GOVERNMENT OF NEPAL

MINISTRY OF IRRIGATION

DEPARTMENT OF IRRIGATION

NORMS FOR FEASIBILITY STUDIES OF IRRIGATION PROJECTS

2072

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Government of Nepal
Ministry of Irrigation
Department of Irrigation

☎ 5537136, 5537313, 5537310, 5537311, 5537312, 5537308, 5537306, 5537302
Ext- 5535382, 5527442

Ref. No:-

Fax No. : 977-1-5537169
Jawalakhel, Lalitpur

Acknowledgement

This Survey Norms for the Feasibility Study of Irrigation Schemes has been approved by the Ministry of Irrigation, Government of Nepal on 1 July 2015 (2072/03/16). The previous Survey Norms was prepared in 1988 to facilitate feasibility studies of Irrigation Schemes to carry out different studies related to Irrigation Development. With the development of technology & widely available computer based programs and need of additional studies such as River Morphology, Environment Impacts, Use of GIS Technology etc., it was felt necessary to revise the existing Survey Norms. Several meetings & discussions held in DOI made the revision possible. Thereafter, a review committee of DOI formed to finalize the Norms. The review committee contributed valuable suggestions after several round of rigorous discussions that helped to refine and finalize the document. Each individual made valuable contributions to this effort. DOI acknowledges all individuals for their involvement and valuable contributions. The contributions of the following persons deserve recognition for their significant input.

Mr. Sushil Chandra Tiwari	Deputy Director General/DOI
Mr. Ashok Singh	Deputy Director General/DOI
Mr. Shashi Bahadur Bista	Project Director/DOI
Mr. Vinay Kumar Koirala	Senior Divisional Engineer/DOI
Mr. Mohan Prasad Sangraula	Senior Divisional Engineer/DOI
Mr. Dhruba Prasad Acharya	Senior Divisional Engineer/DOI
Mr. Tek Bahadur Karki	Senior Divisional Engineer/DOI
Mr. Basudev Timilsina	Senior Divisional Engineer/DOI
Mr. Krishna Prasad Rijal	Senior Divisional Engineer/CRID
Mr. Andy Prakash Bhatta	Senior Divisional Hydrogeologist/ DOI
Mr. Shiba Prasad Adhikari	Chief Account Controller/DOI
Mr. Kalanidhi Paudel	Senior Legal Officer/DOI
Mr. Rajesh Kumar Paudel	Engineer/ DOI

2072/3/16
Madhav Belbase
Director General

E-mail: irrigation@wlink.com.np

NORMS
FOR
IDENTIFICATION STUDIES

FIELD WORK

HEADWORK SITE

a - Hydrological survey

i - Manpower required :

Subengineer (SE)	1
Labour	4

ii Performance criteria :

All Projects	1 day
Hydrological Survey at Headwork site	NRs. ((4 x District Rate for Labor)x1)

CANAL ALIGNMENT

a - Layout Survey

i - Manpower required :

Subengineer	1
Labour	2

Guide	1
Labour	1

ii- Performance criteria :

All Projects	1 day
Canal Layout Survey	NRs. ((2 x District Rate for Labor)x1)

COMMAND AREA

a – Socio-Economical Survey

i - Manpower required :

Association Organizer (AO)	1
Labour	1

Guide	1

ii - Performance criteria :

All Projects	1 day
Socio-Economic Survey	NRs. ((1 x District Rate for Labor)x1)

b – GPS Survey of Command Area

i - Manpower required:

Sub Engineer	1
Labour	2

Guide	1

ii - Performance criteria :

All Projects	1 day
GPS Survey of command area	NRs. ((2 x District Rate for Labor)x1)

MISCELLANEOUS

a - Transportation

Travel Expenses for the departmental employee shall be provided as per GON Rules above that Extra amount NRs. 1 x district rate for labour per day shall be provided for the carrying baggage & other equipments required for survey

b - Equipment :

Compensation of Nrs. 1.5 x district rate for labour per day for the hiring equipments (GPS) shall be provided

OFFICE WORK

REPORT

a - Data Compilation and Report presentation

i - Manpower required :

Engineer	1
Sub-engineer	1
AO	1
Office Assistant	1

ii - Performance criteria :

All projects	7 days

The criteria for the selection of the project for identification may be:

- At least two-third of the beneficiary households should sign the project request form;
- There are no potential water right disputes;
- The beneficiaries commit to take future O&M responsibilities;
- Sufficient water is available;

After the very first initial screening identification study of the project need to be processed. Engineeringand socio-agricultural staff should visit the proposed project site and assess whether the project shouldbe carried on the feasibility study or rejected.

For medium scale irrigation schemes it will be sufficient to carry out two levels of the study:

- **Identification Study**
- **Detail Feasibility Study including Detailed Design& Estimate**

For large scale irrigation schemes,the study will be carried out as follows:
For command area up to 1000 ha in hill & 5000 ha in Terai, three levels of study will be carried out

- **Identification Study**
- **Prefeasibility Study**
- **Detail Feasibility Study, Detail Design & Estimate**

For command area more than 1000 ha in hill & 5000 ha in Terai, four levels of study will be carried out

- **Identification Study**
- **Prefeasibility Study**
- **Detail Feasibility Study**
- **Detail Design & Estimate**

  Note: If DFS recommends DDE, specialized TOR shall be developed & implemented accordingly.

