phase] · Although the EIA establishes the monitoring system for pollution, natural and social environment, malfunction of monitoring system shall be avoided through mitigation measures.

A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown (Examination is needed. Impacts may become clear as study progresses.)

D: No impact is expected

Note: The changes from the FS is shown in bold letters in table.

Source: Revised "FS Report"

The additional points which were considered during the OD are as follows:

Disposal Measures :

During Construction:

In the Project, excavated soil by the construction is basically going to re-use in the Project Site. On the other hand, the soils to be transported to the disposal area is estimated about 16,270 m^3. From The five (5) candidate sites for disposal area recommended by PACC members in Bulambuli and Kween districts, the one site (hereinafter referred to as "the First Candidate Site") was selected through field observation with MAAIF. The conditions of the First Candidate Site are follows:

- It is easily accusable; it is the nearest from the Project Site (only about 11km), and along with national road.
- It is not required to change the national condition in the First Candidate Site, since it has already been used as the disposal area and borrowing pit.
- There is no structure such as residential building.
- The capacity is estimated about 60,000m^3 and enough to dispose the generated soils by the Project.

While the official contract between the land owner and MAAIF has not been concluded yet, it has been confirmed that the owner has no objection to be used by the Project. It will be conducted as one

Disposal Measures：

task of contractor.

As the above explanations, the capacity of the First Candidate Site is enough for the amount of excavated soil by the Project. However, when the deficiency of capacity occurs, the other site will be selected from other 4 candidate sites. One of such site locates the opposite side across the national road from the First Candidate Site, and it is owned by the same owner. Hence, this could be the second option.

Establishment of River Dyke：

The River Dyke will be constructed on the current farmlands which locates away from more than 30m from the hypothetical centerline of the Atari River (in total, more than 60m). It is not the design which requires to change the original river course during the construction of the River Dyke. Thus, it is not expected the significant negative impacts on the river environment such as fish and aquaculture insects, etc. Regarding the construction materials for the River Dyke, the soil in/ around the Project Site will be used.

As mentioned above, land acquisition is required, since the River Dyke will be constructed on the current farmlands. Additionally, the river training at the particular points will be needed to mitigate the impact of land acquisition, in accordance with discussions with the stakeholders. On the other hand, since it is not to divide the current river course, the behavior of aquatic fauna or river environment will not be interrupted.

1-4-1-9 Mitigation Measures

The examination results of mitigation measures during construction and operation based on the baseline survey results are shown in Table 1-4-1-15.

Table 1-4-1-15. Mitigation Measures

Potential Impacts	Mitigation measures
Construction Phase	
Air pollution, Noise and Vibration	· Where necessary acoustic insulation will be used around noisy equipment like pumps and compressors (screening, etc.). · All construction vehicles will be regularly serviced to maintain high combustion efficiencies and minimize emissions. Preventive maintenance of vehicles and machinery will be done to reduce noise generation. · Suitable controls will be implemented for exposed stockpiles and unsealed construction areas (for example covering or spraying with water as appropriate) to minimize dust during the dry, windy weather.
Improper Management of Generated Waste	· A waste management plan will be developed by the Construction and Maintenance Contractors and approved by the project entity to ensure that measures for handling all Project-generated waste are in place. · Waste transportation vehicles will be covered to avoid spillage or waste getting blown off during haulage. · Construction waste shall not be left in stockpiles along roads, but removed and reused or disposed of on a regular basis. · **Regarding excavated soil by the construction, it will be basically reused in the Project Site. When the soil is not applicable for agricultural activities, or when it is surplus for reusing, it will be transported to the disposal area and treated properly.**
Land and Water Resources Degradation	· Through good construction practices and erosion control measures (for example silt traps, interceptor drains) contamination of the downstream river section water resource will be minimized. · Bank erosion during construction and sediment input as a result of storm water during the operational phase into the stream will be prevented by installing a protective working platform at the work site on the river bank. · Riverbed disturbance will be restricted to critical sites.

Potential Impacts	Mitigation measures
Destruction or Disturbance of Habitat and Species	· Restriction modification of river beds at important sites. · Monitoring habitat coverage and quality. · Mechanically removing the invasive species and checking tires of construction vehicles will be undertaken. In addition, their regrowth will be monitored during operation. · Large trees will be spared the by circumventing them as much as possible.
Operation Phase	
Soil Degradation	· Farmers will be re-trained how to operate the system to avoid over-irrigation. · Canals will be stabilized to avoid seepage that contributes to water logging. · Canals and dykes will be located such that they do not obstruct natural drainage.
Pollution of Surface and Groundwater	· **Training for the optimum use of agricultural chemicals will be conducted to the farmers and agricultural extension officers in Atari Area.**
Modification of River Flow Regimes	· **For the purpose of conservation of Atari River and surrounding areas including Ramsar Convention registered wetlands, the Environmental maintenance flow was set to discharge the mount to the downstream of Atari River through the whole year.** · **For avoiding free behavior of fisheries, the screen will not be set at the headworks. The refuse will be removed at the de-silting basin behind the headworks by mon-powered[15].**
Protection of Farmed Plots from Floods	· The height of the River Dyke was designed with surplus allowance height of 60 cm, so that the estimated flood volume can flow down to cross section. · The width of flood protection dyke will be set at 30m each from the river center in order to be restricted within the width of the meandering course of the Atari River.

Note: The changes from the FS is shown in bold letters in table.

Source: Revised "FS report"

1-4-1-10 Environmental Management Plan and Environmental Monitoring Plan

(1) Environmental Management Plan

Regarding the Environmental Management Plan (hereinafter referred to as "EMP") which was considered during the FS, the contents including the results of additional surveys during the OD are shown below:

Table 1-4-1-16. Environmental Management Plan

No.	Potential Impact	Mitigation Measures	Responsibility		Estimated Cost or Burden Organization
		Pre-/ during Construction	Implementation	Supervise	
[Pre-/ during Construction]					
1	Air Pollution	− Water sprinkling near residential area − Speed limit for construction machines at construction sites adjacent to settlement areas	Construction contractor	Supervising consultant, MAAIF	Construction contractor
2	Water Pollution	− Discharge through sedimentation pond and silt fence − Installation of portable toilet for workers − Appropriate waste and construction machines management	Construction contractor	Supervising consultant, MAAIF	Construction contractor
3	Soil Contamination	[Excavated soil] − Reuse or dispose at designated disposal site after treatment.	Construction contractor	Supervising consultant, MAAIF	Construction contractor

[15] Originally, the screen was planned to avoid influx of refugees. However, it has been founded that it can be the constitute a limiting factor of keeping water levels required for irrigation. Hence, the design was changed at the OD.

No.	Potential Impact	Mitigation Measures	Responsibility		Estimated Cost or Burden Organization
		Pre-/ during Construction	Implementation	Supervise	
		[Oil from machinery] − Maintain the machinery and vehicle to prevent oil leakage			
4	Waste	[Construction waste (trees and waste soil)] − After considering the possibility of reuse, construction waste is disposed at designated disposal area. [Waste from base camp] − Waste at workers camp and waste oil shall be brought to disposal site or facility [Night soil] − Temporary sanitation facility such as septic tank shall be introduced to the workers camp.	Construction contractor	Supervising consultant, MAAIF	Construction contractor
5	Noise and Vibration	[Construction noise] − Installing noise barrier and selecting low-noise equipment when necessary − Avoiding works of heavy equipment during night time. − Informing the construction schedule to surrounding communities to obtain their consensus.	Construction contractor	Supervising consultant, MAAIF	Construction contractor
6	Flora, Fauna and Biodiversity	− Restrict the construction activities only to the project foot print areas. − Spare large trees by circumventing them as much as possible. − For wetland management, collaborate the monitoring framework by the JICA's wetland management project.	Construction contractor	Supervising consultant, MAAIF	Construction contractor, MAAIF
7	Protected Areas	− Discharge through sedimentation pond and silt fence − Installation of portable toilet for workers − Appropriate waste and construction machines management	Construction Contractor Farmers' Associations in the Project area, District Local Governments of Bulambuli and Kween	MAAIF	Construction contractor
8	Soil Erosion	− Maintain strength of slope in order to avoid erosion at borrow pits	Construction contractor	MAAIF	Construction contractor
9	Hydrological Situation	− Control water use for construction from the river − Monitor water flow as appropriate − Secure waterways in construction area	Construction contractor	Supervising consultant, MAAIF	Construction contractor
10	Involuntary Resettlement/ Land Acquisition	− Conduct appropriate compensation and livelihood assistance in accordance with RAP	MAAIF	Office of the Chief Government Valuer (CGV)	**1,384,072,209 UGX for RAP Implementation ***
11	Local Economy such as Employment and Livelihood, etc.	− Conduct appropriate compensation and social assistance in accordance with RAP	MAAIF	Farmers' Associations in the Project area, District Local Governments of Bulambuli and Kween	**1,384,072,209 UGX for RAP Implementation ***
12	Landscape	− Layout the construction machinery properly	Construction contractor	Supervising consultant, MAAIF	Construction contractor
13	Land Use and Utilization of Local Resources	− Conduct appropriate land acquisition and compensation − Conduct appropriate land use management	MAAIF	Farmers' Associations in the Project area, District Local	MAAIF

No.	Potential Impact	Mitigation Measures	Responsibility		Estimated Cost or Burden Organization
		Pre-/ during Construction	Implementation	Supervise	
				Governments of Bulambuli and Kween	
14	Existing Social Infrastructures and Services	− Install safety sign boards − Install fences around the construction site to keep out local people such as children − Install parking for idling construction machines	Construction contractor	Supervising consultant, District Local Governments of Bulambuli, and Kween	Construction contractor
15	The Poor, Indigenous and Ethnic People	− Conduct appropriate compensation and social assistance in accordance with RAP	MAAIF	District Local Governments of Bulambuli and Kween MAAIF	**1,384,072,209 UGX for RAP Implementation ***
16	Local Conflict of Interests	− Arrange conflicts happened to solve (e.g. boundary conflict etc).	MAAIF	District Local Governments of Bulambuli and Kween	MAAIF
17	Water Usage or Water Rights and Rights of Common	− Discharge through sedimentation pond and silt fence	Construction Contractor, MAAIF	District Local Governments of Bulambuli and Kween	MAAIF
18	Gender/ Children's Rights	− Conduct appropriate support in accordance with RAP − In order to prevent child labor, promote awareness of the construction contractor	MAAIF	District Local Governments of Bulambuli and Kween MAAIF	MAAIF
19	Hazards (Risk), Infectious Diseases such as HIV/AIDS	− Install sufficient drainage facilities not to provide habitat for vector mosquito − Provide adequate temporary sanitation facilities − Enforce medical screening and periodical medical check-up − In order to prevent spread of infectious diseases such as HIV/AIDS, promote awareness of the labors and local people − In order to prevent crimes including sexual harassment toward women due to inflow of construction workers, promote awareness of the workers and local people − Recommendation to expel vector shellfish and wear boots	Construction contractor MAAIF, Farmers' Associations in the Project area, DPO, DISO	Supervising consultant, District Local Governments of Bulambuli and Kween, MoH, MoGLSD	Construction contractor, MAAIF
20	Working Conditions/ Accidents	− Provide safety training for the workers − Conduct safety patrol at the construction site	Construction contractor	Supervising consultant, MAAIF, MGLSD (OSH Department), District Local Governments of Bulambuli, and Kween	Construction contractor
21	Accident	− Install safety sign boards − Install fences around the construction site to keep out local people such as children − Install parking for idling construction machines − Restrict mobilization speed in and near the construction site − Setup of a sign for accident warning, regular canal patrol and recommendation of reporting when	Construction contractor	Supervising consultant, MAAIF, District Local Governments of Bulambuli, and Kween	Construction contractor

No.	Potential Impact	Mitigation Measures	Responsibility		Estimated Cost or Burden Organization
		Pre-/ during Construction	Implementation	Supervise	
		finding a destructive animal − In order to prevent accident of the child, provide safety education in the elementary school of the neighborhood.			
22	Monitoring System	− Supervise monitoring activity by the construction contractor − Make a routine of reporting monitoring results	Construction contractor	Supervising consultant, MAAIF	Construction contractor
[In Operation Stage]					
1	Water Pollution	− Train farmers to ensure optimum use farm imputes and the practices − Conduct periodic monitoring	MAAIF Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
2	Soil Contamination	− Replace the soil seriously damaged by salt. − Train farmers to reuse agricultural residue for their cultivation or grazing livestock, etc.	MAAIF Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
3	Waste	− Train farmers to dump such residues at a proper site (e.g. not near the irrigation canals) − Setup of additional waste sites (in case of exceeding projected waste amount) − Dispose the waste at a proper site getting farmers across to enhance the reuse of wastes (feeder, organic material, ploughing-in, fuel etc.) through training.	MAAIF Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
4	Flora, Fauna and Biodiversity	− Train farmers to conserve the local nature. − For wetland management, collaborate the monitoring framework by the JICA's wetland management project	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
5	Protected Areas	− Train farmers to ensure optimum use farm inputs such as fertilizers and the prectise emphasized.	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
6	Groundwater	− Train farmers to ensure optimum use farm inputs and the prectise emphasized.	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
7	Hydrological Situation	− Control the volume of water intake based on the water condition status in the irrigation area − Train farmers to remove refuses	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
8	Local Economy such as Employment and Livelihood, etc.	− Conduct community-based on the wetland management guideline	MAAIF Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
9	Land Use and Utilization of Local Resources	− Conduct appropriate land use management base on the related guideline	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
10	Split in Community	− Conduct activities relating to the project by involving local people	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
11	The Poor, Indigenous and Ethnic People	− Follow up the PAPs in line with RAP	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
12	Misdistribution	− Conduct activities relating to the	MAAIF,	District Local	MAAIF

No.	Potential Impact	Mitigation Measures	Responsibility		Estimated Cost or Burden Organization
		Pre-/ during Construction	Implementation	Supervise	
	of Benefit and Damage	project by involving local people	Farmers' Associations in the Project area	Governments of Bulambuli and Kween	
13	Local Conflict of Interests	− Conduct activities relating to the project by involving local people	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
14	Water Usage or Water Rights and Rights of Common	− Install alternative water distribution system when unexpected situation such as reduction of spring water and water level of wells	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
15	Gender/ Children's Rights	− Conduct appropriate support in accordance with RAP	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween	MAAIF
16	Hazards (Risk), Infectious Diseases such as HIV/AIDS	− Promote awareness of diseases to local people − Install windows of health consultation − Recommendation to expel vector shellfish and wear boots	MAAIF, Farmers' Associations in the Project area	District Local Governments of Bulambuli and Kween, MoH, MoGLSD	MAAIF
17	Accident	− Train to comply with traffic rules − Install safety sign boards for traffic and animal attack − Setup of a sign for accident warning, regular canal patrol and recommendation of reporting when finding a destructive animal	MAAIF	MAAIF	MAAIF
18	Monitoring System	− Supervise monitoring activity by the supervisor − Make a routine of reporting monitoring results	MAAIF	MAAIF	MAAIF

Source: Revised "FS report"

(2) Environmental Monitoring Plan

The Environmental Monitoring Plan in accordance with the additional survey during the OD is as shown in Table 1-4-1-17.

Table 1-4-1-17. Environmental Monitoring Plan (Draft)

No	Item	Parameter	Method	Location	Frequency	Responsibility
Pre-/ during Construction						
1	Air Pollution	Dust, (exhaust gas from machinery)	Visual inspection	Near the construction site facing sensitive receptor (house, school etc.)	When heavy machine operating	Contractor & Subcontractor
2	Water Pollution	pH, DO, BOD, TN, TP	Sampling test	2 points: 1) Upstream of Headwork to be constructed 2) After drainage canal to be constructed	Monthly (except TN, TP)	Contractor & Subcontractor
		Turbidity & oil	Visual inspection	-	Biannually (TN, TP)	
3	Soil Contamination	Existence of oil in soils pH & EC	Visual inspection Sampling test	Model Sites of Land Re-organization	Daily As appropriate (when Water Pollution becomes worse)	Contractor & Subcontractor Contractor & Subcontractor
4	Waste	Volume of waste soil, and domestic garbage	Visual inspection	Excavated site, dumping site, workers' camp	Daily	Contractor
5	Noise and Vibration	Noise: LAeq (during operating heavy machine)	Visual inspection	Where heavy machine operating	As appropriate	Contractor & Subcontractor
6	Fauna, Flora & Biodiversity	Extent of disturbance of habitat and species (species, population, location)	Visual inspection (Birds: Line census survey)	Major construction area	Bird: Biannually (January & July) Others: Monthly	Contractor & Subcontractor
7	Hydrological Situation	Volume of river flow	Potable flow velocity meter and staff gauge	At the end of river bed protection	Monthly	Contractor & Subcontractor
8	Involuntary Resettlement/ Land Acquisition	Progress of RAP program (compensation, land acquisition, livelihood assistance)	Hearing from persons concerned	Affected parishes	Quarterly, or when required	MAAIF
9	Local Economy such as Employment, Livelihood & etc.	Progress of RAP program (compensation, land acquisition, livelihood assistance)	Hearing from persons concerned	Affected parishes	Quarterly, or when required	MAAIF
10	Landscape	Complaint about the landscape from local people	Hearing from persons concerned	Wherever complains take place.	As appropriate	Contractor & Subcontractor
11	Land Use and Utilization of Local Resources	Progress of RAP program (compensation, land acquisition, livelihood	Hearing from persons concerned	Affected parishes	Quarterly, or when required	MAAIF

No	Item	Parameter	Method	Location	Frequency	Responsibility
		assistance)				
12	Existing Social Infrastructures & Services	Extent of damage to existing infrastructures such as community roads etc.	Visual inspection	Facilities which the construction give impacts (vehicle roads etc.)	Monthly	Contractor & Local Government Uganda concerned
13	The Poor, Indigenous & Ethnic People	Progress of RAP program (compensation, land acquisition, livelihood assistance)	Hearing from persons concerned	Affected parishes	Quarterly, or when required	Construction Supervisor, Local Government Uganda concerned
14	Local Conflict of Interests	Cause of conflict	Hearing from persons concerned	Construction area & affected parishes	As appropriate	MAAIF & Local Government Uganda concerned
15	Water Usage or Water Rights & Rights of Common	Same as No.13	Visual inspection	Same as No.13	Same as No.13	Contractor & Subcontractor
16	Gender/Children's Rights	Progress of RAP program (compensation, land acquisition, livelihood assistance) Number of child labors Number of crimes including sexual harassment toward women	Hearing from persons concerned	Affected parishes	Quarterly, or when required	MAAIF, Contractor & Subcontractor
17	Hazards (Risks), Infectious Diseases such as HIV/AIDS	Number of infected patients Number of raising awareness consultation meeting about crimes including sexual harassment toward women	Hearing from persons concerned	Construction area, Workers camp & Affected parishes	Quarterly	MAAIF, Local Government Uganda concerned & Contractor
18	Working Conditions/ Accidents	Number of instruments required (helmets, shoes etc.) Number of accidents relating to construction	Construction record made by Contractor and Sub-contractor	Construction area & Workers camp	Quarterly	Contractor
19	Accident	Number of accidents happened Number of the safety education at the elementary school	Construction record made by Contractor and Sub-contractor	In the project area (especially outside the construction area)	Quarterly	Contractor & Subcontractor
20	Monitoring System	Progress of monitoring	Hearing from persons	Monitoring forms and	Quarterly	MAAIF & Consultant

No	Item	Parameter	Method	Location	Frequency	Responsibility
		activity as scheduled	concerned	reports		
[In Operation Stage]						
1	Water Pollution	Quantitative pH, DO, BOD, TN, TP	Sampling test	3 points: 1) Upstream of Headworks 2) Confluence point of drainage canal and Atari River 3) Downstream of confluence point	Monthly (except TN & TP), Biannually (TN & TP)	MAAIF
		Qualitative Turbidity, Oil	Visual inspection	-	-	
		Adrin Atrazine, DDT, Endsulfan, Endrin, Simaxine, Trifluralin	Sampling test	3 points: 1) Upstream of Headworks 2) Confluence point of drainage canal and Atari River 3) Downstream of confluence point	Biannually (1 time x 2 farming seasons)	
3	Soil Contamination	pH & EC	Visual inspection	Model Sites of Land Re-organization	Monthly	MAAIF
4	Waste	Volume of soil and garbage	Visual inspection		Monthly	MAAIF
5	Fauna, Flora & Biodiversity	Extent of disturbance of habitat and species (species, population, location)	Visual inspection (Birds: Line census survey)	Major construction area	Birds: Biannually (January & July) Others: Annually	MAAIF
6	Groundwater	NO_3-N, NO_2-N	Visual inspection	Two points of existing wells: 1) upstream of the Project Site (outside of the Project Site) 2) downstream of the Project Site (within the Project Site)	Biannually (1 time x 2 farming seasons)	MAAIF
		Adrin Atrazine, DDT, Endsulfan, Endrin, Simaxine, Trifluralin	Sampling test	Two points of existing wells: 1) upstream of the Project Site (outside of the Project Site) 2) downstream of the	Biannually (1 time x 2 farming seasons)	

No	Item	Parameter	Method	Location	Frequency	Responsibility
				Project Site (within the Project Site)		
		Turbidity, Oil	-	-	-	
7	Hydrological Situation	Volume of river flow	Potable flow velocity meter and staff gauge	At the end of river bed protection	Monthly	MAAIF
8	Local Economy such as Employment, Livelihood & etc.	Progress of livelihood assistance	Hearing from persons concerned	Affected parishes	Quarterly, or when required	MAAIF
9	Land Use & Utilization of Local Resources	Progress of land use management guideline	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF
10	Split in Community	Number of frictions between communities	Hearing from persons concerned	Affected parishes	Annually	MAAIF & Local Government Uganda concerned
11	The Poor, Indigenous & Ethnic People	Number of complaints	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
12	Misdistribution of Benefit & Damage	Number of complaints	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
13	Local Conflict of Interests	Number of conflicts	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
14	Water Usage or Water Rights & Rights of Common	Number of complaints	Visual inspection	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
15	Gender/Children's Rights	Number of complaints Income of the female-headed household Number of female membership of the water association (to be established) Number of female participants to the community consultation meeting	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
16	Hazards (Risks), Infectious Diseases such as HIV/AIDS	Number of infected patients	Hearing from persons concerned	Affected parishes	Biannually	MAAIF & Local Government Uganda concerned

No	Item	Parameter	Method	Location	Frequency	Responsibility
17	Accident	Number of accidents happened	Hearing from persons concerned	Affected parishes	Quarterly	MAAIF & Local Government Uganda concerned
18	Monitoring System	Progress of monitoring activity as scheduled	Hearing from persons concerned	Monitoring forms & reports	Quarterly	MAAIF & Local Government Uganda concerned

Remarks:

- BOD: Biological Oxygen Demand
- EC: Electrical Conductivity
- DO: Dissolved Oxygen
- NO3-N: Nitrate Nitrogen
- NO2-N: Nitrite Nitrogen
- TN: Total Nitrogen
- TP: Total Phosphorus
- LAeq: Equivalent continuous A-weighted sound pressure Level

Source: Revised “FS report”

(3) Draft Environmental Monitoring Form

The draft Environmental Monitoring Plan Form during construction phase and operation phase are shown Table 1-4-1-18. Regarding the items on social environment, since it will be monitored through RAP activities, the details are presented in "1-4-2-9 RAP Monitoring Structure and Monitoring Form"

Table 1-4-1-18. Environmental Monitoring Form (Draft)

Construction Phase

1. Response/Action to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
No. and contents of formal comments made by the public	
No. and contents of responses from Gov. authorities	

2. Pollution

Air Quality

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard	Measurement point	Frequency
Dust (PM10) (instrument)	μg/m^3			300	Where heavy machine operating	When heavy machine operating
Item		Monitoring result			Measurement point	
Visual inspection (qualitative)					Where heavy machine operating	

*1: WHO's Guidelines Value

Water Quality

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard	Measurement point	Frequency
Quantitative Analysis						Monthly (except TN & TP), Biannually (TN & TP)
pH	-			6.5-8.5*2	2 points: 1) Upstream of Headwork to be constructed 2) After drainage canal to be constructed	
DO	mg/L			6.5*1		
BOD	mg/L			14.0*1		
TN	mg/L			1.7*1		
TP	mg/L			0.3*1		
Qualitative Analysis						
Item		Monitoring result		-	Measurement point	
Turbidity	-			-		
Oil	-			-		

*1: Maximum values obtained by baseline survey described in EIA (2017).
*2: Japan's environmental standards for type-C river water (3rd class for fishery and 1st for industrial water)

Soil Contamination

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Measurement Point	Frequency
Extent of oil in soils			Model Sites of Land Re-organization	Daily
pH				As appropriate
EC				As appropriate

Waste

Monitoring Item	Date	Measured value	Measurement Point	Note	Frequency
Volume of soil (m^3)					Daily
Volume of garbage (m^3)					Daily

Noise

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard*1	Measurement point	Frequency
LAeq	dB(A)			58	Where heavy machine operating	As appropriate

*1: Maximum value obtained by baseline survey during dry season.
*2: WHO's Guidelines value (outdoor) for residential area.

3. Natural Environment

Fauna, Flora & Biodiversity
(1) Birds

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Frequency
Endangered Species:			
Gray-crowned Crane *(Balearica regulorum)*	Population: Location:	4 lines census: (Refer to Figure 1-4-1-11. Proposed map of the birds census) Visual inspection: Binocular glasses and/ or Digital photograph	Biannually (January & July)
Pallid Harrier *(Circus macrourus)*	Population: Location:		
Fox's Weaver *(Ploceus spekeoides)*	Population: Location:		
Shoebill *(Balaeniceps rex)*	Population: Location:		
Other Species:			
	Population: Location:	4 lines census: (Refer to Figure 1-4-1-11. Proposed map of the birds census) Visual inspection: Binocular glasses and/ or Digital photograph	Biannually (January & July)
	Population: Location:		
	Population: Location:		
	Population: Location:		

(2) Others

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Frequency
Extent of disturbance of habitat and species	Spices: Population: Location:	Visual inspection	Monthly
Extent of disturbance of habitat and species	Spices: Population: Location:		

Hydrological Situation

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Measurement Point	Frequency
Volume of river flow (m^3/s)		Potable flow velocity meter and staff gauge	At the end of river bed protection	Monthly

Operation Phase

1. Response/Action to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
No. and contents of formal comments made by the public	
No. and contents of responses from Gov. authorities	

2. Pollution

Water Quality

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard	Measurement point	Frequency
Quantitative Analysis						
pH	-			6.5-8.5*2	3 points: 1) Upstream of Headworks 2) Confluence point of drainage canal and Atari River 3) Downstream of confluence point	Monthly (except TN & TP), Biannually (TN & TP)
DO	mg/L			6.5*1		
BOD	mg/L			14.0*1		
TN	mg/L			1.7*1		
TP	mg/L			0.3*1		
Qualitative Analysis						
Turbidity				-		
Oil				-		
Monitoring for the pesticides use						
Aldrin	µg/			0.01*3	3 points: 1) Upstream of Headworks 2) Confluence point of drainage canal and Atari River 3) Downstream of confluence point	Biannually (1 time x 2 farming seasons)
Atrazine	µg/			2.0*3		
DDT	µg/			0.025*3		
Endsulfan	µg/			0.01*3		
Endrin	µg/			0.01*3		
Simaxine	µg/			4*3		
Trifluralin	µg/			0.03*3		

*1: Maximum values obtained by baseline survey described in EIA (2017).
*2: Japan's environmental standards for type-C river water (3rd class for fishery and 1st for industrial water)
*3: Environmental Quality Standard for Substances And Certain Other Pollutions, European Union

Soil Contamination

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard	Measurement point	Frequency
pH (paddy)	-			5.0-6.5*1	Model Sites of Land Re-organization	Quarterly
pH (maize)	-			5.5-7.5*1		
EC (paddy)	µS/cm			700*2		
EC (maize)	µS/cm			300*2		

*1: Standard for Soil Evaluation, Ministry of Agriculture, Forestry and Fisheries in Japan
*2: Desalting manual for farmland in Japan, Ministry of Agriculture, Forestry and Fisheries in Japan

Waste

Monitoring Item	Date	Measured value	Measurement Point	Note	Frequency
Volume of soil (m^3)					Monthly
Volume of garbage (m^3)					Monthly

3. Natural Environment

Fauna, Flora & Biodiversity
(1) Birds

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Frequency
Endangered Species:			
Gray-crowned Crane *(Balearica regulorum)*	Population: Location:	4 lines census: (Refer to Figure 1-4-1-11.	Biannually (January & July)

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Frequency
Pallid Harrier *(Circus macrourus)*	Population: Location:	Proposed map of the birds census) Visual inspection: Binocular glasses and/ or Digital photograph	
Fox's Weaver *(Ploceus spekeoides)*	Population: Location:		
Shoebill *(Balaeniceps rex)*	Population: Location:		
Other Species:			
	Population: Location:	4 lines census: (Refer to Figure 1-4-1-11. Proposed map of the birds census) Visual inspection: Binocular glasses and/ or Digital photograph	Biannually (January & July)
	Population: Location:		
	Population: Location:		
	Population: Location:		

(2) Others

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Frequency
Extent of disturbance of habitat and species	Spices: Population: Location:	Visual inspection	Annually
Extent of disturbance of habitat and species	Spices: Population: Location:		

Groundwater

Item	Unit	Measured Value (mean)	Measured value (max)	Project Standard	Measurement point	Frequency
Quantitative Analysis						
NO_2-N	mg/L			10[*1] (in total as N)	Two points of existing wells: 1) upstream of the Project Site (outside of the Project Site) 2) downstream of the Project Site (within the Project Site)	Biannually
NO_3-N						
Qualitative Analysis						
Turbidity	-			-		
Oil	-			-		
Monitoring for the pesticides use						
Aldrin	µg/			0.01[*2]	Two points of existing wells: 1) upstream of the Project Site (outside of the Project Site) 2) downstream of the Project Site (within the Project Site)	Biannually (1 time x 2 farming seasons)
Atrazine	µg/			2.0[*2]		
DDT	µg/			0.025[*2]		
Endsulfan	µg/			0.01[*2]		
Endrin	µg/			0.01[*2]		
Simaxine	µg/			4[*2]		
Trifluralin	µg/			0.03[*2]		

*1: Japan's environmental standards for groundwater

*2: Environmental Quality Standard for Substances And Certain Other Pollutions, European Union

Hydrological Situation

Monitoring Item	Monitoring Results during Report Period	Measures to be Taken	Measurement point	Frequency
Volume of river flow (m^3/s)		Potable flow velocity meter and staff gauge	At the end of river bed protection	Monthly

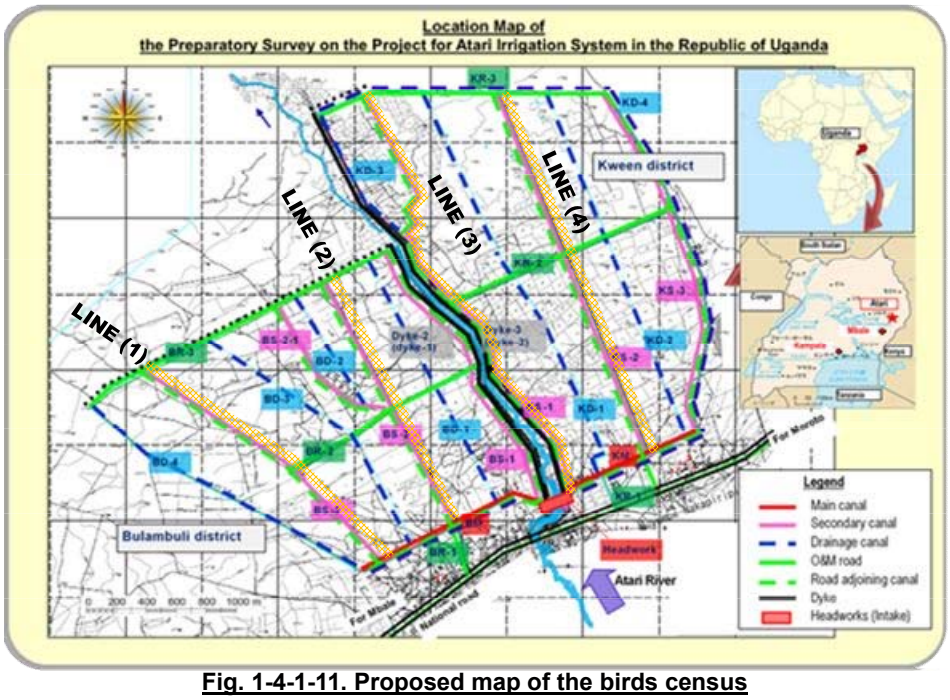


Fig. 1-4-1-11. Proposed map of the birds census

1-4-1-11 Stakeholder Meetings

The Project has organized ten (10) stakeholder meetings. Summary of these stakeholder meeting is shown below. For more details on each stakeholder meetings, see Appendix-4 and Appendix-5.

(1) PDCC Meeting (19th July, 2017)

Venue: Bulambli District Local Government headquarters

Time: 11:00-14:00

Participant:

Stakeholders	Number	Descriptions
PDCC	15	
MAAIF	3	Benon, Olland, Okwanga
JICA OD Team	9	Ieizumi, Akiyoshi, Arakawa, Matsumoto, Ishida, Miki, Esther, Emmanuel, David

Agenda:

1) Land Reorganization
2) Natural condition survey
3) Building facilities

Issues raised:

Issues/ Concerns	Responses
What will happen to the area where facilities will be constructed and also the farmers who have cultivated up to the buffer zone?	MAAIF will get a PAR consultant who will handle the issues of support to the project affected persons whose land will be taken up by the major infrastructure developments but not support for the tertiary channels are those will be directing water to the farmer's plots. MAAIF mentioned that the two districts stakeholders will seat and identify land for project facilities.
The buffer zone*	According to the guidance of senior environment officer in Bulambuli, the protected zone is designated as the

Issues/ Concerns	Responses
	conservation area and so the support to farmers who have cultivated in the protected zone is not required.
The boundary	Atari river course will not change as the river is the boundary between Bulambuli and Kween districts. There might be small pieces of land which might be difficult to reorganize. In that case, negotiation will be encouraged within the beneficiary farmers and for some small pieces of land outside main extreme block to be left out of the project of area.

Note: On the other hand, the estimated impacts on their income source is magnificent, it was decided to provide proper support to them through several discussions.

(2) PACC Meeting (21st July, 2017)

Venue: Atari Apostolic Church

Time: 14:00-17:00

Participants:

Stakeholders	Number	Descriptions
PACC	28	
MAAIF	3	Benon, Olland, Okwanga
JICA OD Team	9	Ieizumi, Akiyoshi, Arakawa, Matsumoto, Ishida, Miki, Esther, Emmanuel, David

Agendas:

1) Land Reorganization
2) Natural condition survey
3) Building facilities

Issues raised:

Issues/ Concerns	Responses
Will the changes be taken into consideration on the ownership of land? Were Some plots going to reduce during land re-organization?	The RAP consultant will handle all those changes.
The building facilities inquired that previously last year, during the FS studies. Why did the two facilities change to one facility?	The Government of Japan is offering Government of Uganda support for only one facility in the grant aid package.
The farmers want to know when leveling works starts, will the farmers be in position to continue farming on their land.	If the land reorganization is accepted in the Project, the leveling works will be done by JICA.

(3) PDCC Meeting (26th July, 2017)

Venue: Bulambli District Local Government headquarters, Climate Change Adaptation Learning Center

Time: 14:00-17:00

Participants:

Stakeholders	Number	Descriptions
PACC	19	
JICA OD Team	3	Ieizumi, Matsumoto, Emmanuel

Agenda:

1) Candidate Location of Contractor's Base Camp
2) Temporary road for construction in the project site

3) Spreading of excavated soil onto farm land

4) Disposal area for spoiled soils in the project site

5) Stability of Electricity Supply in Atari Project Site

Issues raised:

Issues/ Concerns	Responses
Will the disposal site area be the contractor's base camp?	The location for the disposal site would depend on the volumes of earth works generated.
Possibility to use surplus/ surplus soil for embankment construction.	Murram soil can used for dyke. Black cotton soils may work fine for the smaller facilities like a farm ditch.

(4) PACC Meeting (26th July, 2017)

Venue: Atari Apostolic Church

Time: 11:00-14:00

Participants:

Stakeholders	Number	Descriptions
PDCC	14	
JICA OD Team	6	Ieizumi, Akiyoshi, Arakawa, Miki, Esther, David

Agenda:

1) Land reorganization

Issues raised:

Issues/ Concerns	Responses
The buffer zone which was agreed to 5 to 20 meters upon during community resources management plan and put in the Ministry of Uganda signed 4th May 2016.	JICA Study team will consult with the MAIF, MWE and NEMA because they are following what is in the previous reports. The previous reports planted the buffer zone which is 30 meters.
The new design of the protection dyke and the boundary for the two districts.	PDCC members and JICA Study team shall follow the centerline of the meandering of the river although there minor adjustments.
Is the land reorganization the contractors to create the new boundaries and during leveling? Some land will be lost to the facilities.	JICA will do leveling and creating the exterior boundaries, but the farmers will do the internal boundaries.
How will they identify the cadastral boundary? Will they be allowed to cultivate on those portions as well? During land leveling works where will the farmers be cultivating? Will they be able to have access to the land for production?	The allowable periods of cultivation during construction stage should be waited for the completion of outline design and construction planning. MAAIF through the RAP consultant will access seasons together with the farmers and see a way of working out a manageable solution. Regarding the boundary change by Land reorganization, the RAP consultant has to clarify whether or not the existing cadastral boundary has remained after the land organization, because the RAP consultant could assume that existing cadastral boundary will be replaced to the new boundary in accordance with the landform by reorganization.
Is it possible to add farmers who are at downward area of project area?	JICA Study team insisted on the negative possibility to that area.
Project facilities (drying yard, training space and storage for production)	JICA Study team recommends should be taken into consideration and the government need to support the farmers.

(5) PACC Meeting (27th July, 2017)

Venue: Atari Primary School

Time: 14:00-17:00

Participants:

Stakeholders	Number	Descriptions
PACC	32	
MAAIF	2	Benon, Okwanga
Bulambuli District	10	
Kween District	14	
JICA OD Team	6	Ieizumi, Akiyoshi, Arai, Miki, Esther, David

Agenda:

1) Land reorganization

Issues raised:

Issues/ Concerns	Responses
Land boundary	Every land owner got to know the actual size of their land with names and the size, and so after leveling let the RAP consultant should come to relocate them e with GPS coordinate.
Surface soil	Leveling works will not affect the soil fertility as only a smaller layer of soil is moved in the process.
Training to manage the land	There will be training given to the farmers for example to manage water usage and sharing since it will be a new aspect.
The boundary for the two districts	The boundary between Bulambuli and Kween districts will not be changed because Atari River remains as the boundary.
Will the project happen to affect the graves in area?	The RAP consultant will meet with affected persons and agree on how to relocate the graves in case the infrastructure will affect them.

(6) PDCC Meeting (3rd August, 2017)

Venue: Bulambuli District Office

Time: 11:00-13:00

Participants:

Stakeholders	Number	Descriptions
PDCC	3	Samuel, Geofrey, Sarah
MAAIF	1	Benon
JICA OD Team	6	Ieizumi, Matsumoto, Ishikawa, Shiga, Esther, David

Agenda:

1) Buffer Zone

Conclusion:

1) Suggested Buffer Zone which is 30 meters from the hypothetical center line of the river is applicable to the site.

2) Then, if NEMA comments that the Buffer Zone should be referred to the regulation in Uganda and its end is 30 meters away from the highest water mark point, PDCC would submit a letter to Executive Director of NEMA for considering that the Buffer Zone begins at the hypothetical center of the river instead of the highest water mark.

3) The draft letter will be generated by the officers participated in the meeting as soon as possible.

(7) PACC Meeting (4th August, 2017)

Venue: Atari Apostolic Church

Time: 11:00-13:00

Participants:

Stakeholders	Number	Descriptions
PACC	32	
JICA OD Team	5	Ieizumi, Matsumoto, Ishikawa, Shiga, David

Agenda:

1) Candidate Location of Contractor's Base Camp
2) Temporary road for construction in the project site and support by MAAIF
3) Spreading of excavated soil onto farm land
4) Disposal area for excavated soils in the project site
5) Stability of Electricity supply in Atari project site

Issues raised:

Issues/ Concerns	Responses
Temporary road for construction in the project site and support by MAAIF	MAAIF is supposed to support the eligible farmers who will be affected by the construction of temporary road because it will be the permanent road for operation and maintenance road after completion of construction works.
Spreading of excavated soil onto farm land	The amount of excavated soil to be spread will be calculated by seeing the balance of both Bulambuli and Kween in order to make the water flow smooth. The both construction works of land reorganization and canal construction will be carried out simultaneously so that the 30 meters width spreading the excavated soil on either side is not fixed.
Disposal area for spoiled soils in the project site*	PACC members recommended disposing such spoiled soil at downstream after the project area. It is helpful in rising the land level and making land usable. However, the spoiled soils of this context are not suitable for farmlands. Thus, it is decided that the soil will be transported to the specific dispersal land after this meeting.
Stability of Electricity supply in Atari project site	PACC members responded that the electricity supply of the area is not stable.
Washing basin	PACC members need the washing basins and also need for watering points for cattle. PACC members mentioned that such watering points are preferably placed on the end of the project along the canals and/or dykes since the farmer beneficiaries of the project have got a number of local cattle on zero grazing.

(8) PDCC Meeting (14th August, 2017)

Venue: Bulambli District Local Government headquarters, Climate Change Adaptation Learning Center

Time: 14:00-15:30

Participants:

Stakeholders	Number	Descriptions
PDCC	7	Alfred, Christine, David, Sarah, Michael, Rogers, Geofrey
MAAIF	2	Benon, Dominic
JICA OD Team	4	Ieizumi, Ishikawa, Shiga, David

Agenda:

1) Construction planning based on the 4/08/2017 meeting held with PACC

2) Buffer Zone

Conclusion:

1) Basically, there was a general consensus on the 30 meters Buffer Zone, from the hypothetical centerline.

2) The project building structure was recommended that only one site.

