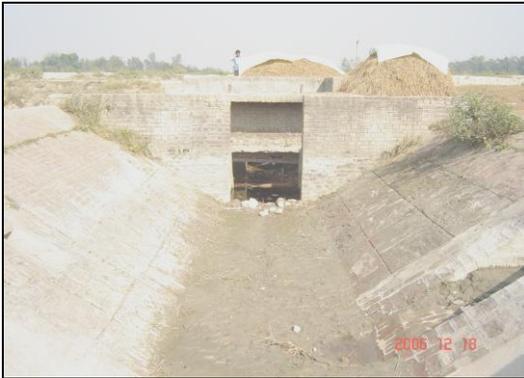


**ASSET INVENTORY, RAPID APPRAISAL REPORT AND
REHABILITATION PLAN OF BLOCK 2 AND 8 OF
NARAYANI IRRIGATION SYSTEM**

Final Report



**Submitted By:
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ACRONYMS

AMIS	Agency Managed Irrigation Systems
BCM	Branch Committee Member
BSC	Branch Secondary Canal
C/R	Cross Regulator
CCA	Cultural Command Area
CTM	Consultant Team Member
CWR	Crop Water Requirements (mm/day)
D/S	Down Stream
DADO	District Agricultural Development Office
DDG	Deputy Director General
DOA	Department of Agriculture
DOI	Department of Irrigation
EIA	Environment Impact Assessment
FMIS	Farmer Managed Irrigation Systems
GDP	Gross Domestic Product
GoN	Government of Nepal
H/R	Head Regulator
HW	Head Work
IDA	International Development Agency
IEE	Initial Environment Examination
ISF	Irrigation Service Fee
IWRMP	Irrigation and Water Resources Management Project
MSC	Main Secondary Canal
NIS	Narayani Irrigation project
NISP	Nepal Irrigation Sector Project
NIMD	Narayani Irrigation Management Division
NPC	National Planning Commission

NR	Not Recorded
NRs	Nepali Rupees
NS	Not Specified
O & M	Operation and Maintenance
RWSS	Rotational Water Supply System
SSC	Sub-secondary Canal
SDE	Senior Divisional Engineer
WB	World Bank
WECS	Water Energy Commission Secretariat
WUA	Water User's Association
WUC	Water User's Committee
WUO	Water Users Organization

SOME LOCAL TERMS

Dhalpa	Day Labour
Chowkidar	Watchman
Nahar	Canal
Kulo	Water Course

Executive Summary

The irrigation and water resources management project has introduced a new concept in agency managed irrigation system before its management hand over to WUAs. The new concept is "Asset Management Plan". Generally Asset Management Plan (AMP) has its original in finance and business sector and is now also applied to the irrigation drainage sector. Traditionally, the investment made in irrigation and drainage infrastructure by government was focused primarily on the cost planning and construction the infrastructure with little attention to the consumption of assets during their economic life. However, the management of infrastructure comprises several other types of events including maintenance, rehabilitation (replacement), modernization or the implementation of the new technology, retirement and disposal of assets. All these events have specific costs which form part of the overall cost of providing a sustainable service.

The Department of Irrigation has done the agreement with Everest Engineering Consultant to prepare asset inventory, rapid appraisal report and rehabilitation plan of block 2 and 8 of Narayani irrigation system since this system is also selected to implement under component B. Asset management plan would be incomplete without preparing the aforementioned things. In order to apply the concept of component B in IWRMP, AMP plays pivotal role.

The NIS lies in the middle *terai* region near Birgunj city. This system has altogether 15 blocks and irrigates large area in Bara and Parsa districts. Block 2 and 8 lies in Parsa and Bara district respectively. Though it was supposed to irrigate Rautahat district's southern part, due to shortage of water in the tail end, block 13, 14, 15 do not get the facility of irrigation.

This report has been prepared on the basis of desk study and field study. Concerned staffs in IWRMP office were met and all available information was collected. Similarly the team met various stakeholders in the block 2 and 8 of NIS. The Narayani irrigation management division no 5 office also provided the relevant data to this study.

Asset inventory of block 2 and 8 were prepared, their ratings has been done. The effort has been done to find out the problem in depth. Walk through survey has been done to check the status of all the structures and canal sections in MSC, BSC and SSC alignments.

Rapid appraisal is a family of methods that has been used for the study to evaluate the existing condition of the system focused on physical features, water delivery, irrigation coverage, productivity and organizational performance of the WUA and the system office and their details. This report has illustrated such aforesaid components of rapid appraisal.

The MSC of block 2 and 8 of NIS are fed by NEC through head regulators with the help of gates. Five of the BSCs of block 8 are directly fed by NEC except BSC 2. Both blocks have common problem in their canal network. Since the NIS has launched the massive rehabilitation program and which will be carried on for next three years, many damaged structures and canal reshaping work will be done.

The system has no major problem of water acquisition and water right since Nepal gets its water share from India as per agreement. However water paucity is a major problem in NIS. For the supplementary of NEC, Tilawe barrage has been constructed. Another barrage in Jamuni River to irrigate the tail end of Rautahat district is in plan and may be implemented soon.

Based on asset inventory and rapid appraisal, rehabilitation plan has been prepared. A major rehabilitation cost is estimated as NRs. 20,299,000.00 for block-2 and NRs. 9,916,000.00 for block-8, minor rehabilitation cost is estimated as NRs. 2,200,000.00 for block-2 and NRs. 1,175,000.00 for block-8 and O&M cost is NRs.1132980.76 for block-2 and NRs. 895093.92 for block-8.

Lacking of institutional development is the major weakness of NIS. Unless and until the Water Users Association come forward to join the hand with government, all concept of management transfer will fail. Hence the capacity buildings of farmers/WUAs are imperative.

In one hand, the locals of the NIS need to learn lessons from other FMIS where WUAs are playing effective role to make the irrigation system sustainable. In the other hand, the government needs to monitor the users committees and its activities so that the slimness can be minimized.

1. Introduction

1.1 Background

Irrigation has been practicing in Nepal since a long time. Initially the irrigation systems are developed and managed by farmers themselves. The government started irrigation development in 1923 with initiating construction of Chandra Nahar Irrigation System in Saptari district of Eastern Development region. Currently 1.16 million hectares of land under irrigation that is about 41% of total cultivated area of the country. Out of the total irrigated area about 28% falls under government built and managed and rest lies under farmer built and managed. The government-managed systems are popularly called as Agency Managed Irrigation Systems (AMIS) where as farmer built and managed irrigation systems are called Farmer Managed Irrigation Systems (FMIS).

The Government of Nepal has been preparing a follow on project of NISP after its completion in last fiscal year. The project is entitled as Irrigation and Water Resources Management Project (IWRMP). The component B of the IWRMP is focused on management transfer of agency managed irrigation systems (AMISs) to the farmers/ WUAs as per irrigation policy. To prepare the background for the handing over of such AMISs, the present status and performance has to be assessed. In order to enhance the overall performance of the irrigation system six AMISs covering an area of around 101,300 ha will be transferred to users under the component B. Kankai Irrigation Project, Sitagunj area of SMIP, West Koshi Irrigation Project, and Block-2, 8 of Narayani Irrigation Project are proposed for the implementation in the first year of project period. The other branches and blocks of Sunsari Morang, West Koshi, Narayani irrigation systems will be transferred in the subsequent years. Similarly the handing over of the irrigation system in Mahakali and Jhanj irrigation system will take place in successive years.

Irrigation agencies need to deliver a predetermined performance level of services, which benefits the users at an affordable cost, making better use of available resources. Significant improvements in level of services may involve substantial additional investment. In short, irrigation is now considered as a business in which its assets are used to generate sufficient revenue to sustain the business and renew and modernize its assets to obtain greater value from the use of water and land.

The requirement for a sustainable management requires the development of asset maintenance and management strategies aimed at preventing the loss of services capability which would affect the ability to deliver the performance level of service. An important task is to identify the cash flow requirements to ensure the sustainability of the system. Under-provision of funding leads to a shortening of

asset life and inability to maintain the performance level of service, with resulting economic loss to farmers and higher replacement costs for the system.

The proposed IWRMP has the overall goal to contribute to reducing poverty of the rural community through improved integrated management of water resources development and rehabilitation of irrigation infrastructures of Farmers' Managed Irrigation Systems (FMISs) and management improvement and management transfer of Agency Managed Irrigation Systems (AMISs).

1.2 Objectives

The objective of the consulting services is to prepare asset inventory and rehabilitation plan and to conduct rapid appraisal of block No. 2 and 8 (5700 ha) of Narayani irrigation system. These are the supplementary and interrelated documents for the preparation of asset management plan that covers financial aspects as well.