Terms of Reference for Identification of the Irrigation Project
Desk Study
Review of Farmers' Request Form and other available documents related with project area;
Locate the project area on Topographic Map/Google/GIS map/s;

Field Visit (Walkthrough Survey)
Send information to the farmers before field visit informing tentative date of site visit.
Identification team should carry the following tools:

- Copy of project request form;
- Project identification questionnaire;
- Topographical maps;
- Note books and necessary stationary;
- GPS;
- Stop watch;
- Calculator;
- Camera;
- Measuring tape;

Verify the appropriate Intake/Head Work location
Measure Discharge at Proposed Intake/Head work location
Walk through along the proposed canal alignment taking GPS point at specific locations
During walk through, landslide/erosion should be assessed
Tentatively Close Traverse of command area using GPS
Assessment of existing cropping pattern
Assessment Existing Irrigation Practices if any
Assessment of Water Management Practices if any
Assessment of Market facility
Accessibility of Project Area
Assessment of construction material availability
Existing WUA & its function if any
Assessment of beneficiary Population/HH of the project
Assessment of Woman Headed HH of the project area
Assessment of Social Composition of the area
Assessment of food sufficiency of the project area
If it is an existing system, brief inventory of the system
Assessment of willingness of the farmers for providing land for developing system
Assessment of willingness of the farmers towards cost contribution as per Irrigation Policy/Regulation

Reporting

Based on the data and information collected during the field visit the team needs to analyze the projectfindings and finalize the identification study. The analysis should be based on technical, economical andsocial aspects of project implementation. In addition to technical details, the analysis should cover the following aspects:
Water Availability;
Type of Diversion works;
Length of main canal;
Size and type of command area (terrace/plain);
Water right problems;
Nature of soil in canal alignment & command area;
Major technical difficulties (cross drainage/landslide/unstable zones);
Poor farmer's presence;
Farmer's interest;

Based on the analysis the team has to prepare a report stating the project recommendation for further actions.

The recommendation may be based on:
Genuineness of demands;
Command area
Technical complication
Water availability and Water dispute;
Potential for increased agriculture production;
Environmental adverse effect
Rehabilitation/ Rehab with extension/ New Scheme/Minor improvements

Selection Criteria:
Based on Scoring of the ID report, the project in general having size 10 ha to 500 ha in hill &100 ha to 2000 ha in Terai will be recommended for detail feasibility study including detail design

The project having size more than 500 ha in hill & 2000 ha in Terai shall be recommended for Pre-Feasibility Study of the project

Assumption/Basis of Norms

- If the assignment is to be performed through the consultant, the estimation should be done based on rate for the different expert approved by DOI & evaluated salary per day shall be based on considering 30 days of a month.
- Field Survey allowance per day for GON employee = ((Basic Monthly Salary + Monthly Remote Area Allowance of the field location) x 1.5)/30
- Daily allowance shall not be provided for the employee who is receiving survey allowance; however other allowances (except daily allowances) shall be provided as per GON rules
- for the desk study Daily allowance for Departmental Employees, considering the over/extra time (rather than normal office hours) to be given for desk study and report preparation, is provisioned at a rate 50% of ((Basic Monthly Salary + Monthly Remote Area allowance at the location of report preparation) x 1.5/30)
- Lodging and Travel allowance will not be provided to the locally hired personnel
- Rates for the material required for the field survey, desk study and report preparation will be based on the general market available rates.

Mode of Payment

a) To Departmental Employees:

The amount shall be paid to the employees as advance assigned for the study as follows;
For mobilization and Field work 60% of the total amount
Upon Submission and acceptance of Final Survey Report 40% of the total amount

The final payment shall not be made if the above mentioned work is not completed as per TOR, and the assigned team will be fully responsible ensuring the quality of report as per requirement.

b) To Consultant (if employed) :

The amount shall be paid as per agreement to the consultant assigned for the study. However, the consultant can claim the payment either in a single installment after submission and acceptance of final report as per TOR or in installment as follows;

First Installment (if necessary), 10% of the total amount upon submission and acceptance of desk study/inception report;

Second Installment, 40% of the total amount upon submission and acceptance of field study report;

Third Installment, 25% of the total amount upon submission and acceptance of draft final report;

Final Installment, remaining of the total amount upon submission and acceptance of final report complying with TOR;

20% of the total amount may be provided as an advance payment on submission and acceptance of bank guarantee and such payment shall be recovered within third installment

NORMS
FOR
PRE-FEASIBILITY STUDIES

FIELD WORK

A. HEADWORK SITE

a - Site selection (Fly level survey)

i - Manpower required :

Senior Surveyor/Engineer	1
Sub-Engineer	1
Labour	7

Tapeman	2
Staffman	2
Instrument man	1
Guide	1
Waterman	1

ii - Performance criteria :

Hills	6 km/day
Terai	8 km/day
Head Work Site Selection for Hills	NRs. ((7 x District Rate for Labor)/6) per km
Head Work Site Selection for Terai	NRs. ((7 x District Rate for Labor)/8) per km

b - Profile Survey

i - Manpower required :

Senior Surveyor/Engineer	1
Sub-engineer	1
Labour	7

Tapeman	2
Staffman	2
Instrument man	1
Guide	1
Waterman	1

ii - Performance criteria :

X-section measured along the profile	1 km/day
X-section survey at HW site	NRs. (7 x District Rate for Labor)/1 per km

c - Hydrological survey

i - Manpower required :

Engineer/Hydrologist	1
Assistant	1
Labour	2

Labour	2

ii - Performance criteria :

All Projects	2 days
Hydrological Survey	NRs. (2 x District Rate for Labor) x 2

B. CANAL ALIGNMENT

a - Layout Survey

i - Manpower required :

Surveyor/Engineer	1
Sub-engineer	1
Labour	5

Staffman	2
Instrument man	1
Guide	1
Waterman	1

ii - Performance criteria :

All Projects	3 days
Canal Layout Survey	NRs. ((5 x District Rate for Labor) x 3)