(9) PACC Meeting (15th August, 2017)

Venue: Atari Apostolic Church

Time: 10:00-12:00

Participants:

Stakeholders	Number	Descriptions
PACC	32	
MAAIF	2	Dominic, Benon
JICA OD Team	4	Ieizumi, Ishikawa, Shiga, David

Agenda:

1) Candidate Location of Contractor's Base Camp

2) Temporary road for construction in the project site and support by MAAIF

3) Spreading of excavated soil onto farm land

4) Disposal area for spoiled soils in the project site

5) Stability of Electricity supply in Atari project site

6) Buffer Zone to be set along Atari River

Issues raised:

Issues/ Concerns	Responses
Why does the map of project site show blue and pink highlights for the Kween half of the project site and not the Bulambuli half?	The blue points in Kween district represent low elevation land, which will therefore require filling. The pink areas are the proposed places for deposition of the surplus generated soils.
What is the difference between black cotton soils and luvisols?	Black cotton soils and luvisols are both good for cultivation. Black cotton soils and luvisols defer in the distribution of cray, sands and silts in the soils, a method of soil classification.
Is the contractor's base camp a permanent establishment?	The contractor's base camp is a temporary station that will host temporary facilities like contractor's home, office, store, motor pool and etc. It only lasts for the duration of the construction period.
Area further away from the river course are at higher elevations than areas closer to river course, won't the arable land then not be depleted in the leveling exercise when fertile topsoil is cut form higher areas for filling in the lower areas ?	To minimize loss of fertile top soils, leveling will be done in a carefully calculated manner with minimum cut and fill, probably block by clock.

(10) Joint farmers' Meeting (19th August, 2017)

Venue: Atari primary School Football Grounds

Time: 14:00-16:00

Participants:

Stakeholders	Number	Descriptions
PACC	37	
Community	130	
JICA OD Team	4	Ieizumi, Fukuda, Shiga, David

Agenda:

1) Candidate Location of Contractor's Base Camp
2) Temporary road for construction in the project site and support by MAAIF
3) Spreading of excavated soil onto farm land
4) Disposal area for spoiled soils in the project site
5) Stability of Electricity supply in Atari project site

Issues raised:

Issues/ Concerns	Responses
If the 4.5 meters wide temporary road were to be upgraded to a permanent road, would the roadway width be increased to 5 meters?	The roadway width will be limited to the ranges of 4.5-5 meters was the reply.
Which roadway width will the RAP consultant consider? Assuming that the JICA Study team set the roadway width as 4.5 meters and during implementation the contractor sets up a roadway width5 meters, will the extra 0.5 meters that were not captured in RAP be compensated?	The RAP consultant will be very considerate not oppressive, there will be no much difference.
Will the land (about 2 acres) for the contractor's base camp be rented? If it will be rented, what rates/terms and conditions will apply?	First priority will be to secure public land for the contractor's base camp. If public land cannot be secured, the space will be rented from a private land owner, following an agreement between the land owner and the tenant (contractor). The land will be rented only for the period of the construction.
A community member wanted to find out how one knows if their lands fall within the project area.	The originator of the question was told to refer their question to the responsible PACC for a clear answer.
A member was curious as to why the project area allocation earlier given to Bulambuli district was later reduced.	Circumstances, both social and technical, led to the current state of affairs. The Bulambuli beneficiaries were urged to maximize the allocation they had been given.
Assuming during excavation between boundaries and one side is slanting and we pour 30m equal distribution of soil; will this raise one side making water flow and distribution complicated.	The pouring of black cotton soils is mainly in the downstream and in depressions to increase the farming lands. The activity of levelling will ensure land leveling enable uniform distribution of irrigation water.
A farmer had a concern connected to livelihood sustenance during the construction period. They claimed to have a small land holding within the project area, which was the sole source of his livelihood. They were concerned what their fate would be during the interruptions of project activities like land levelling.	RAP will address this issue was the response from the technical team.
Farmer's suggestions and proposed way forward	The proposed way forward oscillated about the management of surplus/spoiled soils from the construction works. The community proposed that surplus marram soils be spread on community access roads to improve their motor ability especially in wet conditions. Another suggestion was that surplus fertile soils should be used to fill depressions and water logged areas. Further, it was proposed to use surplus soils to stabilize Atari river banks at the weak points.

1-4-1-12 Draft Environmental Checklist

In reference to the "16. Agriculture, Irrigation and Livestock Industry" of Environmental Checklist (draft) attached to JICA Guidelines, the draft environmental checklist for the Project was prepared as follows:

Table 1-4-1-19. Environmental Checklist (Draft)

Category	Environmental Item	Main Check Items	Yes (Y) No (N)	Confirmation of Environmental Considerations
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) N (d) Y	(a) and (b) ESIA report has been completed and approved by NEMA. (c) It was approved under the conditions that the developer shall confirm safety, health, operational and environmental protection and to carry out their commitments. (d) Environmental audit permit, water use permit, construction permit and National road to connect access road permit are required.
	(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) Affected persons have been informed of the project. They welcome the project. (b) The project design has been reflected by the comment of the stakeholders.
	(3) Examination of alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	In the early stage of the Project, river course plan was examined as an alternative for flood protection dyke. In addition, in the next stage, alignment of protection dyke and protection area was examined considering flood control, environmental impact, biodiversity, social impact, etc. It was proposed a protection zone which can minimize damages to assets such as farmland of the people.
2 Mitigation measures	(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	(a) MAAIF will establish a Water Users Association (WUA) and give guidance about water pollution. Regarding standards, MAAIF will establish. For increasing awareness of the standards among farmers, MAAIF will take action as an activity of WUA. (b) It will be established by MAAIF.
	(2) Waste	(a) Are wastes properly treated and disposed of in accordance with the country's regulations?	(a) Y	The waste is predicted to generate just a soil. The generated waste by the construction will be reused for other purposes such as constructions of irrigation

Category	Environmental Item	Main Check Items	Yes (Y) No (N)	Confirmation of Environmental Considerations
				canals.
	(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) Y (c) N	(a) MAAIF confirmed that threat of salinity has not been reported in the project area. (b) MAAIF will take to prevent soil contamination. (c) As of now, there is no management plans on agrochemicals. However, MAAIF will develop a site specific agro chemicals management plan and also establish a Water Users Association (WUA).
	(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	Ground subsidence is not anticipated during construction and operation, since the project will not plan to do activities causing the ground subsidence.
	(5) Odors	(a) Are there any odor sources? Is there a possibility that odor problems will occur to the inhabitants?	(a) N	The Project is not anticipated to generate serious offensive odor.
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) Y	Since a certain level of impacts to the Ramsar Convention wetland by the river water from the projected area during construction and operation phases respectively is anticipated, careful management of river water is required in order to secure the preservation.
	(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) Y (c) Y (d) N (e) Y	(a) The Project site is outside of the Ramsar Convention wetland. (b) The area has variety of faunal and floral species and the construction work will give adverse impacts on the wetland ecosystem like loss of some plants and wild animal habitats. Based on the ESIA survey, a few animals (Gray-crowned crane etc.) to be treated carefully were observed. (c) There is a possibility that the Project will cause several impacts of breeding and feeding grounds for valuable wildlife. However, there are so many alternative areas nearby the project site. (d) The project will not generate additional livestock or other animals that could lead to overgrazing. (e) If necessary, MAAIF will take measures to reduce the impacts on the ecosystem.
4 Social Environment	(1) Resettlement and Land expropriation	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	(a) Y (b) Y (c) Y (d) Y (e) Y	(a) Resettlement of several structures and land acquisition will be required. It was examined to minimize the land to be acquired and to

Category	Environmental Item	Main Check Items	Yes (Y) No (N)	Confirmation of Environmental Considerations
		(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 compensation 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?	(f) Y (g) Y (h) Y (i) Y (j) N	avoid resettlement as much as possible. (b) Series of Stakeholder meeting and additional meetings with individual PAPs to discuss basic compensation policy for the PAPs has been conducted. (c) Compensation cost for land and assets to be acquired is estimated following the governmental regulations in considering with results of socioeconomic studies. (d) Prior to land acquisition, sufficient compensation/ Livelihood support shall be provided to whole PAPs. (e) It is included in the RAP report which has been prepared in outline design stage. (f) In the RAP, special consideration for vulnerable groups is considered. (g) At the stakeholder meeting, the representatives of PAPs welcomed the project. The Project is Outline Design stage; therefore, after official approval of the project between both Uganda government and Japanese government, final census and asset survey will be done. After that, final agreement between Government of Uganda and individual PAPs on the compensation will be exchanged. (h) RAP Implementation Committee (RIC) will be established during implementation stage. The capacity and budget will be secured to implement the plan. (i) A proposed draft monitoring plan including internal monitoring and external monitoring will be documented in the report. (j) Grievance Committee will be established and will handle complaints in collaboration with traditional mediator.
	(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	(a) N (b)Y and N (c) Y (d) Y (e) Y	(a) It was examined to minimize the land acquisition and relocation as much as possible. (b) Farmers cultivating in the downstream can access stable irrigation water, some of which are exported. (c) The Project will obtain the

Category	Environmental Item	Main Check Items	Yes (Y) No (N)	Confirmation of Environmental Considerations
		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 affect 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?		water use permit form MUE and establish Water Uses Association. (d) The Project is designed with 10-year probability drought discharge for river maintenance flow. (e) Probably, it can be caused. If necessary, MAAIF will give a health education.
	(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) There is a possibility that several graves are required to be moved. If it cannot be avoided, the Project will pay the special consideration.
	(4) Land scape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N	(a) There is no special and esthetic landscape in and around the site.
	(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	(a)~(b) No minority people is observed in the Project area.
	(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 individual 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 individual involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a)~(d) The implementation of the project considers the safety of the working individuals by conducting proper trainings on safety. Adequate trainings are given for equipment handling in order to avoid accidents. Security guards are stationed in strategic locations for proper implementation of safety measures in the Project area.
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?	(a) Y (b) Y (c) Y	(a), (c) These measures will be executed so that it is less impacted during construction. (b) No significant impact on the natural environment is anticipated.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	(a) Y (b) Y (c) Y (d) Y	(a) Monitoring parameters are proposed. (b) Practical methods like sampling on a regular basis

Category	Environmental Item	Main Check Items	Yes (Y) No (N)	Confirmation of Environmental Considerations
		(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?		are proposed in ESIA report. (c) It is included in the ESIA report. (d) Draft monitoring format is attached in the ESIA report.
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 will not affect forestry, since there is no forest area within the Project area. (b) The Project will not construct large-scale weirs, dams and reservoirs.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)N	(a) Such big scale of environmental impact is not anticipated and the construction site is enough far away (longer than 40km) from the international boundaries.

Source: JICA OD Team

1-4-2 Land Acquisition and Resettlement

During the OD, the finalization of RAP for the Project had been conducted by RAP preparation consultant hired by MAAIF, in conjunction with supports from relevant organizations. In September 2018, the RAP was approved by Chief Government Valuer (hereinafter referred to as "CGV") under Ministry of Lands, Housing, and Urban Development (hereinafter referred to as "MoLHUD"). The summary is as shown in below and the original document is attached to Appendix-9.

1-4-2-1 Necessity of Land Acquisition and Resettlement

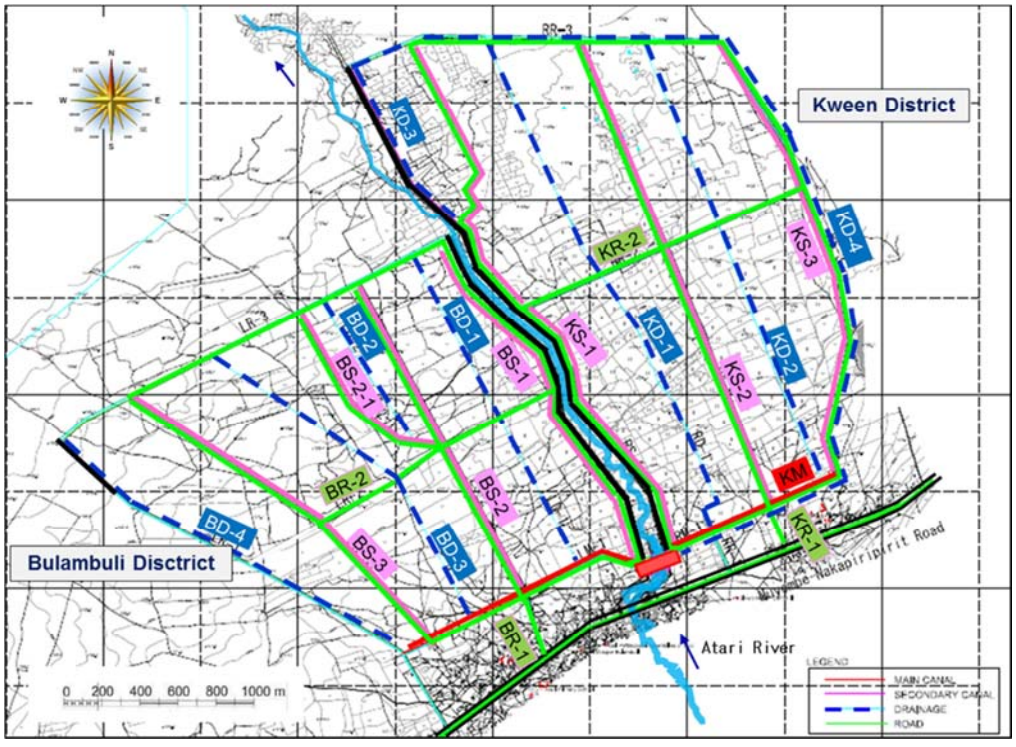
(1) Project component and affected area

For implementation of the Project, the components as shown in Table 1-4-2-1 and Fig. 1-4-2-1 will be developed. In this regard, land acquisition and resettlement are required (the details are described in below).

Table 1-4-2-1. Project Component Requires Land Acquisition and Resettlement

Component	Item	Amount	Remarks
Irrigation and Drainage	Headwork	1 place	Movable weir type, intake de-silting basin
	Main canal	2.3 km	Concrete blocking lining
	Secondary canal	15.0 km	Concrete blocking lining
	Tertiary canal	23.5 km	Earth canal
	Drainage canal	18.3 km	Earth canal
Dyke	River Dyke	5.1 km	Both sides, 1.4m height
Road	Operation and Maintenance road	7.7 km	4m width, laterite pavement with 10mm thickness.
Land Re-organization for model plots	Land leveling etc.	12.0 ha	Both sides, 6ha in each

Source: JICA OD Team



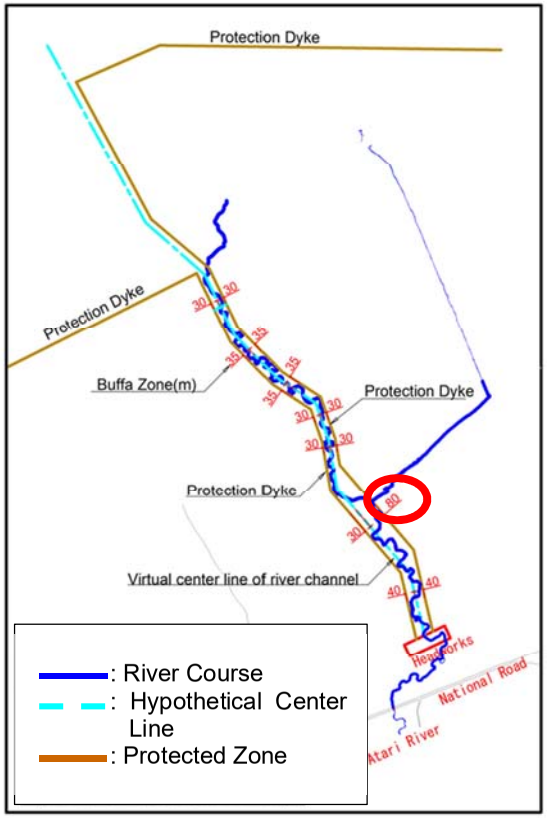
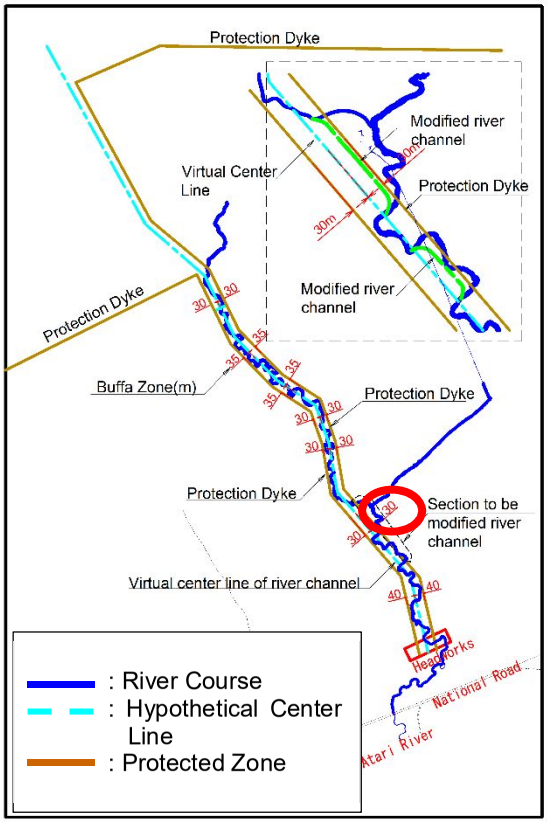
Source: JICA OD Team

Fig. 1-4-2-1. Project Component

(2) Considered alternatives for minimizing impacts by land acquisition

In the Project, River Dykes will be constructed with securing the projected zone which established at 30m from hypothetical centerline of the Atari River (see, “2-2-2-3. Design on Protected Zone”). Additionally, activities within the protected zone without permission from executive director of NEMA are not accepted excepting some activities, in accordance with “The National Environment (Wetlands, River Banks, and Lake Shores Management) Regulations (2000).” Moreover, farming activities are not accepted. Since farmers who have cultivated in the protected zone are not possible to continue their activities after establishment of the protected zone, the lands within the protected zone are to be acquired by the Project. On the other hand, when it designs the protected zone without implementation of river training, area needed to be acquired will increase extremely in two sections. From the aspect for minimizing area acquired, the alternatives are considered regarding to course of River Dykes as follows:

Table 1-4-2-2. Considered Alternatives on Land Acquisition

Item	Case-1	Case-2
Drawings		
Design	• Surrounding area of current water diversion points to Kween side is meandering. When the Project does not implement river training, Protected Zone of right side requires the width of more than 80 m from hypothetical centerline (see, red circle of the above figure).	• The width of Protected Zone is designed as 30m in accordance with the principle of the Project. Additionally, the slight river training is implemented (see, red circle of the above figure).
Land Acquisition	• Since the large width of Protected Zone is required, area needed to be acquired is increased.	• In comparison of Case-1, area of acquired farmland is 25,669m^2 smaller than that of Cade-1.

Source: JICA OD Team

1-4-2-2 Legal Framework on Land Acquisition and Resettlement

(1) Legal framework in Uganda

National policies, laws, and regulations on land acquisition and resettlement in Uganda are summarized as shown in Table 1-4-2-3.

Table 1-4-2-3. Legal Framework on Land Acquisition and Resettlement in Uganda

Legal Framework	Outline
The Constitution of Uganda, 1995	The Constitution provides procedures of land acquisition for public interest and of the "prompt payment of fair and adequate compensation" in prior to taking possession of the land.
The National Land Policy, 2013	The Policy addresses the contemporary land issues and conflicts facing the Uganda.
The Land Act, 1998	The Act address land holding, management control, and dispute processing.
The Land Acquisition Act, 1965	The Act regulates provision for the procedures and method of compulsory acquisition of land for public purpose.
National Environment Management Policy, 1994	The Policy broadly requires projects to assess potential social impacts caused by the project.
National Development Plan 2015/16 –2019/20 (NDPII)	The Plan addresses structural bottlenecks in the economy in order to accelerate socio-economic transformation for prosperity and key among these is improvement of livelihood of farmers cultivating food crops in the lowland (wetland) area of the country through the development of sustainable irrigated agriculture for the rice production taking into account wise-use of wetland area.
National Gender Policy, 1997	The Policy indicates gender considerations on equal opportunity in occasion of recruitment of construction labor, and on decision making during resettlement.
HIV/AIDS Policy, 1992	The Policy indicates requirements that contractors or their subcontractors, especially in regard to having an in-house HIV Policy, worker sensitization and the provision of free condoms.
Local Government Act, Cap. 243, 2008	The Act empowers districts administrations to develop and implement district rates upon which compensation for crops and non-permanent structures is based.
Registration of Titles Act, Cap. 230, 2000	The Act provides the guidance for registration of ownership.
Disabilities Act, 2006	The Act is relevant to the Project since it points out the requirement for support of any PAPs identified as PWDs to ensure that their right to adequate standard of living is not compromised.

Source: RAP (MAAIF, 2018)

The above legal frameworks define land rights, ownership, procedures, and requirements of transfer and land acquisition between individuals and communities. Among the most important legal instruments in this regard are listed below. Particularly, the most decisive document on land is the Land Act of 1998, as amended.

① The Constitution of Uganda (1995);

② The National Land Policy (2013);

③ The Land Act (1998); and

④ The Land Acquisition Act (1965)

Regarding above four legal frameworks, the outline is as following. The details are described in Appendix –9

① The Constitution of Uganda (1995)

In Section 1 of Article 237, the Constitution vests all lands of Uganda in the citizens of the country in accordance with the land tenure system defined in the Constitution. On the other hand, the government or local government may acquire land in the public interest, in accordance with Section 2 (a) of same article. Such acquisition is subject to Article 26 (1) of the Constitution, which gives that every person

in Uganda a right to own property either individually or in association with others. In Section 3 of Article 237, the Constitution prescribes the land tenure regimes in accordance with which rights and interest in which land may be held namely; 1) Customary, 2) Freehold, 3) Mailo, and 4) Leasehold.

Section (2) of Article 26 shows the procedure of land acquisition for the public purpose, and (b) (i) of same Article mentions "prompt payment of fair and adequate compensation" prior to the acquisition of the properties. Regarding the compensation payment, the amount is to be evaluated in accordance with the valuation principles laid out in Section 77 of the Land Act (Cap 227).

② The National Land Policy (2013)

This new land policy addresses the contemporary land issues and conflicts the Country faces with. The vision of the policy is: "a transformed Uganda society through optimal use and management of land resources for a prosperous and industrialized economy with a developed services sector" while the goal of the policy is; "to ensure an efficient, equitable, and optimal utilization and management of Uganda's resources for poverty reduction, wealth creation, and overall socio-economic development."

Regarding the women's rights on ownership and inheritance of lands, this policy said that women in Uganda are generally unable to own or inherit land due to restrictive practices under customary land tenure or to economically difficulties for purchasing land rights in the market. In the Policy Statement, the following sentences are mentioned to improve the women's rights:

- Government shall by legislation, protect the right to inheritance and ownership of land for women and children; and
- Government shall ensure that both men and women enjoy equal rights to land before marriage, in marriage after marriage and at succession without discrimination.

③ The Land Act (1998)

This Act addresses four issues namely; land holding, control, management, and land disputes. In regard to tenure, Section 3 of the Act repeats provision of Article 237 of the Constitution which vests all land ownership in the citizens of Uganda, to be held under customary, freehold, mailo, or leasehold tenure system. In addition, Article 42 "Acquisition of land by the Government" of the Act reconfirms that the Government or a local government may acquire land in accordance with Article 26 and Section 2, Article 237 of the Constitution. Since the Act does not repeal Section 14 of the Land Acquisition Act (1965) which regulates "Reference to the Court," it is assumed that this legislation, meets requirement of Section (2), Article 26 of the Constitution that requires a low to be in place for payment of compensation and access to the courts.

The Act also requires that landowners manage and utilize land in accordance with regulatory land use planning in Section 44 and 46.

In Section 77 of the Act amended in 2000, evaluation of compensation is regulated as followings;

(1) The district land tribunal shall, in assessing compensation referred to in section 76 (1) (b) take into account the following -

  (a) in the case of a customary owner, the value of land shall be the open market value of the unimproved land;

  (b) the value of the buildings on the land, which shall be taken at open market value for urban areas and depreciated replacement cost for the rural areas;

  (c) the value of standing crops on the land, excluding annual crops which could be harvested during the period of notice given to the tenant.

In addition, Section 2 of Article 77 provides for a disturbance allowance on top of the computed

compensated amount as follows:

- 30% of compensation amount if quit notice is given within 6 months.
- 15% of compensation amount if quit notice is given after 6 months.

Since there is no upper limit to the period of vacate in regard to disturbance allowance, 15% of compensation amount shall be certainly paid at least.

④ The Land Acquisition Act (1965)

The Act regulates the procedures and method of compulsory acquisition of land for public purposes, regardless of temporary or permanent use. The Ministry responsible for land may authorizes any person to enter upon the land, survey the land, dig or bore the subsoil or any other actions necessary for ascertaining whether the land is suitable for a given public purpose. However, compensation should be paid to any person who suffers damage as a result of such actions.

The Act clarifies the payment of compensation to PAPs, while there is no mention about preparation of the alternative land. Once affected people are promptly and adequately compensated, the project proponent's obligations stop at this extent and there is no legal requirement that people should be moved or provided with alternative land. In Ugandan legal context, once people are compensated, they are expected to vacate affected properties without further claim.

(2) Gap analysis between JICA Guidelines/ WB OP 4.12 and Ugandan laws

Analyzed gaps between JICA Guidelines/ World Bank (hereinafter referred to as "WB") Operation Manual 4.12 (hereinafter referred to as "OP 4.12") and domestic legal frameworks in Uganda on land acquisition and resettlement, and project policy is shown as follows:

Table 1-4-2-4. Gap Analysis between JICA Guidelines/ WB OP 4.12 and Ugandan Laws, and Project Policy

No.	JICA Guideline/ World Bank OP4.12	Laws of Uganda	Gaps between JICA Guidelines and Ugandan Laws	Project policy
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	The Constitution states that "no person shall be compulsorily deprived of property or any interests in or any right over property of any description except where the taking of possession or acquisition is necessary for public use or in the interest of defense, public safety, public order, public morality or public health."	Uganda has no specific guidelines on involuntary resettlement but even the two principle laws on land; the Constitution and the Land Act do not mention specific provision for avoidance or minimizing involuntary resettlement.	All viable alternatives including the design options have been explored to avoid involuntary resettlement and loss of means of livelihood. Justification for resettlement and measures taken minimize impacts outlined in RAP.
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	Uganda Constitution requires that prompt, fair and adequate compensation be paid prior to displacement.	No gap.	Measures taken to minimize impacts outlined in RAP.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that	The Land Act regulates the compensation of cash compensation for lands, structures and crops, including disturbance allowance.	There is a deduction in the computation of cash compensation for structures in rural areas. Other types of compensation (besides cash) including alternative lands, house and etc. are	Computation of compensation: Replacement value will be evaluated at full market price without deduction and the fully compensated. Other types of compensation: To meet various needs, the Project will offer options for the

No.	JICA Guideline/ World Bank OP4.12	Laws of Uganda	Gaps between JICA Guidelines and Ugandan Laws	Project policy
	they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)		not applicable in Uganda's law.	compensation including alternative lands, house as well as livelihood supports. Additionally, MAAIF or PACC members can support to find out other land outside of Protected Zone for renting to PAPs who currently renting land in Protected Zone.
4	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	The Land Act, Cap 227 provides that; Permanent buildings valued based on replacement cost and on top of this a Disturbance Allowance of 15% or 30%) is provided if more than six or less than six months' notice to vacate compensated assets, respectively, is issued to PAPs. Non-permanent buildings will receive a cash compensation based on District Compensation Rates plus disturbance allowance of 15% or 30% (depending on notice period). Tenants of structures: Repayment of unused rent, and six-month' notice to vacate structure.	The project developer will ensure fair and prompt compensation for the PAPs.	Project will provide compensation based on full replacement cost. This will include the payment of government valuation rates, a disturbance allowance and top-up allowance (based on current inflation rate) to compensate for the rise in price of construction materials. This should be enough to restore the livelihood of the PAP.
5	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	The Constitutions says that no person from whom land is to be acquired shall be required to vacate until they receive full compensation (the exception could be with absentee landlords/ Property owners).	The meaning of "other kinds of assistance" is not explicit in Uganda's law.	Compensation and necessary assistance on a case-by-case basis will be provided prior to displacement.
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	Land Acquisition Act section 3 and 5 only provide for a declaration that land is needed for public purpose and a notice to persons having an interest to be published, respectively.	There is no equivalence on preparation of resettlement plans and making them available to the public.	Preparation of RAP will be undertaken in a consultative manner and final RAP documents made available to the public.

No.	JICA Guideline/ World Bank OP4.12	Laws of Uganda	Gaps between JICA Guidelines and Ugandan Laws	Project policy
7	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	National regulations pertaining to stakeholder consultation are the Constitution of the Republic of Uganda, 1995 and the Access to Information Act, 2005. The Constitution of the Republic of Uganda, 1995 Chapter 4, Section 41 of the Constitution of the Republic of Uganda, 1995, is on the right of access to information in the possession of State or any other organ or agency of the State except where the release of the information is likely to prejudice the security or sovereignty of the State or interfere with the right to the privacy of any other parson. Access to information Act, 2005 Part II of the Access to Information Act, 2005 stipulates right of access to information. It states that subject to the provisions of the Act, every person shall have a right to obtain access to an official document, other than an exempt document.	National legislation envisages limited stakeholder and community consultation. While there are no explicit provisions for consultations and disclosure, there are guidelines.	MAAIF/ JICA/ AES have developed a Stakeholder Engagement Plan as part of the RAP. Stakeholder engagement is already being implemented. Information has provided to PAPs during consultations will be a form, manner and languages that they understand. Formation of the PACC and PDCC has played a key role in Stakeholder Engagement.
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)			Two (2) Stakeholder Engagements were conducted: The first one was already held on 1st February 2018 and the second one was held in 8th June 2018. This is going to a continuous process which will be updated for key project stages of (i) planning; (ii) implementation; and (iii) monitoring and evaluation.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	The Land Acquisition Act, makes provision for an enquiry whereby PAPs can make formal written claim and the assessment officer is obliged to conduct a hearing before making his award.	While PAP participation is inherent in the ESIA/ RAP process, it contains a number of differences with the requirements of JICA Guidelines.	PAP participation has been provided for and promoted throughout the ESIA/ RAP preparation process.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	The Land Act, 1998 had provided for land tribunals to resolve all land related issues. However, since their suspension in 2007, the High Court handles all land-related cases as provided for in the Land Acquisition Act. The Land Act also states that traditional authority mediators must retain their jurisdiction to deal with and settle land disputes. The Land Acquisition Act provides for aggrieved persons to appeal to the High Court.	National law allows for grievance procedures. But potential gap exists in terms of accessibility and affordability by PAPs if the High Court must handle land-related grievances.	The RAP details the grievance procedure, which is accessible to all PAPs and allows grievances in relation to all aspects of the Project at all stages, while ensuring compatibility with national laws and traditional mechanisms. Rather it seeks to resolve issues quickly so as to expedite receipt of entitlements and smooth resettlement without resorting to expensive and time-consuming legal action. If the grievance procedure fails to provide a settlement, complaints can still seek legal redress. Comprehensive grievance mechanism for the Project has already development through the formation of the PACC,

No.	JICA Guideline/ World Bank OP4.12	Laws of Uganda	Gaps between JICA Guidelines and Ugandan Laws	Project policy
				PDCC and RAP Task Force Team
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socio-economic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	The Land Acquisition Act (1965) requires asset inventories for the purpose of valuation by a registered valuer.	Although PAPs are required to be identified and served notices, there is no explicit provision for baseline census and socioeconomic surveys as a part of RAP process in Ugandan Law. The Ugandan Law does not have a clear definition of Cut-off date.	Project undertook household census and socio-economic surveys of all affected households using meaningful indicators, together with asset surveys. These were analyzed in the RAP and used for developing appropriate resettlement and livelihood restoration measures. The cut-off date for the Project was established as the day when the census survey began and the cut-off date for this Project is 20th January 2018.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	The Constitution of Uganda, 1995 vests all land directly in the citizens of Uganda, and states that every person in Uganda has the right to own property. Ugandan law recognizes four distinct land tenure systems: customary tenure, freehold tenure, leasehold tenure, and mailo tenure. Registered and customary land owners are entitled to compensation based on the open market value of the unimproved land. However, there is no specific provision for squatters or illegal settlers and compensation is given to only legal occupants.	National Laws focuses on people with land tenure rights and unclear on compensation for land users without rights and these are considered as illegal.	Dialogue with policy makers will be initiated to explore the possibility of giving compensation to those without formal legal rights or claims to such lands in order to conform to WB OP4.12. The Project will provide compensation based on full replacement cost for land owners. This includes the payment of government valuation rates, the payment of a disturbance allowance that is approved by the CGV and compensation allowance for the farmers who will rendered redundant during construction period as per schedule. If a PAP without land tenure is found in the Project then JICA GL/WB OP4.12 para 15 will be applied.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	According to Land Acquisition Act, once the assessment office takes possession (ownership), the land immediately becomes vested in the Land Commission. The Land Act Cap 227 (Section 42) which provides for compulsory acquisition of land must comply with the provisions of Article 26 of the Constitution of the Republic of Uganda, 1995. In Uganda, it is not a legal requirement for a	The laws not explicit about land-based resettlement strategies in the Uganda law. Therefore “land for land” policy is not applicable in Uganda.	Land-based resettlement strategies for displaced persons whose livelihoods are land-based will be strongly considered as per the JICA GL/ WB OP4.12 Para 11 since it is higher in standard compared to the Ugandan Law.

No.	JICA Guideline/ World Bank OP4.12	Laws of Uganda	Gaps between JICA Guidelines and Ugandan Laws	Project policy
		project to purchase alternative land for affected people. Once affected people are promptly and adequately compensated, the project proponent's obligations stop at this extent and there is no legal requirement or provision that people should be moved or provided with alternative land.		
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	There are no equivalent provisions on relocation assistance, transitional support, or the provision of civic infrastructure.	There are no provisions for transitional support in Uganda.	MAAIF will be requested to provide transition allowance as the JICA/ WB requirements especially during the time of construction when farmers will not be allowed to go to their farmers.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	There is no distinction made on the basis of gender, age, or ethnic origin in Uganda law during compensation.	There is no distinction made on basis of gender, age or ethnic origin in Uganda law during compensation. National law does not make provision for vulnerable assistance.	The Project will conform to the requirements of WB OP4.12 and best practices during preparation of the RAP in regards to the needs of the vulnerable groups.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	There is no explicit provision for RAP in the Uganda law.	There is no explicit provision for RAP in Uganda law.	The Project has conducted RAP study and implemented the recommendations in conformity with JICA GL and WB OP4.12.
17	JICA GL indicates that "full replacement cost must be provided as much as possible", not matter where it is.	The value of buildings on the land is taken at open market value for urban areas, and depreciated replacement cost for rural areas.	The gap exists on the "depreciated replacement cost for rural areas."	The Project will be provided compensation calculated as full replacement cost.

Source: RAP (MAAIF, 2018)

(3) Project policy for land acquisition and resettlement

Project policy for land acquisition and resettlement is shown as follows:

I.	The Government of Uganda will use the Project Resettlement Policy (the Project Policy) for the Project for Atari Irrigation System in the Republic of Uganda (the Project) specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practices, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what Uganda's laws and regulations cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the

PAPs based on the type and degree of their losses. Where there are gaps between the Uganda's legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.

II. Land acquisition and involuntary resettlement will be **avoided** where feasible, or **minimized**, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be **fully compensated** and assisted so that they can improve, or at least restore, their former economic and social conditions.

IV. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

- Standard of living adversely affected;
- Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;
- Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
- Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, **irrespective of tenure status**, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas **as of the date of the latest census** and inventory of lost assets (IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that **lose only part of their physical assets** will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People **temporarily affected** are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. Where a **host community** is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts

of resettlement upon host communities.

IX. The **resettlement plans** will be designed in accordance with Uganda's Land Acquisition Act 1965 and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be **translated** into local languages and **disclosed** for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of **replacement cost**.

XII. Compensation for PAPs dependent on agricultural activities will be **land-based** wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be **within the immediate vicinity** of the affected lands wherever possible and be of **comparable productive capacity and potential**[1]. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a **transition period** needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most **vulnerable** to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be **involved** in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be **consulted** about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate **budgetary support** will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement

[1] Agricultural land for land of equal productive capacity means that the land provided as compensation should be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production should be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household's previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

activities will come from the Government.

XIX. **Displacement does not occur before provision of compensation and of other assistance** required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. **Organization and administrative arrangements** for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. **Appropriate** reporting (including auditing and redress functions), **monitoring and evaluation mechanisms**, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Source: RAP (MAAIF, 2018)

1-4-2-3 Scale/ range of land acquisition and resettlement

As required by the JICA Guidelines, the Project established the cut-off fate to prevent an unfair influx of encroachers of others who wish take advantages of compensation, assistance, etc., and conducted baseline surveys such as population census survey and asset survey. The cut-off date for the Project was the commencement date of population census survey, i.e., 20th January 2018.

PAPs were clearly informed that persons who will claim ownership of any plot after the cut-off date will not be compensated. During baseline surveys such as population census survey, assets and lands survey, etc., the surveyor and valuer moved together with the owners of plots and the local leaders to confirm ownership. Thereafter the identified PAPs were given a valuation form including the size of affected lands and properties to be compensated.

(1) Population census survey

Through population census survey in the Project Site, it was confirmed that there are 2,007 PAPs of 490 PAHs (Table 1-4-2-5). Out of 490 PAHs, only 2 PAHs plus a fence of private school (1 PAH) will be required to move physically and affected economically. Other than above 3 PAHs will mainly lose lands that have been using for farming.

Table 1-4-2-5. Number of PAHs by the Project

Impact Item	District	Sub-county	Parish	Village	Number of PAHs
Construction of Irrigation Facilities	Bulambuli	Bunambutye	Buwebele	Bunambale	145
				Buwechalo	27
				Bukhayaki	2
	Sub-total (a)				174
	Kween	Ngenge	Sikwa	Amukokel	61
				Sikwo	151
				Soset	39

Impact Item	District	Sub-county	Parish	Village	Number of PAHs
	Sub-total (b)				251
Establishment of Protected Zone	Bulambuli				32
	Kween				33
	Sub-total (c)				65
Total (c) = (a) + (b) + (c)					**490**

Source: RAP (MAAIF, 2018)

(2) Assets and land survey

1) Project acquired lands

The lands of current agricultural land or residential land (approx. 48 ha) and lands in the Protected Zone (approx. 12 ha) will be acquired permanently (see Table 1-4-2-6). All the lands to be acquired are belonging to individual persons, while the tenure systems are Customary, Freehold, or etc.

Table 1-4-2-6. Land Acquisition for the Project

District	Sub-county	Parish	Village	Acquired Lands (ha)		
				For Irrigation Facilities	For Protected Zone	Total
Bulambuli	Bunambutye	Buwebele	Bunambale	10.068	7.071	32.546
			Buwechalo	12.948		
			Bukhayaki	2.459		
	Sub-total (a)			25.475	7.01	32.456
Kween	Ngenge	Sikwa	Amukoke;	20.663	4.990	27.305
			Sikwo	1.108		
			Soset	0.544		
	Sub-total (b)			22.315	4.990	27.305
Total ((a) + (b))				47.790 (80 %)	12.061 (20 %)	59.851 (100 %)

Note: In the RAP, amount of lands for irrigation facilities in Kween is described as 23.939 ha wrongly. However, Total ((a) + (b)) is correct.

Source: RAP (MAAIF, 2018)

2) Project affected buildings and structures

Totally, 10 structures will be affected by the Project (Table 1-4-2-7). Out of 10 structures, 7 structures such as commercial house, shades, etc. of Bunabmale Village in Bulambuli District are owned by a household. In the same manner, 2 structures such as temporally houses of Amukokel Vilage in Kween District are owned by another household. Other than these, fence of private school in Amukokel Village will be affected.

Table 1-4-2-7. Affected Buildings and Structures

District	Sub-county	Parish	Village	Structure Type	No. of Affected Structures
Bulambuli	Bunambutye	Buwebele	Bunambale	**Temporally Commercial House**: Roof: GCI* on local poles Celling: Nil Walls: Mud and wattle Doors: Timber Windows: Timber Floor: Earth Condition: Fair	1
				Shade for Commercial 1: Roof: Grass thatched Walls: Wooden poles supporting Doors: Nil Windows: Nil Floor: Earth Condition: Fair	1
				Shade for Commercial 2: Roof: Grass Thatched	1

District	Sub-county	Parish	Village	Structure Type	No. of Affected Structures
				Walls: Woodend poles supporting Doors: Nil Windows: Nil Floor: Earth Condition: Fair	
				Temporally Store House: Roof: Grass thatched Celling: Nil Walls: Mud and wattle Doors: Timber Windows: Nil Floor: Earth Condition Fair	1
				Temporally Kitchen: Roof: Grass thatched Celling: Nil Walls: Mud and wattle Doors: Timber Windows: Nil Floor: Earth Condition Fair **Pit latrine 1**: Roof: Grass thatched Walls: Mud and wattle Doors: Nil Floor: Earth Condition Fair	1
				Pit latrine 2: Roof: Grass thatched Walls: Mud and wattle Doors: Nil Floor: Earth Condition Fair	1
				Bathroom: Roof: Nil Walls: Enclosure of grass tied to wooden poles Doors: Nil Windows: Nil Floor Earth Condition: Fair	1
			Buwechalo	-	-
			Bukhayaki	-	-
	Sub- total (a)			-	7
Kween	Ngenge	Sikwa	Amukokel	**Temporally Residential House**: Roof: GCI* on local poles Celling: Nil Walls: Mud and wattle Doors: Battened timber Windows: Nil Floor; Earth Condition: Fair	1
				Temporally Residential House: Roof: Grass thatched Ceiling: Nil Walls: Mud and wattle with no finish yet Doors: Battened timber Windows: Nil Floor: Earth Condition: Fair	1
				Public structures: School Fence: Barbed wire on local poles	1
			Sikwo	-	-
			Soset	-	-
	Sub- total (b)			-	3

District	Sub-county	Parish	Village	Structure Type	No. of Affected Structures
Grand Total (c) = (a) + (b)				-	**10**

Note: “GCI” means ”Galvanized Corrugated Iron Sheet.”

Source: RAP (MAAIF, 2018)

3) Project affected crops

The below cops will be affected by the Project.