1.2.1 Asset inventory

The main purpose of the asset inventory and its analysis is to identify the assets, assess their values and the liabilities. The analysis of the inventory is to include;

- Technical specifications of infrastructures like canal structures, condition of existing tube wells system, stores, earth moving machinery, vehicles, buildings (office building, residential buildings, guest houses and other site offices), land under the project ownership.
- Historical and replacement cost/values
- Physical condition with ranking say 1-5 and non functional

Rating	Condition
5	Practically new and fully serviceable
4	Generally good with no damage, only routine maintenance required Performs assigned functions satisfactorily
3	Generally good but with some deterioration or damage, Need attention. Still performing assigned functions satisfactorily.
2	Significantly damaged or deteriorated. Suffering from deferred maintenance. Serviceability is impaired. Need urgent rehabilitation
1	Very poor in dilapidated condition. Non-functional. Requires partial restoration or complete replacement to restore serviceability.

1.2.2 Rapid appraisal

Rapid appraisal is a family of methods designed to get practical information on development issues in the irrigation system quickly. The primary objective of the rapid appraisal is to evaluate the system in water delivery (qualitative), irrigation coverage, productivity, organizational performance of the WUA and the system office. The consultant needs to prepare rapid appraisal report to assess the functions of the system in physical, organizational and productive level.

1.2.3 Rehabilitation plan

Based on the asset inventory and rapid appraisal of the system a rehabilitation plan needs to be prepared that reflects the need of users. The rehabilitation plan will show the present physical status of the irrigation system with the present worth of the infrastructures including the rehabilitation cost so as to meet the certain performance level of service. It consists of light rehabilitation and major rehabilitation costs. It needs to contain the action plan showing the cost sharing and responsibilities of users and agency.

1.3 Contract agreement

A contract agreement was signed between IWRMP (also referred to as "the client") and Everest Engineering Consultant (hereafter referred to as a consultant") on 20th November 2006 (5th Mangsir 2063) for the " Asset inventory, rapid appraisal plan and rehabilitation plan for block 2 and 8 of NIS, Birgunj under IWRMP (herein after referred to as "the Project"). The TOR is available in *annex 5*.

1.4 Study area

Before describing the history of Block 2 and 8, it is necessary to understand Narayani Irrigation System. This is a large (37400 ha) gravity flow irrigation scheme located in the central terai region of Nepal. The command area of this scheme lies in the three districts of terai: Parsa, Bara and Rautahat. NIS was developed by Indian government and the headworks of the scheme is built across Narayani river in Balmikinagar, the border of Nepal and India. The main eastern canal of this scheme is called Tirhut main canal that supplies water to Don Branch canal in India. The water enters in Nepal (Janakitol of Parsa District) from this Don Branch canal at the chainage of 92 km, which is the end point of Don Branch canal. Nepal gets 24.1 m³/sec water from this Don Branch canal. This scheme was handed over to HMG/Nepal in two phases that is in 1975 and in 1976.

HMG/Nepal later developed the command area dividing the scheme in 15 blocks with the financial support from the World Bank Development phase of the scheme.

By Indian government

Agreement between Nepal and India: December 4, 1959

Name of the scheme at the beginning: Gandak Project

Construction duration: 1968-1973

Hand over: 1975 and 1976 (Two phase)

Main canal (Nepal main canal): 81 km

Capacity: 24.1 cumecs

Major Structures: 87

Gross Command Area: 47500 ha

Command Area: 37400

By HMG/Nepal

Name of the scheme: Narayani zone irrigation development project

Donor Agency: World Bank

Construction duration: 1972-1991

No of Blocks in command area: 15

First phase: 1972-1981, Block 1-6 (16000ha)

Second phase: 1978-1986, Block 7-12 (12700 ha)

Third phase: 1987-1991, Block 13-15 (8700)*

* Only river training works, no command area development has taken place.

Total main secondary canal: 17 (137km)

Total branch secondary canal: 50 (233km)

Sub secondary canal: 408.5 km

Tertiary canal: 1468 km

Drainage: 305km

Structures: 3574

1.5 Present Status:

Name: Narayani Irrigation management division no. 5 (NIMD no. 5)

Position: Operation and Management Project from 1991

Irrigated area: From block 1-12, 28700 ha.

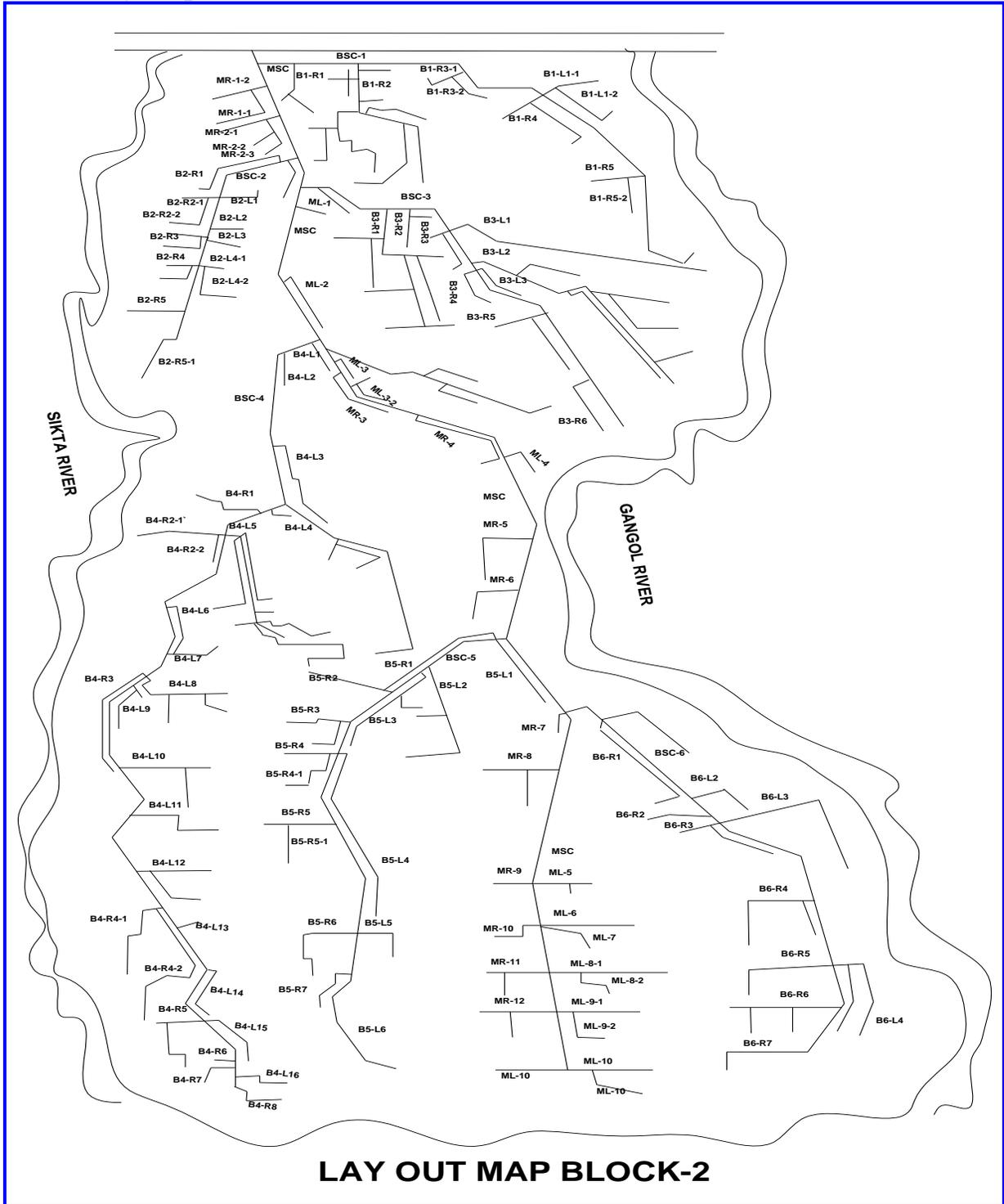
Office location: Birgunj, Parsa

Additional source: 3.5 cumecs water has been added from Tilawe barrage built across Tilawe river by HMG/N that irrigates block 5 and block 6 from eastern and western canals.