C. CROSS DRAINAGE WORKS

a - Hydrological Survey

i - Manpower required :

Engineer/Hydrologist	1
Assistant	1
Labour	2

Labour	2

ii - Performance criteria :

All Projects	3 CD/day
Note : Only major cross-drainages with a river width of more than 10 meter bank to bank or with a discharge more than 200 l/s are to be assessed	
Hydrological Survey	NRs. ((2 x District Rate for Labor)/3) per CD

D. COMMAND AREA

a - Area Survey

i - Manpower required :

Surveyor/Engineer	1
Sub-engineer	1
Labour	3

Note taker	1
Pegman	2

ii - Performance criteria :

Hills	1 day
Terai	2 days
Command Area Survey for Hills	NRs. (3 x District Rate for Labor) x 1
Command Area Survey for Terai	NRs. (3 x District Rate for Labor) x 2

b - Agricultural Survey

i - Manpower required :

Agriculturist/Agronomist	1
Assistant	1
Labour	1

Guide	1

ii - Performance criteria :

All Projects	1 day
Agricultural survey for command area	NRs. (1 x District Rate for Labor) x 1

c - Socio-Economical Survey

i Manpower required :

Sociologist/Economist	1
Assistant	1
Labour	1

Gguide	1

ii - Performance criteria :

All Projects	2 days
Socio-Economic survey for command area	NRs. (1 x District Rate for Labor) x 2

E. MISCELLANEOUS

a - Transportation

Travel Expenses for the departmental employee shall be provided as per GON Rules above that

Extra amount NRs. 2 x district rate for labor per day shall be provided for the carrying baggage & other equipments required for survey

b - Equipment :

Compensation equivalent to 5 x District rate for Labour - per day for the hiring equipment (Level Machine, GPS & other equipment) shall be provided

OFFICE WORK

A. DESK STUDY

a - Data collection, Compilation and Report presentation

i - Manpower required :

Engineer	1
Sub-engineer	1
Office Assistant	1

ii - Performance criteria :

All Projects	4 days

B. HEADWORK SITE

a -L-section and X-section

i - Manpower required :

Engineer	1
Sub-engineer	1
Office Assistant	1

ii - Performance criteria :

All Projects	2 days

b – Hydrology

i - Manpower required :

Hydrologist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

All Projects	1 day

c - Drawings

i - Manpower required :

Engineer	1
Sub-engineer	1
Office Assistant	1

ii - Performance criteria :

All Projects	2 days

C. CANAL ALIGNMENT

a – Layout

i - Manpower required :

Engineer	1
Sub-engineer	1
Office Assistant	1

ii - Performance criteria :

All Projects	2 days

D. CROSS DRAINAGE WORKS

a - Hydrology

i- Manpower required :

Hydrologist	1
Assistant	1

ii - Performance criteria :

All Projects	8 CD/day

E. COMMAND AREA

a - Area

i - Manpower required :

Engineer	1
Sub-engineer	1
Office Assistant	1

ii - Performance criteria :

All Projects	1 day

b - Agriculture

i - Manpower required :

Agriculturist/Agronomist	1
Assistant	1

ii - Performance criteria :

All Projects	1 day

c - Hydrology

i - Manpower required :

Hydrologist	1
Assistant	1

ii - Performance criteria :

All Projects	1 day

d - Socio-Economy

i - Manpower required :

Economist	1
Assistant	1

ii - Performance criteria :

All Projects	2 days

F. MISCELLANEOUS - for Hills and Terai

a – Report Preparation

i - Manpower required :

Expert	1
Office Assistant	1

ii - Performance criteria :

All Projects	2 days

b - Office Equipment

ii - Performance criteria :

Computer, Scanner, Photocopy, Printer, Plotter, Toner, Cartridge, Binder, Stationary	NRs. 14 x district labour rate per day

The pre-feasibility study should be carried out for the large irrigation projects that will decide whether detail feasibility study will be required or not. The study tentatively assesses the technical feasibility, economical viability and institutional suitability of the project implementation. The pre-feasibility study is carried out in the following steps:

- **Desk study**
- **Field survey work**
- **Reporting and recommendation**

Terms of Reference for Pre-feasibility of the Irrigation Project

Desk study

Review of Identification Report and Farmers' Request Form and any other related documents

Locate the project area on Topographical/Google/GIS map/s

Assessment of Intake/Head Work, Canal Layout & Command Area on above map/s

Field survey work

Send information to the farmers before field visit informing tentative date of site visit.
survey team should carry the following tools:

- Copy of project request form;
- Copy of Identification Report;
- Topographical maps;
- Note books and necessary stationary;
- Level Machine
- GPS;
- Stop watch;
- Calculator;
- Camera;
- Measuring tapes

Verify the appropriate Intake/Head Work location,
Take Cross Profiles of the river covering at least 0.5 km u/s & 0.5 km d/s (at an interval but not limited to 250 m) of proposed intake site, and at least one at proposed Intake/Head work location.
Measure Discharge at Proposed Intake/Head work location
Assess the type of Intake/Head Work to be proposed
Walk through along the proposed canal alignment and verify whether alternative alignment can be considered; take GPS point at specific locations
Take a fly level along the proposed canal alignment to assess the ground profile.
Assess the tentative number & type of major/minor structure along the canal
Assess landslide, erosion with possible mitigation measures
Make Assessment of construction material/equipments availability & cost
Make Assessment of skilled/unskilled labor availability in the area
Take close traverse of command area using GPS
Make Assessment of existing cropping pattern
Make Assessment of Existing Irrigation Practices if any
Make Assessment of Water Management Practices if any
Make Assessment of Market facility
Make Accessibility of Project Area
Find and interact with Existing WUA & evaluate its function if any