Table 1-4-2-8. Affected Buildings and Structures by the Project

District	Sub-county	Parish	Village	Crop Name	Perennial/ Annual	No. of Affected Crops
Bulambuli	Bunambutye	Buwebele	Bunambale	Avacado	Annual	2
				Mature Mango Trees	Permanent	6
				Banana Clumps	Permanent	221
				Eucalyptus Trees	Permanent	4
				Paw Paws	Annual	1
				Fig Trees	Permanent	1
				Accaccia Trees	Permanent	26
				Jack Fruit Trees	Permanent	2
				Orange Trees	Permanent	69
				Bush Trees	Permanent	195
			Buwechalo	Banana clumps	Permanent	24
				Bush Trees	Permanent	2
			Bukhayaki	-	-	-
	Sub- total (a)					555
Kween	Ngenge	Sikwa	Amukokel	Acacia trees	Annual	90
			Sikwo	Avocado	Permanent	1
				Mature Mango Trees	Permanent	35
				Banana Clumps	Permanent	1,669
				Eucalyptus Trees	Annual	15
				Paw Paws	Permanent	72
				Fig Trees	Permanent	4
				Acacia Trees	Permanent	156
				Jack Fruit Trees	Permanent	1
				Gravari	Permanent	1
				Coffee Trees	Permanent	8
				Bush Trees	Annual	3
			Soset	Eucalyptus Trees	Permanent	2
				Fig Trees	Permanent	19
				Banana Clumps	Permanent	22
				Mango trees	Permanent	10
				Bush Trees	Permanent	2
				Acacia Trees	Permanent	4
	Sub- total (b)					2,024
Grand Total (c) = (a) + (b)						**2,579**

Source: RAP (MAAIF, 2018)

(3) Socio-economic survey

The socio-economic survey was conducted to 276 households sampled from the two parishes of Buwebere and Sikwa of Bulambuli and Kween districts (Table 1-4-2-9). Household lists were provided by the Local Council Chairpersons and samples were picked while using a sample space of 4 households. In this section, the summarized contents are described in below, while the details are explained in the original RAP.

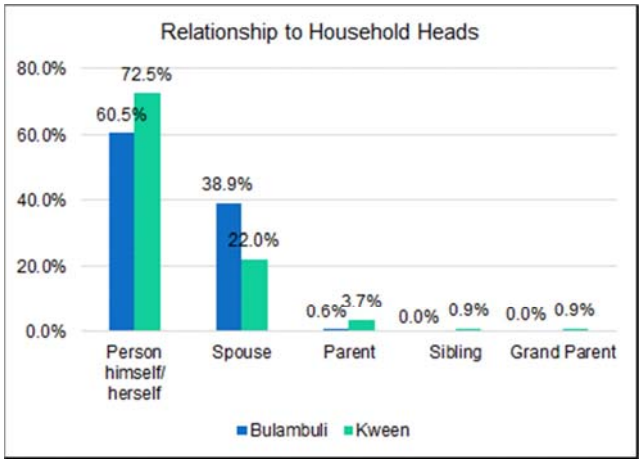
Table 1-4-2-9. Sample Number of Socio-economic Survey

District	Sub-county	Parish	Village	No. of Households in Village (Households)	No. of Sample (Households)	% of Households sampled per Village
Bulambuli	Bunambutye	Buwebele	Bubuya	57	28	49.1
			Bunambale	158	46	29.1
			Buwechalo	102	27	26.5
			Bukhayak	85	66	77.6
	Sub-total (a)			402	167	41.5
Kween	Ngenge	Sikwa	Amukokel	97	35	36.1
			Sikwo	156	51	32.7
			Soset	63	23	36.5
	Sub-total (b)			316	109	34.5
Total ((a) + (b))				718	276	38.4

Source: RAP (MAAIF, 2018)

Relationship to Household Heads

In this socio-economic survey, the most of respondents were household heads (60.5% in Bulambuli District and 72.5% in Kween District). Additionally, the second largest group was Spouse in the both districts (38.9% in Bulambuli District and 22.0% in Kween District).

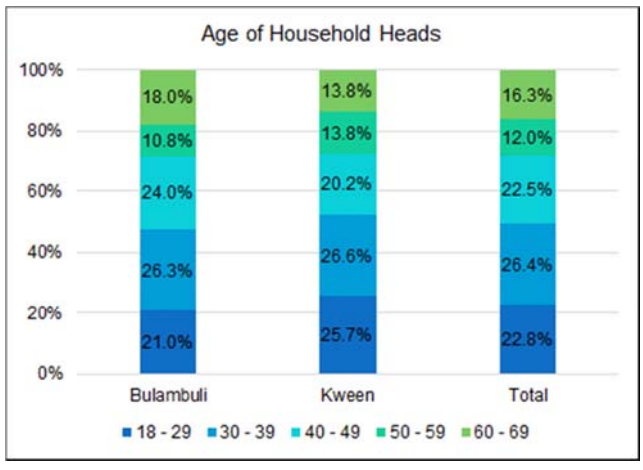


Source: RAP (MAAIF, 2018)

Fig. 1-4-2-2. Relationship to Household Heads

Age of Household Heads

The majority of the household heads in both districts were age group of 30 – 39 (26.4%). While the largest group of both districts were the above group, there were marked differences for some age groups.

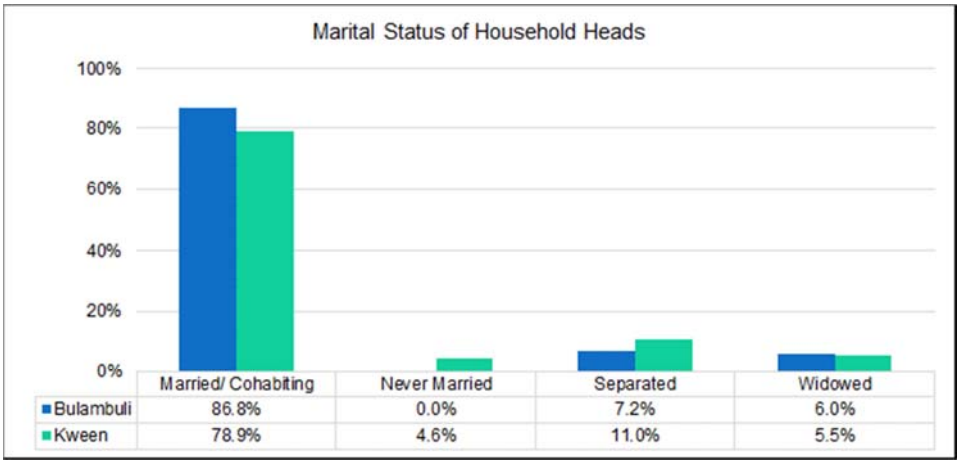


Source: RAP (MAAIF, 2018)

Fig. 1-4-2-3. Age of Household Heads

Marital Status of Household Heads

The majority of households were married or cohabiting (86.8 % in Bulambuli District and 78.9 % in Kween District). While the ratios were approximately 6.0% in both districts, there were household heads who are widowed.

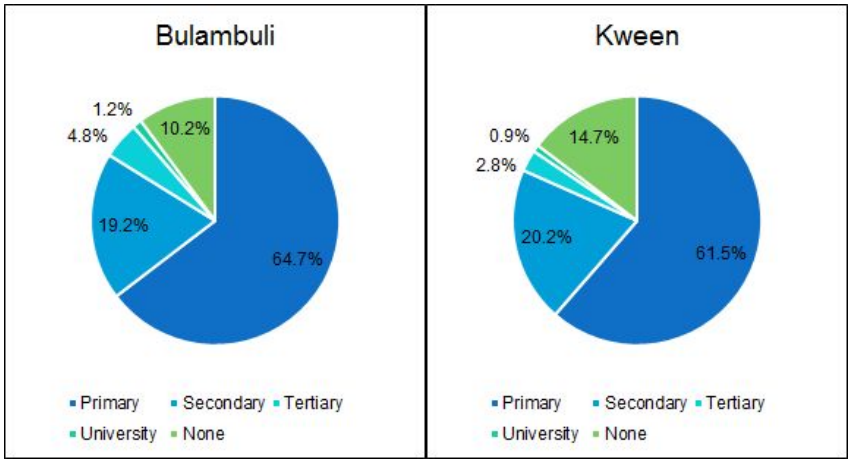


Source: RAP (MAAIF, 2018)

Fig. 1-4-2-4. Marital Status of Household Heads

Highest Educational Status of Household Heads

The both districts had similar tendency, namely the largest group was Primary (64.7% in Bulambuli District and 61.5% in Kween District) and Secondary followed it (19.2% in Bulambuli District and 20.2% in Kween District). In addition, none was the third largest group in both districts.

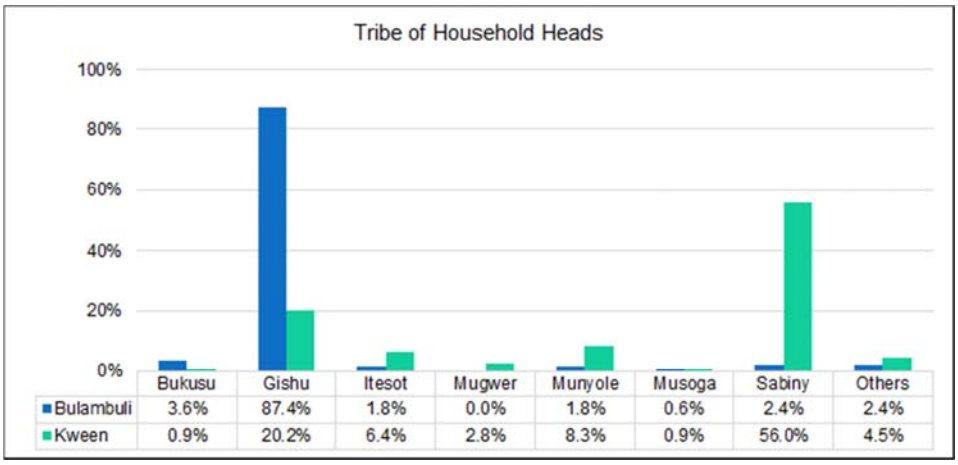


Source: RAP (MAAIF, 2018)

Fig. 1-4-2-5. Highest Educational Status of Household Heads

Tribe of Household Heads

In the Project Site, several tribes lived together with others. Between districts, there were extremely different tendencies. The largest group in Bulambuli District was Gishu (87.4 %), while the group in Kween District was Sabiny (56.0%).



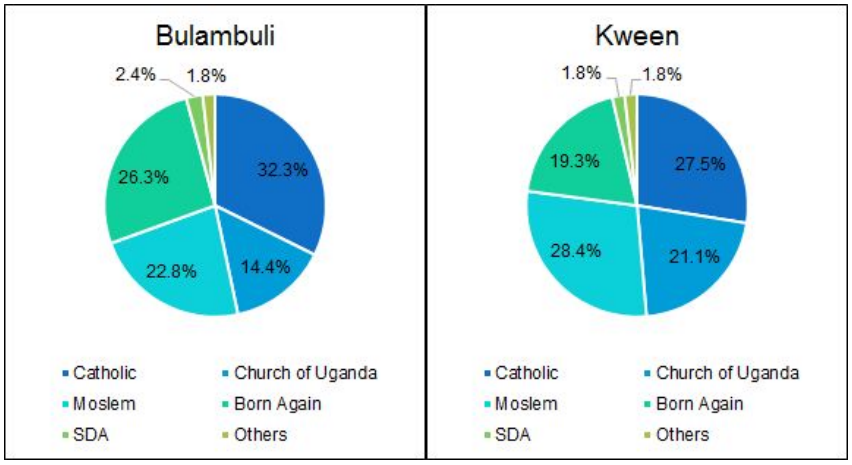
	Bukusu	Gishu	Itesot	Mugwer	Munyole	Musoga	Sabiny	Others
Bulambuli	3.6%	87.4%	1.8%	0.0%	1.8%	0.6%	2.4%	2.4%
Kween	0.9%	20.2%	6.4%	2.8%	8.3%	0.9%	56.0%	4.5%

Source: RAP (MAAIF, 2018)

Fig. 1-4-2-6. Tribe of Household Heads

Religious Affiliation of Household Heads

The largest group in Bulambuli District was Catholic (32.3%), while the largest group in Kween District was Moslem (28.4%). The second largest groups were Born Again and Catholic, respectively 26.3% in Bulambuli District and 27.5% in Kween District.

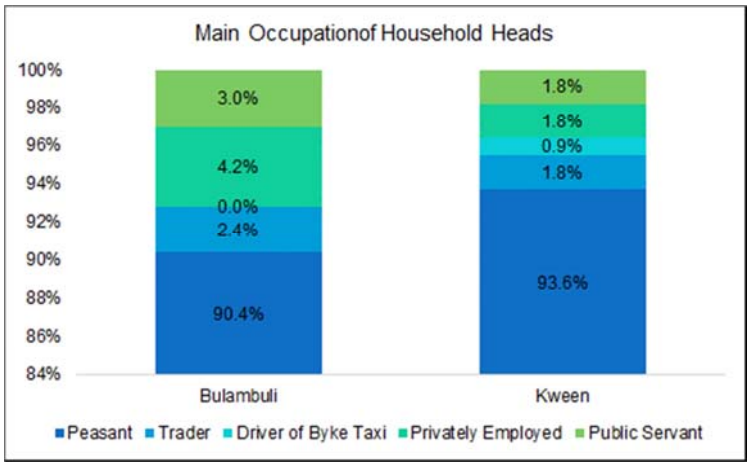


Note: “SDA” means “Seven-day Adventist Church.”
Source: RAP (MAAIF, 2018)

Fig. 1-4-2-7. Religious Affiliation of Household Heads

Main Occupation of Household Heads

In both districts, more than 90% of household heads were Peasant. This means that people in the Project Site has tendency that they strongly rely on agricultural activities for their income. Regarding ratios of the other groups, there were differences between districts.



Source: RAP (MAAIF, 2018)

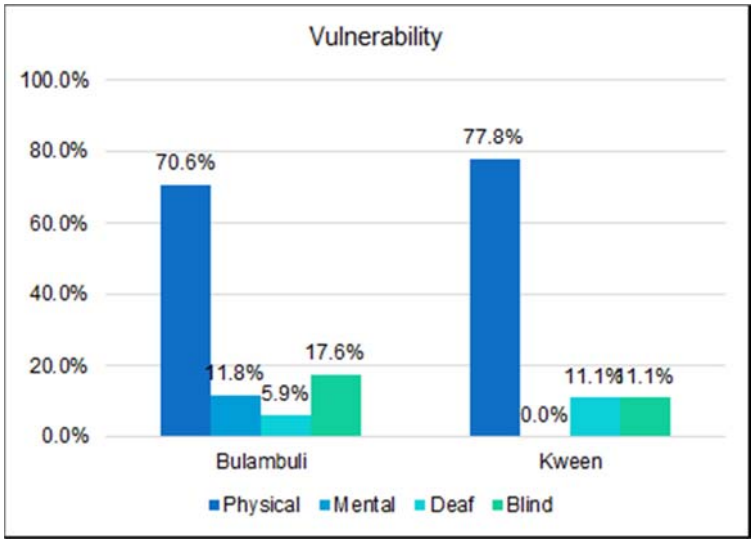
Fig. 1-4-2-8. Main Occupation of Household Heads

(4) Vulnerable group

Through baseline surveys, the vulnerable group within the Project Site was identified as follows:

Vulnerability

The largest groups in both districts was Physical (70.6% in Bulambuli District and 77.8% in Kween District). Blind people were higher (17.6%) in Bulambuli District, compared with those (1.1%) in Kween. Regarding mental disability, Kween District had 11.8%, while there was no those in Bulambuli District.



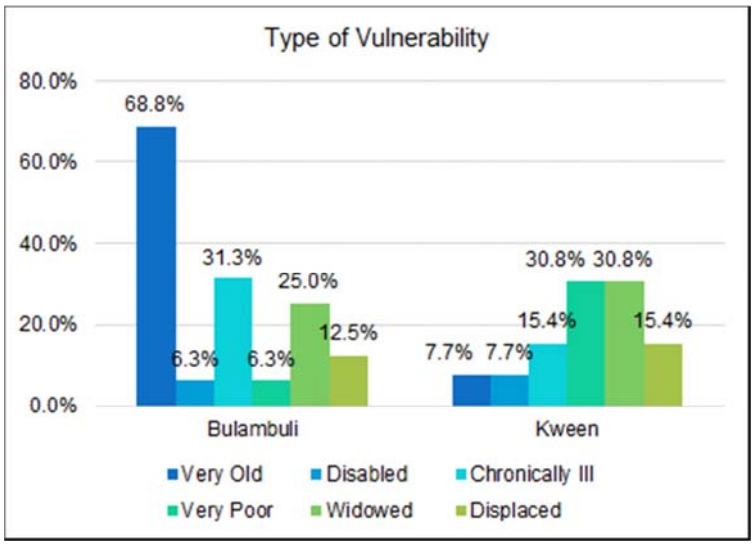
Source: RAP (MAAIF, 2018)

Fig. 1-4-2-9. Vulnerability within the Project Site

Type of other Vulnerable People

Further analysis on vulnerability of the people in the Project Site shows that the very old constituted the majority (68.8%) in Bulambuli District, while the group was only 7.7% in Kween District. The largest groups in Kween District were very poor (30.8%) and widowed (30.8%). Regarding Bulambuli

District, the second largest group was chronically ill that was 31.3% and the third largest group was widowed (25.0%).



Source: RAP (MAAIF, 2018)

Fig. 1-4-2-10. Type of Vulnerability

In general, specific vulnerable groups such as Female Headed Households; Children Headed Households; HIV/ AIDS infected People/ Disabled People; Elderly; Youth and Orphans will require assistance based on need and level of their vulnerabilities. However, results of baseline surveys show that the prominent form of vulnerability among the PAPs is eldered people and female household heads. In Uganda, people are considered old after attaining the age of 65 years. Among the heads of PAHs interviewed, there are 27 households of PAHs (6%) aged 65 years and above. Additionally, 79 heads of PAHs (17%) were female. Moreover, the 2 households that may need to be relocated can be considered vulnerable, since their poverty. These means, 108 households interviewed were categorized as vulnerable group in the Project.

1-4-2-4 Concrete Policy of Compensation and Support

(1) Eligibility

PAP is one who, as consequence of the project, sustains losses as a result of impact on 1) land, 2) structure, 3) immovable asset, and/ or d) livelihood/ incomes. Through the detailed census and assets/ land surveys in the OD, those PAPs were identified. According to WB OP4.12 and JICA Guidelines, a customary land owner who does not have a certificate on the rights to their occupying lands can be treated as same as those who have legal rights.

(2) Concrete contents of compensation

Through several discussions including stakeholder meetings, the contents of compensation and livelihood restoration were concreted as follows;

1) Principles on full replacement cost

All compensation for land and non-and assets owned by households/ shop owners who meet the cut-off date will be caused on the principle of full replacement cost. In the Project, full replacement cost is defined as “sufficient amount to cover full cost of lost assets and related transaction costs.” Specifically, it is calculated as follows:

The agricultural lands is based on the actual current market prices that reflect recent land sales in the Project Site. In the absence of such recent sales, it is based on the recent sales in comparable locations with comparable attributes, fees, and taxes.

The residential lands is based on the actual current market prices that reflect recent land sales. In the absence of such recent sales, it is based on the prices of recent sales in comparable locations with comparable attributes; fees, and taxes.

Existing local government regulations for compensation calculations for building, crops and trees will be used where ever averrable:

- House and other related structures based on actual current market prices of affected materials; and
- Annual crops equivalent to current market value of crops at the time of compensation.

Regarding perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available. Amount is equivalent to current market value given the type and age at the time of compensation.

For timber trees, cash compensation at full-replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast high of each trees.

2) Disturbance allowance

Section 77 (2) of the Land Act (2000) provides for a disturbance allowance on top of the computed compensation amount as follows:

- 30% of compensation amount, if the notice to give up vacant possession is given within 6 months; and
- 15% of compensation amount, if the notice to give up vacant possession is given less than 6 months.

In the Project, the notice is going to give PAPs more than 6 months in prior to the displacement, all PAPs will be provided 15% disturbance allowance.

(3) Measures of livelihood restoration

The nature of resettlement is such that at times cash compensation and other short-term mitigation measures may not be effective to ensure that PAPs get back to their original status or better in terms of their earnings and productivity. Therefore, the planning an income and livelihood restoration is required. Livelihood restoration involves specific measures necessary to mitigate any harmful or negative impacts the Project may have on people's economic assets or activities.

The specific objectives of the livelihood restoration measures for the Project are to:

- Provide training in agriculture;
- Support PAPs, PAHs, and affected communities in overcoming the disruption generated by resettlement and promote the establishment of inclusive and sustainable community livelihood systems;
- Improve the quality of life of PAHs by building their capacity in the management, operation, and maintenance of new replacement assets (housing and infrastructure), replacement lands, and cash compensation;

- Meet the compensation commitments – and support the effective management of compensation commitments – as negotiated with physical and economically displaced PAHs, such that they receive compensation and other assistance in a manner that enables them to create new income sources;
- Provide technical assistance and support the development of technical and vocational capacity such that displaced PAHs can improve their livelihoods though an increased capacity to engage in production, trade, and employment; and
- Help ensure that displaced PAHs can equally access and benefit from other community, district and regional development programs and initiatives (i.e., Government programs, community development activities, etc.).

The assessment of needs on a household basis will be done based on baseline data gathered from the following sources;

- Consultation with government, PAHs and key persons;
- Asset Survey (Structure, Farmlands, and Crops);
- Socio-economic Survey; and
- Field Visits with Extensive Consultations.

Follow up surveys and in-depth interviews during field visits will lead questions to be asked regarding alternative land size and locations, and related questions regarding skills and other assets. Also, information will be gathered on preferences for programs, training opportunities, and community development initiatives. The data collected will be assessment for each household's requirement regarding income and livelihood restoration measures.

(4) Assistance to vulnerable people

The livelihood restoration measures for vulnerable people are follows;

- Giving them priority to be served first;
- Assistance in opening bank accounts by providing them with transport;
- Priority registration for employment on the Project's works;
- Land preparation where possible; and
- Credit facilities where possible.

Apart from the above assistances, the Project should look into some ways of supporting vulnerable people based on the nature of the vulnerability.

(5) Entitlement Matrix

Entitlement Matrix is the main part of any resettlement action plan. It describes compensation for loss of properties and related assistance for each category of PAPs. The entitlement matrix for the Project is proposed as shown in Table 1-4-2-10.

Table 1-4-2-10. Entitlement Matrix

Asset Acquired	Type of Impact	Entitled Persons	Compensation Entitlement	Other Entitlement Measures for Vulnerable Groups and Families
Agricultural land	**Land Acquisition:** When the remaining land after acquisition is economically viable.	· Farmer/ Land owner (Customary, and Freehold)	· **Cash compensation** for affected land by full replacement cost.	-
		· Tenant/ Leaseholder (Leasehold)	· No compensation for affected land. · **Cash compensation** for the affected harvest of affected land equivalent to the average market value over three years or the compensation rates as established by the District Land Boards in collaboration with the CGV whichever is the higher.	-
	Land Acquisition: When more than 20% of land owned is acquired by the Project, or when less than 20% of land owned is remained after acquisition but the land is not economically viable.	· Farmer/ Land owner (Customary, and Freehold)	· **Alternative land**[2] where feasible, **or cash compensation** for the entire land owned, according to PAPs choice. · **Relocation assistance** including costs of shifting + Assistance for re-establishing perennial crops and/ or economic trees up to a maximum of 12 months, while short-term crops mature.	For households who will lose all their land, or for those who cannot continue current activities on remaining land: · **Cash compensation** based on government rates (equivalent to replacement value), **or Alternative land** of similar size, quality and tenure, **or Assistance** from the Project to identify new site. · **Security of tenure**: Where PAHs prefer the alternative land instead of cash compensation, the similar tenure in comparison with lands owned in pre-project will be provided. · **Relocation assistance** in cash or services on a case-by-case basis as is sought.
		· Tenant/ Leaseholder (Leasehold)	· No cash compensation for affected land. · **Cash compensation** for the affected harvest equivalent to the average market value over three years for the mature and harvested crops at the compensation rates as established by the District Land Boards in collaboration with the CGV which is the highest, **or market value** for the remaining period of the tenancy/ lease agreement.	-

[2] Alternative land will be in terms a new parcel of land of equivalent size and productivity which a secure tenure status without encumbrances at an available location which is acceptable by PAPs.

Asset Acquired	Type of Impact	Entitled Persons	Compensation Entitlement	Other Entitlement Measures for Vulnerable Groups and Families
			· **Relocation assistance** including costs of shifting + Assistance for re-establishing perennial crops and/ or economic trees up to a maximum of 12 months, while short-term crops mature. · Regarding PAPs who leased lands within Protected Zone, MAAIF or PACC members will support to find out other land outside of Protected Zone.	
Residential land	**Land Acquisition:** When the land used for residence will be partially affected or limited loss and when the remaining land after acquisition is viable for present use.	· Land owner (Customary, and Freehold)	· **Cash compensation** for affected land.	-
		· Rental/ Lease holder (Leasehold)	· **Cash compensation** equivalent to 10% of lease/ rental fee for the remaining period of rental lease agreement.	-
	Land Acquisition: When premise used for residence will be severely affected, when the remaining area after acquisition will not be sufficient for continued use, or when the remaining area after acquisition becomes smaller than minimally acceptable under the Town and Country Planning Act.	· Land owner (Customary, and Freehold)	· **Alternative land**[3] where feasible, **or cash compensation** for entire land owned, according to PAPs choice. · **Relocation assistance** including costs of shifting + Allowance	-
		· Rental/ Lease holder (Leasehold)	· Compensation for affected lands. · **Cash compensation** for affected assets (verifiable improvements to the property by the tenant e.g. fence). · **Disturbance compensation** to the tenant equivalent to two month's rental costs.	-
Buildings (such as temporary residential houses, and temporary commercial house)	**Physical displacement:** Entire building affected or partially affected but remaining building not suitable for continued use.	· Land owner (Customary, and Freehold)	· **Cash compensation** for entire structure, and other fixed assets without depreciation, or **alternative structure** equivalent or better size and quality in an available location which is acceptable to PAPs. · **Right to salvage materials** without deduction from compensation. · **Relocation assistance** including costs of	Construction of replacement permanent structure. For those moving to a new settlement, or non-adjacent land, transport and labor assistance to move households or business goods.

[3] Alternative land will be minimum plot of acceptable size under the Town and Country Planning Act whichever is larger in the community or a nearby resettlement area with adequate physical and social infrastructure systems as well as a secure tenure status without encumbrances at an available location which is acceptable by the PAPs.

Asset Acquired	Type of Impact	Entitled Persons	Compensation Entitlement	Other Entitlement Measures for Vulnerable Groups and Families
			shifting + Allowance. · **Rehabilitation assistance** if required.	For those moving to adjacent land, labor to move household of business goods, determined on a case by case basis. Building materials maybe salvaged from old housing (transport their own cost).
		· Rental/ Lease holder (Leasehold)	· **Cash compensation** for affected assets (variable improvements to the property by the tenant-e.g., fence) · **Relocation assistance** including costs of shifting + Allowance equivalent to four months rental costs. · **Assistance** to help find alternative rental arrangements · **Rehabilitation assistance** if required.	Cash for fixed assets (if any, based on approved district rates). Assistance to find alternative rental property (business or residence). Arrangement formal lease with similar conditions to previous lease, and provide formal tenancy agreement.
Other structures (such as agricultural structure, latrines, fence, etc.)	**Physical displacement:** Entire structure affected or partially affected but remaining structure not suitable for continued use.	· Land owner (Customary, and Freehold) · Rental/ Lease holder (Leasehold) · Squatter/ Informal dwellers[4]	· **Cash compensation** at government rates, **Disturbance allowance, and Top up** equal to inflation for increase in cost of construction materials (equal to replacement cost). · **Assistance** in the procurement of construction materials. · **Building materials** maybe salvaged from old housing (transport at their own cost). · For those moving to a new settlement, or non-adjacent land, **transport assistance** to move households or business goods.	Construction of replacement structure. For those moving to a new settlement, or non-adjacent land, transport and labor assistance to move households or business goods. Building materials maybe salvaged from old structure (transport at their own cost).
Perennial Crops	**Loss of Income opportunity:** Loss of perennial crops affected by land acquisition or temporary acquisition or easement.	· PAPs (where land owner, tenant or squatter)	· **Cash compensation** at district rates (full replacement cost) · **Transitional allowance of 5% of value of crops** per household which loses perennial crops to cover for income loss.	-
Annual (Seasonal) Crops	**Loss of Income opportunity:** Loss of seasonal crops affected by land acquisition or temporary acquisition or easement	· PAPs (where land owner, or tenant or squatter)	· **Cash compensation**. · **Promote announcement** of construction schedule not to cultivate annual crops.	-

[4] In the Project Site, there is no squatter nor informal dwellers.

Asset Acquired	Type of Impact	Entitled Persons	Compensation Entitlement	Other Entitlement Measures for Vulnerable Groups and Families
Economic trees	**Loss of Income opportunity:** Tree lost	· Land owner	· **Cash compensation** based on type, age, and productive value of affected trees. · **10% premium** of amount of cash compensation.	
Temporary Acquisition	Short term land acquisition for renting during construction. Ad if there are crops and trees in the renting lands, the contractor will negotiate with owners about the amount of compensation.	· PAPs (whether land owner, tenant or squatter)	· Though farming activities will be suspended during construction works. Cash compensation for any assets affected, e.g., crops, trees, etc.	-

Source: RAP (MAAIF, 2018)

1-4-2-5 Grievance Redress Mechanism

A simple Grievance Redress Mechanism (hereinafter referred to as "GRM") has been proposed to enable timely resolution of grievance to the PAPs as follows;

(1) STAGE I: Village grievance resolution committee (VGRC)

There will be established the Village Grievance Resolution Committee (hereinafter referred to as "VGRC") which comprises of the following members:

- Village local council chairpersons;
- PACC chairpersons;
- Representatives of PAPs democratically elected by PAPs (including male and female members); and
- Village/ Community elders.

The VGRC will explore all possibilities to solve the raised grievances at the village level and refer to higher level if the grievances are not solved by the committee. The committee will deal with boundary disputes, identification of rightful owners and disputes among family members. When the aggrieved PAP fails to agree with the committee, the PAP can utilize stage II to solve the grievance. The VGRC members should undergo a briefing session about their roles and requirements at early stage before commencement of RAP implementation activities.

(2) STAGE II: District grievance resolution committee (DGRC)

There will be established the District Grievance Resolution Committee (hereinafter referred to as "DGRC") which comprises of the following members:

- District local council representative;
- District land officer;
- PDCC chairpersons;
- PDCC members (including male and female members); and
- PAP representatives: PACC members (including male and female members).

The DGRC will explore all possibility to solve the raised grievances failed to be solved by the VGRC. When the DGRC and PAP to fail to agree, the PAP can utilize stage III (Land Tribunals) to solve the grievance. The DGRC members should undergo a briefing session about their roles and requirements at early stage before commencement of RAP implementation activities.

(3) STAGE III: LAND Tribunals

All disputes related to land will be resolved with the support of the existing land tribunals. If the grievance resolution committees at the village or district level fail to solve the grievance, it will be referred to the Land Tribunals. At each level such as village, parish, and district, the land tribunals will endeavor to solve the dispute. The graduated solution will be enhanced: e.g., the grievance failed resolution by the Village Land Council will be referred to the Parish Land Tribunals.

- Village land council;
- Parish land tribunal; and
- District land tribunal.

(4) STAGE IV: Courts of law

Ugandan legislation allows a right of access to the courts of law by any person who has an interest or right over property. When the GRM procedure fails to provide a settlement, complaints can still seek legal redress in courts of law as a last resort.

(5) Organizational structures

The following members will be involved to resolve grievances raised from PAPs.

- MAAIF Project Implementation Unit (hereinafter referred to as "PIU") and Resettlement and Compensation Management Unit (hereinafter referred to as "RCMU");
- Grievance Resolution Committees;
- Local Government Officials;
- Land Tribunals; and
- PAPs

(6) Procedures and responsibilities

The grievances will be channeled through VGRC and DGRC either verbally or in writing, but writing will be more preferred. Since the local leaders are nearest contacts to the PAPs, it is expected they will receive the grievances from the PAPs in most cases. On the other hand, PAPs will be free to submit their grievances to any members of the VGRC or DGRC. The committee members will pass on the grievance to the RCMU for proper recording and registration. The RCMU team will include a RAP specialist/ sociologist, a land surveyor, a valuer and a legal officer. These will work together with the grievance resolution committees to handle grievances raised by PAPs or community.

After the registration of the complaint, an investigation will be carried out by the grievance resolution committee members to verify it validity; thereafter a resolution approach will be selected based on the findings. The decisions/ actions taken will be communicated to all parties involved mainly in written form. All avenues will be explored to resolve grievances amicably between the aggrieved parties and the court channels will be in the last resort.

(7) Respect and confidentiality

Recording a complaint can be a difficult or impossible process if a person is afraid of being punished for his or car act, by members of the RCMU, PIU, VGRC, DGRC, or other interested parties. In addition, most of PAPs may not wish to publicize the fact that they have filed a complaint. To address these concerns, the RCMU will have a policy of respect and confidentiality clearly published to all parties that will be integrated in the PIU staff and committees training program. This policy will stipulate that; any person filing a grievance will be treated with respect by the staff of the RCMU, PIU and the committees; the infoemation relating to the complaint and the complaint is confidential and will not be disseminated in the community, etc.

1-4-2-6 Implementation Structure for RAP

(1) MAAIF

Regarding the RAP, MAAIF will be responsible for resources mobilization, distribution and implementation of compensation and resettlement. Specifically, the PIU in MAAIF will be involved with RAP implementation. MAAIF has responsible to directly oversee resettlement. Compensation activities, identifying and coordinating all actors in the resettlement programme, managing grievances and monitoring RAP implementation.

PIU and RCMU will be a part of MAAIF dedicated for the Project implementation with sub units selected to deal with resettlement compensation management. The responsibilities will include follows:

- Giving advices on resolving grievances from PAPs or affected communities in various committees;
- Hiring the external monitors where necessary to oversee the grievances resolution process;
- Providing progress report of the various activities to MAAIF/ JICA and other stakeholders as required; and
- Preparation of the short brochure on the steps in resolving conflicts/ disputes to be distributed in the Project Site.

(2) Ministry of Lands, Housing and Urban Development

The Chief Government Valuer in the Valuation Division in the Ministry of Lands Housing and Urban Development (hereinafter referred to as "MoLHUD") is responsible for approving the property valuation report developed. Additionally, property or cadastral survey report is submitted to the Commissioner for Surveyors and Mapping in MoLHUD for review and approval.

(3) Ministry of Gender, Labor and Social Development

Ministry of Gender, Labour, and Social Development (hereinafter referred to as "MoGLSD") guides all actors in the social development sector and creates and enabling environment for social transformation, leading to improved standards of living for all increased equality and social cohesion. The MoGLSD has a department of occupational health and safety which is mandated inspect workplace to ensure safety and gender equality. MoGLSD has the following programmes which should tie into and compliment objectives of the Project:

- Community Rehabilitation Programme for the Disabled (CBR);
- Functional Adult Literacy Programme (FAL);
- Support to AIDS Orphans and Other Vulnerable Children (PCY);
- Elimination of Child Labour; and
- Relation to the Project

The above programmes are relevant in so far as some PAPs may disabled or need FAL and PCY. Additionally, MoGLSD will ensure that no child labour is involved in any resettlement activities.

MoGLSD , working through Community Department Officers (hereinafter referred to as "CDOs") at district and sub-county level will be responsible for spreading and coordinating gender responsive and community development, in particular, sensitizing community members to form groups that will adequately utilize the water amicably.

(4) Local Governments in the Project Site

The Project Site includes Bulambuli and Kween districts. As provided by the Local Government Act, local governments are mandated to set compensation rates for crops and non-permanent structures through their District Land Boards. Local governments will also be important in managing and monitoring social impact through site visits or resolving complaints from PAPs. Or affected communities.

(5) DGLC

At the district level, the DGRC should be responsible for the follow activities on grievance

mechanisms:

- Receive referrals from lower committees;
- Convening meeting s for hearing of disputes from parties referred from lower committee;
- Mediating between and assist parties to arrive at mutually acceptable settlement of the disputes on any matter concerning land within its area of jurisdiction (Act as a mediator between the Project and PAPs);
- Monitoring of land acquisition, compensation and resettlement activities;
- Sensitization of PAPs with grievances;
- Proactively disclose information about the RAP Process; and
- Ensure constant consultation with PAPs on ways to improve on the mechanisms and processes.

(6) Uganda Land Commission

The Uganda Land Commission holds and manages land in Uganda vested in or acquired by the GoU and would be involved where such land is affected by the Project. This applies to where land affected by the Protected Zone and irrigation infrastructures.

(7) Private Sector Entities

RAP implementation will involve private sector consultants hired by the MAAIF for verification and actual payment of compensation to PAPs. While these entities has not been selected yet, it will be hired through competitive biffing as per Uganda's procurement laws.

1-4-2-7 Implementation Schedule for RAP

Table 1-4-2-11 shows the RAP implementation schedule.

Table 1-4-2-11. RAP Implementation Schedule

Years	2018												2019												2020						
Activities	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Approval RAP by JICA					X																										
2nd Stakeholder meeting						X																									
Valuation Report approvals (seeking the approval of Compensation schedule by CGV)						X	X																								
Valuers to address comments by CGV and submit the clean compensation schedule								X																							
Procurement RAP Implementation Consultant by MAAIF					X	X	X	X																							
Approval for payment by MAAIF								X																							
Preparation of Compensation Funds by MAAIF								X	X																						
Commencement RAP Implementation, Disclosure of compensation amounts									X	X	X																				
Opening of Bank accounts for PAPs											X	X	X																		
Training														X																	

Years	2018												2019												2020						
Activities	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Programmes: (Capacity building of grievances committees, awareness on wise use of compensation money, etc.)																															
Payment of Compensation to all PAPs															X	X	X	X	X	X											
Grievance Resolutions and settlement of disputes																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Implementation of Livelihood Restoration Programs																				X	X	X	X	X	X	X	X				
Assistance of vulnerable PAPs																				X	X	X	X	X	X						
Internal Monitoring and Supervision		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Monitoring and Evaluation																											X	X			
Start of Construction Works, supervision and follow-up of mitigation measures																											X	X	X	X	X

Source: RAP (MAAIF, 2018)

1-4-2-8 Budget for RAP

Table 1-4-2-12 shows the RAP budget estimated in consider with above compensation policy and scale of affected items.

Table 1-4-2-12. RAP Budget Estimated

No.	Category	Cost Estimated (UGX)	Activities involved
1	Total valuation of land	333,174,000	
2	Valuation for crops and trees	89,375,000	
3	Valuation for buildings/ structures	5,964,950	
4	Disturbance allowance 15%	66,235,093	
Sub-total (a)		496,758,543	
5	RAP Implementation and Administration 40%	198,703,417	・ Sensitization of PAPs; ・ Verification of PAPs ・ Disclosure of Amounts of Compensation/ Assistance; ・ Training of PAPs on proper use of compensation funds; ・ Assistance to PAPs for opening accounts; and ・ Preparation accountability report.
6	RAP Update 20%	99,351,708	・ Done before RAP implementation; ・ Ensure all PAPs are captured; ・ Include PAPs who were left out/ absent during the RAP Preparation; ・ Display of final RAP report; and ・ Prepare supplementary report for approval by CGV.
7	Grievance Redress Committee 20%	99,351,708	・ Election of grievance redress committees; ・ Train the committee members; ・ Sitting allowance and transport of committee members; and ・ Prepare grievance redress log report.
8	Stakeholder Participation 20%	99,351,708	・ Continuous process to keep PAPs aboard about the Project activities ・ Disclosure of information about the Project
9	Preparation of Income and Livelihood Restoration during construction 20% **Excluding Income and Livelihood Restoration support**	99,351,708	・ Carry out a needs assessment on all PAPs to establish the opportunity cost of being off their land during construction; ・ To establish the best and agreeable form of compensation; and ・ To establish training opportunities and community development initiatives.
10	Estimated Amount for Income and Livelihood Restoration*	92,500,000	・ Training in agriculture, and other needs will be established after the needs assessment. (e.g., provide improved seeds, agriculture farm equipment)
Sub-total (b)		688,610,249	
10	Monitoring and Evaluation Internal 15%	4,513,718	・ To monitor the effectiveness of the compensation process; ・ To ensure clearance of the site before commencement of construction; and ・ Follow-up on land re-arrangement.
11	Monitoring and Evaluation External 25%	124,189,636	・ To make a follow-up on the resettlement activities evaluate whether the goals and objectives of resettlement were achieved.
Sub-total (c)		**198,703,417**	
Grand Total ((a) + (b) + (c))		**751,113,667**	

Note: It was incorrect that the description of the original RAP said that the income and livelihood restoration support will be provided to the only PAPs within the Buffer Zone (Protected one). In actual, however, the support will be provided to all PAPs.

Source: RAP (MAAIF, 2018)

1-4-2-9 RAP Monitoring Structure and Monitoring Form

(1) RAP monitoring structure

The Project will adopt the below components for the monitoring framework:

- Internal monitoring implemented by Project Resettlement Office;
- External monitoring by a contracted consulting firm or NGO; and
- RAP Completion Audit by a contracted consulting firm or NGO.

Table1-4-2-13 shows the implementer for each monitoring component.

Table 1-4-2-13. RAP Monitoring Implementer

Item	Implementer	Responsibility
Internal Monitoring	MAAIF (PIU)	- Lead the internal daily monitoring and periodic activities. - Regular monitoring to ensure that the approved assessed value for compensation are paid. - Regular monitoring of the planned implementation and its impacts.
	PDCC	Periodic monitoring of the planned implementation and its impacts.
External Monitoring	Contracted consulting firm or NGO	Periodic monitoring and evaluation of the implementation of the RAP.
RAP Completion Audit	Contracted consulting firm or NGO	Final audit of the RAP Implementation

Source: RAP (MAAIF, 2018)

1) Internal monitoring

The objective of the internal monitoring is to monitor the implementation situation of the entire RAP for the Project. The details of indicators to be monitored is described below.

2) External monitoring

In order to ensure the Project implementation of resettlement, a local consulting firm hired by MAAIF will conduct an independent external monitoring of the land acquisition, resettlement and rehabilitation activities of the Project. The firm will consider the overall implementation from broader, long term point of view and will follow the resettlement activities to value whether the goals of resettlement are achieved.