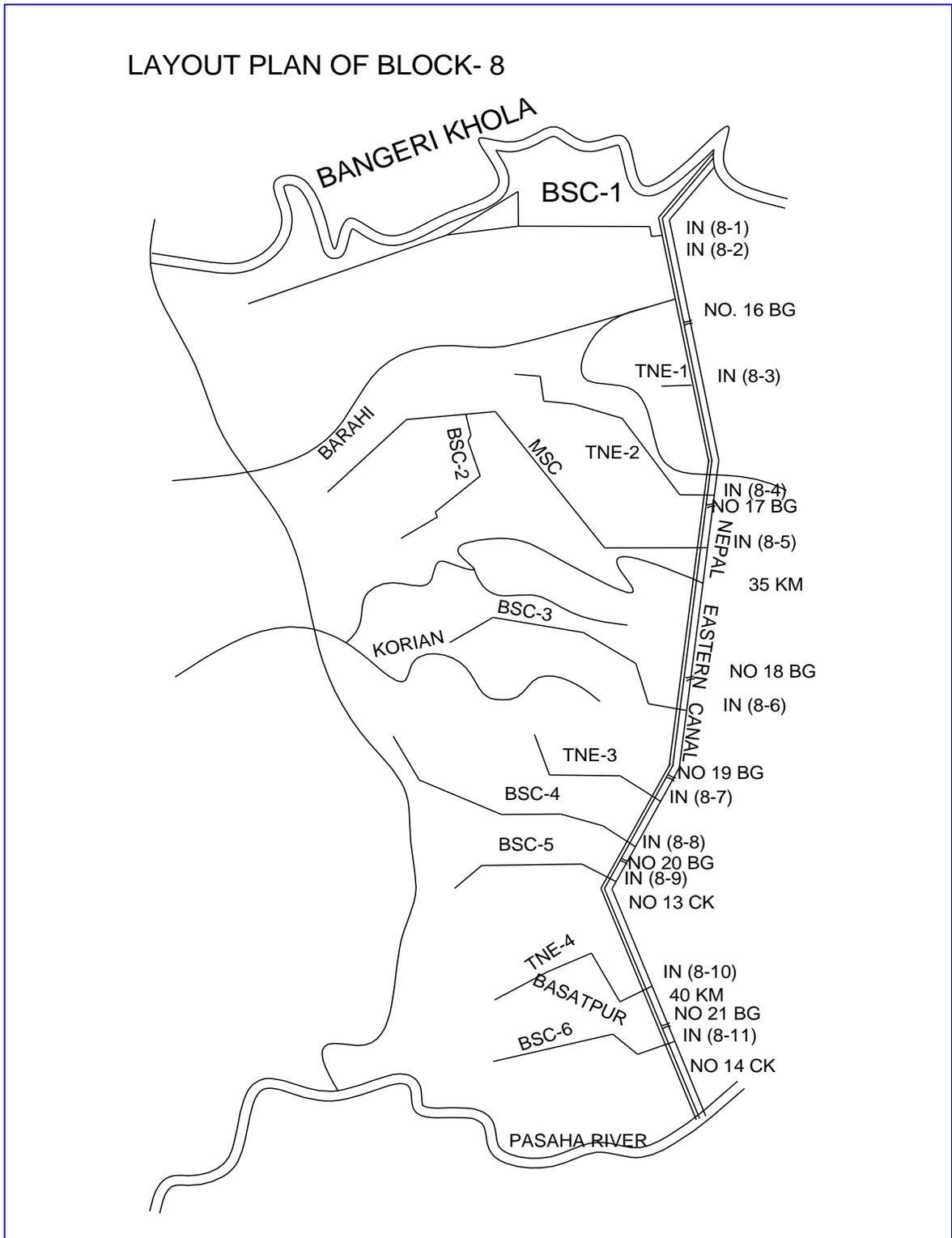
The area of block 2 and 8 are 2996 ha and 2768 ha respectively. The block 2 was built in the first phase of construction and the block 8 was developed in the second phase of construction. The project area is accessible by road and it takes around 6 hours drive from Kathmandu.

The large-scale irrigation system rehabilitation program has been launched for the last two years in whole NIS. In this program, most of the canal reshaping work has been completed and other maintenance work of the structures have been taking place targeting three years to complete from now on. The WUA has been formed and registered in all blocks.

Block 2 layout plan



2.2.5 Block 8 layout plan



1.6 Scope of work

This assignment has been carried out in the block no. 2 and 8 of Narayani irrigation system, which has been undertaken for IWRMP for the first year implementation. Drawings and relevant documents of the irrigation system is provided by Narayani Irrigation management Division Office. The output from this work is derived in the following format;

The asset inventory comprises following information;

- ✦ Salient features of the projects, main canal, branch canal, drainage details of structures in Table form;
- ✦ Details property of projects, land, building, trees and others;
- ✦ Details of heavy machine in table form;
- ✦ Details of stores and others;
- ✦ Asset survey forms attached herewith to be followed to prepare asset inventory, which eventually can be used as reference for the preparation of rehabilitation plan.

The outputs of rapid appraisal are as follows;

- ✦ Background history of the system comprising its original construction in phases, rehabilitation and improvement works made, and any expansion carried out in the past;
- ✦ Assessment of the operation and maintenance of the systems, its current practices, WUA's participation, and agency's roles and responsibility, regular and emergency maintenance, short comings. and users attitude;
- ✦ Assessment of the strength and weakness of the system in totality.

The rehabilitation plan gives following information;

- ✦ Light rehabilitation plan;
- ✦ Detail rehabilitation plan;
- ✦ Description of the physical system indicating its hydrology aspects, the functional status of its subsystems and structures in general.
- ✦ Short term repair and rehabilitation plans (Next two year).

1.7 Limitation of the study

The primary source of data for conduction of this study is the NIMD office, WUA, beneficiary farmer and key informants of the area. The study is limited to available data gathered from the above-mentioned stakeholders.

2. Project Study

2.1 Desk Study

Under this phase of study, the secondary information has been collected and reviewed by the professionals involved in the study team. In addition, interactions with project officials and professionals involved in participatory irrigation management have been done. The operation and maintenance plan of other systems have been reviewed. Based on these, the detailed field study programs have been prepared.

The consultants had performed the following activities before the mobilization for the field survey:

- ✚ Collection of documents, reports, data and information from secondary sources;
- ✚ Collection of pertinent information from DOI websites;
- ✚ Review and analyze the existing documents, reports and data;
- ✚ Preparation of checklists / Questionnaires; and
- ✚ Preparation and submission of Inception report.

2.2 Field Study

In this phase the consultant mobilized its multidisciplinary team to the field to carry out the detail field investigation for one week. The main objective of the field study was to verify the data collected during the desk study stage. The team consulted the authority of NIS, Birgunj and conducted a meeting with them to discuss on the purpose of the field visit. In addition, the team also interacted with the beneficiary farmers and WUAs. The team made close coordination with the NIS staff during the whole survey period in order to get the reliable data/information.

The team conducted key informant interviews with the NIMD No. 5 and group discussions with the farmers, WUAs and beneficiaries. The team visited entire length of the Block 2 and 8 secondary canals and few of its selected tertiary canals. A walk through in some of the water courses carried out with the beneficiaries with prior information. The checklist has been used for information collection through visual inspection, photographs and interactions with the concern agencies and beneficiaries. Apart from this, the other major activities performed were;

Open discussions with the groups of farmers in different reach such as head, middle, tail;

The field report has been prepared containing the data collected during field and submitted to the client.

2.3 Approach

The following are the main approaches adopted in order to carry out this study.

- ✚ A close coordination between the study team, client, WUA, beneficiary farmer, and other related officials maintained in order to obtain the necessary data.
- ✚ The data related to the study obtained from previous study if exist, direct observation, interviews and measurements.
- ✚ The study primarily based on primary and secondary information.
- ✚ Past experience on operation and maintenance analyzed.
- ✚ Based on data analysis and interpretation of the available data asset inventory, Rapid appraisal report and rehabilitation plan has been prepared.



Study team visiting NIS in field



View of cross regulator in MSC 2

3. Asset Inventory

The inventory of the structures of NIS in block 2 and 8 were carried out during field visit and verified with NIS staff and farmers. The inventory survey and reporting are made on the basis of five criteria suggested by the TOR, for identifying the assets, assesses their values and the liabilities. The analysis of the inventory is to include;

- ✚ Technical specifications of infrastructures like canal structures, condition of existing tube well system, stores, earth moving machinery, vehicles, buildings, land under the project ownership;
- ✚ Historical and replacement cost/values;
- ✚ Physical condition with ranking say 1-5 and their functionality as shown in the following table

Rating	Condition
5	<i>Practically new and fully serviceable</i>
4	<i>Generally good with no damage only routine maintenance required, performs assigned function satisfactorily</i>
3	<i>Generally good but with some deterioration or damage. Need attention. Still performing assigned functions satisfactorily</i>
2	<i>Significantly damaged or deteriorated. Suffering from deferred maintenance. Serviceability is impaired. Needs urgent rehabilitation</i>
1	<i>Very poor and dilapidated condition. Non-functional. Requires partial restoration or complete replacement to restore serviceability</i>

3.1 Asset inventory of block 2 of NIS

The water is diverted in block 2 of NIS with the help of cross regulator and head regulator from NEC. The various details and their rating of main secondary canal and other secondary canal of block 2 follows hereafter;

Inventory of Physical Infrastructures of canal

Canal: MSC Block 2

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	4
2	0+063	LD Syphon	4
3	0+070.20	Offtake	4
4	0+071.8	Slab Culvert	3
5	0+093	LD Syphon	4
6	0+121	Outlet	2
7	0+172.40	Regulating structure	3
8	0+662	Outlet	1
9	0+662	Outlet	1
10	0+898.6	Drop Structure	2