Make Assessment of beneficiary Population/HH of the project
Make Assessment of Woman Headed HH of the project area
Make Assessment of Social Composition of the area
Make Assessment of food sufficiency of the project area
If it is an existing system, brief inventory of the system
Make Assessment of willingness of the farmers for providing land for developing system
Make Assessment of willingness of the farmers towards cost contribution as per Irrigation Policy/Regulation

Reporting & Recommendation
Based on the data and information collected during the field visit the team needs to analyze the project findings and finalize the prefeasibility study. The analysis should be based on technical, economical and social aspects of project implementation. The analysis should cover the following aspects:
Length of main canal;
Size and type of command area (terrace/plain);
Water right problems;
Type of soil;
Major technical difficulties (cross drainage/landslide/unstable zones);
Poor farmer's presence;
Farmer's interest;
Make Assessment of tentative cost of the project
Evaluate Cost per ha
Make Assessment of tentative benefit of the project
Evaluate Internal Rate of Return and Benefit Cost Ratio
Based on the analysis the team has to prepare a report stating the project recommendation for further actions.
The recommendation may be based on:
Genuineness of demands;
Command area;
Technical complication;
Environmental adverse effect;
Economic indicators i.e. Cost/ha, EIRR & B/C ratio'

Based on Scoring of the Prefeasibility Report & complexity, the projects generally with a size up to 1000 ha in hill & 5000 ha in Terai will be recommended for Detail Feasibility Study including Detail Design
Based on Scoring of the Prefeasibility Report.., the projects with more than 1000 ha in hill & 5000 ha in Terai shall be recommended for Detail Feasibility Study

Assumption/Basis of Norms

- If the assignment is to be performed through the consultant, the estimation should be done based on rate for the different expert approved by DOI & evaluated salary per day shall be based on considering 30 days of a month.
- Field Survey allowance per day for GON employee = ((Basic Monthly Salary + Monthly Remote Area Allowance of the field location) x 1.5)/30
- Daily allowance shall not be provided for the employee who is receiving survey allowance; however other allowances (except daily allowances) shall be provided

as per GON rules

- for the desk study Daily allowance for Departmental Employees, considering the over/extra time (rather than normal office hours) to be given for desk study and report preparation, is provisioned at a rate 50% of ((Basic Monthly Salary + Monthly Remote Area allowance at the location of report preparation) x 1.5/30)
- Lodging and Travel allowance will not be provided to the locally hired personnel
- Rates for the material required for the field survey, desk study and report preparation will be based on the general market available rates.

Mode of Payment

a) To Departmental Employees :

The amount shall be paid to the employees as advance assigned for the study as follows;

For mobilization and Field work	60% of the total amount
Upon Submission and acceptance of Final Survey Report	40% of the total amount

The final payment shall not be made if the above mentioned work is not completed as per TOR, and the assigned team will be fully responsible ensuring the quality of report as per requirement.

b) To Consultant (if employed) :

- The amount shall be paid as per agreement to the consultant assigned for the study. However, the consultant can claim the payment either in a single installment after submission and acceptance of final report as per TOR or in installment as follows;
- First Installment (if necessary), 10% of the total amount upon submission and acceptance of desk study/inception report;
- Second Installment, 40% of the total amount upon submission and acceptance of field study report;
- Third Installment, 25% of the total amount upon submission and acceptance of draft final report;
- Final Installment, remaining of the total amount upon submission and acceptance of final report complying with TOR;
- 20% of the total amount may be provided as an advance payment on submission and acceptance of bank guarantee and such payment shall be recovered within third installment

NORMS
FOR
DETAILED FEASIBILITY STUDIES

FIELD WORK

HEADWORK SITE

a - Site selection (Total Station or Appropriate Instrument)

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	4

Prismman	2
Instrument man	1
Waterman	1

ii - Performance criteria :

Hills	6 km/day
Terai	8 km/day
Head Work Site Selection for Hills	NRs. ((4 x District Rate for Labor)/6) per km
Head Work Site Selection for Terai	NRs. ((4 x District Rate for Labor)/8) per km

b - Contour Survey

i- Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	8

Prismman -	4
Site clearer	2
Instrument man	1
Waterman	1

ii - Performance criteria :

River type	Days
I small	1
II medium	2
III large	3
Contour Surveyat HW site for small river	NRs. (8 x District Rate for Labor)
Contour Survey at HW site for medium river	NRs. (8 x District Rate for Labor) x 2
Contour Survey at HW site for large river	NRs. (8 x District Rate for Labor) x 3

Note : River type	Hill	Terai
I small	Width <= 5m	Width <=10m
	Area <=3 ha	Area <=5 ha
II medium	Width <=25m	Width <=50m
	Area <=5 ha	Area <=10 ha
III large	Width > 25m	Width > 50m
	Area > 5 ha	Area > 10 ha

Note : if any of the criteria exceeds the upper limit shall govern to fix the river type

c - L-section & X-section Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	7

Chainman	2
Prismman	2
Site clearer	1
Instrument man	1
Waterman	1

ii - Performance criteria :

River type	days
I small	1
II medium	1.5
III large	2
L-section & X-section survey at HW site for small river	NRs. (7 x District Rate for Labor)
L-section & X-section survey at HW site for medium river	NRs. (7 x District Rate for Labor) x 1.5
L-section & X-section survey at HW site for large river	NRs. (7 x District Rate for Labor) x 2

Note : River type	Hill	Terai
I small	Width <= 5m	Width <= 10m
II medium	Width <=25m	Width <=50m
III large	Width > 25m	Width > 50m

d - Geological Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	6
	2 labourers can dig 1 pit a day Pit size :- 1 * 1 * 1.5 meter

ii - Performance criteria :