3) RAP completion audit

The purpose of the completion audit is to confirm 1) whether MAAIF has implemented all the activities needed to ensure compliance with resettlement commitments defined by the RAP and applicable policies, and 2) whether compensation and resettlement has been deemed complete. The key object of the RAP is that compensation, resettlement and other mitigation measures should lead to sustainable restoration or enhancement of the PAPs' equality of life and income levels. The completion audit will be carried out by the same auditor as the compliance audit. Based on data collected during this review and other data collected during implementation, the auditor will form conclusions on the following main issues:

- Identification of PAPs and impacts by the Project;
- Compensation for all the impacts of all PAPs;
- Timely delivery entitlements;

- The adequacy of compensation in mitigation experienced impacts; and
- Situation of livelihood restoration.

Verification of the completion of the RAP will provide a final indication that livelihood restoration is sustainable and that no further action is required. The evaluation report will be made public through the meeting with the PIU through the appropriate media.

(2) RAP monitoring indicator

Regarding internal monitoring, indicators to be involved;

Table 1-4-2-14. Indicators for Internal Monitoring

Indicators for Internal Monitoring
· Level of understanding of the project impact and mitigation, and resettlement options · The number of people and households that have been resettled or their livelihood restored · The number of PAPs (men and women) employed in the Project construction · The number and percentage of PAHs consulted · Degree/ level of involvement of local/ traditional authorities, women and vulnerable groups · Effectiveness of compensation according to the compensation rates described in the RAP · Effectiveness of relocation procedures to new housing sites · Number and place of consultative meetings held with PAPs and local authorities in preparation of, or during RAP implementation · Grievance issues by type and how they were resolved; Total received. Total justified, Total resolved at various levels including the type of agreement reached; Total referred to legal system/courts of law, including clarification on who initiated (local leaders, PAP or MAAIF) the referral and subject matter. · Actual amount paid and timeliness of compensation payment

Source: Summarized contents of RAP (MAAIF, 2018)

In addition, indicators to be monitored as external monitoring are follows:

Table 1-4-2-15. Indicators for External Monitoring

Indicators for External Monitoring		
Subject	Indicator	Variables
Land	Acquisition of land	· Area of land acquired for the Project
Buildings/ Structures	Acquisition of Buildings/ Structures	· Number, type, and size of buildings/ structures acquired by the Project
Trees/ Crops	Acquisition of Trees	· Number and type of trees acquired for the Project
	Destruction of Crops	· Area, type and ownership of crops destroyed
Compensation, Re-establishment and Rehabilitation	Compensation and re-establishment of affected owners/ individuals	· Number of PAHs (lands, buildings, trees, crops)
	Re-establishment of community resources	· Number of community buildings replaced · Number and type of plants lost · Number of seedlings supplied by type
Hazards and Disturbance	Introduction of nuisance factors	· Number of PAHs by hazards and disturbances from construction (levels of noise, blasting, and traffic)
Social/ Demographic	Changes to homestead structure	· Homestead size (births, deaths, migration in and out) · Age distribution · Gender distribution · Marital status · Relationship to homestead head · Status of vulnerable homestead
	Population migration	· Residential status of homestead members · Movement in and out of homestead (place and residence of homestead members)
	Changes to access	· Distance/ travel time to nearest school, health center, church, shop, and village
	Changes to health status	· Nutritional status of resettled PAPs · Number of people with disease by type (STDs, diarrhea, malaria, ARI,

Indicators for External Monitoring		
Subject	Indicator	Variables
		immunizable disease) ・ Mortality rates ・ Access to health care services (distance to nearest facility, cost of services, quality of services) ・ Utilization of health care services ・ Disease prevention strategies ・ Extent of educational programs ・ Latrine provision at schools (school child population per Ventilated Pit Latrine on site)
	Changes to educational status	・ Literacy and educational attainment of homestead members ・ School attendance rates (age, and gender)
	Changes to status of women	・ Participation in training programs ・ Use of credit facilities ・ Landholding status ・ Participation in the project related activities and enterprises
	Homestead earning capacity	・ Main income source ・ Employment status of economically active members ・ Monthly income level ・ Earnings/ income by source, separating compensation payments ・ Changes to income earning activities – pre- and post-project ・ Amount and balance of income and expenditure ・ Ownership of capital assets ・ Ownership of equipment and machinery ・ Landholding size, area cultivated and production volume/ value by crop (cash and subsistence crops) ・ Landholding status (tenure) ・ Redistribution of cultivation land ・ Changes to livestock ownership in pre- and post- project ・ Value of livestock sales and imputed value of barter transactions ・ Consumption of own livestock production ・ Skills of homestead members ・ Possession of consumer durables ・ Realization of homestead income restoration plans (components implemented, net income achieved) ・ Possession of bank and savings accounts ・ Access to income-generating natural resources base (wood, grass, san, stone)
	Changes in social organization	・ Organizational membership of homestead members ・ Leadership positions held by homestead members
	Population influx	・ Number and size of settlements, formal and informal groups in market areas ・ Influx of people from outside of the Project Site
Consultation	Consultation program operation	・ Number of local committees established ・ Number and dates of local committee meeting ・ Involvement of local committees and NGOs in participating in the Project's planning and development
	Information dissemination	・ Number, position, staffing of Information Center ・ Equipment, and documentation of

Indicators for External Monitoring		
Subject	Indicator	Variables
		Information Centers Activities ・ Number of people accessing Information Centers requirements, issues raised at Information Centers
	Grievances resolved	・ Number of grievance registered by type ・ Number of grievance resolved ・ Number of cases referred to court
Training	Operation of training program	・ Number of local committee members trained ・ Number of PAPs trained project-related training course
Management	Staffing	・ Number of implementation agencies by function ・ Number of ministry officials available by function ・ Number of office and field equipment by type
	Procedures in operation	・ Census and asset verification/ qualification procedures in place ・ Effectiveness of compensation delivery system ・ Number of land transfer affected ・ Co-ordination between local community structures, NGOs, and PIU officials

Source: Summarized contents of RAP (MAAIF, 2018)

The tools available to the resettlement unit to implement internal monitoring include;

- Public consultation and informative meetings to obtain PAP satisfaction rate from the RAP activities;
- Simple random sampling to obtain the current socio-economic conditions of household to be used as monitoring benchmark;
- Key informant interviews;
- Formal and informal meetings with PAPs and other relevant stakeholders;
- Focus group meetings with vulnerable groups;
- Field observations by experts;
- Grievance and grievance close out forms; and
- Project progress report

(3) RAP monitoring frequency

Table 1-4-2-16 shows the proposed frequency of planned monitoring items.

Table 1-4-2-16. RAP Monitoring Frequency

Monitoring	Content	Frequency
Internal Monitoring	Field observation during RAP implementation	Monthly
	Follow up with local leaders/ villagers/ PAPs	Quarterly
	Reporting to JICA during RAP implementation	Quarterly
	RAP Implementation Completion of Report	On completion (1 time)
External Monitoring and Compliance Audit	Field observation during RAP Implementation:	**In basic, annually (as necessary)**

Monitoring	Content	Frequency
	- **Key Informant Surveys** - **Field Observation with Experts**	
	Discussions with PAPs and other stakeholders (regardless of formal or informal)	**In basic, annually (as necessary)**
	Focus Group Meetings with Vulnerable Groups	**In basic, annually (as necessary)**
	Simple Random Sampling to obtain the current household socio-economic conditions to be used as monitoring benchmarks	**Annually**
	RAP implementation annual reports - **Project progress report (situation of grievance redress, etc.)**	**Annually**
	RAP Implementation Completion Audit Report to JICA	On completion (1 time)

Source: RAP (MAAIF, 2018)

(4) Draft Monitoring Form[5]

The monitoring form for reporting JICA is proposed as follows;

I	**Monitoring Item;** **Monitoring Frequency;**	**Public Meetings (regardless of official or non-official)** **Quarterly**

No.	Date of Public Meeting	Venue	No. of Participants			Main Topic	Comments/ Requests, etc. from Participants
			Male	Female	Total		
1							
2							

Note: The each record of detailed contents should be kept when the meetings organized.

II	**Monitoring Item;** **Monitoring Frequency;**	**Seminars relevant to the Project*** **Quarterly**

No.	Date of Seminar	Venue	No. of Participants			Agenda	Comments/ Requests, etc. from Participants
			Male	Female	Total		
1							
2							

Note: The each record of detailed contents should be kept when the seminar organized.

III	**Monitoring Item;** **Monitoring Frequency;**	**Water Users' Association (WUA) Member List** **Quarterly**

No.	Village/ Parish/ Sub-county/ District	Sex Tick a box (✓)		Name of Member
		Male	Female	
1				
2				

[5] This format for reporting to JICA was revised after RAP submission to CGV.

IV	**Monitoring Item;** **Complaints relevant to the Project** **Monitoring Frequency;** **Quarterly**

1) Summary

Item	Total No. of Complaints Received	Total No. of Complaints Justified	Total No. of Solved Complaints
VGRC*[1]			
DGRC*[2]			
Land Tribunals			
a) Village level			
b) Parish level			
c) District level			
Courts of Law			
Other (Specific:)			

*1: VGRC (Village Grievance Redress Committee)
*2: DGRC (District Grievance Redress Committee)

2) Complaint List by Issue

No.	Date	Complainant Tick a box (✓)		Name	Subject Matter	Clarification on Who initiated the referral
		Male	Female			
1						
2						

V	**Monitoring Item;** **Progress of RAP Activities** **Monitoring Frequency;** **Quarterly**

Item	Completion Date Period	Expected Date of Completion (If it has not been done yet.)
RAP Finalization Period		
Submission to CGV*[1]		
Approval by CGV		
Procurement of RAP Implementation Consultant		
Approval for payment by MAAIF		
Preparation of Compensation Funds by MAAIF		
Disclosure of Compensation Amounts		
Opening Banks Accounts of for PAPs		
Training Programmes		
Payment of Compensation to all PAPs		
Grievance Resolution and settlement of disputes		
Implementation of Livelihood Restoration Programmes		
Assistance of Vulnerable People		
External Monitoring and Evaluation		
RAP Audit Report		
RAP Completion		

Note: Chief Government Valuer, under Ministry of Lands, Housing, and Urban Development

VI	**Monitoring Item;** **Progress of Compensation Payment, Land Acquisition and Resettlement** **Monitoring Frequency;** **Quarterly**

Resettlement activity	Planned Total	Unit	Progress in Quantity	Progress in Percentage	Expected Date of	Completion Date

			During the Current Quarter	Up to the Previous Quarter	Up to the Current Quarter	Up to the Previous Quarter	Up to the Current Quarter	Completion	
Progress of compensation payment (all lots)									
Lot 1		HHs							
Lot 2		HHs							
Lot 3		HHs							
Lot 4		HHs							
Progress of Providing Livelihood Support (all lots)									
Lot 1		HHs							
Lot 2		HHs							
Lot 3		HHs							
Lot 4		HHs							
Progress of land acquisition (all lots)		ha							
Lot 1		ha							
Lot 2		ha							
Lot 3		ha							
Lot 4		ha							
Progress of asset replacement (all lots)									
Lot 1		HHs							
Lot 2		HHs							
Lot 3		HHs							
Lot 4		HHs							
Progress of resettlement of people (all lots)									
Lot 1		HHs							
Lot 2		HHs							
Lot 3		HHs							
Lot 4		HHs							
Progress of Land Re-organization (all lots of Model Site which has 12 ha)									
Lot 1		ha							
Lot 2		ha							
Lot 3		ha							
Lot 4		ha							

VII	**Monitoring Item;**	**Actual Amount paid and timeliness of Compensation Payment**
	Monitoring Frequency;	**Quarterly**

RAP ID No.	Name of HH members	Amount of Payment (UGX)	Date of Payment	Signature	
				Payer	Receiver
1					
2					
3					

VIII	**Monitoring Item;**	**Involvement of PAPs in Project Construction**
	Monitoring Frequency;	**Quarterly**

Item	No. of PAPs		
	Male	Female	Total
Number of PAPs employed in the Project Construction			

IX	**Monitoring Item;**	**Economic Situation**
	Monitoring Frequency;	**Annually (Simple Random Sampling)**

Sex of HH Head (✓)		Main Income Source of HH	Amount of Annual Income (UGX)	Amount of Annual Expenditure (UGX)
Male	Female			

Sex of HH Head (✓)		Main Income Source of HH	Amount of Annual Income (UGX)	Amount of Annual Expenditure (UGX)
Male	Female			

X	**Monitoring Item;**	**Household Members**
	Monitoring Frequency	**Annually (Simple Random Sampling)**

Name of HH members	Sex (✓)		Age	Marital status (✓)		Relationship to the HH Head	Residential status	Movement in/ out of household members
	Male	Female		Single	Married			

XI	**Monitoring Item;**	**Hazard and Disturbance**
	Monitoring Frequency;	**Monthly (During Construction)**

Item	Monitoring Results
No. of Households Affected by hazards and Disturbance from Construction	HH(s)
No. of Patients among construction workers	Person(s)
No. of accident relevant to the Project Construction	Accident(s)
Children labor during Project Construction	Person(s)
Crimes by construction workers including sexual harassment	Crime(s)

XII	**Monitoring Item;**	**Extent of damage to existing infrastructures**
	Monitoring Frequency;	**Monthly (During Construction)**

No.	Date	Venue	Details of Contents	Owners of existing infrastructures	Solution
1					
2					

XIII	**Monitoring Item;**	**Case of conflict between construction workers and community members**
	Monitoring Frequency;	**Monthly (During Construction)**

No.	Date	Venue	Details of Contents	Solution
1				
2				

1-4-2-10 Consultation Meetings

During the OD, stakeholder meetings of two times have been held for sharing information on RAP to stakeholder continuously. The outline of each meetings are described below.

(1) 1st stakeholder meeting

1) Date and time

15:00 ~ 17:00, 1st of February 2018.

2) Venue

Garden of Atari Primary School.

3) Languages

English, Lumsaba, and Kiswahili

4) Participants

The outline of participants is as shown in the table below.

Table 1-4-2-17. List of Participants of 1st Stakeholder Meeting (1st February 2018)

Stakeholder	No. of Person	Remark
MAAIF	4	-
Ministry of justice and Constitutional Affairs	1	-
MoGLSD	1	-
PDCC	4	From both districts.
PACC	12	From both districts.
Citizen (Farmers etc.)	135	Including neighboring citizens those who are not PAPs.
Associated Engineering Surveyors Ltd. (RAP Consultant)	5	Including director, surveyor, and sociologist.
JICA Uganda Office	2	
JICA Study Team	3	Team leader, Social consideration, and assistant.

Source: RAP (MAAIF, 2018)

5) Main Topics

- Reporting progress of RAP survey;
- Explanation of the Project component with drawing; and
- Discussion.

6) Contents of Discussion

Table 1-4-2-18. Contents of Discussion of 1st Stakeholder Meeting (1st February 2018)

No.	Question/ Comment	Response
1	Participant asked if the PAPs were going to be part of the team to assess how much a person will be paid for during the exercise.	RAP consultant informed the meeting that the compensation rates will be got from the districts which the Chief Government Valuer will approve, so there will be no need for the PAPs to be part of the process.
2	Participant asked whether the farmers will be allowed to go to the field during the construction time.	MAAIF officer informed the meeting that this will not be possible because the construction site shall be out of bounds due to safety concerns. The Constructor will want to minimize accidents as much as possible. In addition, MAAIF officer informed that the period when the farmers cannot enter their field will be shorter, since the entire construction period of the project will be phased by the area.
3	PACC member said that the cooperation with the farmers was still good and prayed that it continues. He also thanked the RAP Consultant for taking the complaints of the farmers and for agreeing to come back and solve the still pending problems. He further requested the RAP Consultant to alert them in time so that they can mobilize for the farmers to stay around.	The project is not going to change any boundary between the two districts. All land will remain the same apart from a little portion that will be taken by the project will be fully compensated by Government of Uganda. This project has not come to divide boundaries; the owner of the affected land will remain the same, so no worries of belonging anywhere. River meandering – spots are very short and close to each other. River training will be done on two spots, try to re-direct the river so that it does not meander a lot. Dykes will to form the boundary of the districts, and if the Project is training in someone's land, that person will be compensated for. Training will be within the buffer zone of 30 meters.
4	Participant raised issue of the river meandering such that some parts of the river have been left out. This river acts as a boundary between Kween and Bulambuli. In	The Project is not going to change any boundary between the two districts. All land will remain the same apart from little portion that will be taken by the project will be fully compensated by GoU. The Project

No.	Question/ Comment	Response
	between there is a land owner, where will that land owner be, is it in ween or Bulambuli?	has not come to divide boundaries; the owner of the affected land will remain the same, so no worries of belonging anywhere. The river meandering- spots are very short and close to each other. River training will be done on two spots, try to re-direct the river so that it does not meander a lot. Dykes will to form the boundary of the district, and if the Project is training in someone's land, that person will be compensated for. Training will be within the Protected Zone of 30 meters.
5	Participant had reservations that this project was hatched by the people of Bulambuli, and JICA FS Team had initially told them the Bulambuli district would own 70% and Kween district would have 30%. But when there reached a time a lot of confusion came up, and now the project Bulambuli has only 45% and Kween has 55%!! This is so unfair to the people of Bulambuli.	RAP Consultant assured the meeting that this is a government project which should benefit everybody and the people should stop talking in terms of Bulambuli or Kween. First of all the communities have inter-married without any problem. The two districts are accommodating many tribes such as Iteso, Bagwere, Kenyans, Samyas etc, so the problem of the Bulambuli/ Kween should not rise.
6	Participant raised the issue of farmers not accessing their fields during the construction time and yet a lot of his food will be inside during the construction. How does he get food to feed his family?	MAAIF Officer responded that construction will be done in bits, and it will not take a long period when a site is condoned off, it may take say 2 -4 days only and that side is open for farmers to pass to go to their fields. The contractor will be very fast because the equipment he will use will be very expensive to hire so more time the contractor spends in a site the more expensive the project becomes.
7	Participant's concern was that the day the construction starts all the land will be leveled, is it true or not? Then how will the machines work? He suggested that for the smooth running of the project, government should resettle the PAPs for say two years, feeding them with their families until the construction of the Scheme is completed.	He was referred to the above response and was told that the issue of leveling the land will be explained in the next stakeholder meeting.
8	Participant said that JICA Study Team went to her garden and planted pegs, when she asked them what the purpose is. Then, they told her that was a government project which was in a position to shift her to another place. But this is her green bank for her family.	It seems there was a miscommunication at that time. However, when her field is needed to be acquired for the project, it will be compensated fully.

Source: RAP (MAAIF, 2018)

(2) 2nd stakeholder meeting

1) Date and time

14:00 – 18:00, 8th of June, 2018.

2) Venue

Garden of Atari Primary School.

3) Languages

English, Lumsaba, and Kiswahili

4) Participants

The outline of participant is as shown in the table below.

Table 1-4-2-19. List of Participants of 2nd Stakeholder Meeting (8th June 2018)

Stakeholder	No. of Person	Remark
MAAIF	5	-

Stakeholder	No. of Person	Remark
PDCC	4	From both districts.
PACC	15	From both districts.
Citizen (Farmers, etc,)	135	Including neighboring citizens those who are not PAPs.
Associated Engineering Surveyors Ltd. (RAP Consultant)	5	-

Source: RAP (MAAIF, 2018)

5) Main Topics

- Project objectives, background, and scope;
- Construction schedule; and
- Results of socio-economic survey and population survey.

6) Contents of Discussions

Table 1-4-2-20. Contents of Discussions of 2nd Stakeholder Meeting (8th June 2018)

No.	Question/ Comment	Response
1	Participant asked that they were promised that the construction would start in March 2018 and they have been eagerly waiting because we expect to benefit a lot from this project. In addition, we expect that after the land has been re-organized the flooding will be controlled as you can see we are really suffering with water which is everywhere right now.	MAAIF Officer informed him that the Project is being funded by a grant of over 100 billion from GoJ and for that matter all processes have to be followed to the dot since the Japanese are very strict and would not like to hurry the process without proper documentation and ensuring that the Project will succeed. He was informed the meeting that construction will not start until all PAPs are paid and right now we are in the process of completing the RAP, have people paid, then the detailed feasibility studies will take place. Construction is expected to begin in 2020. He therefore requested the farmers to bear with the slow process but expect best results where all parties will be happy.
2	Participants asked if his graves located within the Project Site will be compensated for.	He was informed that compensation will be only for the land going to be affected by the irrigation infrastructure such as, roads, main canals, secondary canals, and primary canals. However, from the survey done, no graves were identified in the affected land. Therefore, no compensation will be given for graves which are not affected.
3	Participant asked that during implementation people shall not be allowed to work in their fields within the Project Site, what method will be put in place in order for them to get food during construction?	MAAIF Officer reiterated that RAP study has budgeted for livelihood restoration for all the PAPs and some of this money will be used provide food during construction. However, he also cautioned PAPs to plan for this period and cooperate with MAAIF and the contractor in ensuring that people do not suffer much during the construction period. Farmers will also be required to volunteer land for land organization and farm demonstration which will be used as a model farm to show farmers on how to maximize yields from a small piece of land.
4	Participant asked that during Project implementation, our lands will be no go zone; does time means that our land is now for government?	MAAIF Officer responded that government was not going to take anybody's land, the purpose of the Project is to eradicate poverty in the community and your land will remain yours. The request to avoid going to the land is only for safety purposes, because huge equipment will be used and accidents are likely to take place. Therefore, to be on the safe side, people will be required to avoid going to the construction site which will be condoned off.
5	Participant asked whether the lawyer in the team was to help government to acquire their land or help the RAP consultant.	MAAIF Officer answered him that the lawyer was here to help guide on the legal matters arising out the land acquisition and he was here to help both MAAIF and PAPs. He again emphasized that the Project is for the people but not for grabbing their land.
6	Participant informed the meeting that one of	The RAP Consultant informed him that a member of

No.	Question/ Comment	Response
	the PAPs is sick and admitted in Kapchorwa hospital, how will he be part of the ongoing exercise?	RAP Consultant will draft a note for him to give the Participant or anybody next of kin the right to sign for him/ her. Even those PAPs who are in prison will be kin to represent them in matters regarding their land.
7	Participant complained that the Project affected his land and houses. Additionally, some houses have already fallen down. He was wondering when he will be compensated.	He was told that compensation cannot be done in piece meals all people affected will be compensated at once when CGV approves the RAP report, he was requested to be patient and wait until the appropriate time comes. Note: Upon consultation, it was ascertained that this particular person is outside the Project Site and his house fell down due to him abandoning his home. Therefore, no compensation will be given to him since he is not part those affected by the Project.

Source: RAP (MAAIF, 2018)

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

In formulation of the Project, the significance, the effects, the technical and economic feasibility/ relevance of Japanese Grant Aid toward the implementation of the Project are to be verified, thereby essential and optimum design of the planned facilities is proposed for obtaining proper fruit/outputs of the Project. The project purpose and output are shown as follows[1];

- Project Purpose : Increasing rice productivity in the Project Site by the construction of irrigation facilities
- Project Output : Construction of the irrigation facilities at the Project Site

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

The Project basic policy is to increase rice production through stable irrigation farming in the Project Site, where is divided into Bulambuli and Kween Districts by the Atari River. In addition, the Project pays consideration to the facility design to alleviate the flood damage of Atari River for reliable agriculture. Moreover, in accordance with the law in Uganda, the Protected Zone (referred to "2-2-3 Design on Protected Zone" for detail) on the both river sides shall be proposed for preservation of the river circumstance.

The soil type of the Project Site is characterized by the existence of Vertisol, called as "the Black Cotton Soil" in the Eastern Africa (hereinafter referred to as "BCS"). BCS is distributed in the downstream of the Project Site with 1 - 2 meter thickness from ground surface, soil in and around the area consists of Luvisol mainly, though. Hence, these soil mechanical conditions should be properly assessed for the facilities design. BCS is generally regarded as improper soil for the construction materials, while it is deemed as fertile soil in terms of rice cultivation. For upland cultivation, BCS contributes to farming with soil improvement mixing with fully-fermentation fertilizer, green manure, and microbial materials (liquid fertilizer).

2-2-1-2 Consideration of Natural Environmental Conditions

The necessary considerations for the facilities design in terms of natural environmental conditions of the Project Site are as follows:

(1) Meteorological Conditions

Annual average temperature at the Project Site ranges from 23 degrees Celsius in August to 26 degrees Celsius in February. The annual rainfall ranges from 1,050mm to 1,800mm, and the mean annual rainfall is 1,340mm, showing that the target area belongs to the heavy rainfall area. The rainy season continues from the end of March to November, especially, the heavy rain is observed from April to August, while the dry season continues usually from December to the middle of March. Since the rainfall at the Project Site is characterized by its intermittent pattern, and the construction works should be implemented even in the rainy season as far as the work safety is secured.

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[1] According to the FS, the product of irrigated rice is 3 ton/ha. Target product is expected to advance to 5 ton/ha by the construction and operation of irrigation facilities in the Project. The rate of advance is assumed as 1.7 times as well as the rate planned in the Uganda Rice Development Strategy, MAAIF., Since the present product of irrigated rice is 2.0 – 2.5 ton/ha from the result of interview survey in OD, potential of planned product is 3.4 – 4.3 ton/ha considering advance rate 1.7.

(2) Geological Feature of the Project Site

As mentioned above, Luvisol ranges widely in and around the Project Site. In addition, BCS is observed on the ground surface in the downstream of the Project Site with approximately 1~2 meter layer thickness. The soil is tough and hard in dry condition, while it expands with clayey character in wet condition. Hence, its durability almost disappears under high moisture condition, accordingly, it is regarded as an improper material for the construction works. N-value, which represents soil strength in terms of foundation of structures, is assessed at around 20 for Luvisols which has high percentage of clay, and the value should be regarded as the standard for foundation design of the facilities.

(3) Discharge of Atari River

The FS unveiled that there is correlation between the discharge of the Atari River and that of the Sipi Rivers, which is located on near the Atari River. The discharge of the Atari River was assumptively evaluated by using actually measured the Sipi River discharge. Basically, the results of flood discharge and drought discharge obtained during the FS are applied in the OD also. However, as for drought discharge, the correlation with the Sipi River discharge should be re-assessed, which could lead to review of the design discharge.

(4) Impact on Backwater from Wetland

In the Project Site, in addition to the flood from the Atari River in rainy season, back-water from the wetland in the downstream of the Project Site causes inundation in the part of the Project Site. Although the flood protection dyke to prevent the Project Site from the backwater was examined during the FS, the OD judged that it is difficult to drain water collected from the project area due to the geographical and hydraulic constraints, difference in elevation between the Atari river and neighboring farmland. Therefore, the original design regarding the protection dyke at the downstream side of the project site should be cancelled. As the result of the cancellation, agricultural conditions in the affected area from the backwater will not be changed from the current situation even after the implementation of the Project. For this, a firming approach, e.g., utilization of improved seeds of rice, potato, etc. could contribute to minimization of damage from backwater and to increment of farming products. This approach will be transferred to farmers through the activities in the technical support expected to start after several years.

2-2-1-3 Policy on Socio-economic Status

The Project Site is located in both Bulambuli and Kween Districts bordered by Atari River, and each district has tribes speaking different languages in different cultural norms. For smooth and safe implementation of the Project, stage-wise explanation to obtain entire consensus from all of the stakeholders should be conducted, to the governmental committees, namely, the Project District Coordination Committee (hereinafter referred to as “PDCC”) which consists of the Ministry of Agriculture, Animal Industry and Fisheries (hereinafter referred to as “MAAIF”), the Ministry of Water and Environment (hereinafter referred to as “MWE”) and related districts and a representative organization of farmers, namely, the Project Area Coordination Committee (hereinafter referred to as “PACC”). The procedure to gain understanding of the Project has been applied in the OD, and it is continuously to be practiced in the next stage as well.

As for the environmental impacts, the Project is classified as “Category A,” according to the JICA Guidelines for Environmental and Social Considerations, issued in April 2010 (hereinafter referred to as “the JICA Guidelines”), since the Project Site is regarded as a “Sensitive Area” considering that the

Atari River flows into Lake Opeta and Lake Bisina, which are registered in Ramsar Convention. On the other hand, JICA's Advisory Committee for Environmental and Social Considerations made a decision that significant impacts were not identified in the FS after several examinations and discussions. Then, in the OD survey, from the aspect of implementation of proper environmental and social considerations complied with the JICA Guidelines.

2-2-1-4 Policy on Construction and Procurement

(1) Standard, Code, etc.

The minimum wage and the working hour should be taken into account based on the Employment Act (2006) in Uganda, and the design of facilities and/or the control criteria for construction should be complied with the standards in Uganda as well. However, if there are unclear points and some items are not stipulated in such standards, the Japanese standards should be applied. In addition, the specifications, the quality control, the quality test and etc. should be complied with International Organization for Standardization (ISO) and/or Japanese Industrial Standards (JIS).

(2) Construction and Procurement Condition

The road network in Uganda is still under development, and many road construction works are on-going. Consequently, heavy equipment for the construction works is available from the local rental and/or the lease companies, in addition, the construction materials necessary for the Project are commonly used in Uganda. Therefore, they are easily procured in Uganda.

2-2-1-5 Policy on Employment of Local Contractor

In the capital city, Kampala, there are some construction companies which have working experiences with Japanese construction companies. Since the Project construction works do not require special arrangements and equipment, it is possible to employ such local contractors for the construction works under the quality control by the Japanese contractor.

2-2-1-6 Policy on Management and Maintenance for Facilities

In the Project Site, since the institutional irrigation farming has not been conducted, O&M of irrigation facilities and water management have been shouldered by the farmers, individually. Especially, official personnel of Bulambuli District and Kween District do not have a few opportunities to discuss proper water distribution. Currently, GoU is formulating a framework of irrigation activities, aiming at demarcation of responsibilities between the government and the farmers. In the framework, the government, MAAIF and MWE are in charge of design and technical support of construction of irrigation facilities. On the other hand, farmers are responsible for O&M of facilities on-farm level. However, since these activities have just begun, it is quite important to provide farmers' organizations with support of capacity development.

As the first step, capability development of the government officials in terms of O&M of irrigation facilities is needed, and the Project plans to implement the soft component activities along with the construction works. The planned contents of soft component are i) technical instruction for O&M of the target irrigation facilities, and ii) acquisition of knowledge and techniques of water management. In next stage, the officials who will participate in the soft component activities are expected to transfer their knowledge and experiences obtained by the soft component activities to the farmers for sustainable irrigation farming.

Therefore, in the activities of the soft component, technical instruction for O&M of the target irrigation facilities, water management, and teaching technique to farmers are transferred from a Japanese expert to officers responsible in MAAIF, MWE and members of PDCC in Bulambuli and Kween. Then, to guide and extend these techniques from these officers to farmers, sustainability of O&M of facilities and water management is secured.

2-2-1-7 Policy on Facilities Grade

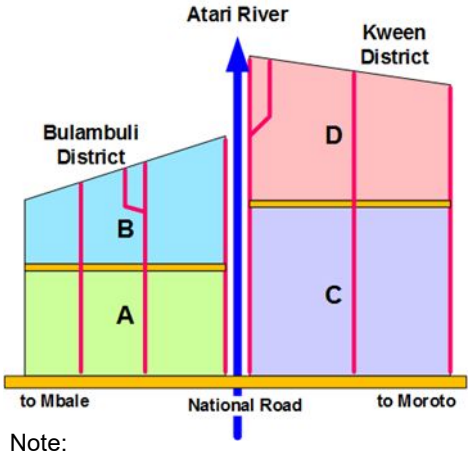
In order to achieve an increment of rice production in the beneficial area of approximately 680 ha, the facilities with intake, canal networks, road networks and river dyke should be properly designed for stable and even water distribution to the entire Project Site. In addition, the Project is expected to become a model project of irrigation development in Uganda, and the facilities should have high reliability and quality. Furthermore, they should be constructed by using local materials and equipment available in Uganda as much as possible so that the Project could be a reference case. Based on these concepts, some minor damages on the facilities should be manageable by the farmers under the presumption of lasting maintenance work. As a result, the proposed facilities should be designed as not to have excessively high specification.

In terms of protection against flood and back-water influence from wetland, the integrated plan considering entire watershed of the Project area should be proposed, because individual protection plans giving priority on protection of the project area only could give damages to outside of the Project Site, on the contrary. Therefore, it is necessary to consider the facilities design which can mitigate the effects of floods and back-water as much as possible. Furthermore, information of the area to be affected by flood and back-water should be shared among MAAIF, the farmers and other related parties. In the affected area, improvement of farming by introduction of foundation seeds can be considered as ones of measures to offset such damages.

2-2-1-8 Policy on Construction/Procurement Method, Project Period

It is planed that the construction works will be implemented in both dry and rainy seasons. Especially in the rainy season, the access to the Project Site will be difficult due to the road conditions, which can affect the transportation of construction materials. As one of the support from GoU to the Project, information of road and traffic status in the rainy season should be provided to the contractor through the related agencies.

In the Project, development of new farmlands is not planned, while the rearrangement of existing farmlands will be conducted. For minimizing the negative impacts on the current agricultural activities by the construction works, the area where construction works have been completed will be handed over to the land owners in sequence (see, Fig. 2-2-1-8-1). On the other hand, farming activities at the construction sites can be affected due to the traffic of construction vehicles in terms of safety. The explanation about stage-wise construction area and period when farmers can cultivate in their lands shall be provided in advance. The tentative construction schedule phased by area is shown in Table 2-2-1-8-2.

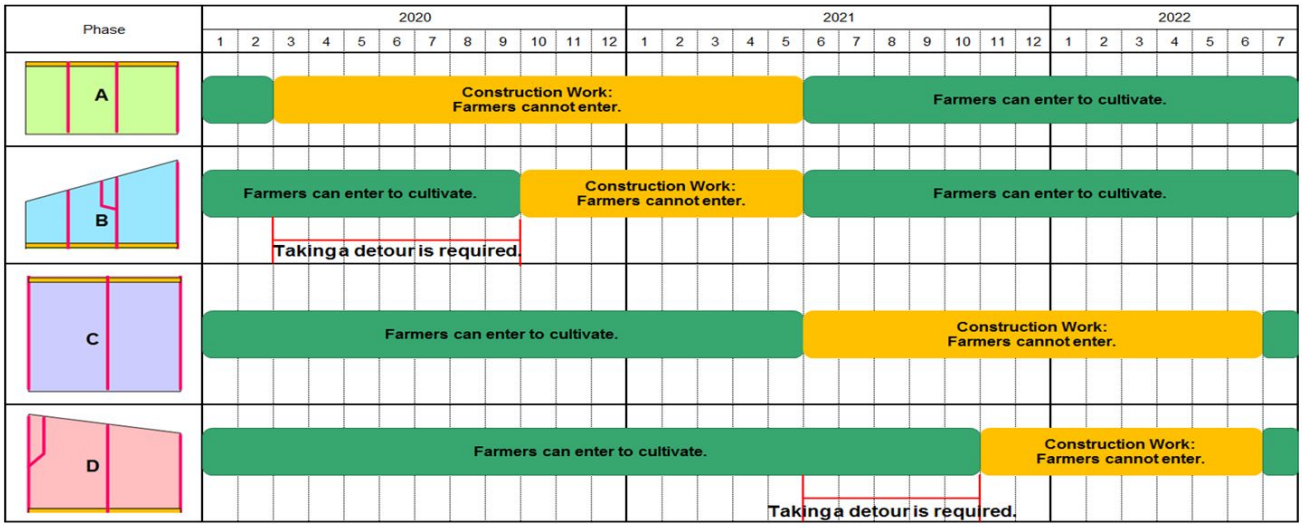


Note:
A: Upstream of Bulambuli District
B: Downstream of Bulambuli District
C: Upstream of Kween District
D: Downstream of Kween District
Source: JICA OD Team

Fig. 2-2-1-8-1. Phasing for Construction Works by Area

Regarding BCS which will be generated by the construction works, it is planned to return them to the farmlands because BCS is suitable for farming.

Table 2-2-1-8-1. Construction Schedule Phased by Area



Source: JICA OD Team

2-2-2 Basic Plan

2-2-2-1 Irrigation Water Requirement

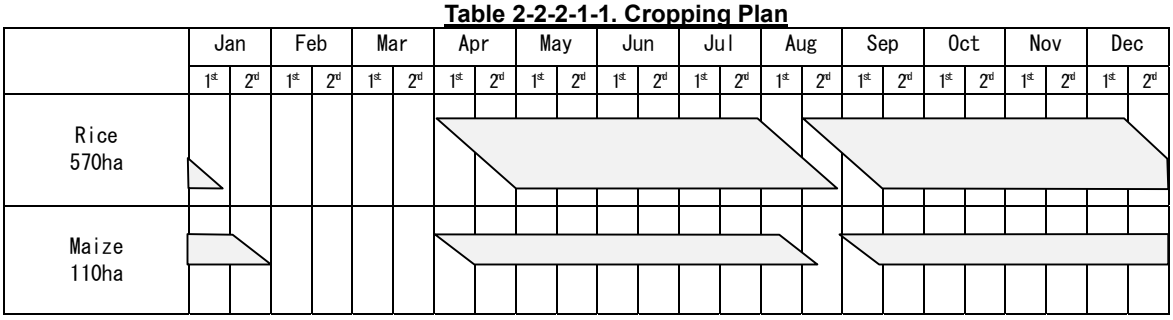
2-2-2-1-1 Cropping Plan

The main crops in the target area are rice, maize, bean and cassava. Popular rice varieties are Kaiso and Supa and the most popular variety is Kaiso which has relatively light fragrance. Those two varieties are cropped mixed with each other in the paddy field. In such situation, the Technical Support Project by the Government of Japan, namely, Promotion of Rice Development Project (hereinafter "PRiDe"), supports the activities of rice production increase, development of new varieties and purification of foundation seeds.

One of the wet-rice varieties supported by PRiDe is WITA-9. WITA-9, which has various advantages such as lodging tolerance (has single culm), disease tolerance, early harvest, many offshoot and high yield, is favorably impressed by farmers. Considering those situations, the cropping plan is to be developed on the assumption that early harvested varieties, growing period is 120 days, will be cropped in this project.

The discussion with the local farmers during the FS clarified that the farmers want to cultivate not only rice but also their staple food, maize in 110 ha (net) in the project area. In the FS, it is confirmed that the planned maximum irrigable area is 680 ha (net) from the water balance calculation, however, considering their demand, the following cropping plan is to be proposed.

Table 2-2-2-1-1. Cropping Plan



Source: The Project on Irrigation Scheme Development in Central and Eastern Uganda Atari Irrigation Scheme Development Project (February 2017), hereinafter referred to as “FS Report.”

2-2-2-1-2 Calculation of Required Irrigation Water

In case of paddy filed irrigation, the period of maximum water demand is corresponded to the high season of puddling. Thus, the puddling of the 1st term cropping should be completed before the month which maximum irrigation water can be taken. Maximum capacity of irrigation facilities is designed on the condition that the net irrigable area is 680 ha and effective rainfall is negligible, base on the calculation in the FS.

2-2-2-2 Design on Headworks

2-2-2-2-1 Basic Condition for Headworks Design

The location and structure of main intake facilities such as headworks and intake in Atari River are basically complied with those examined in the FS, but the following concepts and ideas should be introduced in the design of this survey from the viewpoints of enhancing the function and usability.

Table 2-2-2-2-1. Basic Concept of Intake Facilities Design

Facility	FS	Modified contents and concept in OD
Type of headworks	Gated weir：Two gates	Gate number is same as previous survey
Apron	✓ Floating type ✓ 0.5m-drpp height is designed on apron at gates. ✓ Apron edge at D.S. and U.S. gradually adjust to river bed.	✓ Floating type ✓ 0.5m-drop height is designed on apron between U.S. and D.S., which is adjusted by slope on apron surface in order to enhance the flashing capacity.
Intake	✓ Both sides: Every two gates	✓ Same as left contents
Spillway	✓ Both sides: Same design	✓ ditto
Fish ladder	✓ Both sides: Same design ✓ Separator type: Some separators generate various flow velocities in channel.	✓ Both sides: Same design ✓ Mild gradient type: Bolder to generate various flow velocities in channel, so separators are unnecessary.
O&M bridge（D.S.）	✓ Concrete type bridge ✓ Total width: 5m	✓ Concrete type bridge ✓ Entire width : 5m
O&M bridge（U.S.）	✓ Concrete type bridge ✓ Entire width: 5m	✓ Concrete type bridge for pedestrian and operation of intake gates. ✓ Entire width: 2m
De-silting basin (right and left)	✓ Deep depth basin.	✓ Wide width basin with shallow depth. ✓ Settled soils are removed by the man power, so approach road is designed

Source: JICA OD Team

Reviewing the vital design conditions such as the design flood discharge and design intake discharge in the FS, the adequacy of those conditions is confirmed therefore following values are consequently applied in this survey.

Table 2-2-2-2-2. Design Conditions

Conditions	FS	OD
Design flood discharge	38m^3/s	Same as previous survey
Design intake discharge	2.24m^3/s (Right：Kween1.20m^3/s, Left：Bulambuli1.04m^3/s)	Ditto
Maintenance flow discharge	0.171 m^3/s	Ditto

Source: JICA OD Team

(1) Design Flood Discharge

Return period for the design flood discharge was defined as 10 years in the FS. This return period seem to be shorter than typical periods which are commonly used to 50 years for headworks or 100 years for dam in Japan. In general, the long return period increases the flood discharge as well as the facilities scale.

The Protected Zone for preservation of river environment, which establishment is obligated in Uganda, was discussed in the FS. The FS team made a consensus with Uganda side on the optimum Protected Zone which defined from the viewpoint of environmental preservation and necessary river section for the flood discharge in 10-year return period. Accordingly, the design flood discharge in the OD set to be 38m^3/s in line with the FS.

(2) Design Intake Discharge

Reviewing the water balance calculation for the demand and the supply in the FS, the design intake discharges are judged to be the same as the previous design which are 1.04m^3/s for left side and 1.20m^3/s for right side respectively. Furthermore, the design water elevation at headworks is set at WL. 1,076.4m, based on the hydraulic examination for required canal bed elevation and the water head (water energy).

(3) Design for River Maintenance Flow

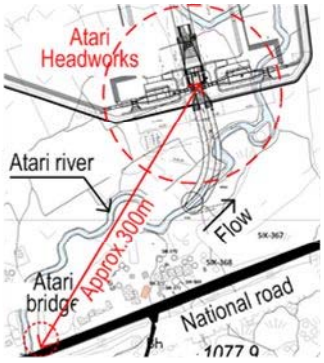
FS team built the consensus that the discharge for maintenance flow was determined to 10-year

probable drought discharge through a series of discussion on river environmental preservation. Consequently the discharge for maintenance flow set to be 0.171m^3/s as the FS.