11	1+508	Offtake	4
12	1+510.40	Regulating structure	3
13	1+720	LD Syphon	4
14	1+746	Offtake	1
15	1+751	Check Structure	3
16	1+820	Outlet	1
17	1+907	Regulating structure	3
18	1+907	Slab Culvert+Drop	4
19	2+320	LD Syphon	4
20	2+606	Outlet	1
21	2+606	Outlet	1
22	2+634	Outlet	1
23	2+636	Regulating structure +drop	2
24	3+354	Offtake	2
25	3+360	VRB	4
26	3+429	Offtake	4
27	3+439	Outlet	1
28	3+439	Outlet	1
29	3+456	Check Structure	2
30	3+460	Regulating structure	3
31	3+975	Outlet	1
32	3+977	Regulating structure	3
33	4+377	Outlet	1
34	4+390	Outlet	1
35	4+512	Outlet	1
36	4+552	Regulating structure	3
37	4+652	Drop Structure	3
38	5+269	Outlet	2
39	5+274	Regulating structure	3
40	5+678	LD Syphon	4
41	5+838	Culvert	4
42	5+900	Culvert	4
43	5+933	Outlet	4
44	5+935	Regulating structure	4
45	6+274	Outlet	1
46	6+276	Regulating structure	1
47	6+643	VRB	3
48	6+773	Outlet	1
49	7+075	Culvert	
50	7+154	LD Syphon	4
51	7+193	Offtake	2
52	7+195	Regulating structure	1
53	7+895	Outlet	1
54	8+021	Offtake	2
55	8+022	Regulating structure	4
56	8+036	Parshal flume	4
57	8+268	Culvert	3
58	8+679	Culvert	4

59	8+707	Outlet	1
60	8+710	Regulating structure	4
61	9+164	Outlet	1
62	9+164	Outlet	1
63	9+223	Regulating structure	4
64	9+658	Outlet	1
65	9+661	Outlet	1
66	9+661	Outlet	1
67	9+662	Culvert	4
68	10+162	Outlet	1
69	10+162	Outlet	1
70	10+163	Regulating structure	4
71	10+649	Outlet	1
72	10+649	Outlet	1
73	10+515	Culvert	4
74	10+649	Regulating structure	3

Canal: BSC-1

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	4
2	0+019	Parshall Flume	4
3	0+312	B1-R1	3
4	0+497	Foot Bridge	4
5	0+808	Offtake	4
6	0+810	Regulating structure	4
7	0+825	LD syphon	4
8	1+220	Aqueduct	4
9	1+234	Culvert	4
10	1+537	B1-R2	2
11	1+539	Check Structure	3
12	1+761	Culvert	3
13	1+969	LD syphon	4
14	2+048	Culvert	3
15	2+085	LD syphon	4
16	2+214	B1-R3 and B1-L1	4
17	2+215	Check Structure	3
18	2+608	Culvert	4
19	2+716	Culvert	3
20	2+894	LD syphon	4
21	3+140	B1-R4	4
22	3+141	Check Structure	3

Canal: BSC-2

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	4
2	0+026	Parshall Flume	4
3	0+055	B2-L1	4
4	0+095	LD syphon	4

5	0+137	B2-R1	4
6	0+139	Regulating structure	3
7	0+383	Culvert	3
8	0+733	B2-L2 & B2-R2	4
9	0+734	Regulating structure	3
10	1+189	Culvert	3
11	1+312	B2-L3 & B2-R3	4
12	1+358	Regulating structure	3
13	1+625	B2-L4 & B2-R4	3
14	1+627	Regulating structure	3

Canal: BSC-3

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+047	Parshall Flume	3
3	0+198	LD syphon	4
4	0+352	LD syphon	4
5	0+743	Offtake	3
6	0+793	Regulating structure	3
7	0+984	B3-R1	4
8	1+036	Culvert	3
9	1+223	LD syphon	4
10	1+413	Culvert	4
11	1+750	B3-L1 & B3-R2	4
12	1+753	Regulating structure	3
13	1+295	Offtake	3
14	2+197	Regulating structure	3
15	2+430	LD syphon	4
16	2+467	Culvert	4
17	2+545	B3-L2 & B3-R3	4
18	2+694	Regulating structure	3
19	2+903	Culvert	3
20	3+262	LD syphon	4
21	3+278	Culvert	4
22	3+368	B3-L3 & B3-R4	4
23	3+465	Regulating structure	3
24	3+782	Culvert	4
25	3+937	B3-L4 & B3-R5	4
26	3+940	TS	1

Canal: BSC-4

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+037	B4-L1	4
3	0+108	Escape (spilway)	4
4	0+346	FS	4
5	0+445	Regulating structure	3
6	0+800	CD	4

7	1+125	CD	4
8	1+153	B4-L2	4
9	1+161	Culvert	4
10	1+300	Bridge	4
11	1+472	Culvert	4
12	1+598	Offtake	3
13	1+610	CD	4
14	1+610	Lined Canal	4
15	1+779	B4-R1	3
16	1+780	Check Structure	3
17	1+968	Culvert	4
18	1+968	Offtake and B4-R2	3
19	1+987	Regulating structure	3
20	2+426	Check Structure	3
21	2+580	Culvert	4
22	2+841	B4-L3	4
23	2+843	Regulating structure	3
24	3+252	Culvert	4
25	3+326	L (FS)	3
26	3+750	Culvert	4
27	3+750	B4-L4 & B4-R3	4
28	3+830	B4-L5	3
29	3+875	Check Structure	3
30	4+487	B4-L6	4
31	4+853	B4-L7	4
32	4+853	Check Structure	3
33	5+348	B4-L8	4
34	5+468	Check Structure	4
35	5+721	B4-R4	4
36	5+825	CD	4
37	5+901	B4-L9	4
38	5+901	Check Structure	3
39	6+111	CD	4
40	6+125	Culvert	4
41	4+420	B4-L10/B4-R5	4
42	6+422	Check Structure	3
43	6+780	CD	4
44	7+015	Culvert	4
45	7+015	B4-R6	4
46	7+150	Culvert	4
47	7+482	B4-L11/B4-R7	4
48	7+482	TS	1

Canal: BSC-5

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+049.85	B5 - L1/B5 - R1	4
3	0+050.75	Check Structure	3

4	0+183.25	Culvert	4
5	0+581.70	B5 - L2	4
6	0+586	B5 - L3	4
7	0+588	Check Structure	3
8	0+761	Culvert	4
9	1+079	B5 - R2	4
10	1+156	B5 - R3	4
11	1+158	Check Structure	3
12	1+334	CD	4
13	1+340	Culvert	4
14	1+603	Check Structure	3
15	2+068	B5 - R4	4
16	2+088	Check Structure	3
17	2+224	CD	4
18	2+529	B5 - R5	4
19	2+549	B5 - L4	4
20	2+551	Check Structure	3
21	3+019	B5 - R6	4
22	3+019	Check Structure	3

Canal: BSC-6

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+015	Parshal flume	4
3	0+169	B6 - R1/B6 - L1	4
4	0+169	Chek Structure	3
5	0+380	Culvert	4
6	0+868	B6 - L2	4
7	0+869	Chek Structure	3
8	1+400	CD	4
9	1+442	B6 -R2/B6 - L3	4
10	1+442	Chek Structure	3
11	1+598	Culvert	4
12	1+700	CD	4
13	1+735	CD	4
14	1+738	Culvert	4
15	1+973	CD	4
16	2+051	CD	4
17	2+244	B6 - R3	4
18	2+565	CD	4
19	2+679	B6 -R4/B6 - L4	4
20	2+682	Chek Structure	3
21	3+220	B6 - R5	4
22	3+222	Chek Structure	3

Canal: BSC-1A

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3

2	0+007	B1A - L1	4
3	0+025	CD	4
4	0+316	B1A - R1	4
5	0+738	TS	1

Canal: SSC-1

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+024	Culvert	4
3	0+144	CD	4
4	0+357	Culvert	4
5	0+567	S1 - L1	4
6	0+775	TS (S1 - R1) (S1 - L2)	4
7	0+775	TS	1

Canal: SSC-2

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+022	S2 - L1/S3 - R1	4
3	0+025	CD	4
4	0+750	S2 - L2	4
5	0+750	TS	1

Canal: SSC-3

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+113	CD	4
3	0+188	Culvert	4
4	0+300	TS	4
5	0+300	TS	1

Canal: SSC-4

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+065	S4 - L1	4
3	0+115	Culvert	4
4	0+670	S4 - R1/S4 - L2	4
5	0+670	TS	1

Canal: SSC-5

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+220	Culvert	4

3	0+303	CD	4
4	0+320	S5 - R1	4
5	0+322	Regulating structure	4
6	0+652	Culvert	4
7	0+680	S5 - L1/S5 - R2	4
8	0+680	TS	1

Canal: SSC-6

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+056	S6 - L1	4
3	0+058	Regulating structure	4
4	0+267	Culvert	4
5	0+353	CD	4
6	0+364	Culvert	4
7	0+633	CD	4
8	0+636	Culvert	4
9	0+765	S6 - R1	4
10	0+767	Regulating structure	4
11	0+991	S6 - L2/S6 - L3	4
12	0+991.5	TS	1

Canal: SSC-7

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+044	S7 - R1	4
3	0+047	Culvert	4
4	0+810	S7 - R2	4
5	1+150	TS	1

Canal: SSC-8

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+045	S8 - L1	4
3	0+770	S8 - L2	4
4	0+941	TS	1

3.2 Asset inventory of block 8 of NIS

The block 8 of NIS is not similar to block 2. Here except one BSC, other BSC get water directly from NEC. The details of structures and its rating are given in the following table.