River width	Pit c/c	Days
<=20 meter	4 meter	1
<= 50 meter	5 meter	2
<=100 meter	7 meter	2.5
> 100 meter	10 meter	3
Geological Survey for <= 20 m river width		NRs. (6 x District Rate for Labor)
Geological Survey for <=50 m river width		NRs. (6 x District Rate for Labor) x 2
Geological Survey for <=100 m river width		NRs. (6 x District Rate for Labor) x 2.5
Geological Survey for > 100 m river width		NRs. (6 x District Rate for Labor) x 3

Note : one extra day shall be added for surface geological study
(one geologist & one labour)

e - Hydrological survey - (+ Water quality test)

i - Manpower required :

Hydrologist	1
Assistant	1
Labour	3

Guide	1
Labour	2

ii - Performance criteria :

Hills	2 days
Terai	2 days
Hydrological Survey for Hills	NRs. (3 x District Rate for Labor) x 2
Hydrological Survey for Terai	NRs. (3 x District Rate for Labor) x 2

f –River morphology and Sedimentation survey through consultant –

i - Manpower required :

Engineer/Silt Analyst/Geotechnical Engineer	1
Assistant	1
Labour	3

Guide	1
Labour	2

ii - Performance criteria :

Hills	2 days
Terai	3 days
Sedimentation Survey for Hills	NRs. (3 x District Rate for Labor) x 2
Sedimentation Survey for Terai	NRs. (3 x District Rate for Labor) x 3

g - Environmental survey - (for IEE/EIA)

i - Manpower required :

Environmental expert	1
Assistant	1
Labour	3

Guide	1
Labour	2

ii - Performance criteria :

Hills	1 day
Terai	1 day
Environmental Survey for Hills	NRs. (3 x District Rate for Labor) x 1
Environmental Survey for Terai	NRs. (3 x District Rate for Labor) x 1

h – Incase works is to be performed through consultant (Site Selection for Headwork/Settling Basin)

i - Additional Manpower required :

Team Leader/Irrigation Management Expert	1
Hydraulic Engineer	1
Labour	2

Guide	1
Labour	1

ii - Performance criteria :

Hills	1 day
Terai	1 day
Head Work Site Selection for Hills	NRs. (2 x District Rate for Labor) x1
Head Work Site Selection for Terai	NRs. (2 x District Rate for Labor) x 1

CANAL ALIGNMENT

a - Layout Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	2
Labour	5

Prismman	2
Site clearer	1
Instrument man	1
Waterman	1

ii - Performance criteria :

Hills	3 km/day
Terai	6 km/day
Canal Layout Survey for Hills	NRs. ((5 x District Rate for Labor)/3) per km
Canal Layout Survey for Terai	NRs. ((5 x District Rate for Labor)/6) per km

b - L-section Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	8

chainman	2
Prismman	2
Instrument man	1
Pegman	2
Waterman	1

ii - Performance criteria :

Hills	3km/day
Terai	6 km/day
Canal L-Section Survey for Hills	NRs. ((8 x District Rate for Labor)/3) per km
Canal L-Section Survey for Terai	NRs. ((8 x District Rate for Labor)/6) per km

c - X-section Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	8

Prismman	4
Site clearer	2
Instrument man	1
Waterman	1

ii - Performance criteria :

Location	Distance	
Hills	50 meter	1.5 km/day
Terai	100 meter	3 km/day
Canal X-Section Survey for Hills		NRs. ((8 x District Rate for Labor)/1.5) per km
Canal X-Section Survey for Terai		NRs. ((8 x District Rate for Labor)/3) per km

d - Bench mark Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	10

Chainman	2
Prismman	2
Instrument man	1
Pit digger	2
Pillar carrier	2

Waterman	1
Pillar size	0.15 * 0.15 * 0.50

ii - Performance criteria :

Location	Distance c/c	BM/day
Hills	0.5 km	10
Terai	1.0 km	10
BM Survey along canal alignment for Hills		NRs. ((10 x District Rate for Labor)/10) per BM
BM Survey along canal alignment for Terai		NRs. ((10 x District Rate for Labor)/10) per BM

e - Geological Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	6
	2 labourers can dig 1 pit a day Pit size :- 1 * 1 * 1.5 meter

ii - Performance criteria :

Location	Distance c/c	km/day
Hills	0.25 km	1.5
Terai	0.25 km	1.5
Geological Survey along Canal Alignment for Hills		NRs. ((6 x District Rate for Labor)/1.5) per km
Geological Survey along Canal Alignment for Terai		NRs. ((6 x District Rate for Labor)/1.5) per km

f - Infiltration rate Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	4

Water carrier	3
Digger	1

ii - Performance criteria :

Location	Distance c/c	km/day
Hills	0.5 km	1
Terai	0.5 km	1
Infiltration rate surveyalong canal alignment for Hills		NRs. ((4 x District Rate for Labor)/1.0) per km
Infiltration rate survey along canal alignment for Terai		NRs. ((4 x District Rate for Labor)/1.0) per km

g - Environmetal Survey (IEE/EIA)

i - Manpower required :

Environmetal Specialist	1
Assistant	1
Labour	3

Guide	1
Labour	2

ii - Performance criteria :

Location	km/day
Hills	3
Terai	6
Environmental Surveyalong the canal alignment for Hills	NRs. ((3 x District Rate for Labor)/3) per km
Environmental Survey along the canal alignment for Terai	NRs. ((3 x District Rate for Labor)/6) per km

h– Incase works is to be performed through consultant

i - Additional Manpower required :

Team Leader/Irrigation Management Expert	1
Hydraulic Engineer	1
Labour	2

Guide	1
Labour	1

ii - Performance criteria :