2-2-2-2-2 Location of Headworks

For selecting the location of headworks, the following points should be taken into account:

- To secure the irrigable and necessary water head for distributing irrigation water to beneficial area;
- To avoid irrigation suspended during construction works; and
- To adjust the headworks facilities to the alignment of the dykes provided by Protected Zone along the river banks.



Source: JICA OD Team

Fig. 2-2-2-2-1. Location of Headworks

Based on the points above, the designed headworks in the FS was located at the head of beneficial area without demanding excessive flection on the dykes alignment. In addition, since the location was proposed on the existing farmland, not on the Atari river bed, irrigation suspended was restrained minimal during construction works. As a result of this review, the location proposed in the FS is confirmed feasible and appropriate.

The design flood discharge designed in the FS is decided by the analysis of comparison, which are shown the large difference of discharge (the observed unit discharge by the Atari river is far smaller than the examined one at Soroti meteorological observation), between the unit rainfall examined by the rainfall at Soroti meteorological observation located at the upstream of site and, the observed one in the Atari river discharge and rainfall. The FS deem to assess that this phenomenon is caused by the theory which is equally rained in the catchment area with the observed rainfall. However, actual river capacity is smaller than the discharge examined by Soroti meteorological observation due to the narrow section of Atari river, and having the rainfall observed at Soroti meteorological observation equally apply provides the trend of overestimated discharge in terms of comparison of the specific discharge with the other rivers near the Atari river, are assessed. Accordingly, applied the design flood discharge, 38m^3/s is defined as the reliable value assessed by means of the proper consideration of actual river status and the comparison with the specific discharge with the other rivers near the Atari river.

2-2-2-2-3 Type of Headworks

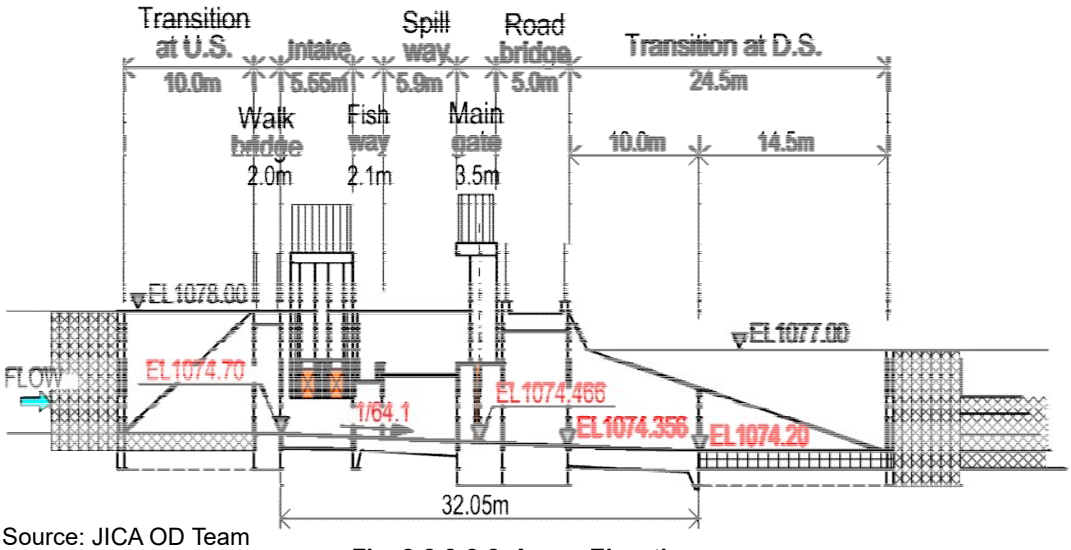
The landscape of target beneficial area has gentle slope from the headworks toward the downstream. The required intake water elevation (WL1,076.4m), lifted up the river water level by weir closes to the ground elevation beside headworks (approx. EL1,077~1,078m). In the FS, considering both securing the necessary section area for the safe release of flood flow and adjusting the section size both at normal and flood situations, the movable weir is proposed for appropriate weir type. Following the examination in the FS, the steel movable weir is applied in the OD.

In general, long-span gates are applied to the movable weir for smooth discharge of flood flow, however, considering that the operation of headworks takes charge of discharge control, short-span gates have advantages from the view point of discharge control. Furthermore, short-span multiple gates can reduce risk of troubles such as malfunction. In the FS, 6.5 meter-width weir was designed to adjust the section to natural river section between the upstream and the downstream and the OD survey follows this width. Since the number of gates has an influence on the easiness of the gate

operation and the risk reduction of management, two gates should be placed as well as the design in the FS. The gate operation is done by the manual from the viewpoint of river scale.

2-2-2-2-4 Examination of Elevation of Main Structures of Facilities

(1) Elevation of Apron



Source: JICA OD Team

Fig. 2-2-2-2-2. Apron Elevation

(2) Top Elevation of Main Gates

In general, the top elevation is determined adding 0.1m, which is freeboard for wave affection on water level. Herein, intake water elevation is EL.1,076.40m and the bottom elevation of gates are EL.1,074.466m. Given that the overflow depth at the crest of spillway, that freeboard 0.3m shall be taken into account (refer to "(2-2-2-2-10) Spillway"). Therefore, required gates height shall be 2.235m which is calculated adding 1.935m (EL1,076.40m - EL1074.466=1.934→1.935m) plus 0.3m freeboard at crest of spillway. Accordingly, gates top elevation are determined as EL1,076.701m.

(3) Top Elevation of Lower Pier

Top elevation of lower pier is set to be the same as the main gates elevation, EL1076.701m.

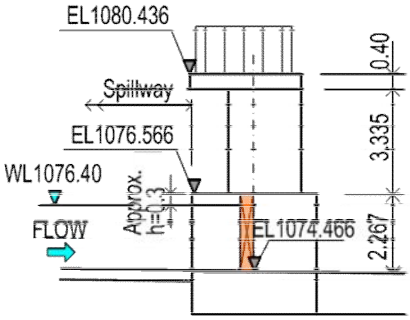
(4) Head Elevation of Upper Pier

Head elevation of upper pier is taking into account an extra 0.5m height for the gate installation works, which is added to the bottom elevation of gate in the full open position.

In general, bottom elevation of gate in the full open position is designed taking into account freeboard for the design flood level, but in the condition of this headworks, design flood level ($38m^3/s$ flood flow) is lower than design intake water levelEL1,076.15m (< EL1,076.4m).

Hence, height of upper pier is possible to be lower when freeboard is added on flood level, but considering damage from flowing garbage including raft, 60cm freeboard shall be added to head elevation of lower pier, EL1,076.701m and bottom elevation of gate in the full open position becomes EL1,077.301m. Accordingly, head elevation of upper pier is derived from the following calculation.

Bottom elevation of gate in the full open position: EL1,077.301m + Gate height: 2.235m + Freeboard for installation works: 0.5m + Thickness of top slab: 0.4m ＝EL1,080.436m.

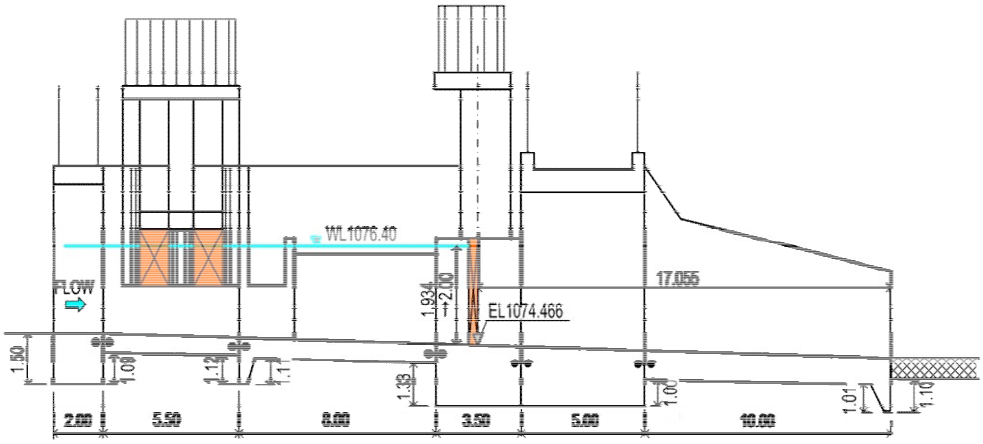


Source: JICA OD Team

Fig. 2-2-2-2-3. Head Elevation of Upper Pier

2-2-2-2-5 Examination of Apron

On the consideration of apron, the hydraulic computation is done to assumed cross section which designed from the considerations mentioned above.



Source: JICA OD Team

Fig. 2-2-2-2-4. Assumed Structural Section on Headworks

Table 2-2-2-2-3 illustrates the result of hydraulic computation for the design flood discharge (38m^3/s).

Table 2-2-2-2-3. Result of Hydraulic Consideration

	D.S. of headworks (Edge of D.S. apron)	Gate point of headworks (No.0)	U.S. of headworks (Edge of U.S. apron)
Q: discharge (m3/s)	38	38	38
A: flow area (m2)	26.63	9.4	13.85
v : velocity (m/s)	1.44	4.0	2.7
h : water depth (m)	2.09	1.67	2.13
Z: water level (m)	1076.29	1076.15	1076.83
Fr: Froude number	0.32	1.00	0.60

Source: JICA OD Team

(1) Length of Apron

Apron length is designed based on "Design Standard of Headworks in Japan". As a result of geological survey, the clay layer which N-value is around 20 is observed at the expected basement elevation of headworks, hence, that layer is able to regard as reliable foundation layer. In general, clay layer is less concern about the piping, but in this area BCS is partially observed. Therefore, from the viewpoint of the safe side, intermediate value of Bligh's creep coefficient on the settling materials is adopted. Since the intermediate value is (13.5 = (18+9)/2), C=12, equivalent to Bligh's coefficient of Coarse sand is

applied to this examination.

1) Examination of Bligh's formula

$L = 0.9 \cdot C \cdot \sqrt{D1}$

where L : Length of downstream apron (m)

C: Bleigh's coefficient 12 (Coarse sand)

D1: Height from the surface of downstream apron to the crest of the weir 2.00 (m)

$L = 0.9 \times 12 \times \sqrt{2.00} = 15.27m$

Table 2-2-2-2-4. Bligh's C and Lane's weighted creep ratio C'

Foundation	Bligh's C	Weighted
Creep ratio C'		
Silt or precipitated mud	18	8.5
Fine sand	15	7.0
Medium sand	—	6.0
Coarse sand	12	5.0
Fine gravel	—	4.0
Coarse gravel	—	3.5
Sandy gravel	9	—
Cobble stone with Gravel	—	3.0
Rocks with Cobble stone and gravel	—	2.5
Rocks with gravel & sand	4-6	—

Source: "Design Standard of Headworks in Japan"

2) Length of downstream apron

Required apron length is more than 15.27m by Bligh's formula, hence, the target length from the gate to edge of downstream apron is decided 17.055m considering adjustment to the road bridge and bed protection. This length consists of three sections, 2.055m of gate to pier edge, 5m of Road Bridge and 10m of downstream apron.

(2) Examination on Piping

Piping is examined on assumed section adopting from Bligh's and Lane's formulas on "Design Standard of Headworks in Japan." It is concluded from the following examinations that assumed section is safe against piping.

・Bligh's Method

$S \geqq C \cdot \Delta H$

where S : Length of path of percolation measured along the foundation face of the weir (m)

$\Sigma V = 8.17m$

$\Sigma H = 34.00m$

$S = \Sigma V + \Sigma H = 8.17m + 34.00m = 42.17m$

C : Bligh's coefficient 12 [previously cited]

ΔH : Maximum difference of water head between upstream and downstream sides 2.00 (m)

$12 \times 2.00 = 24.00$ (m) $\leqq$ S = 42.17 (m) → OK

・Lane's Method

$L \geqq C' \cdot \Delta H$

where L : weighted length of percolation path (m)

$L = \Sigma V + 1/3 \cdot \Sigma H = 8.17m + 1/3 \times 34.00m = 19.50m$

V : Length of percolation path to vertical direction (45° or steeper) 8.17 (m) : the same as by Bligh's formula

H : Length of percolation path to horizontal direction (45° or gentler) 34.00 (m) : the same as by Bligh's formula

C' : Weighted creep ratio 5.0 (coarse sand: former cited)

ΔH : Maximum difference of water head between upstream and downstream sides 2.00 (m)

$5.0 \times 2.00 = 10.00$ (m) $\leqq$ L = 19.50m → OK

(3) Examination on Apron Thickness

The examination on apron thickness is derived from "Design Standard of Headworks in Japan" It is concluded that the safety of assumed section is secured from the following examinations.

$t = 4/3 \times (\Delta H - Hf) / (\gamma - 1)$

where t : thickness at an assumed point（m）

ΔH : Maximum difference of water head between upstream and downstream sides 2.00（m）

Hf = ΔH / S × S' : Head loss of seepages up to an assumed point（m）. Herein, at D.S. of gate

γ : Specific weight of the material of weir body and apron 2.35

4/3 : Safety factor

S : Total designed length of percolation path 42.17（m）: the same as by Bligh's formula

S' : Length of percolation path to any point（m）: Percolation pass from the edge of headworks to D.S. of gate 18.67m

・Lane's Method

$$HfA = \frac{2.00}{42.17} \times 18.67tf = 0.89 \ (tf)$$

$$TA = \frac{4}{3} \times \frac{2.00 - 0.89}{2.30 - 1} = 1.14 \ (m) \leqq 1.71 \ (m) \quad OK$$

2-2-2-2-6 Examination of Bed Protection

(1) Examination on the Length of Bed Protection

Scale of bed protection is determined considering prevention for disturbing and erosion of river bed. Examination of its scale and length should comply with Bligh's formula on "Design Standard of Headworks in Japan".

$L = Lb - La$

$Lb = 0.67 \cdot C \cdot \sqrt{(Ha \cdot q)} \cdot f$

where L : Length of seed protection（m）

Lb : Total length to protect including the length of the apron "La" and that of bed protection "L"（m）

La : Length of downstream apron（m）

Ha : Maximum difference of water level between upstream and downstream 2.00（m）(On the safe side, gate position is assumed to be just before opening)

q : Discharge per unit width at design flood discharge（$Q = 38 m^3/s$）（m3/s/m）

B=6.5m Design channel width（On the safe side, target width is 6.5m of minimum width at downstream of gate）

$q = Q / B = 38 m3/s \div 6.5m = 5.85 \ m^3/s/m$

f : Safe ratio 1.5 for movable weir

C : Bligh's coefficient by type of foundation ground 12

Then, $Lb = 0.67 \times 12 \times \sqrt{(2 \times 5.85)} \times 1.5 = 41.252m$ (required length including apron and bed protection)

La = 17.055m （Total length of apron）

L = 41.252m – 17.055 = 24.197 m →25m

Accordingly, length of bed length is determined as 25m.

(2) Examination of Blocks for Bed Protection

Unit weight of a block is determined through the examination of stability per each block in conformity with the following formula described in "Standard Design on Head works in Japanese."

According to the hydraulic analysis examination at flood discharge ($38m^3/s$), the velocity at the downstream of headworks is approximately 4m/s, hence, enough block durability is requested against this velocity. Since the block is manufactured by cast-in-place concrete, universal cross-shaped block is applied to this type of structure.

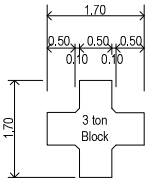
$$Ua = \left(\frac{2g \cdot W}{3.19 \cdot A} \right)^{1/2}$$

where A : Contact area of flow water（m2）

W : Weight of each block（t）

Ua : Allowable flow velocity （m/s）

Table 2-2-2-2-5. Weight of a piece of block and allowable flow velocity

Specification of block	3 ton
Size of block (m)	
Weight of block	2.4ton
Contact area of flow water	1.70 x 0.35 = 0.595 m2
Maximum allowable velocity	4.98 m/s

Source: JICA OD Team

Maximum allowable velocity of block is decided as 4.98 m/s through the examination in the Table 2-2-2-2-5. This velocity satisfies the maximum allowable velocity of 4m/s.

2-2-2-2-7 Examination of Intake

(1) Evaluation of elevation of Inlet

To prevent sand influx into inlet, elevation of inlet is positioned at 1m higher than upstream apron i.e., EL1,074.70m＋1.0=EL1,075.70m.

(2) Evaluation of scale of Inlet

1) Examination of width of inlet

Inlet width of intake is derived from the following formula based on "Design Standard of Headworks in Japan" and the target approach velocity of intake is commonly applied to 0.6m/s～1.0m/s. In this regards, target approach velocity is designed as 0.6m/s of the lower limit velocity to alleviate soil influx to intake as much as possible. Since intake volume of Bulambuli and Kween District are $1.04m^3/s$ and $1.20m^3/s$ respectively, intake scales are slightly different.

In the intake design of the FS, two intake gates of Bulambuli and Kween District are planned to install. Installation of one gate with long span is assume to have difficulties for operating gates accurately considering that main body of gate operation is done by the farmers, on the contrary, multiple gates with short-span alleviate the risk of malfunction, which is the advantage on maintenance works. Therefore, the OD design is in conformity with above-mentioned concepts and two gates are installed at inlets both Bulambuli and Kween districts respectively with the following scales.

$B = Q / (h \cdot v)$

where B : Required inlet width（m）
Q : Intake discharge（m3/s）：1.04m^3/s、1.20m^3/s
v : Approach velocity（m/s）：0.6m/s
h : Intake water depth (m)：0.7m = EL1076.4m – EL1075.7m

Table 2-2-2-2-6. Examination of intake scale

	Bulambuli(left bank)	Kween(right bank)
Q (m^3/s)	1.04	1.20
v (m/s)	0.60	0.60
h (m)	0.70	0.70
B (m)	2.50	2.85
B/2 (m)	1.25	1.425
b (m)/ 1 gate	1.30	1.50

Source: JICA OD Team

2) Height of inlet

Height of inlet is determined including required freeboard on design water level to avoid flowing full water level. Freeboard is derived from the following formula on "Design standard of canal works in Japan" and height of inlet is decided.

$$Fb = 0.07d + \beta hv + hw$$

where d : Water depth at target discharge：0.70m
hv : Velocity head：v=0.6m/s, hv=$V^2/2g$=0.0.183m
β：0.5
hw：5cm

Table 2-2-2-2-7. Examination of Height of inlet

	Bulambuli and Kween
h(m)	0.70
v (m/s)	0.60
hv (m)	0.0183
β (m)	0.50
hw (m)	0.05
Fb (m)	0.108→0.15
H (m) : inlet	0.70+0.15=0.85→1.00m

Source: JICA OD Team

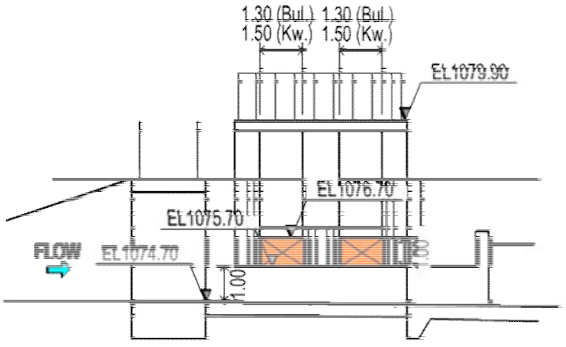
Accordingly, required height is 0.85m, but the height of inlet is decided as 1m from the viewpoint of easiness of maintenance works.

3) Top Elevation of Pier of Intake gate

Top elevation of pier of intake is decided to add 0.5m freeboard for gate installation works to the bottom elevation of gates full opening, which is the same as ground elevation (EL1,078.0m).

Top elevation of intake pier is derived from the following calculation.

Gate bottom elevation EL1,078m + Gate height 1.00m + freeboard for installation works 0.5m + Thickness of top slab 0.4m ＝EL1,079.90m



Source: JICA OD Team

Fig. 2-2-2-2-5. Front View of Intake

2-2-2-2-8 De-silting Basin

In the design of de-silting basin, flashing by gravity force is not possible to apply to this headworks due to the constraints of topographic condition, because landscape around this facilities do not have required altitude difference between ground level of facilities and river bed at the outlet of flashing conduit. Therefore, in the OD, structural design should be modified for the easiness of removal works of settled sand by manpower. Designed structure of de-silting basin is not having deep depth but with wide width to improve accessibility of vehicles and labors. De-silting basin structure is designed in

response to "Design Standard of Headworks in Japan".

(1) Width of De-silting Basin

Based on "Design Standard of Headworks in Japan", de-silting basin is designed as the type of non-gradient on surface of basement. Consequently, the following formula is applied to calculation of basin width. The water depth from surface of settlement (h), which is used in the calculation, is a difference between 1.4m of total water depth from intake water elevation (H) and 0.5m from averaged depth of sand settlement (W).

$$B = Q / (h \cdot Uc)$$

where B : Width of de-siting basin（m）
Q : Design discharge for de-silting channel : 1.04m^3/s (Bulambuli)、1.20m^3/s (Kween)
h : Water depth from surface of settlement 0.9 m
Uc: Critical tractive velocity of a target sand particle（m/s）

$$Uc = U_{*}c \cdot R^{1/6} / (n \cdot g^{1/2})$$

where R : Hydraulic mean depth when target sand particle is settled completely
n : Roughness coefficient on surface of settlement 0.018
g : Acceleration of gravity 9.81（m/s^2）
$U_{*}c^2$:Critical friction velocity of a target sand particle 8.41 $dm^{11/32}$ $\times 10^{-4}$
dc : Target sand particle 0.3mm

Table 2-2-2-2-8. Examination of Width of De-silting Basin

	unit	Bulambuli intake	Kween intake
Q : design intake velocity	m^3/s	1.04	1.20
d : Min. size of settled soil	mm	0.30	0.30
c : Critical friction velocity	cm/s	1.587	1.587
H: Total water depth	m	1.40	1.40
W : Depth of settlement	m	0.50	0.50
A : Area of flow	m^2	4.05	4.59
P : Wetted perimeter	m	6.30	6.90
R : Hydraulic mean depth	m	0.643	0.665
n : Roughness coefficient	-	0.018	0.018
g : Acceleration of gravity	m/s^2	9.81	9.81
Uc : Critical tractive velocity	m/s	0.262	0.263
Br : Required width of basin	m	4.42	5.07
B : Applied width of basin	m	**4.50**	**5.10**

Source: JICA OD Team

(2) Length of De-silting Basin

Length of de-silting basin is determined based on the FS, which is derived from following formula.

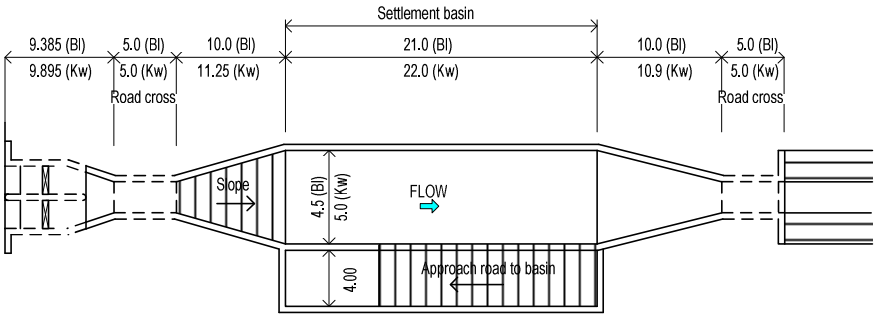
$$L = 20 \sqrt{Q}$$

where L : length of de-silting basin（m）
Q : Design discharge for de-silting channel : 1.04m^3/s (Bulambuli)、1.20m^3/s (Kween)

Table 2-2-2-2-9. Examination of Length of De-silting Basin

	unit	Bulambuli intake	Kween intake
Q : design intake velocity	m^3/s	1.04	1.20
Lr : Required length of basin	m	20.4	21.9
L : Applied length of basin	m	21.0	22.0

Source: JICA OD Team



Note) Flow direction on Kween side is reversal for Bulambuli side, but in here shows on same direction expediently.

Source: JICA OD Team

Fig. 2-2-2-2-6. General Plan of De-silting Basin

2-2-2-2-9 Examination of Fish Ladder

The separate wall type was applied in the FS, however, type of fish ladder is modified to mild gradient type embedded stone to canal bed to prevent inhibition of flow by obstructions like garbage. This type is expected to reduce maintenance cost and works. Width of fish ladder is 1.5m as the same as the FS design and the basement elevation is designed to secure the discharge0.171m^3/s (gross discharge of both sides) for river maintenance flow at the design intake water elevation, WL 1,076.4m. Examination should be calculated by Govinda-Rao formula.

$$Q = C \cdot B \cdot h^{3/2}$$

where Q : Design discharge : （m^3/s）

C : Coefficient of discharge :1.642 $(h/L)^{0.022}$ $(0<h/L\leqq 0.1)$

1.552+0.083 (h/L) $(0.1<h/L\leqq 0.4)$

1.444+0.352 (h/L) $(0.4<h/L\leqq 1.5\sim 1.9)$

1.785+0.237 (h/W) $(1.5\sim 1.9<h/L)$

h : Water depth of overflow （m）0.11 m

h/L = 0.11, when L : Crest length（m）: 1m

B : Width of wire （channel）（m）: 1.5m

W : Height of weir（m）

When overflow depth is 0.11m, coefficient of discharge is C= 1.561.

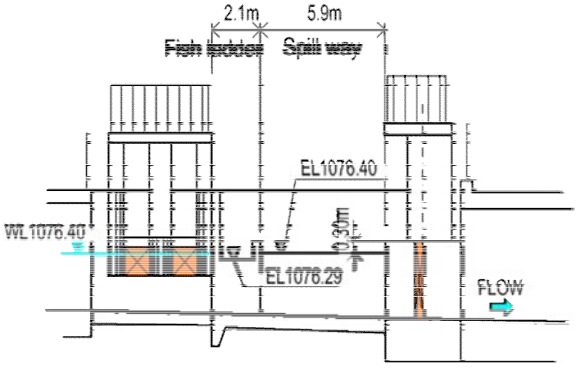
Therefore, Q=1.561×（1.5m×2 sides）×0.11$^{3/2}$=0.1708 → 0.171m3/s

and the crest elevation of fish ladder is WL 1,076.4m－0.11m＝EL1,076.29m

2-2-2-2-10 Examination of Spillway

Spillway is placed based on the result of the examination of the FS. However, since intake water elevation is modified to EL1,076.4m due to the examination of required water head of canal, crest level of spillway is modified to EL1,076.4m as well, and overflow depth for the examination of spillway is 0.3m, the same as the FS. Accordingly water elevation of overflow on the crest is 1,076.7m.

In the FS, 4.76m^3/s was defined as design discharge



Source: JICA OD Team

Fig. 2-2-2-2-7. Width of Fish Ladder and Spillway

from 95-day probable discharge, hence, examination of crest length of spillway shall be take into consideration the discharge from fish ladder.

Since overflow depth of 0.41m which is derived from EL1,076.7m of overflow elevation, discharge from fish ladder is calculated to be $Q=1.588 \times (1.5m \times 2sides) \times 0.41^{3/2}=1.251m^3/s$ by above-mentioned Govinda-Rao formula. Therefore, target design discharge of spillway for examination is $4.76m^3/s - 1.25m^3/s = 3.51m^3/s$. Applied formula for the examination is in conformity with the FS.

$$Q= C \cdot L \cdot h^{3/2}$$

where Q : Design discharge : $3.51m^3/s$
C : Coefficient of discharge 1.8
L : Required crest length of spillway (m)
h : Water depth of overflow 0.3m

Required total crest length of spillway is $L = Q / (C \cdot h^{3/2}) = 3.51 / (1.8 \cdot 0.3^{3/2}) = 11.867m$, hence, the length on each side is 5.9m derived from $11.867m \times 1/2 = 5.934m$.

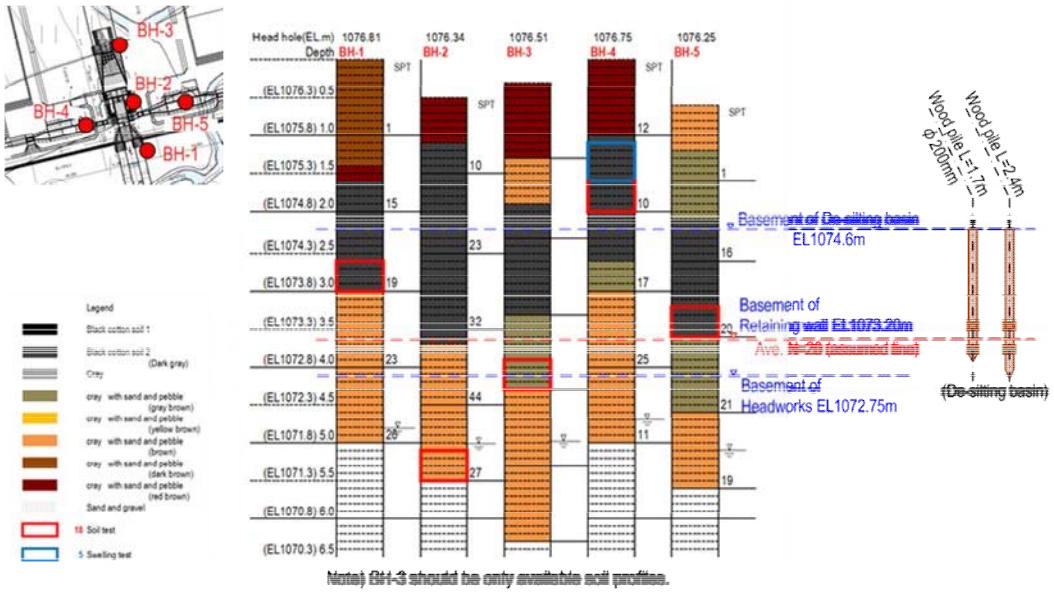
2-2-2-2-11 Examination of Foundation

Foundation of headworks is considered by an evaluation of the boring result in geological survey. Soils around headworks are mostly categorized into clay, hence, N-value of clay foundation layer is requested over 20 which is commonly assessed as reliable layer. The foundation type is decided from the consideration of the reliable layer.

Basement elevation of headworks and maintenance bridges across river at the upstream and the downstream are ranged from EL1,073.2m to EL1,072.7m considering the apron thickness and elevation approaching to river bed. As a result of evaluation of BH-1 and BH-2 which are drilled around headworks, soil type of EL1,073.2m~EL1,072.7m are categorized to clay with sand and gravel and its N-value is mostly over 20. Accordingly, the direct foundation (raft foundation) is applied.

Basement of intake and de-silting basin become higher than river bed level to avoid sand intrusion to intake water, hence, the basement level is EL1,075.2~EL1,074.5m. Geological profiles of BH-4 (Bulambuli side) and BH-5 (Kween side) illustrates geological features respectively. Since both boring logs indicates that N-values at the elevation of both basement are 10~15, the pile foundation is applied to secure stability of these facilities. Pile tails are planned to reach at target foundation layer lied approx. EL 1,073.8m obtained more than 20 N-value. In addition, wooden pile is adopted from the viewpoint of its easy availability. Pile diameter is φ200mm and pile tails is embedded the same length of plie's diameter into target layer.

Basement of retaining walls is placed at the same elevation as headworks and O&M bridge, hence, target layer obtains more than 20 N-value. The direct foundation (raft foundation) is applied as well.



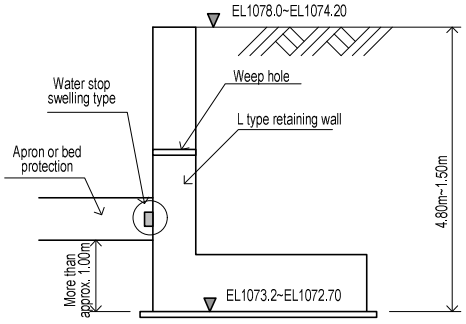
Source: JICA OD Team

Fig. 2-2-2-2-8. Geological Profile of Boring and Foundation Plan

2-2-2-2-12 Examination of Retaining Wall

Retaining walls at the upstream and the downstream of the headworks shall be L-type wall considering facilities layout in construction area of headworks, especially the connection with apron and bed protection. The swelling type water-stop is placed at the part contacted with apron to prevent water leakage.

Furthermore, basement of retaining wall shall be placed lower than the basement of apron and bed protection, which embedded depth is 1.0m.



Source: JICA OD Team

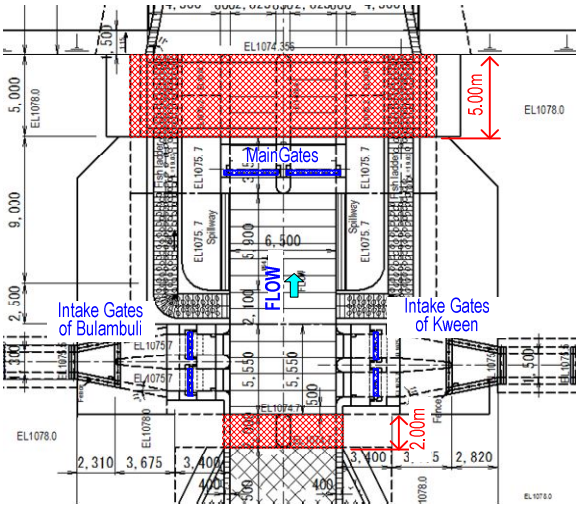
Fig. 2-2-2-2-9. L-type retaining wall

2-2-2-2-13 Examination of O&M Bridge

In the FS, O&M bridges were planned at the upstream and the downstream respectively, hence, the OD design is in conformity with that concept. Although, in the FS design, both bridges were designed as 5m width, these widths are reconsidered from the view point of rational design taking into account the role of each bridge.

Purpose of the downstream bridge is assumed to be crossing river, gates operation of headworks and maintenance works (painting and repair). In particular, maintenance works are necessary for vehicles to park on the bridge, hence, required width of bridge at downstream is 5m.

Role of the upstream bridge is assumed to be mainly gates operation of both inlets, hence, pedestrian



Source: JICA OD Team

Fig. 2-2-2-2-10. Layout of O&M Bridge

and/or motorcycle etc. are main traffic of the bridge. In addition, the vehicles for gates operation and maintenance works can be parked at the back yard of intake gates and do not need to park on the bridge. Therefore, required width of bridge is designed for the pedestrian and motorcycle and 2m width.

2-2-2-3 Design on Protected Zone

2-2-2-3-1 Background of Protected Zone

"The National Environmental (Wetlands, River Banks and Lake Shores Management) Regulations (2000)" (hereinafter referred to as "The National Environmental Regulation") stipulates the establishment of the protected zone along rivers to prevent indiscriminate land development surrounding wetlands and/or river. Additionally, from the viewpoints of flood management and environmental conservation, no activity has permitted in protected zones without permission by the Executive Director of NEMA, except specified activities to be allowed in "the National Policy for the Conservation and Management of Wetland Resources (1995)[1]."

Article 29 (1) and (2) of "The National Environmental Regulations" stipulate the Protected Zone as follows;

(1) The rivers specified in Sixth Schedule (see, Table 2-2-2-3-1) to these Regulations shall have a protection zone of one hundred meters from the highest water mark of the river.

(2) Rivers not specified in the Sixth Schedule shall have a protected zone of thirty meters from water mark of the river (see, Table 2-2-2-3-2 a)).

Table 2-2-2-3-1. Rivers Listed in Sixth Schedule

No.	Name of River	No.	Name of River
1	R. Nile from Lake Victoria to Lake Albert	11	R. Semliki
2	R. Aswa	12	R. Mubuku
3	R. Katonga	13	R. Mayanja
4	R. Nkusi	14	R. Sezibwa
5	R. Kafu	15	R. Malaba
6	R. Rwizi	16	R. Sipi
7	R. Kagera	17	R. Namatala
8	R. Mpanga	18	R. Sironko
9	R. Manafwa	19	R. Muzizi
10	R. Mpologoma	20	R. Nabuyonga

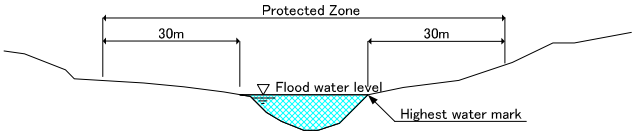
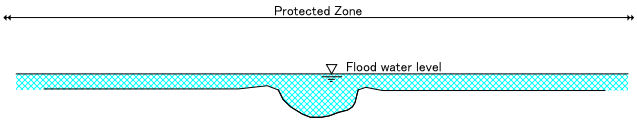
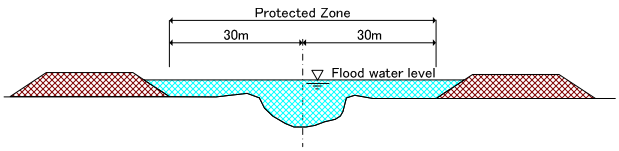
Source: Sixth Schedule, "The National Environmental (Wetlands, River Banks and Lake Shores Management) Regulations (2000)"

While JICA Guidelines regulates the basic principles of compliance with domestic laws, there are challenges for the establishment of Protected Zone based on the regulations in Uganda; 1) the method of measuring highest watermark of rivers is not clarified, and 2) it is not practically possible to identify the highest watermark of the river level, since the floods easily overflow the narrow cross section of the Atari River (see Table 2-2-2-3-2 b)).

During the FS stage, the series of the meeting of Joint Coordination Committee and Joint Technical Committee (hereinafter referred to as "JCC" and "JTC," respectively) were held with the relevant ministries including NEMA. As the results, the policy which the area of Protected Zone is 30m from the hypothetical centerline of river was applied in Atari area (see Table 2-2-2-3-2 c)).

[1] As the Specific Guidelines in the policy, Traditional Used and Access Rights, Water Utilization, Papyrus Harvesting, Traditional Aquaculture and Fish Ponds, Grazing of Cattles, etc. are mentioned to be allowed, while Agricultural Activities are not allowed.

Table 2-2-2-3-2. Considerations for Establishment of the Protected Zone

Outline of the Considerations	Illustration Drawing
a) The National Environmental (Wetlands, River Banks and Lake Shores Management) Regulations (2000) In case of the Atari River, environment of riverside is protected by establishing Protected Zone which has 30m width from the highest watermark of the rivers. However, the concrete measurement method of the highest watermark of the rivers is not mentioned in any regulation, guidelines, etc. in Uganda.	
b) Actual Situation of the Atari River (During flood) It is not practically possible to set the Protected Zone based on the idea of the Regulation (2000), on the ground that narrow cross section of the Atari River and gentle topographic condition surrounding the river make floods spread widely.	
c) Conclusion at JCC/ JTC during the FS Stage Flood flow down in the Protected Zone safely surrounded by river dyke located 30m away from the hypothetical centerline of the Atari River to both banks. However, for avoiding disturb of the original (existing) river course of Atari, some adjustments of width of the Protected Zone will be considered while keeping the minimum width of 30m.	

Source: JICA OD Team

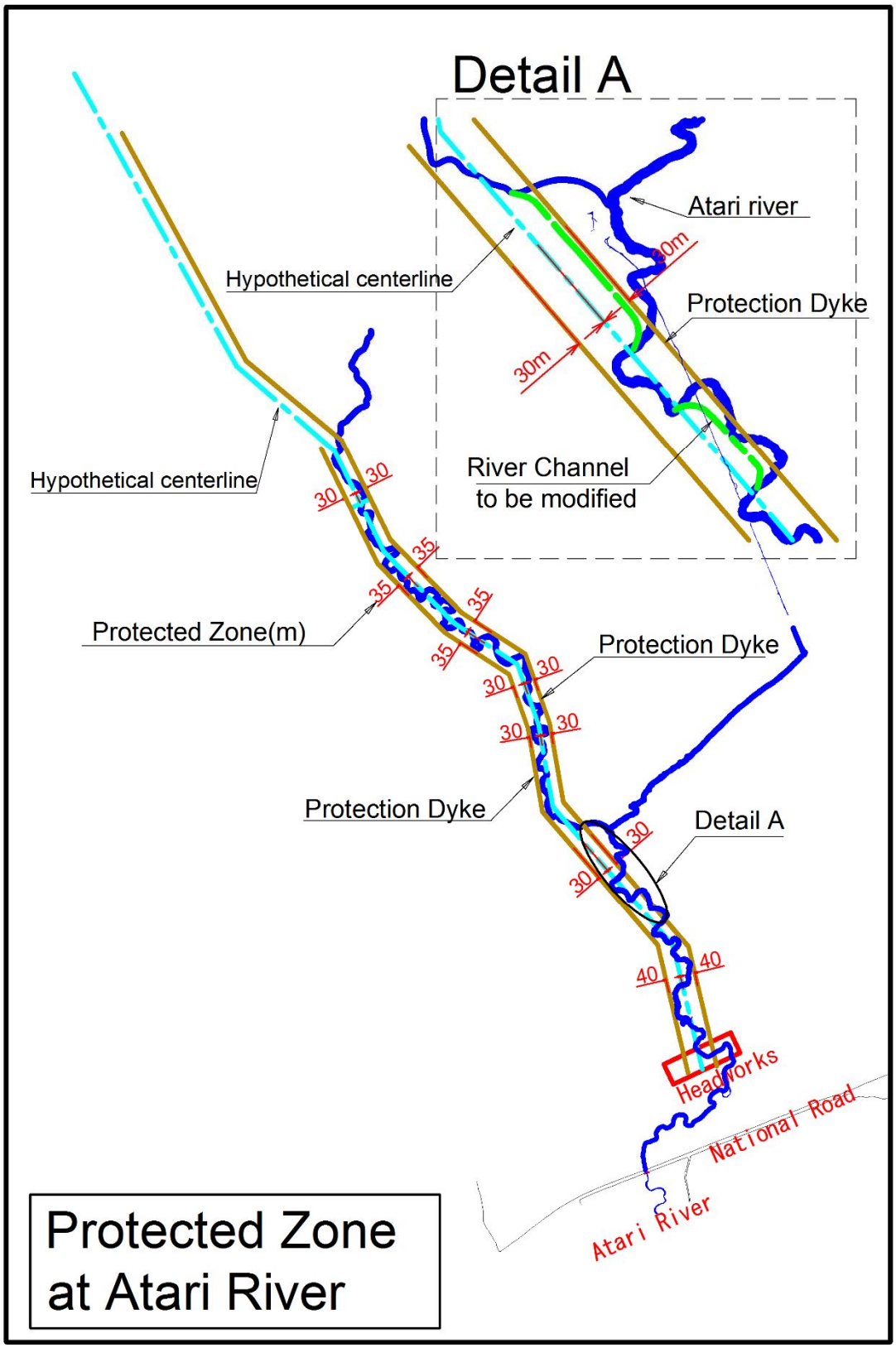
2-2-2-3-2 Determination of Base Point and Range of Protected Zone

Through the above-mentioned process, the method of setting the Protected Zone was reconfirmed in the 5th JTC held on August 29, 2017. The approved policies are as follows;

a) Since the Atari River is excluded from the list in the Sixth Schedule of "The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations (2000)," 30m shall be taken as the protected zone; and

b) The base point of the protected zone shall be the hypothetical centerline of the Atari River. And then, the protected zone is designed 30m range on both sides from the hypothetical centerline.