Inventory of physical infrastructures of canal

Canal: MSC BLOCK -8

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	1
2	0+042	Slab culvert	4
3	0+044	Parshal flume	4
4	0+609	Slab culvert	4
5	0+796	Slab culvert	4
6	1+100	Cross Drainage work	3
7	1+150	Cross Drainage work	3
8	1+396	Slab culvert	4
9	2+152.7	Slab culvert	4
10	2+230	Hume Pipe culvert	3
11	2+252.8	Regulating Structure	3
12	2+328	Parshal flume	4
13	2+817.30	Regulating Structure	4
14	2+876	Outlet	4
15	2+880	Regulating Structure	4
16	3+285	Regulating Structure	4
17	3+441	Slab culvert	4
18	3+863.8	Slab culvert	4
19	3+871	outlet	3
20	3+875.2	Regulating Structure	4
21	4+450	Terminal structure	1

Canal: BSC-1

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	4
2	0+035	Regulating Structure	4
3	0+130.8	Outlet	3
4	0+550.60	Outlet	3
5	0+572.80	Outlet	3
6	0+576.90	Check structure	4
7	0+728.80	Culvert (slab)	4
8	0+959.60	Outlet	5
9	1+016.30	Check structure	4
10	1+300	L.D.Syphon	3
11	1+480	Culvert (H.P)	4
12	1+561	L.D.Syphon	3
13	1+857.70	Slab Culvert	3
14	1+857.70	Outlet	5
15	2+100	L.D.Syphon	5
16	2+700	L.D.Syphon	5
17	2+750	Culvert (slab)	4
18	1+850	Culvert (H.P)	3
19	2+900	Culvert (H.P)	3
20	3+00	L.D.Syphon	3
21	3+057.7	Culvert (H.P)	3

22	3+600	Culvert (slab)	3
23	3+601	Outlet	3
24	3+609.38	Regulating Structure	4
25	3+624	L.D.Syphon	4
26	4+173	Outlet	4
27	4+176	Regulating Structure	3
28	4+468	Outlet	4
29	4+800	Outlet	4
30	4+815	Outlet	4

Canal: BSC-2

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	1
2	0+012.9	Outlet	4
3	0+013.6	Regulating Structure	3
4	0+782	Culvert (slab)	4
5	1+073.70	Outlet	3
6	1+231.50	Outlet	3
7	1+238.40	Check Structure	1
8	1+410	Outlet	3
9	1+742	Outlet	3
10	1+837.40	Regulating Structure	3
11	2+245	Outlet	3
12	2+251.7	Regulating Structure	3
13	2+700	Outlet	4

Canal: BSC-3

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+041.3	Outlet	3
3	0+097.6	Culvert (slab)	3
4	0+598.7	Outlet	4
5	0+711.30	Culvert (slab)	4
	0+724.6	Outlet	1
	0+726	Check Structure	3
6	0+973.30	Culvert (slab)	4
7	1+113.90	Drop	1
8	1+274.40	Culvert (slab)	4
9	1+495.50	L.D. Siphon	3
10	1+764	Culvert (slab)	4
11	1+732	Outlet	3
12	2+373.50	Terminal Structure	1

Canal: BSC-4

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	3
2	0+035	Parshal flume	1

3	0+131.30	Culvert	4
4	0+451.20	Culvert	3
5	0+626.6	Outlet	2
6	0+627.6	Check structure	3
7	0+673.7	Culvert	3
8	0+858.30	Outlet	2
9	0+862.60	Regulating Structure	1
10	1+111.40	Culvert	3
11	1+340	Culvert	3
12	1+626	Culvert	3
13	1+932	L.D. syphon	3
14	1+933.7	Culvert	3
15	1+960	Check structure	2
16	2+123.20	Culvert	4
17	2+151	Terminal structure	1

Canal: BSC-5

S.No.	Chainage	Structures	Condition Rating
1	0+000	H/R	4
2	0+030	Parshal flume	1
3	0+041.79	Regulating Structure	1
4	0+310	Culvert	3
5	0+724	Regulating Structure	2
6	0+731.90	Culvert	3
7	0+924	Culvert	3
8	1+154	L.D. syphon	4
9	1+213.10	Terminal structure	2
10	1+800	Culvert	2

Canal: BSC-6

S.No.	Chainage	Structures	Condition Rating
1	0+000	HR	4
2	0+033	Regulating Structure	3
3	0+150.45	Outlet	4
4	0+822.50	Culvert	3
5	0+837	Outlet	2
6	1+030.40	L.D. syphon	4
7	1+162	Culvert	4
8	1+324.45	Culvert	4
9	1+492	Culvert	4
10	1+539	L.D. syphon	4
11	1+573	L.D. syphon	3
12	1+588	Culvert	3

4. Rapid appraisal

Rapid appraisal is a familiar of methods that has been used for the study to evaluate the existing condition of the system focused on physical features, water delivery, irrigation coverage, productivity, organizational performance of the WUA and the system office and their details.

4.1 Physical features of the system

The MSC of block 2 and 8 of NIS are fed by NEC through head regulators with the help of gates. Five of the BSCs of block 8 are directly fed by NEC except BSC 2. Both blocks have common problem in their canal network. Since the NIS has launched the massive rehabilitation program and which will be carried on for next three years, many damaged structures and canal reshaping work will be done. However the present status of the block 2 and 8 as seen in field are explained below.

The length of main secondary canal of block 2 is 10.65. Almost all part of the canal length is unlined, except u/s and d/s of structures where the canal is lined. The shape of the canal in u/s is so far not disturbed, however the d/s shape is totally deteriorated. The right bank in tail end is almost disappeared and has come to the level of field. Reshaping is needed in head reach and middle reach structures where the offtake structures lies. The outlet has to be regulated with gates. Most gates are damaged or stolen and the offtake remain without gates hampering water distribution equitably. Only the frame of the outlet exists and the gate needs to be installed. In total NRs 45.16 million is needed for light maintenance and reshaping of the canal system in block 2.



The scouring in MSC of block 2

The length of the MSC of block 8 is 4.7 Km. The total length of the canal is earthen and needs to be reshaped in various chainages. Gates are missing in all

outlet structures. The structures in canal need to be protected with normal maintenance. Regulating gates are corroded and needs to be replaced with the new one. The tentative cost estimated for this purpose NRs 33.75 million



Silt deposition and bush growing in block 8 canals.

4.2 Water Delivery

The system has no major problem of water acquisition and water right since Nepal gets its water share from India as per agreement. However water paucity is a major problem in NIS. For the supplementary of NEC, Tilawe barrage has been constructed. Another barrage in Jamuni River to irrigate the tail end of Rautahat district is in plan and may be implemented soon.

During the water scarcity, the rotation practice has been developed by office and farmers. The NIS office make schedule to deliver the water as soon as it gets information from Indian side. Since the water has to travel long way in India, the Indian feeder canal to Nepal plays major role to receive the agreed amount of water.

The block 2 and block 8 lies in head reach and middle reach of NEC. So far, the office has regulated water to these blocks in spite of various technical difficulties. One of the major technical difficulties arose due to missing of regulating gates in various offtakes. Once the gate is established, calibration is needed in all gates so that it will be easier to farmers to understand the quantity of water they receive.

4.3 Agriculture system and services

Paddy and wheat are major crops in practice in Summer and Winter. Presently, the yield of the paddy varies from 5 to 6.5 ton per ha whereas this value for wheat is 1.5 to 2.5 ton per ha. The traditional labor intensive system is gradually changing into mechanization system. The incremental benefit of rice and wheat in irrigation and without irrigation are Rs 30,000 and Rs 3500 per ha respectively. Marketing system for the crops is found satisfactory and market is easily available at an interval of 1 – 2 km.

4.4 Institutional development

Unlike other surface irrigation schemes, NIS does not have strong WUAs. Though the process of forming WUA started in 1994 and 1995, they all became inactive in the lapse of time. The NIS have been rekindling and rejuvenating these WUAs again for the last couple of years.