Location	km/day
Hills	3
Terai	6
Verification of the canal alignment for Hills	NRs. ((2 x District Rate for Labor)/3) per km
Verification of the canal alignment for Terai	NRs. ((2 x District Rate for Labor)/6) per km

CROSS DRAINAGE WORKS

a - Contour, L-section and X-section Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	6

Chainman	2
Prismman	2
Instrument man	1
Waterman	1

ii - Performance criteria :

Hills	4 CD/day
Terai	6 CD/day
Contour, L & X section survey for Cross Drainage for Hills	NRs. ((6 x District Rate for Labor)/4) per CD
Contour, L & X section survey for Cross Drainage for Terai	NRs. ((6 x District Rate for Labor)/6) per CD

b - Geological Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	12
	2 labourers can dig 1 pit a day Pit size :- 1 * 1 * 1.5 meter

ii - Performance criteria :

CD – width	Center to Center	days
<= 20 meter	4 meter	1
<= 50 meter	5 meter	2
<= 100 meter	7 meter	2.5
> 100 meter	10 meter	(2.5 + (river width more than 100 m)*(0.5/50))
Geological Survey for Cross Drainage with <=20 m river width		NRs. (12 x District Rate for Labor) x 1
Geological Survey for Cross Drainage with <=50 m river width		NRs. (12 x District Rate for Labor) x 2
Geological Survey for Cross Drainage with <=100 m river width		NRs. (12 x District Rate for Labor) x 2.5
Geological Survey for Cross Drainage with > 100 m river width		NRs. (12 x District Rate for Labor) x (2.5 + (river width more than 100 m)*(0.5/50))

c - Hydrogical survey

i - Manpower required :

Hydrologist	1
Assistant	1
Labour	4

Guide	1
Labour	3

ii - Performance criteria :

Hills	4 CD/day
Terai	4 CD/day
Hydrological Surveyfor Cross Drainage for Hills	NRs. ((4 x District Rate for Labor)/4) per CD
Hydrological Survey for Cross Drainage for Terai	NRs. ((4 x District Rate for Labor)/4) per CD

d - Environmental survey

i - Manpower required :

Environmental Expert	1
Assistant	1
Labour	3

Guide	1
Labour	2

ii - Performance criteria :

Hills	6 CD/day
Terai	6 CD/day
Environmental Survey for Cross Drainage for Hills	NRs. ((3 x District Rate for Labor)/6) per CD
Environmental Survey for Cross Drainage for Terai	NRs. ((3 x District Rate for Labor)/6) per CD

e – Incase works is to be performed through consultant

i - Additional Manpower required :

Team Leader/Irrigation Management Expert	1
Hydraulic Engineer	1
Labour	2

Guide	1
Labourers -	1

ii - Performance criteria :

Hills	4 CD/day
Terai	4 CD/day
Field verification for Cross Drainage for Hills	NRs. ((2 x District Rate for Labor)/4) per CD
Field verification for Cross Drainage for Terai	NRs. ((2 x District Rate for Labor)/4) per CD

COMMAND AREA - for Hills and Terai

a - Traverse Line Survey

i - Manpower required:

Engineer/Surveyor	1
Sub-Engineer	1
Labour	6

Prismman	4
Instrument man	1
Waterman	1

ii - Performance criteria :

Command Area (CA)	days
<=100 ha	2
<=200 ha	3.5
<=300 ha	4.5
<=500 ha	5
<=1000 ha	6
<=5000 ha	7.5
> 5000 ha	(7.5 + (hectarage more than 5000 ha)*(1/1000))
Traverse Line Survey for Command area with <= 100 ha	NRs. (6 x District Rate for Labor) x 2
Traverse Line Survey for Command area with <= 200 ha	NRs. (6 x District Rate for Labor) x 3.5
Traverse Line Survey for Command area with <= 300 ha	NRs. (6 x District Rate for Labor) x 4.5
Traverse Line Survey for Command area with <=500 ha	NRs. (6 x District Rate for Labor) x 5
Traverse Line Survey for Command area with <= 1000 ha	NRs. (6 x District Rate for Labor) x 6
Traverse Line Survey for Command area with <=5000 ha	NRs. (6 x District Rate for Labor) x 7.5
Traverse Line Survey for Command area with > 5000 ha	NRs. (6 x District Rate for Labor) x (7.5 + (hectarage more than 5000 ha)*(1/1000))

b - Topographical Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	6

Prismman	4
Instrument man	1
Waterman	1

ii - Performance criteria :

Hills	20 ha/day
Terai	30 ha/day
Topographical survey of command area for Hills	NRs. ((6 x District Rate for Labor)/20) per ha
Topographical survey of command area for Terai	NRs. ((6 x District Rate for Labor)/30) per ha

c - Bench mark Survey

i - Manpower required :

Engineer/Surveyor	1
Sub-Engineer	1
Labour	12

Prismman	2
Instrument man	1
Pit digger	4
Pillar carrier	4
Waterman	1
Pillar size	0.15 * 0.15 * 0.50

ii - Performance criteria :

Location	Distribution	BM/day
Command Area (CA)	1 BM/ 50 ha	10
Bench Mark Survey for command area		NRs. ((12 x District Rate for Labor)/10) per BM

d - Agricultural Survey

i - Manpower required :

Agronomist	1
Assistant	1
Labour	1

Guide	1

ii - Performance criteria :