In addition, with respect to the hypothetical centerline set for meandering river course of Atari River, the alignment of centerline is made straight so as to flush floods smoothly. The designed protected zone is shown in below.



Source: JICA OD Team

Fig. 2-2-2-3-1. Protected Zone along the Atari River

2-2-2-4 Land Re-organization

2-2-2-4-1 Basic Policy for Land Re-organization

Given that the shape of present plots in the Project area are small and irregular, introduction of mechanized farming and improvement of labor productivity are not prospective. In order to realize expansion of the rice production by efficient and equitable water distribution, it is effective to implement land-reorganization which includes the construction of standard plots including leveling land and Construction of farm ditch, small drainage and levee. However, since the land owned by each and every farmer shall be restructured (hereinafter land-demarcation), careful implementation is necessary through the consensus building with the land owners. As the result of a series of the detailed explanation and discussion with PDCC, PACC and the land owners, a total of 12ha of the priority model farmland, which derived approval from owners, will be selected, and constructed by Japan side. For expansion of the land-reorganization activity to the remaining land, it is expected to be implemented gradually by MAAIF in the future.

For smooth implementation of the land-reorganization, coordination with the farmers is quite important, so it is essential to foster an implementation environment by MAAIF. As a result of discussion with MAAIF, therefore, the allocation between Japan and Uganda side has been determined as in the table below.

Particularly, an important understanding for both parties has been confirmed that the standard plot (large section: hereinafter "Farm block") of Model Sites (referred to “2-2-2-4-3 Establishment of Model Sites on Land Re-organization” for detail) including the land leveling will be constructed by Japan side, and after that the construction, Uganda side will deal with arrangement of dividing the model sites into some plots (small section: hereinafter "Farm plot"), which is called “Land Re-demarcation”, construction of farm ditch, small drainage, and levee. Regarding these construction, technology of route selection of firm ditch and method of canal excavation are transferred to the farmers who will be involved in the model sites activities through soft component activity of the Project.

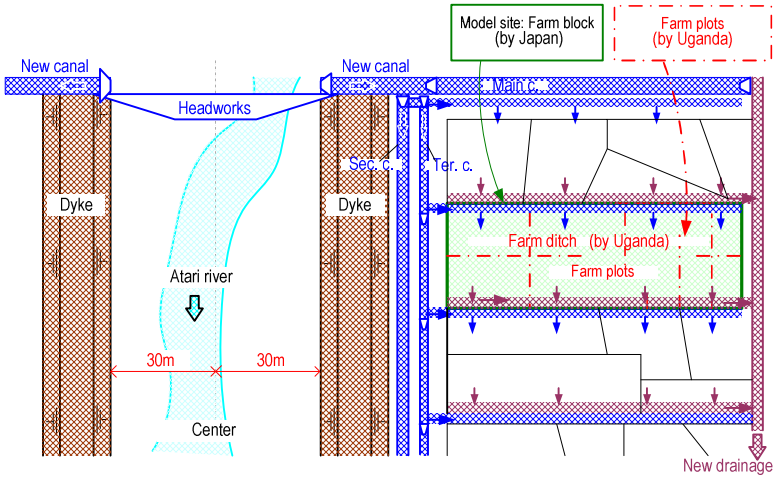


Fig. 2-2-2-4-1. Image Layout of the Model Site

Table 2-2-2-4-1. Work Share on Land Re-organization between Uganda and Japan

Item		Japan	Uganda
(1) Outline design of land-reorganization for entire project site (680ha)		✓	-
(2) Design of irrigation facilities and construction (Headworks, Canal, Drain, Distributer, Road, River dyke)		✓	-
(3) Model Sites (12ha)	Planning	✓	-
	Construction of the standard plot (farm block) including leveling and exterior levee	✓	-
	Implementation of land re-demarcation in the model sites to divide the model site into some small plots (Farm Plots)	-	✓
	Construction of farm ditch, small drainage, levee in the model plots	-	✓
(4) Land Re-organization for construction of the standard plots including land-leveling and construction of farm ditch in the entire project site except the model sites		-	✓
(5) Land Re-demarcation of the standard plots for the entire project site except the model sites		-	✓

Source: JICA OD Team

2-2-2-4-2 Design of Land Re-organization

The land-reorganization is designed based on the criteria of "Design Standard of Field Improvement (Paddy Field) in Japan" and also taken into consideration the actual paddy field scale of Doho Irrigation scheme.

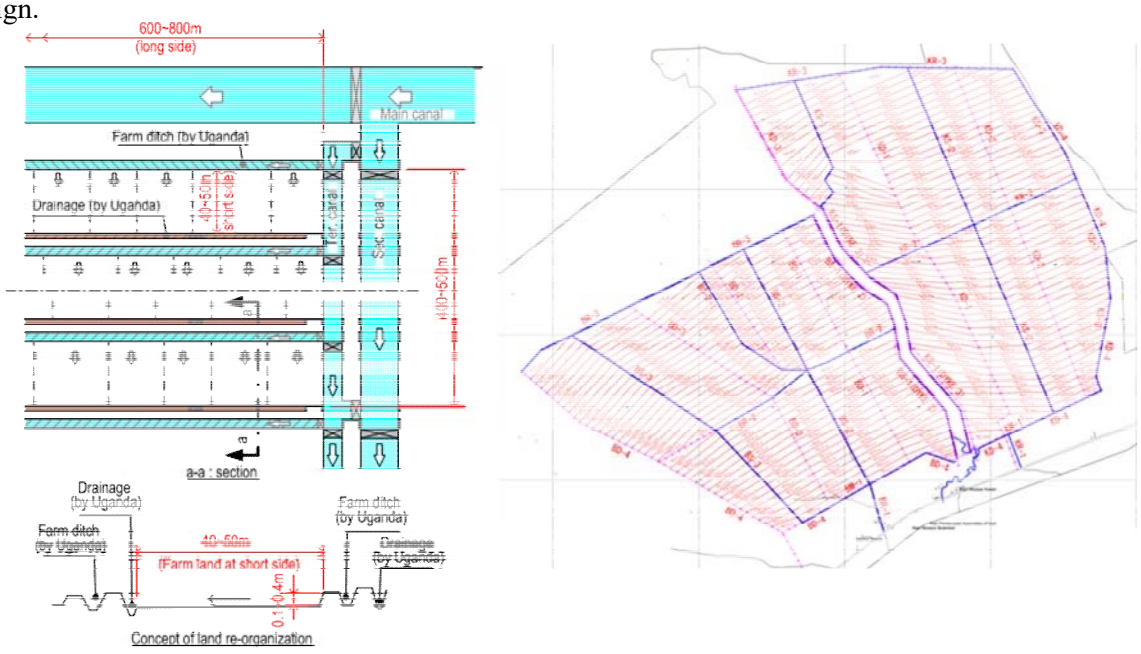
(1) Examination of Typical Scale of Standard Lot[2]

Based on the following concepts and considerations, scale and form of standard plot should be 600~800m at the long side, 40~50m at the short side and 0.3m~0.4m difference between each standard plots. Irrigation and drainage canals and roads are placed depended on scale of standard plots.

- In the Design Standard of Field Improvement (Paddy Field) in Japan, the long side of standard plot should be 300m~600m based on the allowable length of tertiary canal.
- In the Design Standard of Field Improvement (Paddy Field) in Japan, short side of standard plot should be 100~150m from the viewpoints of gate operation for irrigation and drainage and pest control.
- In Doho irrigation scheme, the long side (between each gate on secondary canal) of 600m~800m is slightly larger scale than the Design Standard of Field Improvement (Paddy Field) in Japan, but Japanese design standard should be applied from the viewpoint of an effective drainage function . Although the short side of 40m~50m is shorter than the Japanese design standard, it is conceivable scale from the viewpoints of agricultural works in Uganda. Accordingly, the short side length is applied to the same as Doho irrigation scheme.

(2) Conceptual Design of Land Re-organization

Based on the concept and outline above, conceptual design of the target area is planned as following design.



Note: Red lines in figure shows boundary of standard lot, Blue lines shows road alignment, "BS-" and "KS-" shows irrigation canals respectively

Source: JICA OD Team

Fig, 2-2-2-4-2. Conceptual design of land re-organization in target area

[2] "Standard lot" means a block surrounded by road and canal (small irrigation and drainage canal), in other words, it is the maximum block for the water management properly. Farm block is divided by levees, namely, it is the minimum block for agricultural works.

2-2-2-4-3 Establishment of Model Sites on the Land Re-organization

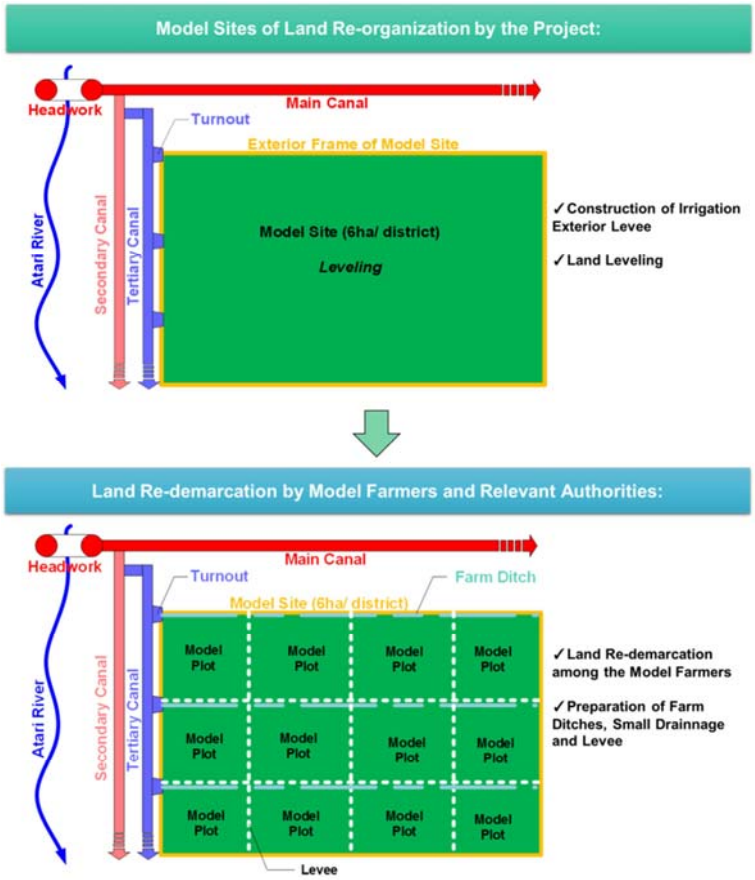
(1) Concept of Model Sites

This Project will establish two model sites in Bulambuli and Kween districts respectively (6ha each and in total of approx. 12ha) which are used for capacity building of farmers on irrigation scheme management as well as demonstration of advanced agricultural techniques. This would include;

- Training on Operation and Maintenance(O&M) of irrigation facilities (tackle them in soft components),
- Production of Quality Seeds (QS) multiplication activity for the improvement of rice production in the target area through the promotion to widely broaden the activity,
- And Demonstration of land re-organization and training on land re-demarcation (the concept of land re-organization and land re-demarcation is shown as Figure 1).

Land re-organization will contribute to improving operational efficiency including better use of water, faster seeding, better weed control, and increasing crop yield and the concept of land re-organization which shall entail land re-demarcation is shown in the Figure below.

This Project will select and establish two “Model Sites” in Bulambuli and Kween districts respectively (6ha each) to carry out land re-organization which are primarily used for arousing famers’ understanding to necessity of the land re-organization through establishment of Water Users Association (hereinafter referred to as “WUA”), training on operation and maintenance of irrigation facilities, and practicing of seed multiplication of Quality Declared Seeds (hereinafter referred to as “QDS”) by the local farmers with technical and financial support provided by national and local authorities.



Source JICA OD Team

Fig. 2-2-2-4-3. Concept on model site

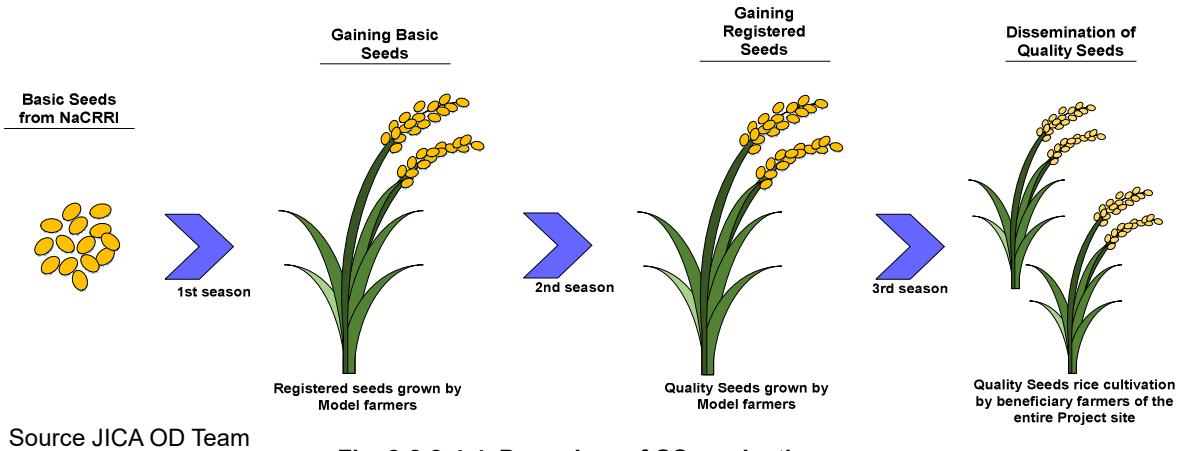
(2) Purposes of the Model Sites

a) Training on Operation and Maintenance of Irrigation Facilities

The Project will provide O&M trainings through its Soft Component Activities to primarily national and local government officials so that they provides technical guidance and support to farmers.

b) Quality Seeds (QS) multiplication activity

Limited availability of good quality seed, which significantly contribute to increasing the yield, is a key constraint to farmers in rural areas especially in Atari. The Project will conduct seed multiplication activities using QS as well as technical support provided by on-going JICA's rice promotion project (Promotion of Rice Development Project (PRiDe)), and QS produced by this activity will be used to the rest of the Project area. The outline of QS multiplication activity is shown as follows;



Source JICA OD Team

Fig. 2-2-2-4-4. Procedure of QS production

c) Demonstration of land re-organization and training on land re-demarcation

Land re-organization will contribute to improve efficiency of agricultural resources including water, labor, agricultural machinery and etc. as well as crop yield. The Project will carry out land re-organization with in the model sites, and provide technical support for land re-demarcation, which is primarily taken care by farmers, along with trained government officials in MAAIF.

(3) Selection of the Model Sites/ Model Framers and Supports from Authorities

The location of two model sites will be determined with careful selection criteria from a technical point of view so that the model sites demonstrate new technics effectively. MAAIF in conjunction with local authorities including PDCC and PACC will set a selection criteria of farmers participating in the model sites. as mentioned above, considering the effective exhibition of model site, the model site should be desirable to locate along the national road, the maintenance road in the project site or main canals.

the farmers who will participate in the works for Model Site activity are selected together with the selection of the model site. The qualified farmers are required to the willingness for the activity and the cooperative group, which farmlands are closely located each other, in order to smooth construction works. Suggested selection criteria are shown as follows ;

- Farmers who have legal rights in the selected model sites, or those who do not have legal rights but have a claim to the selected model sites in accordance with legal framework,
- Farmers who understand and agree to the compensation policy described in the Resettlement

Action Plan (RAP) of the Project,

- Farmers who are trained through Soft Component activities including construction of farm ditch, small drainage, and farm levee,

The selection of the Model Site and the famers will be done in the detailed design stage.

(4) Selection Procedure of the Model Sites

The procedure of model site selection is followed by the figure below. MAAIF announces the conditions of the selection in the second stakeholder meeting and qualifies the Model Site from the recommended farmland. The result of selection is finally reported in the 3rd stakeholder meeting.

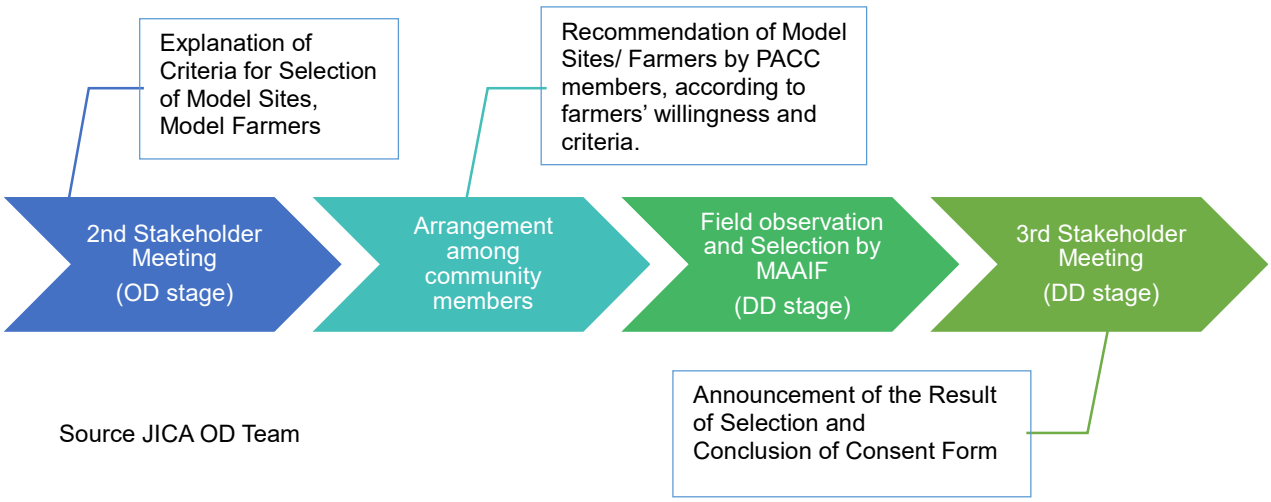


Fig. 2-2-2-4-5. Procedure of Model Site selection

(5) Compensation Policy

For the assets to be acquired or relocated by the Project, adequate compensation will be provided in accordance with compensation policy stipulated in the RAP for the Project. On the other hand, land loss which will be required for the implementation of obligations of Uganda's side such as construction of farm ditch is not eligible for the compensation.

2-2-2-5 Design on Irrigation Canal

2-2-2-5-1 Design Discharge

(1) Design Maximum Water Requirement

The design maximum water requirement of 2.24m^3/s in Atari area is determined based on the five (5) years probability of Atari river discharge in water balance calculation, and water requirements of Bulambuli side and Kween side are shown respectively on table below.

Table 2-2-2-5-1. Designed Maximum Water Requirement and Irrigable Area

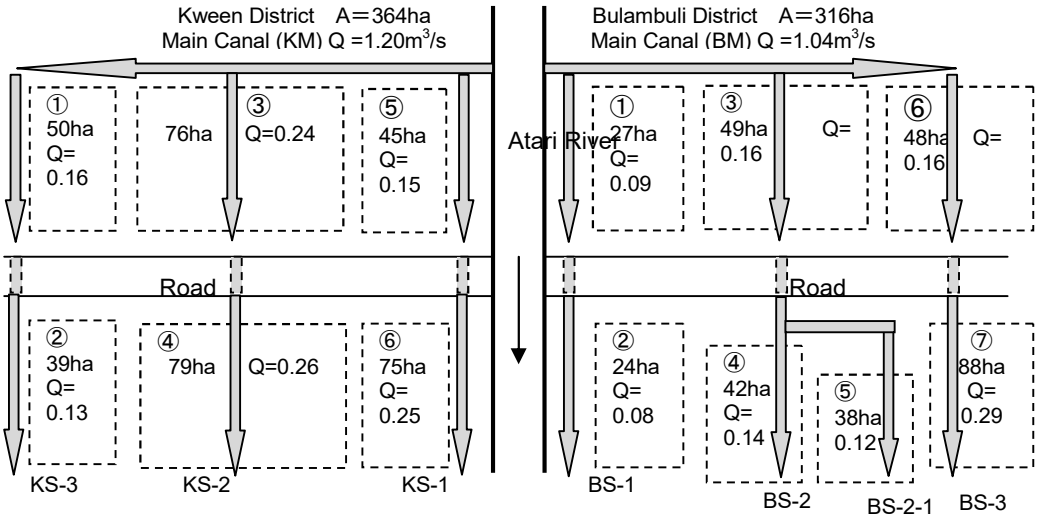
Area	Kween District	Bulambuli District	Total
Design Maximum Water Requirement（m^3/s）	1.20	1.04	2.24
Irrigable Area（ha）	364	316	680

Source: JICA OD Team

(2) Irrigated Areas and Design Water Requirement

Main canals (BM, KM) and secondary canals (BS, KS) are constructed in Bulambuli side and Kween side respectively. Water requirement in irrigation area of each canals are shown on figure below.

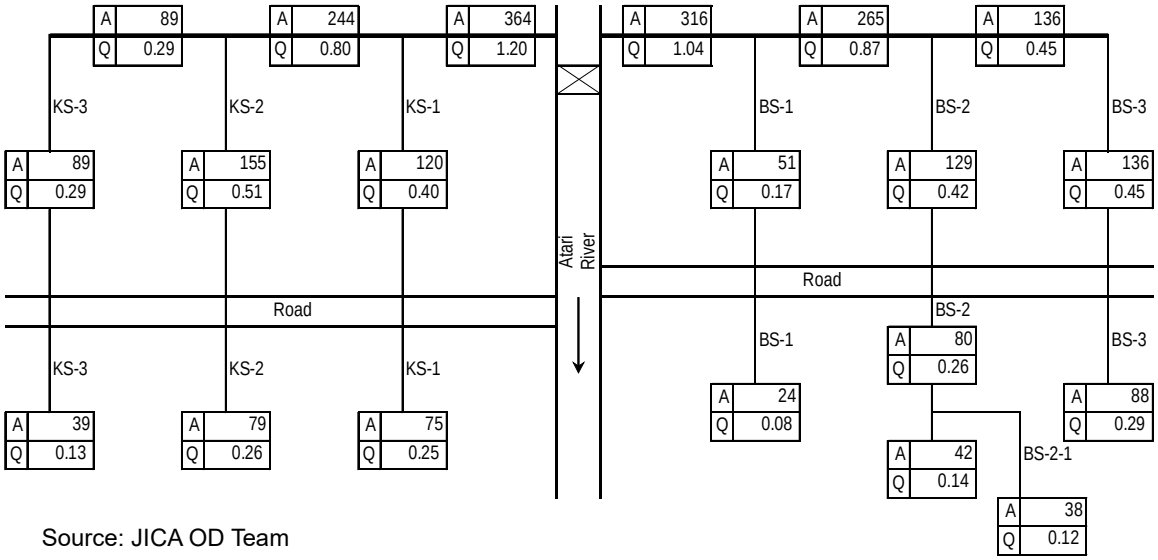
Unit Water Requirement q= (1.20+1.04)/680 = 0.003294 m^3/s/ha



Source: JICA OD Team

Fig. 2-2-2-5-1. Irrigated Areas and Water Requirement

(3) Design Water Requirement Network



Source: JICA OD Team

Fig. 2-2-2-5-2. Design Water Requirement Network

(4) Length of Irrigation Canals

Length of main canals and secondary canals are shown on the following table

Table 2-2-2-5-2. Length of Irrigation Canals

Kween District		Bulambuli District	
Name of Canal	Length (km)	Name of Canal	Length (km)
Main Canal (KM)	1.0	Main Canal (BM)	1.3
Secondary Canal (KS-1)	3.0	Secondary Canal (BS-1)	2.1
Secondary Canal (KS-2)	2.6	Secondary Canal (BS-2)	1.8
Secondary Canal (KS-3)	2.4	Secondary Canal (BS-2-1)	1.1
		Secondary Canal (BS-3)	2.0
Total	9.0	Total	8.3

Total length of Main Canals L= 2.3 km
Total length of Secondary Canals L= 15.0 km

Source: JICA OD Team

(5) Design Discharge of Irrigation Canal

Design discharges of irrigation canals based on the design water requirement network are shown as follows;

Table 2-2-2-5-3. Design Discharge of Irrigation Canal

Kween District		Bulambuli District	
Canal & Section	Design Discharge (m^3/s)	Canal & Section	Design Discharge (m^3/s)
KM, Upper section	1.20	BM, Upper section	1.04
KM, Middle section	0.80	BM, Middle section	0.87
KM, Lower section	0.29	BM, Lower section	0.45
KS-1, Upper section	0.40	BS-1, Upper section	0.17
KS-1, Lower section	0.25	BS-1, Lower section	0.08
KS-2, Upper section	0.51	BS-2, Upper section	0.42
KS-2, Lower section	0.26	BS-2, Middle section	0.26
KS-3, Upper section	0.29	BS-2, Lower section	0.14
KS-3, Lower section	0.13	BS-2-1	0.12
		BS-3, Upper section	0.45
		BS-3, Lower section	0.29

Source: JICA OD Team

2-2-2-5-2 Alignment of Irrigation Canal Network

There are no organized existing canal networks which shall be taken into account for the design of new irrigation canal alignments although a few small ditches are scattered in Bulambuli side. On the other hand, some main earth canals exist in Kween side, which were constructed by NGO, Action Aid in 2003 as the multipurpose canal which is, namely, combination with irrigation and drainage canal. Therefore, existing canals network in Bulambuli will be affected by new canal network planned.

As the concept of canal design, alignments of irrigation and drainage canal shall be clearly separated for the proper water management and the contribution to increase the rice yield.

2-2-2-5-3 Canal Type and Lining

Irrigation canal should be the open channel type. Since the main and the secondary canals are important conduits, Uganda side requested to construct those canals by concrete structure for the purpose of enhancement of stable canal section and alleviation of maintenance works. Therefore, concrete types including the concrete lining as a premise are examined and an optimal section and structure should be adapted in terms of the compared initial construction cost.

In general, canal section is designed as trapezoidal or rectangular type. In case that constraint of land acquisition are non-significant, the trapezoidal type with the plain concrete lining is commonly applied from the viewpoints of an economic advantage compared with the other types such as reinforced concrete type. Accordingly, trapezoidal type is determined to irrigation canal, which surface is lined by plain concrete of 10cm.

Table 2-2-2-5-4. Comparison of Canal Type and Lining

Name of Canal	Design Discharge (m^3/s)	Trapezoidal Canal Type with Plan Concrete Lining	Rectangular Canal Type with Reinforced Concrete
Main Canal (BM)	0.87	B=1.15m, H=0.85m, N=1:1.0 V= 3.74 m^3/10m **75,000Yen/10m**	B=1.10m, H=1.30m V= 5.15 m^3/10m **167,000Yen/10m**
Main Canal (BM)	0.45	B=0.40m, H=0.80m, N=1:1.0 V= 2.85 m^3/10m **57,000Yen/10m**	B=0.90m, H=0.95m V= 3.98 m^3/10m **129,000Yen/10m**
Secondary Canal (BS-1)	0.17	B=0.40m, H=0.45m, N=1:1.0 V= 1.86 m^3/10m **37,000Yen/10m**	B=0.50m, H=0.60m V= 2.55 m^3/10m **83,000Yen/10m**

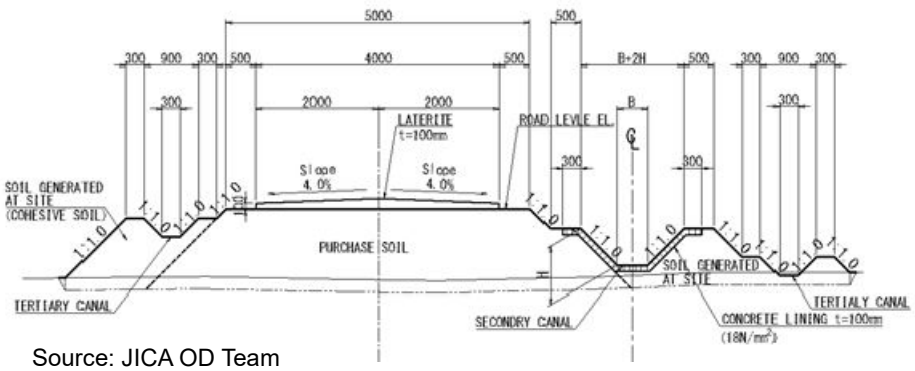
Note: B: Bottom width of canal, H: Height of canal, N: Gradient of side wall, V: Volume of concrete per 10m length

Source: JICA OD Team

2-2-2-5-4 Typical Cross Section of Designed Irrigation Canal

(1) Designed Irrigation Canal Section

Sectional size of irrigation canal is examined by Manning formula. Typical section of irrigation canal is determined as the figure below. Maintenance road along canal is placed for maintenance works of those canals, and tertiary canal is applied to earth canal type from the viewpoints of economic advantage, which embankment is filled by cohesive soil generated from excavation works, but BCS should be prohibited from using due to the improper for embankment. According to the Design standard of Filed Improvement (Paddy Field) in Japan, the side slope of embankment should be 1:1.0 for that the height of slope is less than 1m.



Source: JICA OD Team

Fig. 2-2-2-5-3. Typical Cross Section of Secondary and Tertiary Canal

(2) Maintenance Road

Width of road is determined 4.0m as effective width (entire width 5.0m) to enable double-lane traffic. In addition, since the road will be used for the transportation of agricultural production, surface of road elevation should be higher than basin elevation in the rainy season. Murrum soil is applied to embankment material, which is commonly used and purchased at a borrow site. Another name of Murrum is Laterite and it has a advantage to compacting works, and enable to strengthen embankment. Therefore, Murrum should be applied to the pavement works on road surface.

2-2-2-5-5 Tertiary Canal and Check Water Level of Secondary Canal

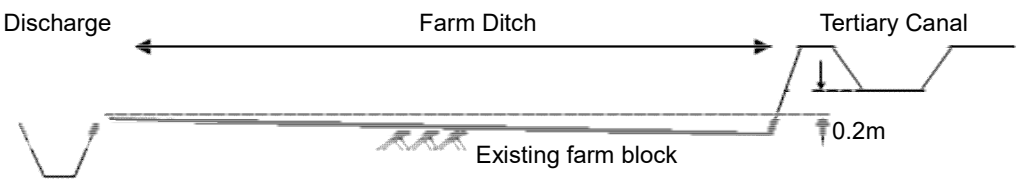
(1) Bed Elevation of Tertiary Canal

The tertiary canal should be designed taking into consideration the ground elevation of existing farmland because the completion of entire land re-organization by Uganda side deems to be taken long time. Design of bed elevation of tertiary canal should be taken into account the comparison of ground level in the vicinity of tertiary canal and the elevation of the drainage canal at the end of individual farmland, and in which the higher elevation should be applied.

Table 2-2-2-5-5. Bed Elevation of Tertiary Canal

	Condition of Ground Level (GL)	Determination of Bottom Elevation of Tertiary Canal
Case 1	In case GL around tertiary canal is higher than drainage canal	GL around tertiary canal is adopted.
Case 2	In case GL around drainage is higher than tertiary canal	GL around drainage canal is adopted, and basically elevation determined including +0.2m as an extra height to GL for securing necessary gradient on farmland. Furthermore, extra height should be not less than 0.1m in case of the constraints of topographic conditions

Source: JICA OD Team



Source: JICA OD Team

Fig. 2-2-2-5-4. Bed Elevation of Tertiary Canal (Case-2)

(2) Check Water Level of Secondary Canal

In general, check water level is examined by basin water elevation of the highest farm block in

targeted standard plot. However, given that the completion of entire works of land re-organization by Uganda side deems to be taken long time, hence, check water elevation is determined including the consideration of the ground elevation of existing farmland. As shown in the figure, check water elevation of secondary canal are determined to satisfy with both conditions which are not less than ground elevation of existing farmland and not less than planned bed level at the start points of each tertiary canal.

Table 2-2-2-5-6. Check Water Level of Secondary Canal

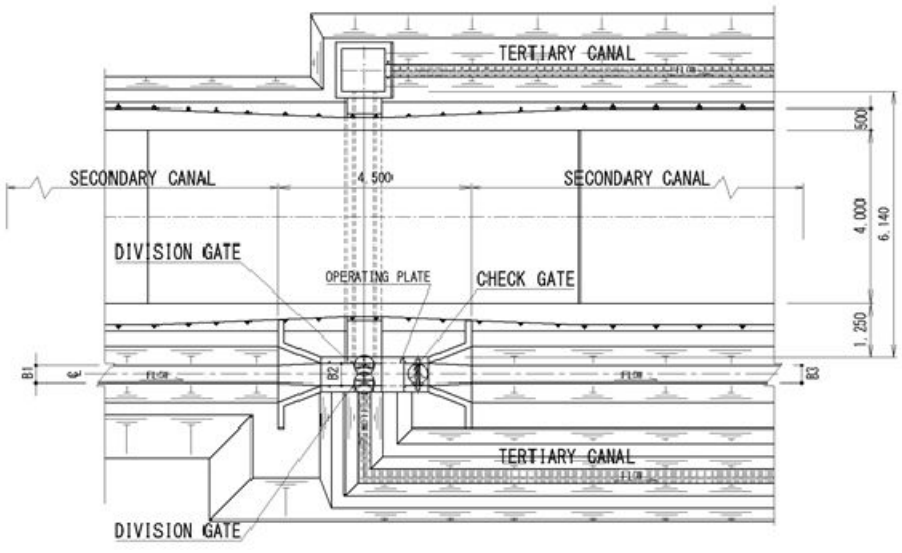
Name of Canal		Existing ground elevation (WL.m)	Planned bed elevation of tertiary canal (EL.m)	Check water level of secondary canal (WL.m)
Bulambuli District	BS-1	1075.90	1075.90	1076.20
	BS-2	1075.60	1075.60	1075.90
	BS-3	1074.88	1074.88	1075.18
Kween District	KS-1	1076.14	1076.04	1076.20
	KS-2	1073.69	1075.10	1075.04
	KS-3	1074.66	1074.66	1074.96

Source: JICA OD Team

2-2-2-5-6 Division Works and Sluice Gate

(1) Division Works

Division works of secondary canal are generally placed at the interval approx. 400 ~ 500 m along canal, but it should be properly placed depending on farmland and topographic conditions. In order to operate water elevation to circumstansly adjust the reqired discharge varied as demand, sulice gates (check gate) should be palced at division works of secandary canal. Two gates are installed at inlet of tertiary canal which are on right and left of division works, which is made by reinforced concrete.



Source: JICA OD Team

Fig. 2-2-2-5-5. Division Works on Secondary Canal

(2) Sluice Gate

Sluice gates operated by the manual are installed at the division works of main and secondary canals in Bulambuli and Kween respectively. Since appropriate and accurate water management is required to division works, these gates are planned to be procured from Japan, which have ascendant of smooth and functional operation.

2-2-2-5-7 Spillway

In order to avoid overflow from main canal, spillway should be properly placed and the safe operation should be ensured. The facility is designed as reinforced concrete structure. Design discharge of spillway is derived from the difference of design discharge between the upstream and the downstream on main canal. Spilled water from main canal is released to drainage canals which are planned as shown on the figure below. Design discharge and the drainage canal are calculated by the following formula.

$$Qw = Qu - QD$$

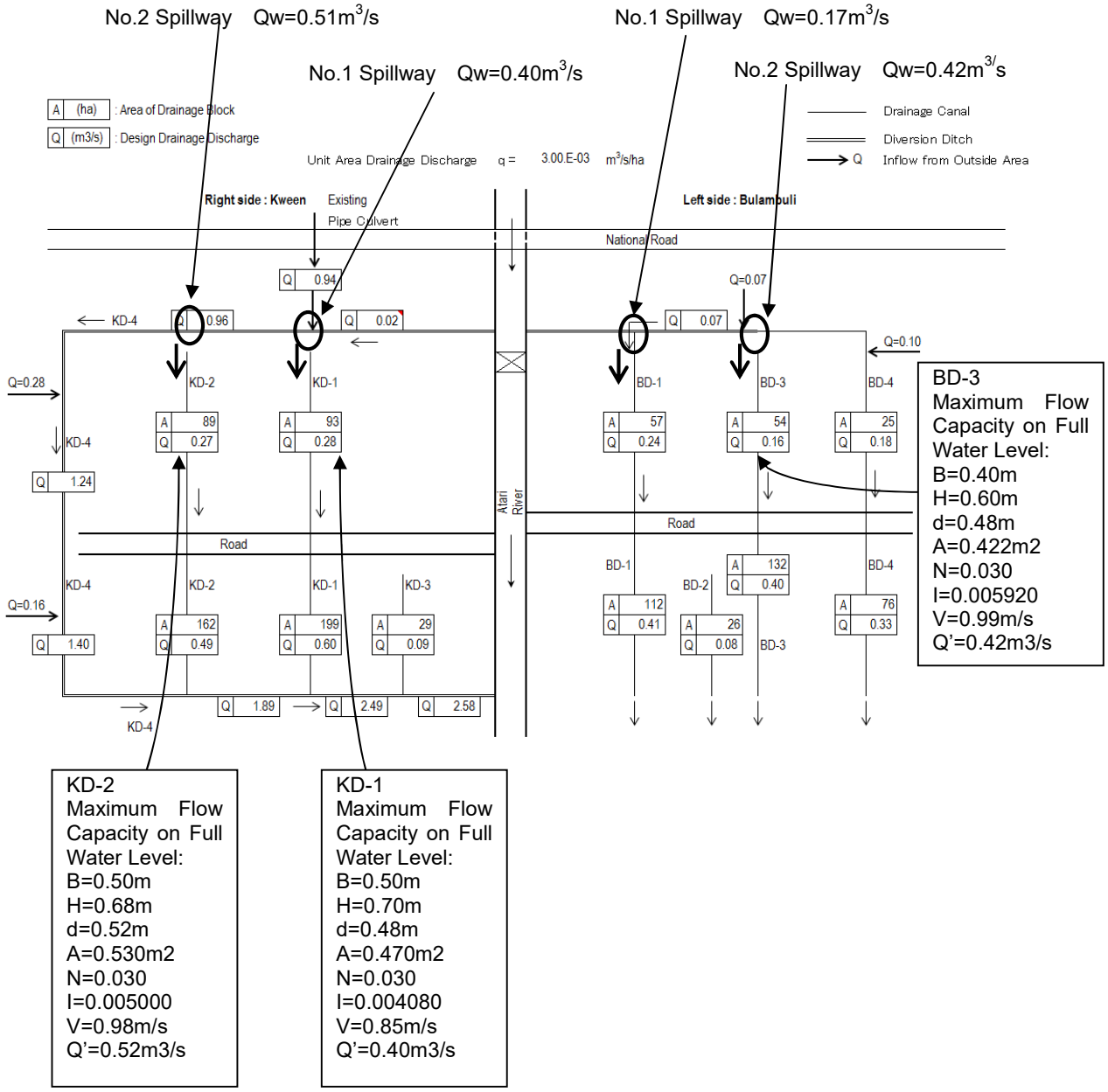
Qw: Design discharge of spillway (m^3/s)
Qu: Design discharge of canal upstream at the spillways (m^3/s)
QD: Design discharge of canal at the downstream of spillways (m^3/s)

No.1 Spillway in Bulambuli $Qw = 1.04 – 0.87 = 0.17 m^3/s$ (release to BD-1)
No.2 Spillway in Bulambuli $Qw = 0.87 – 0.45 = 0.42 m^3/s$ (release to BD-3)
No.1 Spillway in Kween $Qw = 1.20 - 0.80 = 0.40 m^3/s$ (release to KD-1)
No.2 Spillway in Kween $Qw = 0.80 – 0.29 = 0.51 m^3/s$ (release to KD-2)

Table 2-2-2-5-7. Spillway

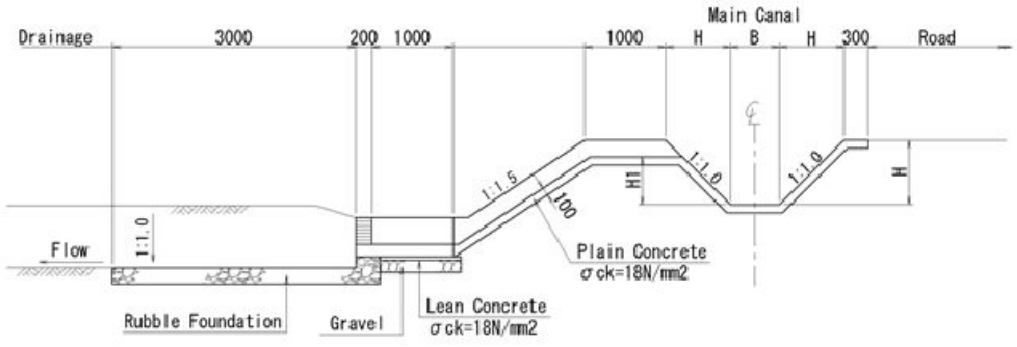
Name of Canal	Station	Number of Spillway	Design Discharge (m^3/s)	Overflow Length (m)	Mean Overflow Water Depth (m)	Outlet of Drainage
BM	No.0+406	No.1	0.17	14.0	0.035	BD-1
	No.1+030	No.2	0.42	11.0	0.075	BD-3
KM	No.0+021	No.1	0.40	14.5	0.060	KD-1
	No.0+831	No. 2	0.51	7.5	0.110	KD-2

Source: JICA OD Team



Source: JICA OD Team

Fig. 2-2-2-5-6. Location of Map of Spillway



Source: JICA OD Team

Fig. 2-2-2-5-7. Spillway Section

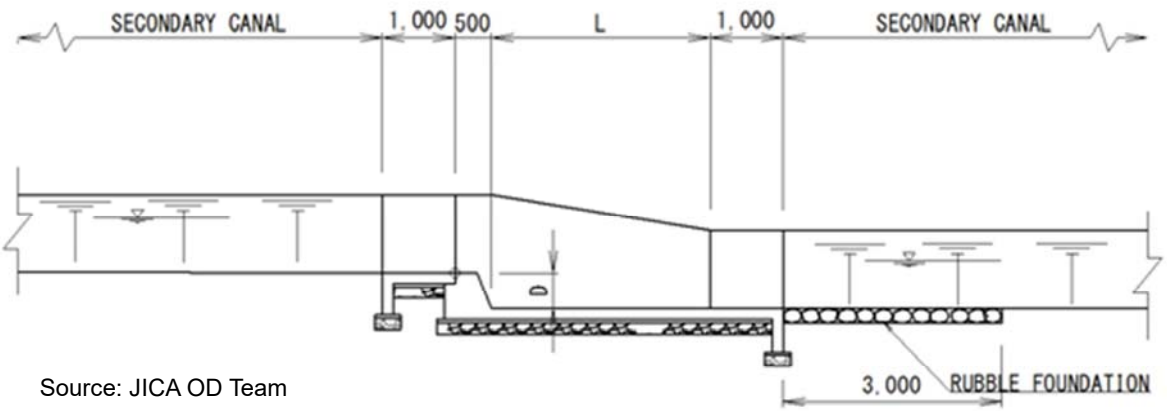
2-2-2-5-8 Drop

Gradient of canal bed should be designed so that the design velocity cannot exceed the maximum allowable velocity. Drop facilities are properly placed, which are structured with reinforced concrete, considering the difference of longitudinal gradient between planned canal bed and topography.