4.5 Operation and maintenance

The availability of the water and the water demand for crops indicate that the canal could be made rotational during the transplanting period to cover maximum demands for transplantation and puddling requirement of paddy. During maintenance period of the paddy crop the system could be operated on continuous basis. Like wise during winter season the canal must be operated in rotational or demand basis, because excess water might damage the crop itself. It is recommended introducing crop diversification in the spring season, which certainly will boost up the income of the farmers. However, the market and other economic factors will always govern the end product. The consultant on the water management and on-farm crop water management will study and introduce new improved water management plan including operational practices.

This system has entered in operation and maintenance stage since 1994-95 and it is supposed to be followed the joint management strategy. However, due to the gap of information between government and farmers it has been realized that the system has been fully operated by government alone. NIS do not have sufficient fund to maintain its network annually. Every monsoon flood and deposition of silt in canal has reduced its efficiency causing deterioration in canal system. The previous records of Operation and maintenance expenditure of the NIS office indicated that major part of the annual maintenance expenditure was made on NEC's structure. In the present context of Management Transfer to WUA, the annual maintenance plan should be designed to be based on actual needs for the system. The present plan of system management transfer has been designed to transfer the (i) MSC (and its network in block 2 and 8) operation.

4.6 Existing Problems

The system has the following problems;

- ✚ Regular O&M is missing;
- ✚ Some structures are having major defects and some are having minor;
- ✚ Some reaches of the canal face scouring and some reaches face silting;
- ✚ Presence of bushes seen in MSC of block 8;
- ✚ The embankment height in d/s of block 2 needs to be raised
- ✚ The service road needs to be graveled

4.7 Strengths and Weaknesses

The strengths and weaknesses of the system are outlined below;

Strengths

- ✦ The system has fulfilled the real need of the farmers of the command area and converted the rainfed barren and pastures lands into cultivable land;
- ✦ The value of the land in the command area is drastically increased;
- ✦ The system has provided road linkage facility in the command area;
- ✦ The system is fairly in good condition and provides irrigation facility more or less in the entire block 2 and 8;
- ✦ The existing cropping intensity of the command area is more than 190%;
- ✦ The command area has become one of the exporters of the agricultural products;
- ✦ Employment opportunities in the agriculture field and most of the manpower are engaged either in their own agricultural work or other agricultural land;
- ✦ Awareness of the people has become higher;
- ✦ Market centre is Birgunj which is quite near from command area;
- ✦ Due to incessant government effort, farmers have started realizing the ownership towards the system;
- ✦ Agro based factories are evolving within the command area;
- ✦ The farmers are thinking about crop diversification;

Weakness

- ✦ Lack of regular cleaning and O&M caused major defects in some structures as well as in the canal function;
- ✦ Farmers are less interested to raise ISF;
- ✦ Animal encroachment and cutting of banks causing outflanking of water from the canal bank and thus damaging the system;
- ✦ Water users group/til or committee should show interest towards system and come forward to give joint effort to make system entact.

The checklist / questionnaire were used for the collection of said information.

5. Rehabilitation plan

Based on the asset inventory and rapid appraisal of the system presented in the preceding chapters a rehabilitation plan has been prepared. The prepared plan reflects the need of users and light rehabilitation as well as major rehabilitation costs to meet the certain performance level of the services and cost sharing and responsibilities of users and agency.

A total major rehabilitation cost is estimated as NRs. **24,699,000.00** for block-2 and NRs. **13,416,000.00** for block-8, the details of work has been presented in table 5.1 and 5.2 below. The cost sharing responsibility of deferred maintenance and year wise scheduling are presented in table 5.3, 5.4, 5.5, and 5.6 below.

Table 5.1 Summary of Major Rehabilitation work of NIS Block-2

S.No.	Description	Quantity	Unit	Unit Cost (Rs)	Amount (Rs)
1	Main Secondary Canal Reshaping	7.65	km	300,000.00	2,295,000.00
2	Secondary Canal and Sub secondary canal Reshaping	17.54	km	100,000.00	1,754,000.00
3	Main Secondary Canal Structures Development	26	nos	100,000.00	2,600,000.00
4	Secondary Canal and Sub secondary canal Structures Development	45	nos	10,000.00	450,000.00
8	Service Road maintenance	33	km	400,000.00	13,200,000.00
				Total	20,299,000.00

Table 5.2 Summary of Major Rehabilitation work of NIS Block-8

S.No.	Description	Quantity	Unit	Unit Cost (Rs)	Amount (Rs)
1	Main Secondary Canal Reshaping	3.2	km	300,000.00	960,000.00
2	Branch Secondary Canal Reshaping	13.83	km	200,000.00	2,766,000.00
3	Main Secondary Canal Structures Development	4	nos	100,000.00	400,000.00
4	Secondary Canal Structures Development	35	nos	10,000.00	350,000.00
8	Service Road maintenance	13.6	km	400,000.00	5,440,000.00
				Total	9,916,000.00

Table 5.3 Summary of Minor Rehabilitation work of NIS Block-2

S.No.	Description	Quantity	Unit	Unit Cost (Rs)	Amount (Rs)
1	Main Secondary Canal Reshaping	3	km	100,000.00	300,000.00
2	Secondary Canal and Sub secondary canal Reshaping	12	km	50,000.00	600,000.00
3	Main Secondary Canal Structures Development	20	nos	50,000.00	1,000,000.00
4	Secondary Canal and Sub secondary canal Structures Development	30	nos	10,000.00	300,000.00
				Total	2,200,000.00

Table 5.4 Summary of Minor Rehabilitation work of NIS Block-8

S.No.	Description	Quantity	Unit	Unit Cost (Rs)	Amount (Rs)
1	Main Secondary Canal Reshaping	1.5	km	100,000.00	150,000.00
2	Branch Secondary Canal Reshaping	12.5	km	50,000.00	625,000.00
3	Main Secondary Canal Structures Development	3	nos	50,000.00	150,000.00
4	Secondary Canal Structures Development	25	nos	10,000.00	250,000.00
Total					1,175,000.00

Table 5.5 Sharing of Responsibility of Deferred Maintenance for Block-2

Particulars	Retained with NIS block-2	Equivalent Cost NRs.	To be Transferred to WUO	Equivalent Cost NRs.
A. Deferred Maintenance	Main Secondary Canal reshaping	2,295,000.00	Secondary and sub secondary canals reshaping	1,754,000.00
	Main Secondary Canal Structures development	2,600,000.00	Secondary and sub secondary canals structures development	450,000.00
	Service Road maintenance	13,200,000.00		
Total Amount		18,095,000.00		2,204,000.00
B.Regular O & M	Administrative Expenditure	217400.00		
	Operation Cost of NIS Block-2	120570.00	Operation Cost of NIS	40,190.00
	Regular Maintenance Cost	566115.57	Regular Maintenance Cost	188,705.19
	Total Amount	904,085.57		228,895.19

Table 5.4 Sharing of Responsibility of Deferred Maintenance for Block-8

Particulars	Retained with NIS block-8	Equivalent Cost NRs.	To be Transferred to WUO	Equivalent Cost NRs.
A. Deferred Maintenance	Main Secondary Canal reshaping	960,000.00	Secondary canals reshaping	2,766,000.00
	Main Secondary Canal Structures development	400,000.00	Secondary canals structures development	350,000.00
	Service Road maintenance	5,440,000.00		
	Total Amount	6,800,000.00		3,116,000.00
B. Regular O & M	Administrative Expenditure	217400.00		
	Operation Cost of NIS Block-2	93090.00	Operation Cost of NIS	31,030.00
	Regular Maintenance Cost	415180.44	Regular Maintenance Cost	138,393.48
	Total Amount	725,670.44		169,423.48

Table 5.6 Sharing of Responsibility of Minor Maintenance for Block-2

Particulars	Retained with NIS block-2	Equivalent Cost NRs.	To be Transferred to WUO	Equivalent Cost NRs.
A. Minor Maintenance	Main Secondary Canal reshaping	300,000.00	Secondary and sub secondary canals reshaping	600,000.00
	Main Secondary Canal Structures development	1,000,000.00	Secondary and sub secondary canals structures development	300,000.00
	Total Amount	1,300,000.00		900,000.00

Table 5.7 Sharing of Responsibility of Minor Maintenance for Block-8

Particulars	Retained with NIS block-2	Equivalent Cost NRs.	To be Transferred to WUO	Equivalent Cost NRs.
A. Minor Maintenance	Main Secondary Canal reshaping	150,000.00	Secondary canals reshaping	625,000.00
	Main Secondary Canal Structures development	150,000.00	Secondary canals structures development	250,000.00
	Total Amount	300,000.00		875,000.00