Command Area (CA)	days
<= 100 ha	2
<= 200 ha	3
<= 300 ha	4
<= 500 ha	5
<= 1000 ha	6
> 1000 ha	(6 + (hectarage more than 1000 ha)*(1/500))
Agricultural survey for command area with<= 100 ha	NRs. (1 x District Rate for Labor) x 2
Agricultural survey for command area with <= 200 ha	NRs. (1 x District Rate for Labor) x 3
Agricultural survey for command area with <=300 ha	NRs. (1 x District Rate for Labor) x 4
Agricultural survey for command area with <= 500 ha	NRs. (1 x District Rate for Labor) x 5
Agricultural survey for command area with <= 1000 ha	NRs. (1 x District Rate for Labor) x 6
Agricultural survey for command area with > 1000 ha	NRs. (1 x District Rate for Labor) x (6 + (hectarage more than 1000 ha)*(1/500))

e - Soil Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	4
	2 labourers can dig 1 pit a day Pit size :- 1 * 1 * 1.5 meter

ii - Performance criteria :

Command Area (CA)	Distribution	days
<= 100 ha	one sample / 25 ha	2
<= 200 ha	one sample / 35 ha	3
<= 400 ha	one sample / 50 ha	4
<= 700 ha	one sample / 70 ha	5
<=1000 ha	one sample / 90 ha	6
<= 1500 ha	one sample / 110 ha	7
<= 2000 ha	one sample / 130 ha	8
> 2000 ha	one sample / 150 ha	(8 + (hectarage more than 2000 ha)*(1/500))
Soil Survey for command area with<=100 ha		NRs. (4 x District Rate for Labor) x 2

Command Area (CA)	Distribution	days
Soil Survey for command area with <=200 ha		NRs. (4 x District Rate for Labor) x 3
Soil Survey for command area with <=400 ha		NRs. (4 x District Rate for Labor) x 4
Soil Survey for command area with <=700 ha		NRs. (4 x District Rate for Labor) x 5
Soil Survey for command area with <=1000 ha		NRs. (4 x District Rate for Labor) x 6
Soil Survey for command area with <= 1500 ha		NRs. (4 x District Rate for Labor) x 7
Soil Survey for command area with <= 2000 ha		NRs. (4 x District Rate for Labor) x 8
Soil Survey for command area with > 2000 ha		NRs. (4 x District Rate for Labor) x (8 + (hectarage more than 2000 ha)*(1/500))

f - Infiltration rate Survey

i - Manpower required :

Geologist	1
Assistant	1
Labour	4

Water carrier	3
Digger	1

ii - Performance criteria :

Location	Distribution	IT/day
Command Area (CA)	1 IT/50 ha	2
Infiltration Rate survey for command area		NRs. ((4 x District Rate for Labor) / 2) per IT
Note : IT = Infiltration Test		

g - Socio-Economical Survey

i - Manpower required :

Economist	1
Sociologist	1
GESI expert	1
Assistant	3
Labour	3

Guide	3

ii - Performance criteria :

Command Area	days
<= 100 ha	5
<= 200 ha	6
<= 300 ha	7
<= 500 ha	8
<=1000 ha	9
> 1000 ha	(9 + (hectarage more than 1000 ha)*(1/500))
Socio Economical Survey for command area with<= 100 ha	NRs. (3 x District Rate for Labor) x 5
Socio Economical Survey for command area with <=200 ha	NRs. (4 x District Rate for Labor) x 6
Socio Economical Survey for command area with <= 300 ha	NRs. (4 x District Rate for Labor) x 7
Socio Economical Survey for command area with <= 500 ha	NRs. (4 x District Rate for Labor) x 8
Socio Economical Survey for command area with <= 1000 ha	NRs. (4 x District Rate for Labor) x 9
Socio Economical Survey for command area with > 1000 ha	NRs. (4 x District Rate for Labor) x (9 + (hectarage more than 1000 ha)*(1/500))

h - Environmental Survey

i - Manpower required :

Environmental Expert	1
Assistant	1
Labour	1

Guide	1

ii - Performance criteria :

Command Area	Days
<= 100 ha	5
<= 200 ha	6
<= 300 ha	7
<= 500 ha	8
<= 1000 ha	9
> 1000 ha	(8 + (hectarage more than 1000 ha)*(1/500))
Environmental survey for command area with< 100 ha	NRs. (1 x District Rate for Labor) x 5

Command Area	Days
Environmental survey for command area with < 200 ha	NRs. (1 x District Rate for Labor) x 6
Environmental survey for command area with < 300 ha	NRs. (1 x District Rate for Labor) x 7
Environmental survey for command area with < 500 ha	NRs. (1 x District Rate for Labor) x 8
Environmental survey for command area with < 1000 ha	NRs. (1 x District Rate for Labor) x 9
Environmental survey for command area with > 1000 ha	NRs. (1 x District Rate for Labor) x (9+ (hectarage more than 1000 ha)*(1/500))

i - – Incase works is to be performed through consultant

i - Additional Manpower required :

Team Leader/Irrigation Management Expert	1
Hydraulic Engineer	1
Labour	1

Guide	1

ii - Performance criteria :

Command Area	Days
<=100 ha	5
<= 200 ha	6
<= 300 ha	7
<= 500 ha	8
<= 1000 ha	9
> 1000 ha	(9 + (hectarage more than 1000 ha)*(1/500))
verification for command area with <= 100 ha	NRs. (1 x District Rate for Labor) x 5
verification for command area with <= 200 ha	NRs. (1 x District Rate for Labor) x 6
verification for command area with <=300 ha	NRs. (1 x District Rate for Labor) x 7
verification for command area with <=500 ha	NRs. (1 x District Rate for Labor) x 8
verification for command area with <= 1000 ha	NRs. (1 x District Rate for Labor) x 9
verification for command area with > 1000 ha	NRs. (1 x District Rate for Labor) x (9 + (hectarage more than 1000 ha)*(1/500))

PUBLIC CONSULTATION

a. - For IEE

i - Manpower required :