Table 2-2-2-5-8. Drop Structure

Name of Canal	BS-1	BS-2	BS-2-1	BS-3	KS-1	KS-2	KS-3	Total
Number	10	8	5	8	9	7	9	56
Maximum Drop Height (m)	0.60	0.71	0.62	0.65	0.73	0.60	0.70	

Source: JICA OD Team



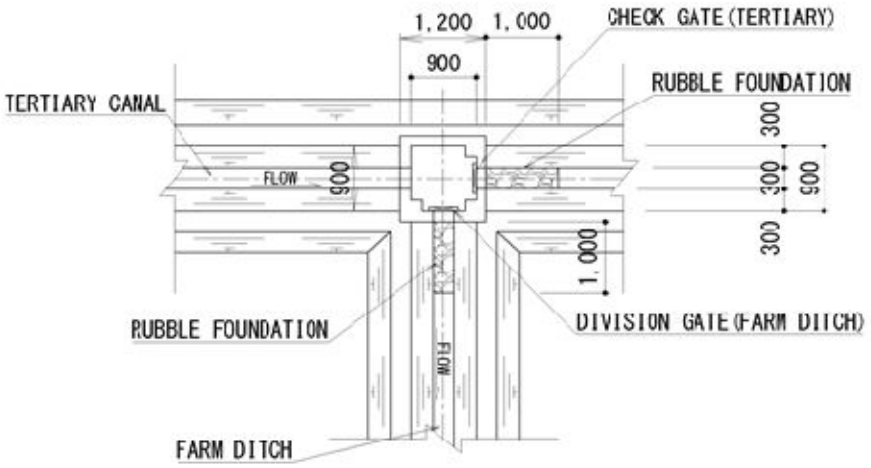
Source: JICA OD Team

Fig. 2-2-2-5-8. Drop Section

2-2-2-5-9 Division Box of Tertiary Canal

On tertiary canal, division boxes for diverting water to farm ditch are placed. The structure of division boxes are made of plain concrete. Gates installed to division works, which size is (B)300×(H)300, is simple and is not required to highly accurate operation, hence, those gates are judged to be fabricated in Uganda and procured from domestic fabricators

Division boxes are placed at the interval of approx. 40~50m, but the final location of them will be determined by the famers. Farm ditch, which type is the earth canal, is constructed by the farmers, namely, this implementation is responsible for Uganda side.

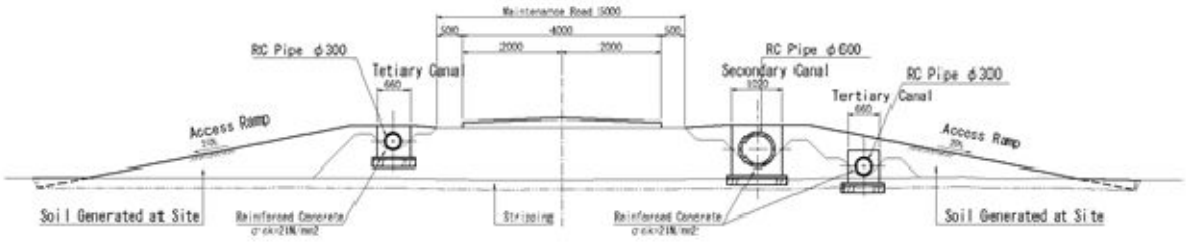


Source: JICA OD Team

Fig. 2-2-2-5-9. Division Boxes on Tertiary Canal

2-2-2-5-10 Access Ramp to Farmland

Access ramp is placed to cross canals and access to farmland. Concrete pipes (reinforced by lining concrete) are set on the alignment of secondary and tertiary canals. Embankment materials for access ramp are obtained from construction site, which are generated by the excavation works. Access ramps are planned to place at the interval of approx. 50m, but the final location of them will be determined by the famers.

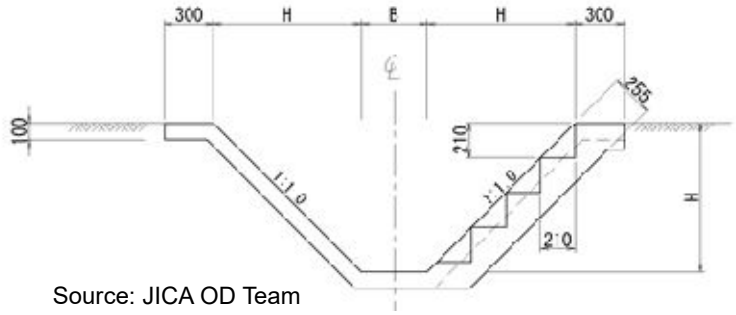


Source: JICA OD Team

Fig. 2-2-2-5-10. Access Ramp for Farmland

2-2-2-5-11 Washing Basin

Washing Basin is placed at the interval of approx. 200m for the cleaning and the washing equipment after agricultural works. Access steps are designed for improving the accessibility.



Source: JICA OD Team

Fig. 2-2-2-5-11. Washing Basin

2-2-2-6 Design on Drainage Canal

2-2-2-6-1 Design Discharge

(1) Drainage Canal and Catch Drain

Drainage canals are placed in the farmland in order to properly release excess water to the off-targeted area. In addition, catch drains are placed along the boundary of target area in Kween to prevent drained water from coming into the target area and should be reached to the Atari River.

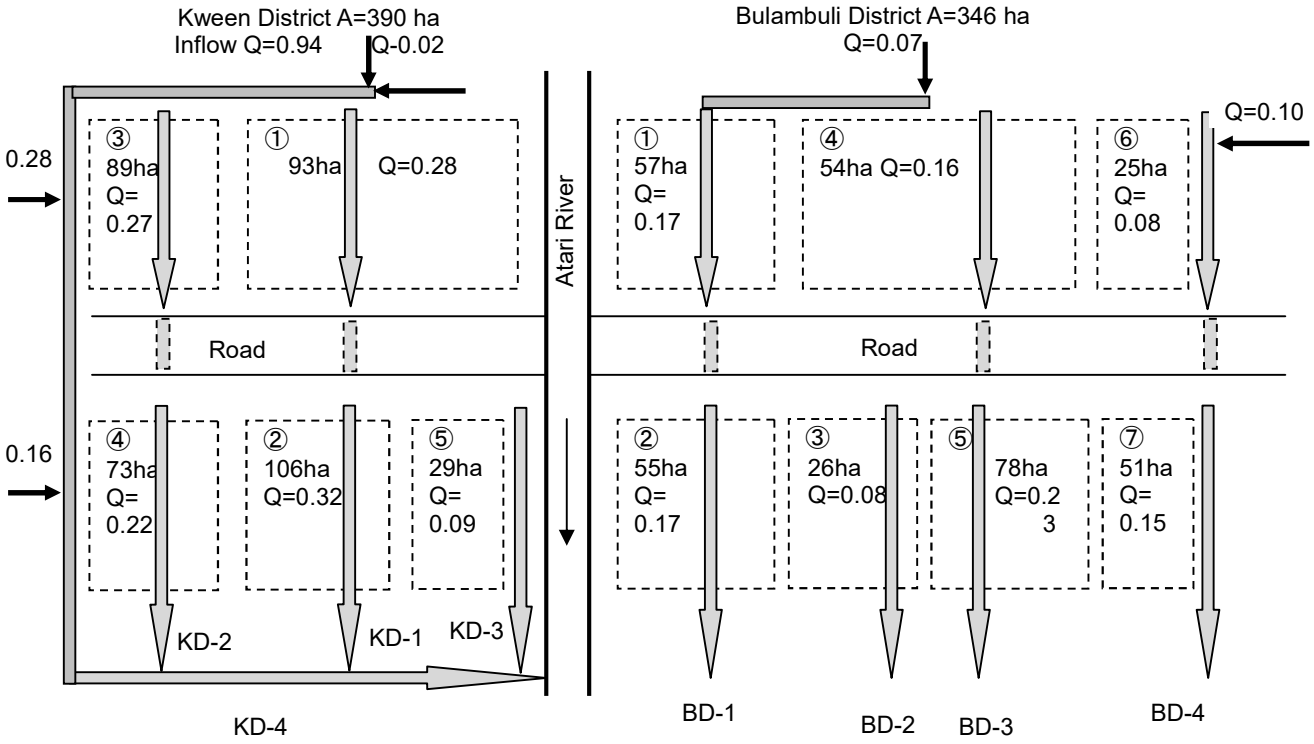
(2) Design Drainage Discharge from Drainage Block

According to the FS, the drainage discharge was examined, which unit discharge is 0.003m^3/s/ha by means of Kinematic wave method based on the daily rainfall data at the Soroti observation station. In the OD the unit drainage discharge is in conformity with the FS and the design drainage discharge shown on following table.

Table 2-2-2-6-1. Design Drainage Discharge

Kween District			Bulambuli District		
Block No.	Area (ha)	Discharge (m^3/s)	Block No.	Area (ha)	Discharge (m^3/s)
1	93	0.28	1	57	0.17
2	106	0.34	2	55	0.17
3	89	0.27	3	26	0.08
4	73	0.22	4	54	0.16
5	29	0.09	5	78	0.23
			6	25	0.08
			7	51	0.15
Total	390		Total	346	

Source: JICA OD Team

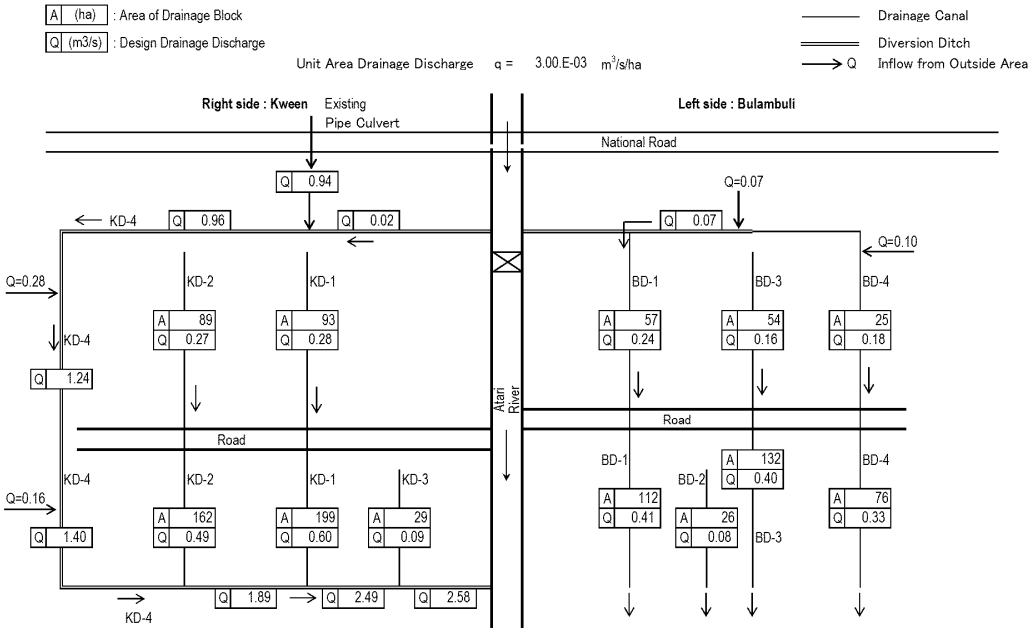


Source: JICA OD Team

Fig. 2-2-2-6-1. Drainage Block

(3) Design Drainage Network

As a result of the OD, an original diagram of drainage plan is modified to the following diagram:



Source: JICA OD Team

Fig. 2-2-2-6-2. Design Diagram of Drainage Plan

(4) Length of Canals

Length of the drainage canals and the catch drain are shown on the following table.

Table 2-2-2-6-2. Length of Canals

Kween District		Bulambuli District	
Name of Canal	Length (km)	Name of Canal	Length (km)
KD-1	2.8	BD-1	1.8
KD-2	2.4	BD-2	0.9
KD-3	1.0	BD-3	2.0
KD-4	5.3	BD-4	2.1
Total	11.5	Total	6.8

Note: Total length L = 18.3 km

Source: JICA OD Team

(5) Design Discharge of Drainage Canal

Design discharges of the drainage canal and the catch drains are shown on the following table.

Table 2-2-2-6-3. Design Discharges of Drainage Canal and Catch Drain

Kween District		Bulambuli District	
Canal & Section	Design Discharge (m^3/s)	Canal & Section	Design Discharge (m^3/s)
Drainage Canal: KD-1 Upstream section	0.28	Drainage Canal: BD-1 Upstream section	0.24
KD-1 Downstream section	0.60	BD-1 Downstream section	0.41
KD-2 Upstream section	0.27	BD-2	0.08
KD-2 Downstream section	0.49	BD-3 Upstream section	0.16
KD-3	0.09	BD-3 Downstream section	0.40
Catch Drain (KD-4)	0.94	BD-4 Upstream section	0.18
KM Parallel section	0.96	BD-4 Downstream section	0.33
KS-3 Upstream Par. Sec.	1..24		
KS-3 Downstream Par. Sec.	1.40		
KD-2 Infall & Downstream	1.89		
KD-1 Infall & Downstream	2.49		

Kween District		Bulambuli District	
Canal & Section	Design Discharge (m^3/s)	Canal & Section	Design Discharge (m^3/s)
KD-3 Infall & Downstream	2.58		

Source: JICA OD Team

2-2-2-6-2 Canal Type

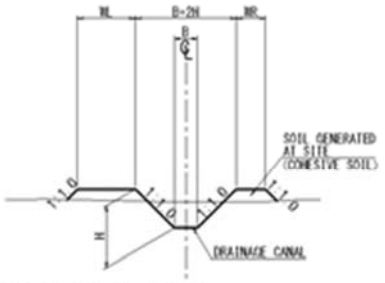
Canal type of the drainage canal and catch drain are earth canal from the view point of the economic advantage.

2-2-2-6-3 Designed Canal Section and Maintenance Path

Sectional size of drainage canal is examined by Manning formula and is determined to typical section of drainage shown below. In the plan, maintenance road passable by vehicles is not placed along the drainage canal in order to alleviate the abandon area for construction from the viewpoints of economic aspect. However, maintenance path should be placed on the both sides of drainage canal so as to make maintenance and inspections walking along canal.

Excavated soil generated by the construction works of drainage is planned to use for the construction of this canal. Maintenance path is placed within the area to be compensated. Typical sections are shown on the table 2-2-2-6-4.

Table 2-2-2-6-4. Dimension of Design Drainage Canal Section



Dimension of Drainage structure

Canal Name	Station Number	B (mm)	H (mm)	WL (mm)	WR (mm)
BD-1	No.0+010~No.0+375	400	840	1200	500
	No.0+375~No.0+425	400	810	1200	500
	No.0+425~No.0+675	400	660	800	500
	No.0+675~No.0+725	400	670	800	500
	No.0+725~No.0+875	400	820	1200	500
	No.0+875~No.1+025	500	1030	2000	1150
	No.1+025~No.1+125	500	980	2000	1150
	No.1+125~No.1+275	500	1030	2000	1150
	No.1+275~No.1+575	500	880	1150	500
	No.1+575~No.1+813	500	990	2000	1200
BD-2	No.0+010~No.0+275	400	570	200	150
	No.0+275~No.0+425	400	500	200	150
	No.0+425~No.0+725	400	730	1150	500
	No.0+725~No.0+859	400	530	300	500
BD-3	No.0+010~No.0+575	400	600	400	500
	No.0+575~No.0+725	400	710	1100	500
	No.0+725~No.0+839	400	760	1400	500
	No.0+839~No.0+975	500	770	580	500
	No.0+975~No.1+025	500	770	1000	500
	No.1+025~No.1+525	500	980	1150	500
	No.1+525~No.1+675	500	770	1800	500
	No.1+675~No.2+005	500	990	1200	500

Dimension of KD-4 Drainage structure

Canal Name	Station Number	B (mm)	H (mm)	WL (mm)	WR (mm)
KM	No.0+010~No.0+210	300	400	1000	500
	No.0+210~No.0+939	1000	1100		
KS-3	No.0+000~No.1+500	1000	1100		
	No.1+500~No.2+384	1800	1090		
KR-3	No.0+000~No.0+350	1800	1090		
	No.0+350~No.0+850	2000	1150		
	No.0+850~No.1+150	2000	1340		
	No.1+150~No.1+850	2000	1510		
	No.1+850~No.1+912	2000	1530		

BD-4	No.0+400~No.0+575	400	640	270	200
	No.0+575~No.0+775	400	840	1200	500
	No.0+775~No.0+925	400	640	1200	500
	No.0+925~No.1+075	500	740	600	500
	No.1+075~No.1+375	500	1040	2000	1150
	No.1+375~No.1+525	500	740	1400	500
	No.1+525~No.1+825	500	720	1400	500
	No.1+825~No.1+975	500	1100	2000	1300
	No.1+975~No.2+175	500	850	1650	500
	No.2+175~No.2+529	500	950	2000	650
KD-1	No.0+010~No.0+325	500	1120	1800	1000
	No.0+325~No.1+575	500	1050	1800	1000
	No.1+575~No.1+775	500	900	1650	500
	No.1+775~No.1+025	500	1500	1250	1000
	No.1+025~No.1+425	500	1000	1750	1000
	No.1+425~No.1+454	500	700	1000	500
	No.1+454~No.1+525	700	1050	1850	1000
	No.1+525~No.1+725	700	1200	2000	1000
	No.1+725~No.1+975	800	1050	1650	500
	No.1+975~No.2+775	800	1730	1600	1000
	No.2+775~No.2+871	800	1230	1400	500
KD-2	No.0+010~No.0+225	500	780	1300	500
	No.0+225~No.0+575	500	930	1400	1000
	No.0+575~No.1+025	500	680	1200	500
	No.1+025~No.1+425	500	1080	1400	500
	No.1+425~No.2+125	700	1910	1750	1000
	No.2+125~No.2+437	700	1360	1850	1000
KD-3	No.2+100~No.2+525	300	550	1000	800
	No.2+525~No.2+675	300	1180	1000	1500
	No.2+675~No.2+775	300	780	1000	1100
	No.2+775~No.2+825	300	860	1000	1100
	No.2+825~No.3+110	300	960	1000	800

Source: JICA OD Team

2-2-2-6-4 Comparison of Drainage Plan ant Bulambuli District

As a result of OD survey, landform of the Atari River at the downstream of target area was identified as a raise bed river, namely, river bed elevation is higher than the ground level at the vicinity of the river. Hence, it is obvious that drainage through the planned drainage canal in Bulambuli in the FS is impossible.

After a series of discussion with MAAIF about the comparison of some feasible alignment plans, Plan D (see, Table 2-2-2-6-6) is finally applied. Accordingly, the drainage plan of Bulambuli in the FS entails the modification, including, catch drains at the downstream of Bulambuli are cancelled, alternatively, the tail end of drainage canals connects to the existing small wash paths or depressions at the off-targeted area. These locations and situations in off-targeted area where canals connect with them will be surveyed and an outline plan will be designed by Japanese side in DD stage which will start after completion of this survey. In Uganda side takes place the discussion with land owners based on the outline plan, settle this issue and implement the construction works of those canals.

2-2-2-6-5 Drainage Drop Structure

Gradient of canal bed should be determined so as not to exceed the maximum allowable velocity for the variety of lining materials. Drop facilities are properly placed, which are structured by reinforced concrete considering the difference of longitudinal gradient between planned canal bed and surrounding topography.

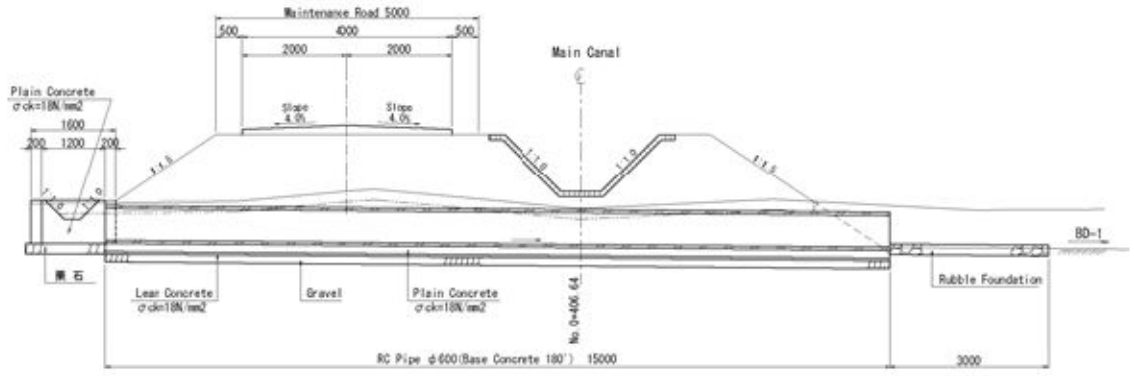
Table 2-2-2-6-5. Drainage Drop Structure

Name of Canal	BD-1	BD-4	KD-1	KD-2	KD-4	計
Number of Point	1	3	5	3	7	19
Maximum Drop Heights (m)	0.50	0.50	0.60	0.50	0.50	

Source: JICA OD Team

2-2-2-6-6 Drainage Pipe Culvert

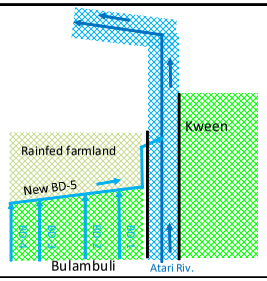
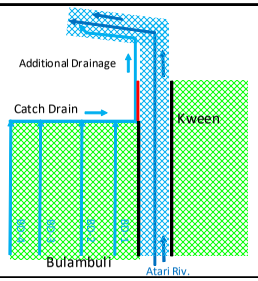
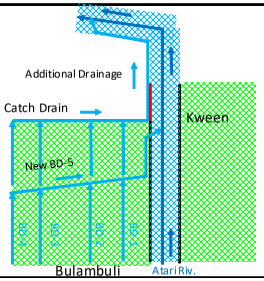
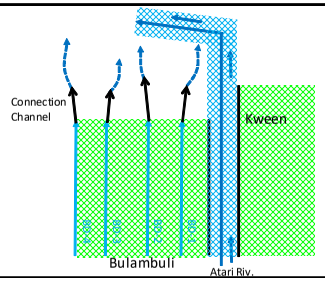
Concrete pile for drainage is placed under the main canal at the station No.0+406 in Bulambuli. Drained water, which discharge is 0.07m^3/s, coming from the off-targeted area is led to BD-1 drainage canal.



Source: JICA OD Team

Fig. 2-2-2-6-3. Drainage Pipe Culvert

Table 2-2-2-6-6. Comparison of Drainage Plan in Bulambuli

Plan	Plan A	Plan B	Plan C	Plan D
Overview figure				
Measures	· A new drainage route (new BD-5) is placed in the current beneficiary area and connected to the Atari River. It is planned not to discharge outside the Project area. · The area downstream of the new BD-5 will be a rainfed farmland. · The irrigated area will be reduced by approximately 170ha.	・Construct an additional drainage channel (about 1.6 km) outside the Project area and discharge from the beneficiary area to the Atari River. · Construct a catch drain in the direction of the Atari river along the district boundary (it will have a reverse gradient topographically), then connect with an additional drainage. · To protect additional drainage, stretch the protection dyke of Bulambuli side with keeping 30m buffer zone. ・Furthermore, extension of the protection dyke will contribute to alleviate the damage caused by river flooding on the beneficiary area.	· Combination plan of Plan A and Plan B (Plan A: The new BD-5 discharges the half of drainage volume at Bulambuli area to the Atari river.) (Plan B: Additional drainage channel (about 1.6km) discharges the remaining water of downstream area of the new BD-5 to the Atari River.) · This will make the scale of additional drainage channel smaller than Plan B. · To protect additional drainage, stretch the protection dyke of Bulambuli side with keeping 30m buffer zone. ・Furthermore, extension of the protection dyke will contribute to alleviate the damage caused by river flooding in the beneficiary area.	· A plan to connect to the current canal or recessed area outside the Project area from the planned drainage channel (BD-1 to 4). · Construct "Connection Channel" outside the Project area. · Since the overall water flow outside the beneficiary ground uses the current topography, there is no major change outside the Project area. · It is possible to use water from beneficiary area for irrigation on farmland around channel.
Beneficiary area	Approx 510ha	680ha	Approx 680ha	680ha
Additional consent from farmers outside the Project area	Not required	Required（Approx 50 people）	Required（Approx 50people）	· The irrigable area by connection channel is expected to increase partly, but agreement of the farmers concerned is required to set up connection channel. · Waterway construction shall be done by farmers (because the activity is carried out outside the beneficiary area).
Land acquisition outside the Project area	Not required	Required: 6.2 ha (about 15.5 acre) Breakdown: Drainage 2.4 ha (6.0 acre), Protection Dyke 0.7 ha (1.8 acre), Buffer zone 3.1 ha (7.8 acre)	Required: 6.1 ha (about 15.3 acre) Breakdown: Drainage 2.3 ha (5.8 acre), Protection Dyke 0.7 ha (1.8 acre), Buffer zone 3.1 ha (7.8 acre)	Required, but it will not be a large-scale land acquisition. In order to grasp the area, it is necessary to check existing canal and topography.
Agreement from farmers within the Project area	・Affected farmland and people concerned Rainfed farmland (170ha), Farmers（70 people）	Not required	Not required	Not required
Additional EIA	Not required	・Confirm the necessity of EIA regarding the construction outside the Project area (Additional Drainage, Protection Dyke)	・Confirm the necessity of EIA regarding the construction outside the Project area (Additional Drainage, Protection Dyke)	・Confirm the necessity of EIA regarding the use of wastewater in the beneficiary area as agricultural water in a non-beneficial area
Additional construction cost	・Construction of BD-5 $0.107M ・Construction of Secondary Canal (Downstream from BD-5) - $1.044M Total - $0.937M	・Construction of Additional Drainage $0.205M ・Construction of Protection Dyke (Bulambuli Side) $0.295M Total $0.500M	・Construction of BD-5 $0.107M ・Construction of Additional Drainage $0.151M ・Construction of Protection Dyke (Bulambuli Side) $0.295M Total $0.553M	No change in construction cost (Local burden)
Project Cost※ (Based on $22.642M)	Approx $21.705M	Approx $23.142M	Approx $23.195M	Approx $22.642M
Disposal cost of waste soil due to additional construction (Cost to be transported	Disposal does not occur. Project cost is the same as above	・Disposal cost $0.669M ・Project cost $23.142M Total $23.811M	・Disposal cost $0.741M ・Project cost $23.195M Total $23.936M	Disposal does not occur. Project cost is the same as above
Evaluation	△ Explanation and persuasion to farmers concerned is required. However, because the drainage does not pass through the farmland outside the project area, there is no concern that the project will be delayed or stopped due to the opposition of the farmers outside the project area.	△ · It is necessary to form consensus among farmers outside the Project area to drain to the Atari River via their farmland. · Because the total drainage volume at Bulambuli area is allowed to flow down in one drainage channel, the catch drain size is larger than Plan C. · However, Plan B can secure the 680ha irrigation area because there is no need to install BD-5. · Farmers outside the Project area have collapsed areas due to additional protection dyke, but there is an advantage that the farmland can be protected to some extent by stretching the dyke. · Sufficient explanation to the farmers outside the Project area is important so that the project (especially construction) will not stop.	○ · It is necessary to form consensus among farmers outside the Project area to drain to the Atari River via their farmland. · The new BD - 5 can discharge a half of the total drainage volume at Bulambuli area to the Atari river, so the size of the catch drain can be made smaller than Plan B. ・For the construction of the new BD-5, it is necessary to reduce approx 3ha from the irrigation area and to be required explanation and persuasion to the farmers concerned. · Farmers outside the Project area have collapsed areas due to additional protection dyke, but there is an advantage that the farmland can be protected to some extent by stretching the dyke. · Sufficient explanation to the farmers outside the Project area is important so that the project (especially construction) will not stop.	◎ · It is necessary to form consensus among farmers outside the Project area to drain to the Atari River via their farmland. ・From the viewpoint of efficient use of water, it is possible to expand the water use of farmers outside the Project area and less waste. ・Also, because the overall water flow outside beneficiary area uses the current topography, Plan D has an advantage that the influence of construction outside the project area can be minimized compared to Plan B and Plan C.

※ "Project Cost" is based on $22.642M including project supervision fee of $2.677M and reserve cost of $1.205M.

Source: JICA OD Team

2-2-2-7 Design on Road

2-2-2-7-1 Present Condition and Alignment Plan

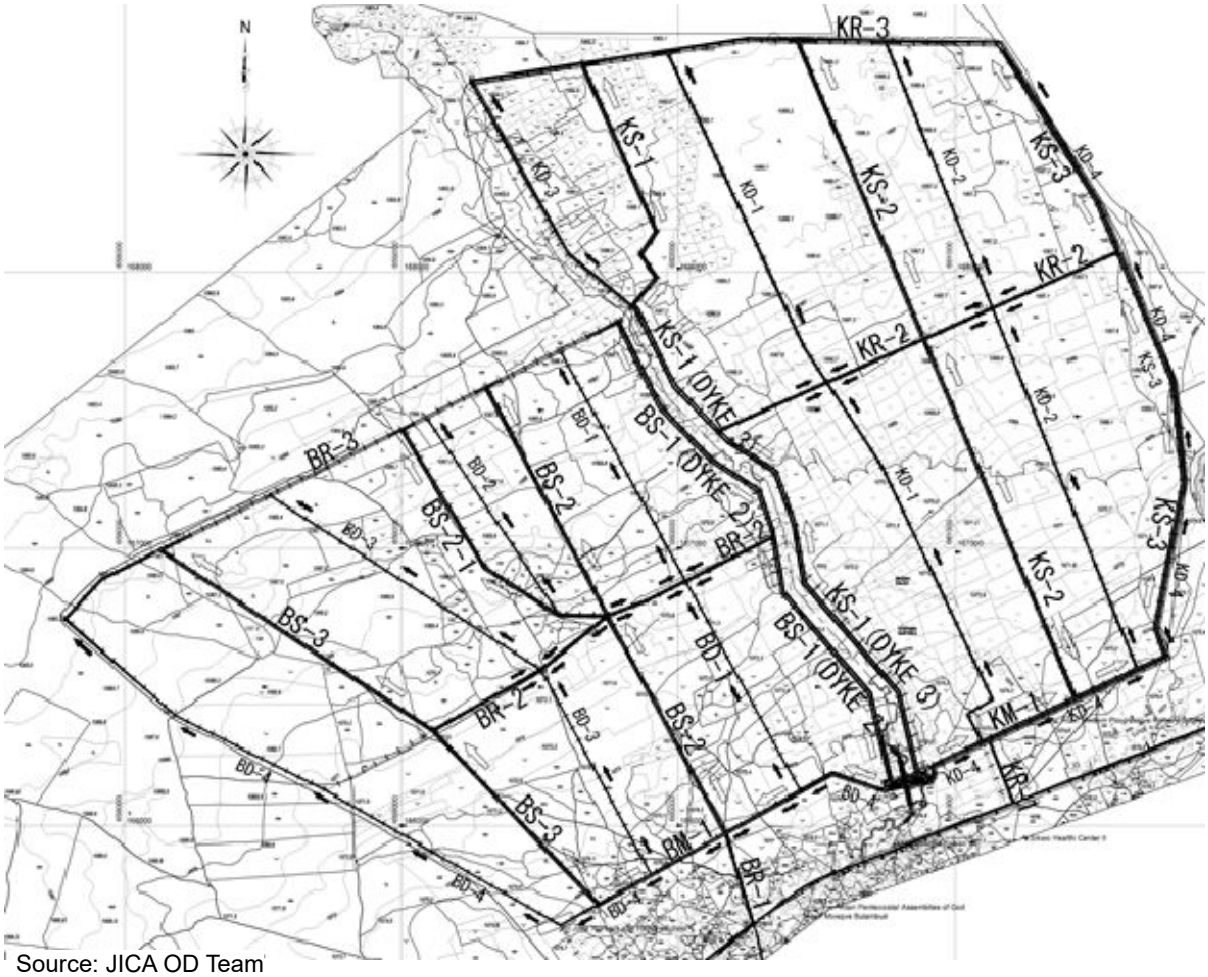
Although there are the existing roads in each side of Bulambuli and Kween, respectively, to approach to the Project site form the national highway Mbale - Moroto line, convenience of transportation is low because construction vehicles are not passable these existing road .

For this reason, the farm roads in the Project site shall be constructed along the main canal and the secondary canal for the purpose of improving the trafficability of construction vehicles and operation and maintenance activity of irrigation facilities (headworks, irrigation canals, etc.). Regarding the approach road from the national road in the OD, the existing road of Bulambuli should be renovated and Kween side's road should be newly constructed instead of using the existing road.

Table 2-2-2-7-1. Classification of Farm Road

Type of Road	Classification	Plan
Approach Road	Road to approach from the National Road to the Project Site	• BR-1 (Bulambuli) • KR-1 (Kween)
O&M Road	Road along the main road and secondary road for operation and maintenance of irrigation facilities	• BM,BS-1～BS-3 (Bulambuli) • KM,KS-1～KS-3 (Kween)
	Road to connect the canals and the plots	• BR-2,BR-3 (Bulambuli) • KR-2,KR-3（Kween）
Plot Approach Rad	Road for access from O&M Road to the plots	

Source: JICA OD Team



Source: JICA OD Team

Fig. 2-2-2-7-1. Plan of Farm Road Arrangement

2-2-2-7-2 Design Policy

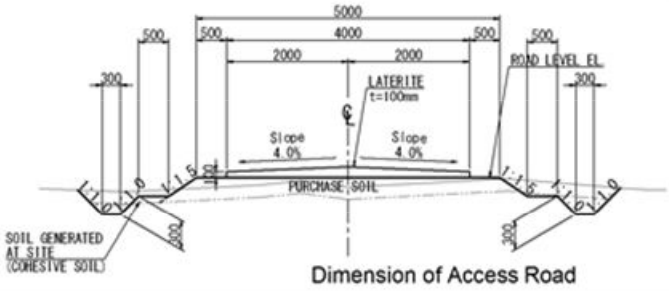
Farm road is designed to referring the design standards of both Japan and Uganda (refer to the followings).

- Design Standard on "Farm Road" of Land Improvement Project, Ministry of Agriculture and Fisheries (March 2005), Japan (hereinafter referred to as "Farm Road")
- "Uganda Road Design Manual (2010) ", Ministry of Works and Transport, Uganda
- "District Road Works Manuals (2002)", Ministry of Works and Transport, Uganda (Reference)

(1) Cross Section

a) Approach Road and O&M Road

The width of 5.0 m (4.0 m of roadway width and 0.5 m in each side of road shoulder width) should be adopted based on the design standards of Japan and Uganda, and the same earth pavement as the national road running around the Project area should be adopted (see, Fig. 2-2-2-7-2). The cross slope of the road is given as 4.0% according to the standard of Japan and Uganda for proper drainage of rainfall.



Source: JICA OD Team

Fig. 2-2-2-7-2. Typical Cross Section of Approach Road and O&M Road

(2) Longitudinal Section

The longitudinal section of the farm road is set for smooth traffic of the vehicles taking account of the planned elevation of the plots the longitudinal slope of the canal and the surrounding topography.

Surrounding topography in/around the Project area is inclined very gently from the upstream to the downstream with a 0.4 % of the gradient, so the longitudinal section of the farm road should follow the current terrain gradient.

Since there are the buried pipes such as concrete pipes which cross with the canals/drains and the farm road, it is necessary to raise the elevation of the road at the crossing point higher than the surroundings in order to ensure an appropriate overburden depth. The longitudinal gradient of the farm road at such points shall be less than 4.0 % in order for adjustment on the surrounding road. ("Farm Road" P.344 defines that the longitudinal slope of the sediment road does not exceed 4.0 %.)

(3) Pavement

The national road running near the Project area is paved with Murrum, but the approach road accessing into the Project site from the national road is unpaved in the present condition. The road pavement ratio of Uganda is about 3% (as of 2008[3]) which is actually lower than that of the neighboring countries. The main purpose of the O&M road is to operate and manage the facilities, access to the farmland, and the road having such functions is categorized in "Community Access Road

[3] Source: Calculated by JICA OD Team by using data of 2008 of World Bank Development Indicators Database. The ratio is lower than that of the surrounding counties: Kenya: 13 %, Tanzania: 8%, and Rwanda: 8%.

(CAS)" in Uganda standard. There is no clear definition of CAS road specifications, and there is no functional problem even if it is unpaved. However, in order to secure the sustainability of farming of the Project site, the pavement of the approach road and O&M road should adopt the simple pavement using high quality soil (Marrum soil) which is the same as the national road so that road function can be maintained for a long term. The thickness of the pavement shall be 10 cm with reference to the thickness of the roadbed of gravel road in Japanese Standard.

(4) Material for Embankment

Referring to the design standard of "Farm road" P.344, it is desirable that the soil as the embankment material for the earth road should contain a large percentage of coarse particles and an appropriate amount of clay as a binder. It also describes that the material containing 35 % or more fine particles (75 μm or less) should not be used for embankment of the earth road because such material becomes easily muddy by rainfall. The table below shows as an appropriate formulation of sand and clay mixture for using road embankment.

As the results of particle size test of Murrum soil sampled from candidate quarry site which is approximately 10 km away from the Project site, the content of fine particles (silt and clay) of 75 μm or less is 22 to 23%. Because it is suitable as a road embankment and pavement material, Marrum soil should be adopted as a road embankment material for the Project.

Table 2-2-2-7-2. Standard Formulation of Sand and Clay Mixture for Road Embankment Material (%)

Type of Soil	Ideal Ratio	Range of Appropriate Ratio
Clay	7.5	5~10
Silt	15.0	10~20
Sand (75μm～425μm)	25.0	20~40
Sand (425μm～2.36mm)	52.5	45=60

Source: “Farm Road.”

(5) Construction Road

During the construction period, a large amount of embankment materials and disposal soil are carried in/out, and heavy traffic of construction vehicles in the Project site is assumed.

The construction road of the Project will be utilized to future O&M road expecting consolidation settlement which is the same as a Preloading method[4] and becomes countermeasures against adverse influence of BCS during the construction period. The quality of the construction road, therefore, shall be secured the same specifications as the O&M road for a permanent structure. Regular repair work such as reshaping irregularities is planned during the construction stage.

2-2-2-7-3 Distribution of Soil and Countermeasure to BCS (Improvement Policy of BCS)

As a result of the soil survey, BCS is distributed in the northern and eastern parts of the Project area and covers about 60% of total area. . The maximum thickness of BCS is about 2.0 m. BCS is inadequate for the foundation of facilities because it becomes swell and muddy if it contains water.

For effective utilization of the soft soil and BCS, the loading test was carried out in the filed survey of the OD to confirm the effectiveness of “Sandbag (“Donou” in Japanese) Method” for road maintenance.

[4] This method is to construct a temporary structure by loading an equal or heavier than that of planned structure on a soft clayey ground. This load makes consolidation settlement and increases the strength of ground, and the temporary structure is removed before constructing planned structure.

Source: JICA OD Team

Fig. 2-2-2-7-3.Pictue on Implementation of Sandbag Method

As a result of the test the availability of sandbag method and the possibility of effective use of BCS were confirmed, however it was judged not to adopt the method for the Project due to the following main concerns:

- The method requires a lot of times and the labor works to pack BCS into the sandbag and to place the sandbags, which means that the method tested is inferior to other construction methods in terms of workability. It is not suitable for large scale construction.
- BCS is arable soil, and that BCS generated in the construction works is planned to be returned to farmland and reused for cultivation. There are few BCSs that can be reused to the embankment of the road.

The BCS in the Project area does not have high swelling property, according to the physical test. The maximum swelling pressure measured by the swelling pressure test is 30 kPa (30 kN / m2).

The replacement method of BCS is adopted as a for countermeasure in the neighboring countries such as Kenya and Tanzania, however the replacement is limited only surface part in case of low grade road. Although the thickness of BCS in the Project area is not so thick which maximum thickness is about 2 m, construction expenses for removing all swelling soil is costly since the total length of the road extends to 20 km. According to "Volume 3 Part III Gravel Roads Manual" P.15 of the "Uganda Road Design Manual" (2010), the countermeasure against swelling soil for the road which design traffic volume (Annual Average Daily Traffic, AADT) is less than 50 vehicles/day, is indicated as follows:

- To remove the150 mm thickness of swelling soil. The removed soil is used for shaping road slope.
- The roadbed shall be compacted 90% of D value. (According to AASHTO standard)After excavation, to perform backfilling with non-swelling soil having a CBR value of 3-4 or more (to compact with 95% of D value in each layer of 150 mm).

In consideration of the OD survey's results that the AADT is less than 50 vehicles/day and the swelling property of BCS is not so high, the following design policy against BCS in road construction is adopted with reference to the design criteria of Uganda.

- Swelling soil is removed with 300 mm thickness, which is the safer side than the standard value of 150 mm indicated in Uganda standard.
- For prevention of differential settlement at construction, the preloading by conducting embankment on the construction road is performed for the swelling ground in order to promote the consolidation settlement.
- After the excavation of swelling soil, the rolling compaction to swelling soil shall be done with 90% of D value.

- Non-swelling soil shall be used for replacement and it is sufficiently compacted with 95% of D value. Construction of the road embankment is to be done with the same specifications.