Table 5.8 Year wise Scheduling of Deferred and Minor Maintenance in NIS Block-2

S. No.	Descriptions	Deferred Maintenance of NIS Block-2 Asset					Total
		Year 1	Year 2	Year 3	Year 4	Year 5	
1	Main Secondary Canal						
a	Main Secondary Canal reshaping	639000.00	1278000.00	1278000.00			3195000.00
b	Main Secondary Canal Structures development	460000.00	1840000.00	1840000.00	460000.00		4600000.00
	Sub Total	1099000.00	3118000.00	3118000.00	460000.00		7795000.00
2	Secondary and sub secondary canals						
a	Secondary and sub secondary canals reshaping		886200.00	1181600.00	590800.00	295400.00	2954000.00
b	Secondary and sub secondary canals structures development		225000.00	300000.00	225000.00		750000.00
	Sub Total		1111200.00	1481600.00	815800.00	295400.00	3704000.00
3	Service Road						
a	Service Road maintenance		3960000.00	5280000.00	3960000.00		13200000.00
	Total Amount	1099000.00	8189200.00	9879600.00	5235800.00	295400.00	24699000.00

Table 5.9 Year wise Scheduling of Deferred and Minor Maintenance in NIS Block-8

S. No.	Descriptions	Deferred Maintenance of NIS Block-8 Asset					Total
		Year 1	Year 2	Year 3	Year 4	Year 5	
1	Main Secondary Canal						
a	Main Secondary Canal reshaping	282000.00	564000.00	564000.00			1410000.00
b	Main Secondary Canal Structures development	70000.00	280000.00	280000.00	70000.00		700000.00
	Sub Total	352000.00	844000.00	844000.00	70000.00		2110000.00
2	Secondary canals						
a	Secondary canals reshaping		1579800.00	2106400.00	1053200.00	526600.00	5266000.00
b	Secondary canals structures development		180000.00	240000.00	180000.00		600000.00
	Sub Total		1759800.00	2346400.00	1233200.00	526600.00	5866000.00
3	Service Road						
a	Service Road maintenance		1632000.00	2176000.00	1632000.00		5440000.00
	Total Amount	352000.00	4235800.00	5366400.00	2935200.00	526600.00	13416000.00

5. Conclusions and Recommendations

At present, only blocks 2 and 8 of NIS have been taken as mode of transfer. Asset inventory, rapid appraisal, and rehabilitation plan have given a defined picture of the existing condition, its functioning, replacement cost, light rehabilitation cost and major rehabilitation cost as well. The aforesaid findings support in preparation of the "Asset Management Plan". This AMP will facilitate the O&M of the system after handover of management to water users.

It has to be taken in consideration to develop the damaged and defunct part of the system to be repaired so as it leads the way to management transfer. In general, the overall condition of the system could be assessed as good, however, lack of regular maintenance and unfinished works in CAD are the main issues identified in the system.

The newly formed water users committee needs to make link with NIS office. The management transfer will only be successful with their full cooperation and efforts. Users committee and farmers need to be energized in ISF collection. It is the major source of their income. Once being autonomous, farmers should motivate their institutional independently and they should learn various method of resource mobilization. Resource mobilization plays the effective role in the sustainability development of institutions of WUAs.

This report only consist the information of block 2 and 8. It would have been more effective if the study would have been taken in the whole NIS. For example, the vehicle and equipment mentioned in this report have been using in other blocks as well. The office building currently in use has been excluded in this report since the office buildings and the occupied land by the buildings is the asset of the whole NIS rather than block 2 and 8.

Since NIS has launched the massive rehabilitation program, the hand over of the completed blocks needs to be handed over to the WUAs. Government needs to hand over the rehabilitated blocks to the users simultaneously.

Annexes

Anenx-1 Summary of Finding: Rapid Appraisal

Summary Findings of Rapid Appraisal Survey of NIS (Block 2 and 8)

S. N.	Particulars	Descriptions
1. Physical Features		<p>Block 2: The system comprises of a main secondary canal, 7 branch secondary canals, and 8 sub secondary canals. The water enters in main secondary canal with the help of cross regulator and head regulator from NEC. The length of MSC is 10.65 Km. Similarly the length of BSC and SSC is 29.54 Km.</p> <p>Block 8: The system comprises of a main secondary canal, 6 branch secondary canals, and 1 sub secondary canals. The water has been diverted in all branch secondary canals except BSC 2 from NEC. The length of MSC is 4.7 Km. Similarly the length of BSC and SSC is 26.33 Km.</p>
1.1	Canal Structures	No major damage occurred in the structures both in block 2 and block 8. However few slab culverts in road crossings are damaged. Protection works needed in u/s and d/s of regulating structures and drop structure and installation of gates in almost all offtakes are needed. Gauging is needed to know the water quantity in canals.
1.2	Tertiary Canal	The system developed many tertiary canals, however in the course of time farmers encroached many tertiary canals. Except few tertiaries many are disappeared.
2. Water Delivery		In the system, there is no major problem of water acquisition and water right since Indian side release water according to agreement; however there is paucity of supply of water during winter season. In rainy season, whole command area of block 2 and 8 is benefited with the system. It is noted that phase wise rotation of water distribution is in practice during the winter season when the water scarce. During the rotation, NIS & WUA are responsible to conduct water distribution activities. Presently, the system fails to supply irrigation facility in Rautahat districts.
2.1	Main Secondary Canals	<p>Block 2: The water delivery efficiency of the canal is estimated as around 70%. The water delivery efficiency decreases as increasing the length (from head to tail) of the canal. It is due to ungated offtakes, lack of maintenance in canals etc.</p> <p>Block 8: The water delivery efficiency of the canal is estimated as around 70%. 4-8% of water is lost through seepage. The head reach users get water easily than tail reach users due to decreasing trend of efficiency in the canal. It is due to ungated offtakes, lack of maintenance in canals etc.</p>
2.2	Branch Secondary canal and below.	The water delivery efficiency of the canal is estimated as only 50 to 70% in average in both block 2 and 8. . The water delivery efficiency decreases as increasing the length (from head to tail) of the canal due to lack of cleaning and O & M. In block 8 many branch secondary canals are fed by NEC hence the efficiency of the canal is good as much as main secondary canals.
2.3	Irrigation Facility	The NIS of block 2 and 8 irrigates 2996 ha and 2768 ha command area respectively.

S. N.	Particulars	Descriptions
3. Agriculture System and Services		<i>Summer paddy is planted in the majority of the command are. It is followed by winter wheat which is cultivated almost 70% of the command area in both blocks. Pulses are cultivated in 20% of command area in winter and spring. Presently, the yield of the paddy varies from 5 to 6.5 ton per ha whereas this value for wheat is 1.5 to 2.5 ton per ha. The traditional labor intensive system is gradually changing into mechanization system. The incremental benefit of rice and wheat in irrigation and without irrigation are Rs 30,000 and Rs 3500 per ha respectively. Marketing system for the crops is found satisfactory and market is easily available at an interval of 1 – 2 km.</i>
		<i>Existing market rate of the crops are as follows: • Paddy = NRs. 7,000 - 10,000/ t; • Wheat NRs.10,000 - 14,500/t ; and The traditional method for land preparation is practiced by 70% farmers whereas modern method by 30%. Use of both fertilizer and manure are practiced.</i>
3.1	Cropping Intensity	<i>An average cropping intensity of the system is more than 190% and it varies in block 2 and 8. Even it varies in BSC and SSC.</i>
3.2	Cropping Pattern	<i>It is found that the cropping schedule of Summer Crop (Paddy) is from June/July to November/December; of Winter Crop (Wheat & Maize & others) form December to April and of Spring Crop from February to May.</i>
3.3	Use of Seeds	<i>Local seeds for all crops are used.</i>
4. Institutional		<i>Unlike other surface irrigation schemes, NIS does not have strong WUAs. Though the process of forming WUA started in 1994 and 1995, they all became inactive in the lapse of time. The NIS have been rekindling and rejuvenating these WUAs again for the last couple of years.</i>
4.1	WUA	
4.1.1	Structure	<i>Three tiers of WUA have been formed. They are Water Users group (Tertiary), Water Users group (MSC and BSC) and Water Users Committee (Block).</i>
4.1.2	Role and Responsibility	<i>The major role and responsibility of WUA are the followings;</i>
		<i># To coordinate with the entire branch & tertiary committees and make good relationship among them; # To conduct meeting on regular basis in order to resolve problem; # To operate branch & tertiary canals in time and make timely O & M plan of the canals; # To arrange entire process & land for new construction of canal or water</i>

S. N.	Particulars	Descriptions
		<p><i>course to fulfill the demand of the farmers;</i></p> <p><i># To make Yearly Water Distribution Schedule and distribution of water accordingly;</i></p> <p><i># To recommend for exemption of water charge for the lands that were deprived from irrigation facility;</i></p> <p><i># To send the list of conflicts/problems to the related offices, which are not resolved by the WUGs;</i></p> <p><i># To conduct the work related to the O & M of the canals on the basis of equality;</i></p> <p><i># To make relationship with the irrigation office and other stakeholders.</i></p>
4.1.3	Functions	<p><i>The major functions of WUA are the followings;</i></p>
		<p><i># To conduct Election of General Assembly once a year;</i></p>
		<p><i># To collect membership fee as well as renewable fee of the membership;</i></p>
		<p><i># To conduct meeting/discussion with branch committee on regular basis, however, with tertiary committee as & when required basis. The meeting mainly focuses on the resource mobilization for O & M, conflict resolution, collection of water charge and other activities.</i></p>

Anenx-2 Ranking Formats

Analysis of Physical condition of Canal and its structures with ranking say 1-5 and non functional as per guidelines supplied by World Bank Team.

Rating	Condition
5	Practically new and fully serviceable
4	Generally good with no damage, only routine maintenance required Performs assigned functions satisfactorily
3	Generally good but with some deterioration or damage, Need attention. Still performing assigned functions satisfactorily.
2	Significantly damaged or deteriorated. Suffering from deferred maintenance. Serviceability is impaired. Need urgent rehabilitation
1	Very poor in dilapidated condition. Non-functional. Requires partial restoration or complete replacement to restore serviceability.

Ranking and Replacement cost of Assets

S. No	Asset	Physical Quantity	Replacement cost value at the present price in NRs
1	Canal reshaping		
	Block 2	40.19 Km	12.26
	Block 8	28.88 Km	7.86
2	Acquired land		
	Block 2	43.87 ha	32.90
	Block 8	28.77 ha	25.89
3	Canal structures		
	Block 2	278 nos	124.98
	Block 8	115 nos	53.88
4	Vehicle and equipment	90 nos	41.49
5	Service road		
	Block 2	33.07 Km	14.88
	Block 8	13.6 Km	6.12
	Total		320.27

Anenx-3 Asset Survey Forms

Anenx-4 Evaluation Forms

Anenx-5 Terms of Reference (ToR)

**Terms of Reference for the preparation of
Asset inventory, rapid appraisal plan and rehabilitation plan
for
Block no. 2 and 8 of Naryani Irrigation System
under
Irrigation and Water Resource Management Project (IWRMP)**

1. Background:

The Government of Nepal has been preparing a follow on project of NISP after its completion in last fiscal year. The project is entitled as Irrigation and Water Resources Management Project (IWRMP). The component B of the IWRMP is focused on management transfer of agency managed irrigation systems (AMISs) to the farmers/WUAs as per irrigation policy. To prepare the background for the handing over of such AMISs, the present status and performance has to be assessed. In order to enhance the overall performance of the irrigation system six AMISs covering an area of around 101,300 ha will be transferred to users under the component B. Kankai Irrigation Project, Sitagunj area of SMIP, West Koshi Irrigation Project, and Block-2, 8 of Narayani Irrigation Project are proposed for the implementation in the first year of project period. The other branches and blocks of Sunsari Morang, West Koshi, Narayani irrigation systems will be transferred in the subsequent years. Similarly the handing over of the irrigation system in Mahakali and Jhanj irrigation system will take place in successive years.

Irrigation agencies need to deliver a performance level of services which benefits the users at an affordable cost, making better use of available resources. Significant improvements in level of services may involve substantial additional investment. In short, irrigation is now considered as a business in which its assets are used to generate sufficient revenue to sustain the business and renew and modernize its assets to obtain greater value from the use of water and land.

The requirement for a sustainable management requires the development of asset maintenance and management strategies aimed at preventing the loss of services capability which would affect the ability to deliver the performance level of service. An important task is to identify the cash flow requirements to ensure the sustainability of the system. Under-provision of funding leads to a shortening of asset life and inability to maintain the performance level of service, with resulting economic loss to farmers and higher replacement costs for the system.

The proposed IWRMP has the overall goal to contribute to reducing poverty of the rural community through improved integrated management of water resources development and rehabilitation of irrigation infrastructures of Farmers' Managed Irrigation Systems (FMISs) and management improvement and management transfer of Agency Managed Irrigation Systems (AMISs).

2. Objective of consulting services

The objective of the consulting services is to prepare asset inventory and rehabilitation plan and to conduct rapid appraisal of block No. 2 and 8 (5700 ha.) of Narayani irrigation system . These are the supplementary and interrelated documents for the preparation of asset management plan that covers financial aspects as well.

2.1 Asset inventory

The main purpose of the asset inventory and its analysis is to identify the assets, assess their values and the liabilities. The analysis of the inventory is to include;

- Technical specifications of infrastructures like canal structures, condition of existing tube wells system, stores, earth moving machinery, vehicles, buildings (office building, residential buildings, guest houses and other site offices), land under the project ownership.
- Historical and replacement cost/values
- Physical condition with ranking say 1-5 and non functional

Rating	Condition
5	Practically new and fully serviceable
4	Generally good with no damage, only routine maintenance required Performs assigned functions satisfactorily
3	Generally good but with some deterioration or damage, Need attention. Still performing assigned functions satisfactorily.
2	Significantly damaged or deteriorated. Suffering from deferred maintenance. Serviceability is impaired. Need urgent rehabilitation
1	Very poor in dilapidated condition. Non functional. Requires partial restoration or complete replacement to restore serviceability.

2.2 Rapid appraisal

Rapid appraisal is a family of methods designed to get practical information on development issues in the irrigation system quickly. The primary objectives of the rapid appraisal is to evaluate the system in water delivery (qualitative), irrigation coverage, productivity, organizational performance of the WUA and the system office. The consultant needs to prepare rapid appraisal report to assess the functions of the system in physical, organizational and productive level.

2.3 Rehabilitation plan

Based on the asset inventory and rapid appraisal of the system a rehabilitation plan needs to be prepared that reflects the need of users. The rehabilitation plan will show the present physical status of the irrigation system with the present worth of the

infrastructures including the rehabilitation cost so as to meet the certain performance level of service. It consists of light rehabilitation and major rehabilitation costs. It needs to contain the action plan showing the cost sharing and responsibilities of users and agency.

3. Scope of Work

This assignment will be carried out in the Narayani irrigation system which is undertaken for IWRMP. Drawings and relevant documents of the irrigation systems will be provided by concerned irrigation offices. The output from this work is expected in the following format;

The asset inventory should comprise following information;

- Salient features of the projects, details of head works, main canal, branch canal, drainage details of structures in Table form;
- Details property of projects, land, building, trees and others;
- Details of heavy machine in table form;
- Details of stores and others;
- Asset survey forms attached herewith to be followed to prepare asset inventory which eventually can be used as reference for the preparation of rehabilitation plan.

The expected outputs from the rapid appraisal are as follows;

- Background history of the system comprising its original construction in phases, rehabilitation and improvement works made, and any expansion carried out in the past;
- Assessment of the operation and maintenance of the systems, its current practices, WUA's participation, and agency's roles and responsibility, regular and emergency maintenance, short comings. and users attitude;
- Assessment of the strength and weakness of the system in totality.

The rehabilitation plan should reflect the following information;

- Light rehabilitation plan;
- Detail rehabilitation plan;
- Description of the physical system indicating its hydrology aspects, the functional status of its subsystems and structures in general.
- Short term repair and rehabilitation plans (Next two year).

The above-mentioned outline of outputs may be refined as per the mutual agreement between PPT and the concerned consultancy firm in due course of the assignment. For the process documentation report necessary formats and checklists in simple form should be designed (if necessary) and incorporated in the annex of the text.

4. Personnel required

The team of consultants is advised to include the following personnel;

- Irrigation/Civil engineer/Water Management expert having at least 10 years experience in related field.
- Supporting staff.

5. Time frame

The maximum time for the completion of the work will be 36 days and it will be started from the day of agreement between the firm and DOI.

6. Implementation arrangement

Available drawings, documents, data and other materials will be provided by project office. All the arrangement including logistic support, supporting staffs, movement to field, typing etc to carry out the job should be managed by firm itself with its own convenience. Any further guidance if necessary will be provided from PPT/IWRMP.

7. Budgeting

The total budget allocated to carry out the job is NRs 99411.00 including all taxes as per HMGN financial rules and regulations.

8. Deliverables

The consultant needs to submit two copies of inception, interim, draft report each and five copies of final report after incorporating the comments from office and one electronic compact disk of the report to the project office IWRMP, DOI, Jawalakhel.

9. Mode of payment

The payment shall be made as mentioned below:

- First Installment (20% of total cost) will be provided against the submission and approval of **Inception Report** to the PPT/IWRM.
- Second installment (30% of total cost) will be provided against the submission and approval of **Interim Report** to the PPT/IWRM.
- Third installment (20% of total cost) will be provided against the submission and approval of **Draft Final Report** to the PPT/IWRM.
- Last installment (30% of total cost) will be provided against the submission and approval of **Final Report** to the PPT/IWRM.