2-2-2-8 Design on Dyke

2-2-2-8-1 Basic Policy

The dyke shall be installed for flood control and stabilizing of the river course. Its installation policy shall be as follows:

- The alignment of the river dykes should be arranged according to the layout of the protected zone to be established along the Atari River.
- According to the survey results of the backwater in the Atari area, it is concerned that the poor drainage would occur in the beneficiary area due to the influence of backwater from the wetland at the downstream of the project area. For this reason, the flood protection dykes planned in the FS is excluded. ("backwater" here means that the fluctuation of water level affects the target farmland from the downstream.）
- The original river course shall not be changed with the exception of the some river restoration points where the Atari River is interrupted due to the construction of the river dyke.
- The design flood discharge of the Atari River to determine the height of river dykes is Q=38.0 m^3/s as set in the FS.

2-2-2-8-2 Range of the Dyke

In the field survey, it is concerned about poor drainage in the beneficiary area, as it was grasped that the maximum backwater level influences to a part of the downstream of the beneficially area (see, Fig. 2-2-2-8-1). Therefore, poor drainage and flood in the beneficiary area are also concerned.

. Especially, the downstream of the beneficiary area in Bulambuli, the flooded water on the beneficial area cannot be drained because the river bed elevation of Atari is higher than that of the beneficial area (see, Fig.2-2-2-8-2). Therefore, the two downstream flood protection dykes planned in the FS would be abolished and the drainage canals in beneficiary area are extended to the outside of the project area so as to prevent flooding in the beneficiary area (Table 2-2-2-6-6).

In addition, it was found that seasonal flooding of the Atari River and backwater from the downstream wetland reaches to WL.1064.50 m in usual year (see, Fig. 2-2-2-8-3), and there is little influence on the beneficiary areas of both Bulambuli and Kween sides at this scale of floods. However, since some parts of the crop fields and irrigation facilities are located along the Atari River, river banks are set up where the river is in contact to the beneficially area from the viewpoint of flood protection.

With the construction of the river bank within this range, although the influence of the wetland backwater becomes similar to the present situation when the maximum backwater elevation (WL.1066.13 m) occurs, the river bank is effective to the usual flood of scale and enable to alleviate the backwater from the downstream.

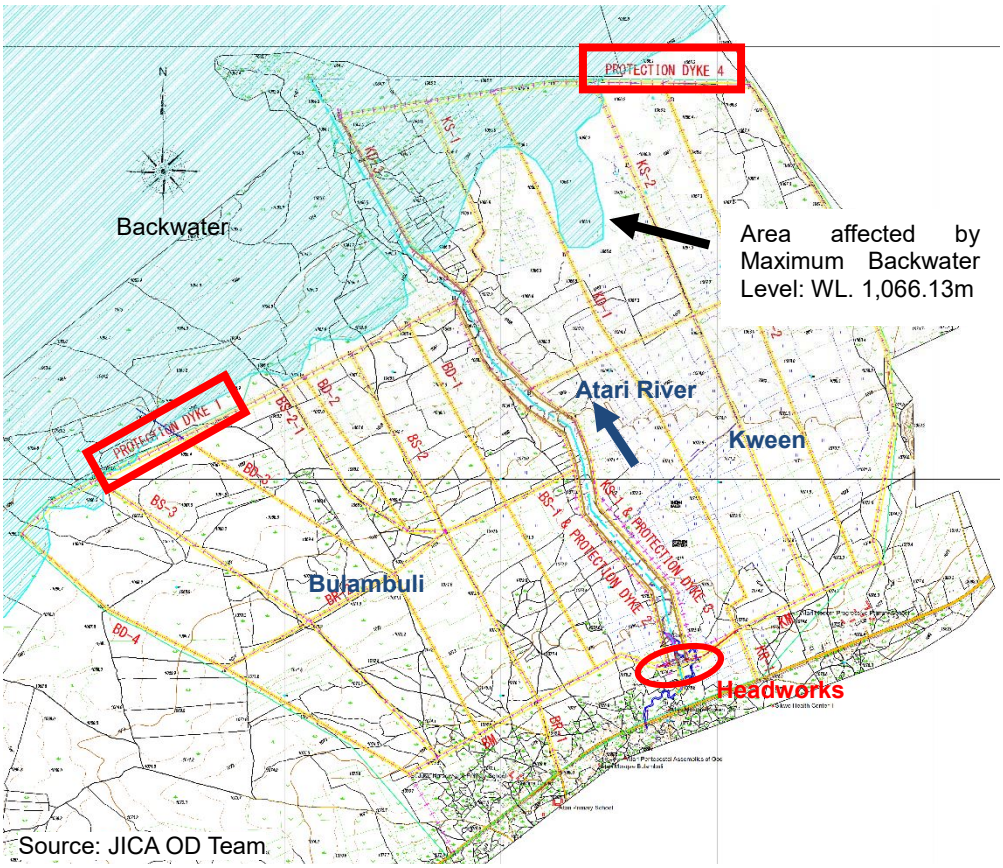


Fig. 2-2-2-8-1. Affected Area of the Maximum Submergence in Atari

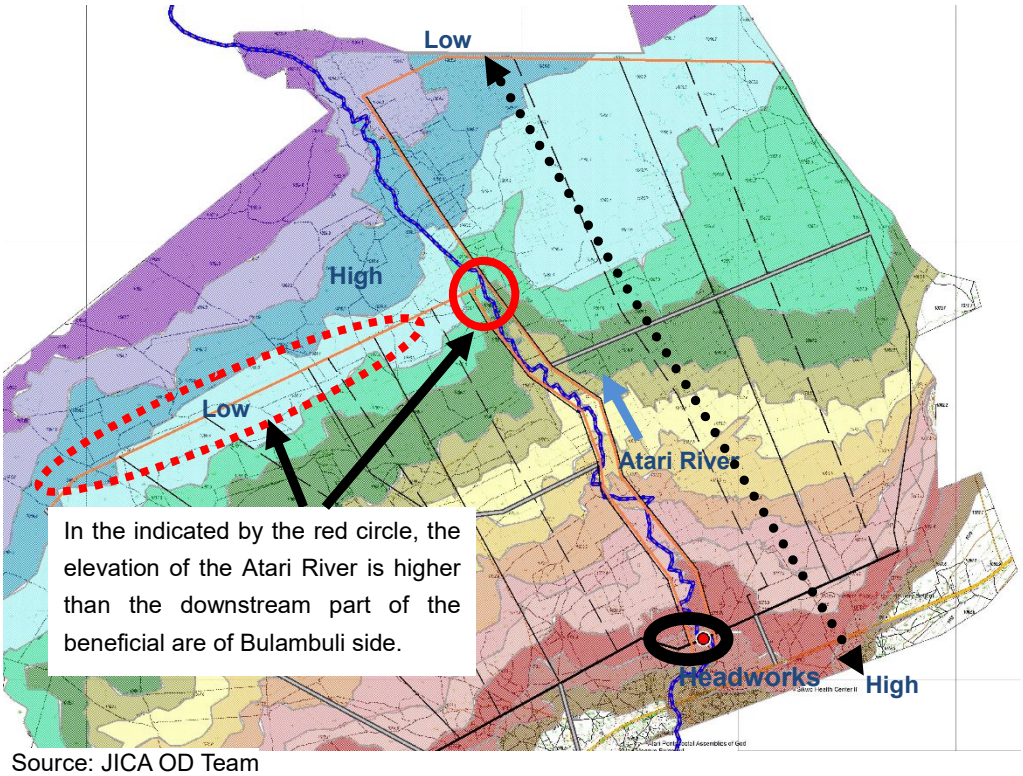
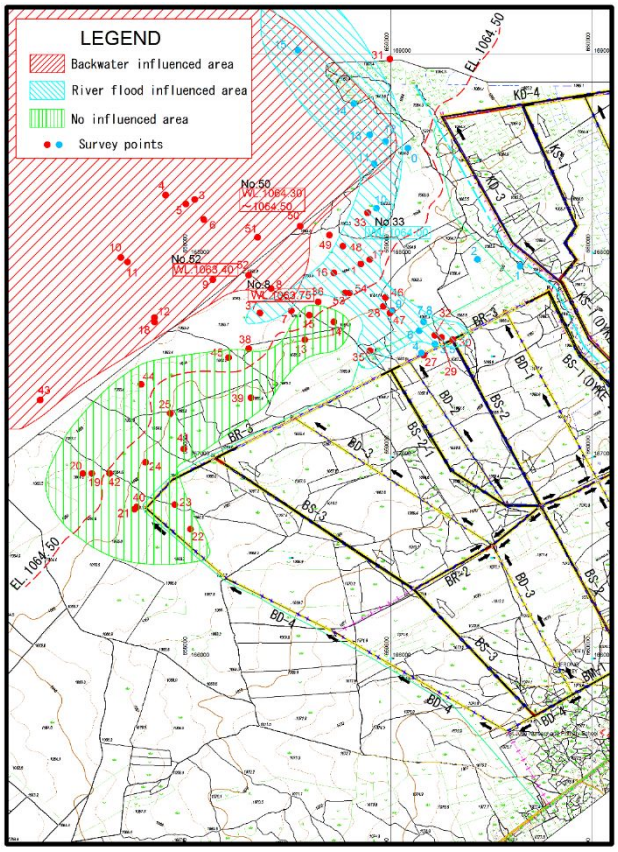


Fig. 2-2-2-8-2. Topographical Contour Map in Atari

According to the survey result, the flooding at the downstream side of the Project area occurs in normal year due to the backwater from wetlands and the floods from the Atari River. The flooding elevation is WL.1063.5 to WL.1064.5 as shown in the figure 2-2-8-3.



Source: JICA OD Team

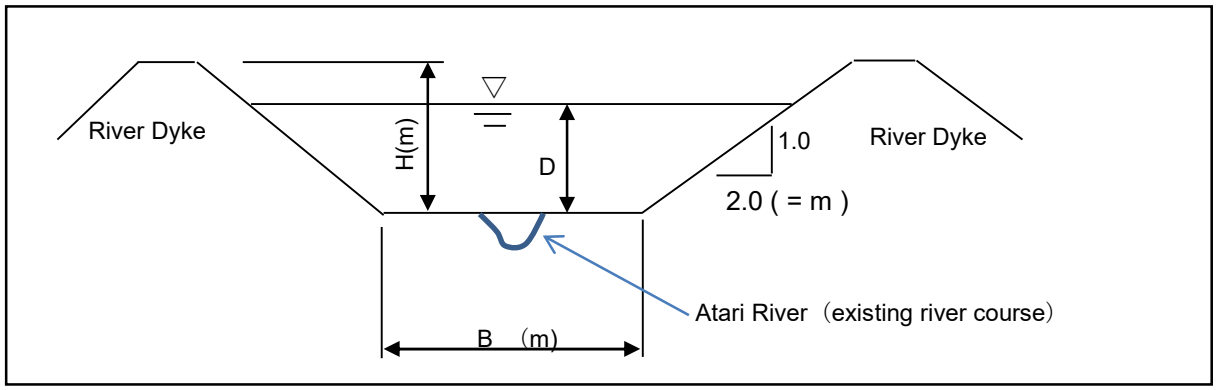
Fig. 2-2-2-8-3. Flooding Area in Normal Year

2-2-2-8-3 Design on Dyke

(1) Determination of Dyke Height

The necessary dyke height should be determined so as to flush the planned flood discharge (Q=38 m^3/s) safely and promptly in the width of protected zone of 60 m - 80 m. The planned flood discharge Q = 38.0 m^3/s shall flow down with a water cross section (trapezoidal part in the figure below) in between both river dykes to be constructed along the Atari River. Since a present river course of the Atari is meandering with small cross section, the hydraulic calculations for dike height do not take into account water cross section of existing flow capacity.

The crest elevation of dike is determined based on the planned high water level, namely, the planned high water elevation + the freeboard. In accordance with P. 108 and P. 109 of the River Sabo Technology Standard (draft) edited by Ministry of Construction (Japan), the freeboard is to be 0.6 m which is the margin against the planned flood under 200 m^3/s.



Source: JICA OD Team

Fig. 2-2-2-8-4. Atari River Hydraulic Calculation Schematic Sectional

The hydraulic calculation results for each Protected Zone width are as shown in the table below.

Table 2-2-2-8-1. Hydraulic Calculation of River Dyke Height

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Water Depth (m) D	Bottom Width (m) B	Gradient m	Area (m2) A	Wetted perimeter (m) P	hydraulic radius (m) R ④/⑤	Velocity (m2/s) V	Flow rate (m3/s) Q ④×⑦	Freeboard (m) d	Required height (m) H ①+⑨
0.532	60.00	2.00	32.486	62.379	0.521	1.170	38.00	0.60	1.132
0.485	70.00	2.00	34.438	72.170	0.477	1.103	38.00	0.60	1.085
0.448	80.00	2.00	36.245	82.004	0.442	1.048	38.00	0.60	1.048
0.416	90.00	2.00	37.926	91.867	0.413	1.002	38.00	0.60	1.016

note: Manning roughness coefficient : n=0.035, River longitudinal gradient : I= 0.004

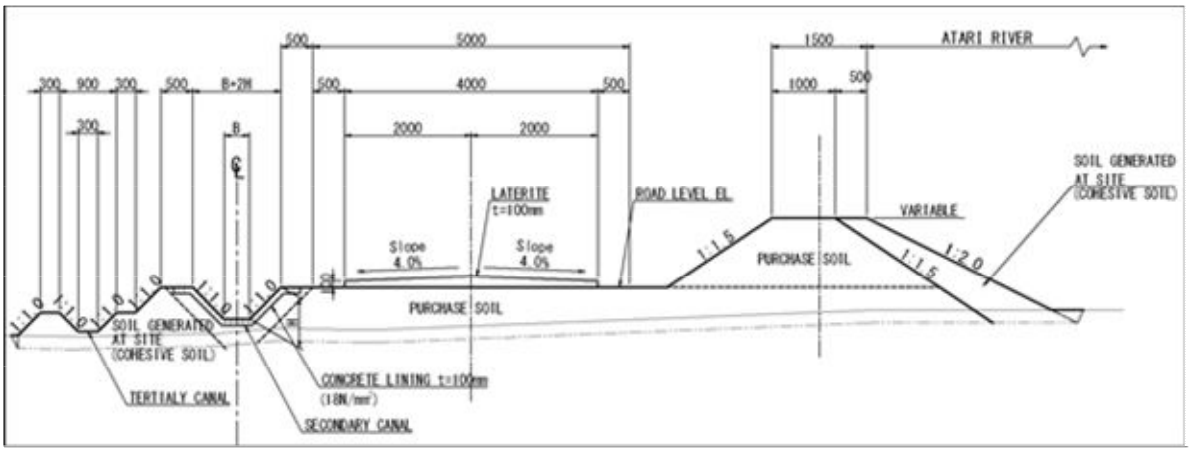
Source: JICA OD Team

The required dyke height is 1.132m at the case of Protected Zone width 60 m (30m each side) which is the case of the highest embankment height, and the height is round up to 1.2m in the unit of 10cm. Considering the continuity of the dyke and workability etc., the bank height is designed to secures 1.2m even in cases where the protected zone width is wider than 60 m.

(2) Specification of flood protection dyke

The river dyke is designed with a height of 1.2 m and a side slope gradient of 1:1.5. Murrum is used for the material of the dyke. Although high water pressure does not act on the dyke, a protective layer should be provided on the dyke surface to prevent erosion caused by river flow and rain. Side slope gradient of the protective layer is 1: 2.0.

The standard cross section of the flood protection dyke is shown on the following figure.



Source: JICA OD Team

Fig. 2-2-2-8-5. Standard Cross Section of Flood Protection Dyke

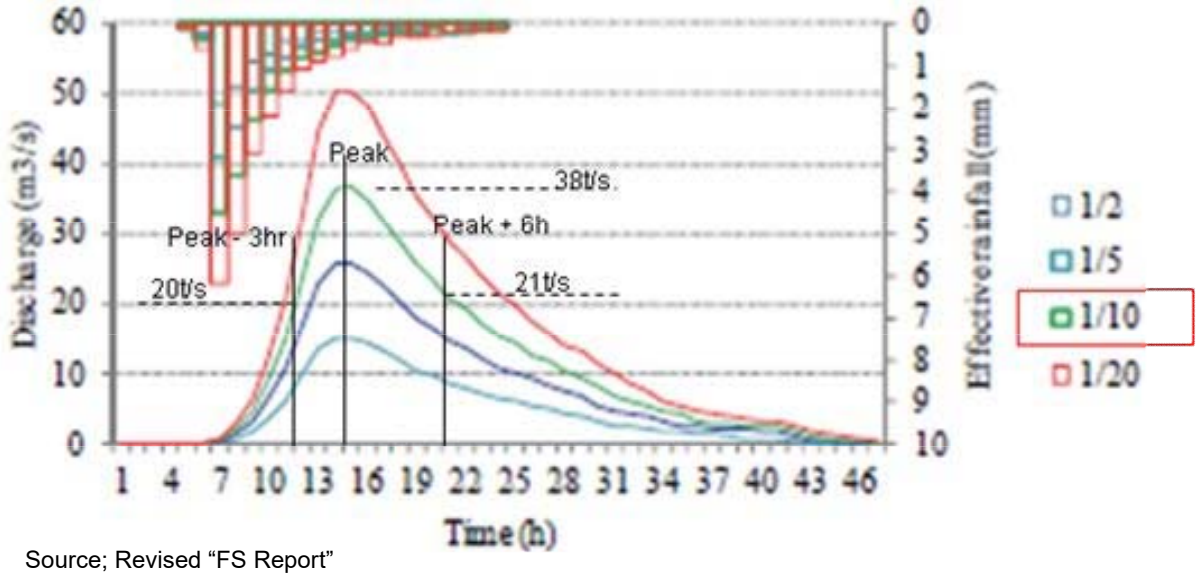
2-2-2-8-4 Flood Analysis in the Downstream of Bulambuli

To understand the flood influence in the downstream of Bulambuli, simple hydraulic analysis is carried out.

(1) Method and Cases of Analysis

The uniform flow calculation is adopted for the analysis. According to the F/S report, peak flood discharge at 10-year-flood is estimated to be 38m^3/s. However, peak discharge is shown in temporarily and does not maintain longtime. Therefore analysis is carried out the following 3 cases, a) 3-hour before the peak, b) peak discharge and c) 6-hour later from the peak in order to estimate the flood level in the downstream of Bulambuli.

Discharge at 3-hour before and 6-hour later are 20m^3/s and 21m^3/s respectively reading the value in the hydrograph.



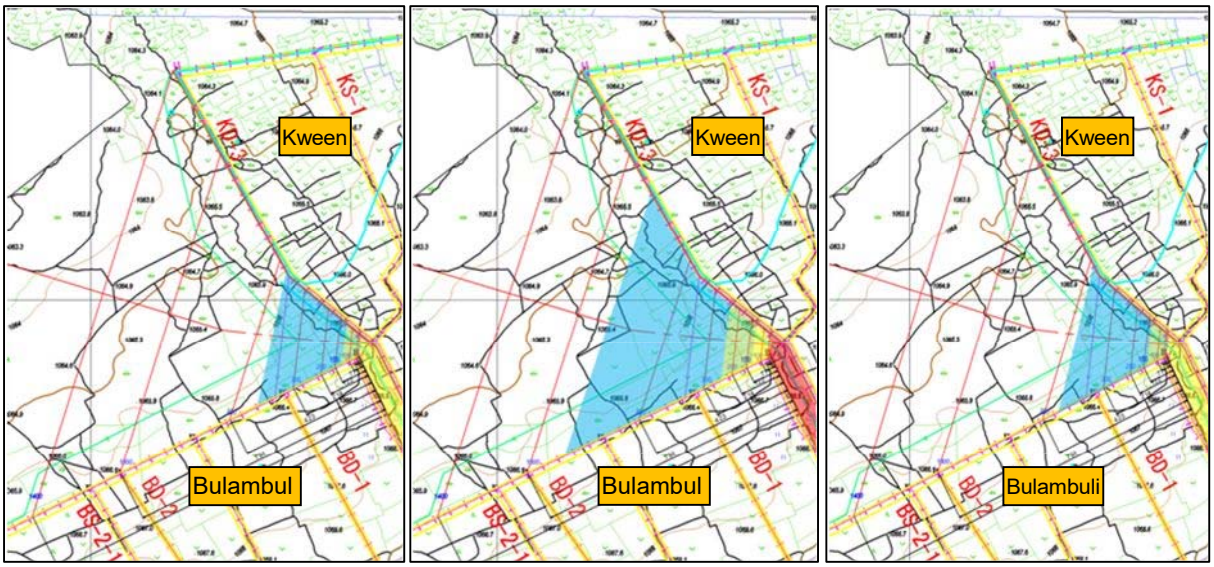
Source; Revised “FS Report”

Fig. 2-2-2-8-6. Hydrograph of the Atari River

(2) Flood affected time and flood depth estimated by the uniform flow analysis

The result of the analysis is illustrated on Figure 2-2-2-8-7. Flood level degreases rapidly at the end of river dike in Bulambuli. Maximum flood level is 0.50m at the peak, but the deeper flood level is limited in narrow area and flood level remains less than 0.10m in most area.

From the flood level distributions at a) 3-hour before the peak and c) 6-hour later, flood area of these 2 cases are smaller than that of peak discharge. Therefore, it is assumed that flood affection is limited only at the peak discharge and less severe at before and after the peak discharge. In addition, agricultural damage by flood is avoided because the flood time is not so long.



a) 3 hours before from the peak b) Peak discharge c) 6 hours later from the peak

Source: JICA OD Team

Fig. 2-2-2-8-7. Fluctuation of the Flood Level at the Downstream of Bulambuli

2-2-2-9 Plan of Building Facility

Building facilities are out of the scope of this Japanese Grant Aid Project due to some reasons mentioned below, but the following plans are proposed taking account of the possibility of further irrigation farming plans in the Project site and their implementation by GoU.

2-2-2-9-1 Background of the Plan

Target building facilities are training facilities equipped with office, grain storage with seed storage and agricultural machine garage, drying yard (paddy dryer), which has been requested by GoU based on the FS results. As the results of the OD, it has been judged that the building facilities are not included in the Project as the following situations were grasped.

- GoU already has experience of construction on similar facilities (e.g. Doho irrigation scheme);
- Such building facilities can be simply constructed, so the necessity to apply Japanese technology is low; and
- It is considered that MAAIF can address in the future depending on the national budget.

By consulting with MAAIF, the facilities designs such as drawings, quantities, specifications, etc. will be provided by JICA OD Team as a reference of future plan for MAAIF.

2-2-2-9-2 Plan of Building Facility

(1) Facilities Layout

The Project site is divided into two districts by the Atari River: Bulambuli of left bank and Kween of right bank. Additionally, the residents of different tribes live in each district, so there are differences in the language used and the norm of behavior. Taking account of this situation, therefore, it is deemed desirable to operate and maintain the building facilities separately in each side for proper farming activities such as handling of harvests and decision making of marketing. Based on this policy, the layout of building facilities is planned as shown in the table below.

Table 2-2-2-9-1. Layout plan of building facilities

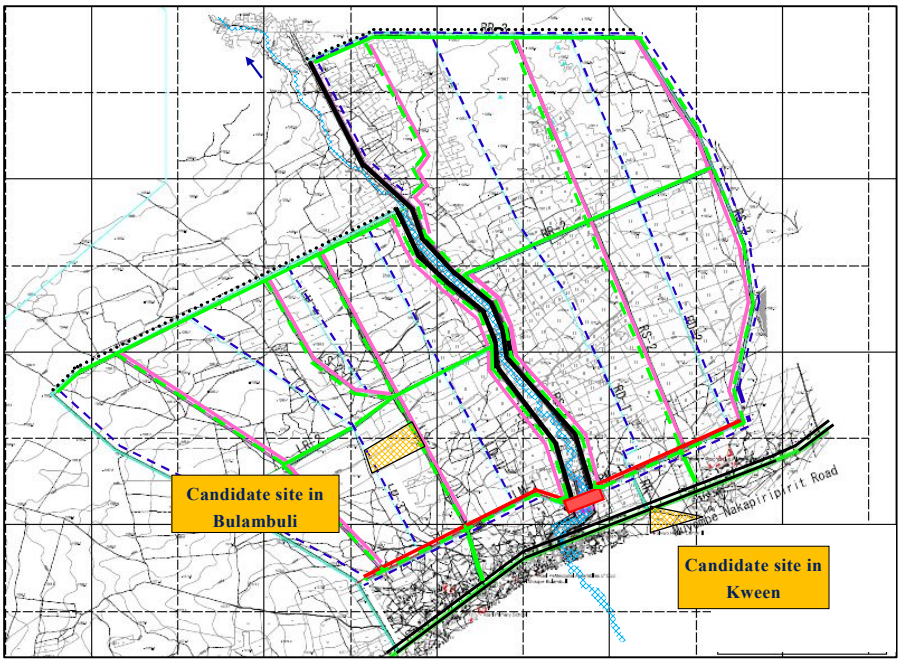
Building Facility	Bulambuli	Kween	Remark
Training Building	—	✓	Training room, Office
Dry Yard (for paddy drying)	✓	✓	
Grain Storage	✓	✓	Seed storage (Only in Kween)
Garage	—	✓	Agriculture equipment, O&M equipment

Source: JICA OD Team

(2) Location

Based on the layout plan mentioned above, both Bulambuli and Kween Districts offered the construction locations in each district. The basic conditions for selection of the locations indicated by JICA OD Team to the Districts are: the construction site is provided free of charge from the land owner, the construction facilities and land are not attributable to the land owner in the future, and it is desirable along the road.

As a result of the consultation with local residents, Bulambuli and Kween districts decided to offer the private land and the communal land, respectively. The figure below shows the location of each offered place.

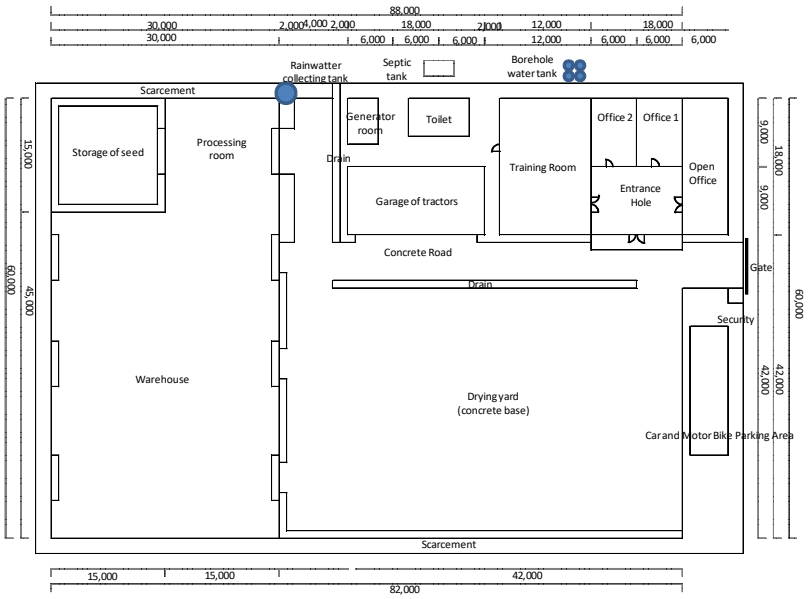


Source: JICA OD Team

Fig. 2-2-2-9-1. Planned Location of Building Facilities

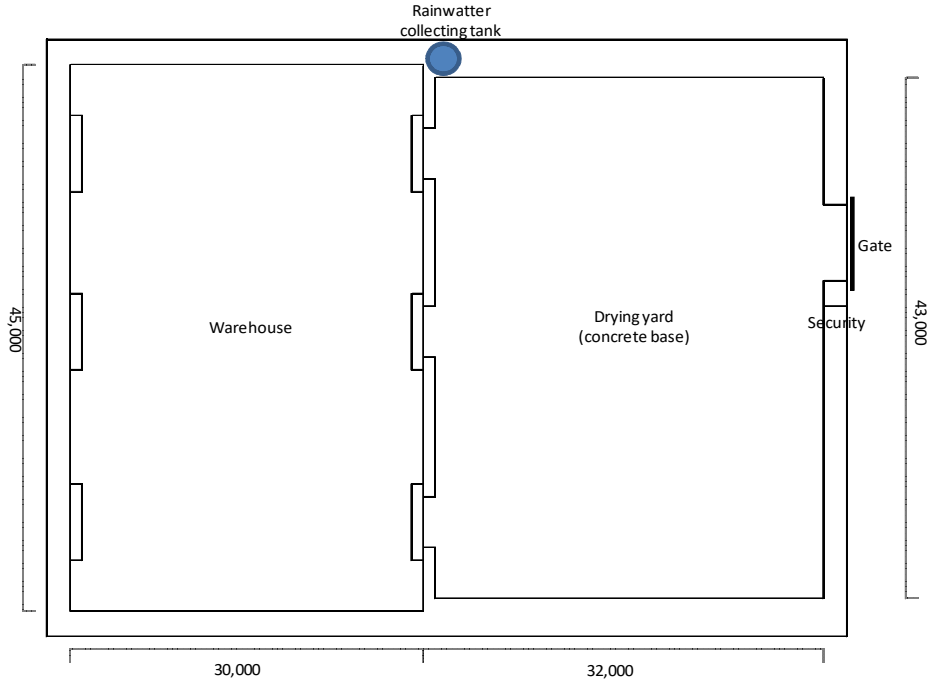
(3) Design of Facilities

The drawings below show the size and dimension of building facilities. And also, the outline design drawings, major quantities, and rough cost estimation are attached in the Final Report.



Source: JICA OD Team

Fig. 2-2-2-9-2. Outline Design of Building Facilities (Kween)



Source: JICA OD Team

Fig. 2-2-2-9-3. Outline Design of Building Facilities (Bulambuli)

2-2-2-10 Plan of Equipment

2-2-2-10-1 Basic Policy of Equipment Planning

The validity of the equipment requested (tractor, tiller, threshing machine as agricultural machinery, and rice mill, dryer, packing machine, fork lift as post-harvest processing machine) by GoU was confirmed through the field survey of the OD. As a result, it turned out that there are issues in maintenance of equipment because any water users group or association which is expected to make a role as operation and maintenance entity has not been formed at the Project site. For this reason, it is judged that it would be premature to install these equipment through Japanese Grant Aid Project.

Meanwhile, as there is a possibility of MAAIF efforts in the future, the quantities and specification of priority equipment are provided by JICA OD Team, which was agreed based on discussion between MAAIF and JICA OD Team.

2-2-2-10-2 Selection of Priority Equipment

(1) Agricultural Mechanization Policy of MAAIF

The selection of priority equipment and its procurement are planned from the point of view of the actual needs in the Atari area and agricultural mechanization strategic plan of MAAIF, focusing on i) mechanization on on-farm work saving, ii) decrease of postharvest losses and quality upgrading of agricultural products, and iii) operation and maintenance of irrigation facilities.

The contents of equipment have been reviewed with the engineers of MAAIF-DAIMWAP considering the results of the site survey of the OD, the FS stood on the direction stating in MAAIF Agricultural Mechanization Policy[5];

1) Promoting acquisition and utilization of agricultural mechanization technologies using a series of Public-Private-Partnership (PPP)
2) Promoting sustainable local manufacture and maintenance of suitable agricultural machinery for farm production and postharvest processing
3) Formulation and implementation of incentive frameworks for acquisition and financing of labor saving technologies
4) Establish an agricultural mechanization resource center for training machinery operators, generating technical information, and provision of referral workshop services for testing/ evaluating agricultural machinery
5) Strengthen the capacity of technical and vocational institutions for training agricultural mechanics and technicians
6) Strengthen collaboration with the National Bureau of Standards to eliminate importation and trade of substandard agricultural mechanization equipment

The budget is allocated as 159.84 million UGX in five years. However, the concrete activities of each pillar have not been examined. It is considered that boosting the vitality of the private sector is a feasible measure. In addition, it is necessary to improve accessibility by incorporating elements of agricultural mechanization into agricultural infrastructure development.

Toward labor-saving, increase in unit yield, and improvement of farm income by improving quality of

[5] Drafted by Eng. Ronald Kato Kayizzi, Commissioner, DAIMWAP, MAAIF, Sep. 2017

agricultural commodities, it is important to conduct trainings for capacity development of operators and maintenance workers in target areas in cooperation with the private sector as well as procurement of agricultural equipment by local enterprises. And also, it is desirable to maximize the project effect by combining some measures: i) monitoring the operation and management of field machinery by the agricultural mechanization unit of MAAIF – DAIMWAP, ii) monitoring the improvement of unit yield and quality through introduction of the certified seed of rice and improvement of post-harvesting technology by Buginyanya ZARDI, NARO.

(2) Equipment Plan on the FS

Major equipment suggested in the FS is shown in the table below. For agricultural machinery for exhibition purpose, the number of units is posted, but there is no description about such work equipment. It seems that the idea of installing 82 HP of tractor is a spec-in of Massey Ferguson 185 which was popular at the FS stage. However, introduction of this tractor is not appropriate for the Project area because the body weight of the tractor is as heavy as 2.7 tons, and it is settled in the paddy field of BCS. Regarding post-harvest processing machines, rice polishing machines are described to improve the quality of milled rice, which will boost the farm income up. In the request letter issued by GoU, the function of drying and packaging of paddy was added. As per construction machinery, basic equipment related to earthwork is proposed for maintenance and management of irrigation facilities. The table below shows the details of equipment proposed in the FS and the request letter, and the survey result of the OD.

Table 2-2-2-10-1. Equipment Proposed in the FS and Request Letter, and Survey Results of the OD

Purpose	FS Proposal		Request Letter	Survey Results of the OD
	Item	Quantity		
Agriculture	Tractor (82HP)	2 nos.	○	Considering the way of tilling and threshing services including the existence of carriers and also after-sale service, maintenance method, proper specifications that can be used for BCS, the type of machine and the required number of them. In particular, the choice of a tractor is important so that farmers themselves can make the paddy field level smoothly.
	Tiller (10HP)	4 nos.	○	
	Harvester	×	○	
Post-harvest	Rice milling machine	2 nos.	×	Considering the way of milling service and influence to existing rice millers. It shall be considered that various equipment such as truck scale, preliminary rider, dryer, weighing / packaging machine, bag, pallet, moisture meter are needed to operate the rice milling. Considering the farmers' intentions for farming activity because the type and/ or capacity of priority machines are changeable depending on whether targeting high quality rice or general quality rice, shipping in paddy rice or milled rice.
	Dryer	×	○	
	Packing machine	×	○	
	forklift (2ton)	4 nos.	○	
Construction (Maintenance)	Dump track (4ton)	2 nos.	×	It is estimated that it will be used for conveying sediments generated in maintenance works of irrigation facilities such as settling basin, canal, and drain, but it will also be considered for use in construction work.
	Back hoe ($0.8m^3$)	1 nos.	×	A small backhoe is advantageous for maintenance work for the terminal canal/ drain which have small size dimension. it will also be considered for use in construction work.
	Belt conveyor (5m)	4 nos.	×	Although it is presumed that the machine is used for sediment loading, the necessity shall be considered.
	Rammer (60kg)	4 nos.	×	It will be used for compacting soil of embankment and roads, but construction use is also considered.

Source: Item and quantity are referred from "FS Report."

(3) Preconditions on Equipment Plan

Taking account of the result of the FS and the OD results of this time and MAAIF's direction on dissemination of agricultural machinery, the revised equipment list from the initially-requested list issued by GoU has been prepared under the following conditions thorugh discussion with MAAIF-DAIMWAP:

- It is expected that the tilling works will be implemented mainly by the private tractor service providers. The 4-wheel tractor services including 1 ploughing and 2 rotavating will be concentrated in the certain limited periods. One unit of tractor can provide the services at around 20ha/unit/cropping season due to concentration of the demands of soil preparation works.
- Relationship between tractor service and its work machine is as shown in the table below. Since low availability, subsoiler machine and prasoiler machine are not introduced. Poly Disc Harrow which is suitable for clayey soil and has the function of ploughing is adopted.

Table 2-2-2-10-2. Equipment of 4 Wheel Tractor and Work Contents

Name of Equipment	70~90hp Class Tractor	45~60hp Class Tractor
Disk Plough	Ploughing work for upland fields (1st cropping season)	Ploughing work for paddy fields (1st cropping season)
Disk Harrow	Ploughing works for upland fields (2nd cropping season)	Ploughing works for paddy fields (2nd cropping season)
Rotavator	-	Rotary tilling works for paddy fields, and land leveling
Threshing Machine	-	Threshing works for paddy ears
Trailer	Transport of produce	-

Source: JICA OD Team

- There are possibilities to prevail working tractors (2-wheel tractors by means of financing by Savings and Credit Cooperatives Organization (SACCO) for farmers' groups, but the working performance will be less than 5 ha/unit/cropping season.
- The 4-wheel tractors shall perform the advantages than the power tillers due to lack of financial capacity of farmers, high working performance of 4-wheel tractors, and shorter planting periods caused by climate changes which can bring concentration on demand for tilling works among the farmers. The priority to introduce the power tillers in the demonstration farms would be relatively lower.
- It is assumed that the agricultural machineries to be procured are consigned from MAAIF-DAIMWAP to the local private service providers. The proposed numbers of units (total 6 units) are not sufficient to cover all Project areas of 680 ha, but under the manageable level. Some farmers will use oxen-plough continuously.
- Introduction of the pre-cleaner for certified seeds and the rice milling machines for edible rice are planned in order to upgrade the rice quality and increase the milling recovery. It is assumed that the agricultural machineries to be procured are consigned from MAAIF-DAIMWAP to the local private millers. For operation of the pre-cleaner, the researcher of crop science in Buginyanya Zonal Agricultural Research and Development Institute (ZARDI) will supervise and check seed quality. The rice milling machine will be installed one unit of motor-driven type at Kween side and one unit of engine-driven type at Bulambuli side depending on availability of electric power supply.
- The water users' cooperative will conduct the works for maintenance of agricultural infrastructures, and minimum sizes of construction machineries and tipper trucks will be operated.

- MAAIF will conduct training of equipment to the operators in Atari areas and District Agricultural Officers using the facility of Agricultural Mechanization Unit (the former Agricultural Engineering & Appropriate Technology Research Center at Namalere).

2-2-2-10-3 Priority Equipment

The equipment list has been revised from the initially-requested list from the above-mentioned directions.

Table 2-2-2-10-3. Proposed Equipment List and Priority

No.	Name of Equipment	Purpose	Main Specifications	Q'ty	Priority
1.	Farm Machinery				
1-1.	4-Wheel Tractor A	General works for upland fields	75-90 hp, 4-wheel drive, diesel engine, with front dozer	2 units	A
1-2.	Disk Plough	Ploughing work for upland fields	3-4 disks	2 units	A
1-3.	Disk Harrow	Harrowing work for upland fields	7 disks, poly disk type	2 units	A
1-4.	Trailer	Transport of inputs and crops	6-9tonloading capacity, hydraulic brake, damper	2 units	A
1-5.	4-Wheel Tractor B	General works for paddy fields	45-60 hp, 4-wheel drive, diesel engine, with front dozer	2 units	A
1-6.	Disk Plough	Ploughing works for paddy fields (1st cropping season)	2～3 disks	4 units	A
1-7.	Disk Harrow	Ploughing works for paddy fields (2nd cropping season)	6 disc, poly disk type	4 units	A
1-8.	Rotavator	Rotary tilling works for paddy fields	18-22 rotary blades	4 units	A
Not recommended	Hand Tractor（Power Tiller）	Ploughing and rotary tilling works for upland and paddy fields	10-16 hp, with disk plough and rotavator	2 units	B
1-9.	Threshing Machine	Threshing works for paddy ears	Attachable on the PTO of 4-60hp tractors	4 units	A
Not recommended	Fabrication Tools	Repair and maintenance of agricultural machines and attachments	Gas welder, Arc welder, Soldering welder, Hand grinder, air compressor, hand drill, mechanical & electrical tools	1 set	B
2.	Processing Machinery				
2-1.	Pre-Cleaner	Cleaning of Paddy Certified Seeds	Processing capacity 1-2 ton/hr, composed of receiving hopper, pre-cleaner & elevators	1 set	A
2-2.	Rice Mill Set A	Milling of rice (for the available site on electric power supply)	Motor driven: Processing capacity 0.75～1.0 ton/hr, composed of receiving hopper, de-stoner, rubber roll husker, rice whitening machine, gravity separator, elevators	1 set	A
2-3.	Rice Mill Set B	Milling of rice (for the unavailable site on electric power supply)	Engine driven: Processing capacity 0.50～0.75 ton/hr, composed of diesel engine, top-mill type husker and mill, de-stoner, elevators	1 set	A
2-4.	Weighing Scale	Weighing of receiving paddy and loading rice	Scaling capacity 0-100 kg, analog type platform scale	4 units	A
2-5.	Bag Sewing	Packaging of paddy and rice	Portable, 100-120 W	4 units	A

No.	Name of Equipment	Purpose	Main Specifications	Q'ty	Priority
	Machine	bags			
2-6.	Hydraulic Trolley	Carriage of palletized heavy bags	Manual, loading capacity 2-3 ton	4 units	A
3.	Heavy Machinery and Vehicle				
3-1.	Mini Hydraulic Excavator	Maintenance works for sedimentation basin, terminal cannels, drain canals and farm roads	5-7 ton, diesel engine, bucket capacity 0.14-0.16 m3, with dozer	4 units	A
3-2.	Damper Truck	Transport of soils and agricultural products	4×2, diesel engine, loading capacity 5-7 ton	4 units	A
Not recommended	Mobile Workshop	Managed by Agricultural Mechanization Unit, DAIMWAP, MAAIF for maintenance of machineries.	Body with mono-rail crane, 4×4 truck, diesel engine, tool set for agricultural and construction machineries	1 unit	B

Note:

1) The spare parts shall be provided at 10% of the prices for major equipment.
2) Training for the trainers for tractor maintenance of Agricultural Mechanization Unit (AMU), Department of Agricultural Infrastructure, Mechanization and Water for Agricultural Production (DAIMWAP) - Namalere, MAAIF shall be conducted at Namalere.
3) AMU shall design and provide the grain dryers in appropriate local technology in cost recovery base (Priority C).
4) AMU shall design and provide the trailers to carry the mini excavators in cost recovery base (Priority C).
5) AMU shall advice to procure the packing machine for milled rice and package design/materials after improving the rice quality (Priority C).
6) Priority A: High priority of introduction of the equipment, Priority B: Middle priority, Priority C: Low priority

Source: JICA OD Team