Environmental Expert	1
Sociologist	1
Assistant	1
Labour	1

ii- Performance criteria :

Command Area	Days
<= 100 ha	5
<= 200 ha	6
<= 300 ha	7

b. - For EIA

i - Manpower required :

	Number	Days Required
Environmental Expert	1	14
Sociologist	1	22
Assistant	1	50
Labour	4	50

MISCELLANEOUS - for Hills and Terai

a. Accommodation & Equipment

A compensation of NRs. 6 x district labour rate/day, per person shall be provided for accommodation and equipments (Tent, Bed, Furniture, Utensil etc.) during field period.

b . Transportation

Travel Expenses for the departmental employee shall be provided as per GON Rules above that Extra amount NRs. 2 x district rate for labor per day shall be provided for the carrying baggage & other equipments required for survey

c . Equipment required :

Compensation of Nrs. 6 x district rate for labour per day for the hiring equipments (Total Station, Prism, Level Machine& other equipments) shall be provided

OFFICE WORK

DESK STUDY

a - Data collection, Compilation and Report presentation

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	1
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	7 days

HEADWORK SITE

a - Contour, L-section and X-section

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	1
Auto CAD Expert	1
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	6 days

Note : Project type	Hills	Terai
I Minor	Width <= 5 m	Width <=10 m
	Area <=3 ha	Area <= 5 ha
II Major	Width > 5 m	Width > 10 m
	Area > 3 ha	Area > 5 ha

b - Geology

i - Manpower required :

Geologist	1
GIS expert	1
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	4 days
Major	5 days

Note : Project type	Hills	Terai
I Minor	Width <= 10 m	Width <=50 m
II Major	Width > 10 m	Width > 50 m

c - Hydrology

i - Manpower required :

Hydrologist	1
GIS expert	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Minor	3 days
Major	3 days

d - Design and Drawings

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	10 days

Note : Project type	Hills	Terai
I Minor	Width <= 10 m	Width <= 50 m
II Major	Width > 10 m	Width > 50 m

e - Estimate

i - Manpower required :

Engineer	1
Sub-Engineer	2
Office Assistant	1

ii - Performance criteria :

Minor	4 days
Major	7 days

Note : Project type	Hills	Terai
I Minor	Width <=10 m	Width <=50 m
II Major	Width > 10 m	Width > 50 m

CANAL ALIGNMENT

a - Layout

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	1
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	2 days
Major	2 days

b - Contour, L-section and X-section

i - Manpower required :

Engineer	1
Sub-Engineer	2
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	2 days
Major	2 days

c - Geology

i - Manpower required :

Geologist	1
GIS expert	1
Office Assistant	1

ii - Performance criteria :

Minor	10 pits/day	2 km/day
Major	10 pits/day	2 km/day

d - Design and Drawings

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
AutoCAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	3 days
Major	6 days

Note : Project type	Hills	Terai
Minor	Q <= 0.5 m^3/ s	Q <=1.0 m^3/ s
	C.L <= 5 km	C.L <=7 km
Major	Q > 0.5 m^3/ s	Q > 1.0 m^3/ s
	C.L > 5 km	C.L > 7 km

e - Estimate

i - Manpower required :

Engineer	1
Sub-Engineer	2
Office Assistant	1

ii - Performance criteria :

Minor	4 km/day
Major	4 km/day

Note : Project type	Hills	Terai
Minor	Q <= 0.5 m^3/ s	Q <=1.0 m^3/ s
	C.L <= 5 km	C.L <=7 km
Major	Q > 0.5 m^3/ s	Q > 1.0 m^3/ s
	C.L > 5 km	C.L > 7 km

CROSS DRAINAGE WORKS

a - Contour, L-section and X-section

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
AutoCAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	3 CD/day
Major	2 CD/day

Note : Project type	Hills	Terai
I Minor	Width <=5 m	Width <=10 m
II Major	Width > 5 m	Width > 10 m

b - Geology

i - Manpower required:

Geologist	1
GIS expert	1
Assistant	1
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	3 CD/day
Major	2 CD/day

Note : Project type	Hills	Terai
I Minor	Width <= 5 m	Width <=10 m
II Major	Width > 5 m	Width > 10 m

c - Hydrology

i - Manpower required :

Hydrologist	1
GIS expert	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Minor	3 CD/day
Major	2 CD/day

Note : Project type	Hills	Terai
I Minor	Width <= 5 m	Width <=10 m
II Major	Width > 5 m	Width > 10 m

e - Design and Drawings

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Minor	1 CD/ 2 day
Major	1 CD/ 4 day

Note : Project type	Hills	Terai
Minor	Q <= 0.5 m^3/ s	Q <=1.0 m^3/ s
	span <= 10 m	span <= 25 m
Major	Q > 0.5 m^3/ s	Q > 1.0 m^3/ s
	span > 10 m	span > 25 m

f - Estimate

i - Manpower required :

Engineer	1
Sub-Engineer	2
Office Assistant	1

ii - Performance criteria :

Minor	2 CD/day
Major	2 CD/day

Note : Project type	Hills	Terai
Minor	Q <= 0.5 m^3/ s	Q <= 1.0 m^3/ s
	span <= 10 m	span <= 25 m
Major	Q > 0.5 m^3/ s	Q > 1.0 m^3/ s
	span > 10 m	span > 25 m

COMMAND AREA - for Hills and Terai

a - Traverse Line Survey

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
Auto CAD expert	1
Office Assistant	1

ii - Performance criteria :

Command area (CA)	Days
<= 200 ha	2
<=500 ha	3
<=1000 ha	4
> 1000 ha	(4 + (hectarage more than 1000 ha)*(1/500))

b - Topography

i - Manpower required :

Engineer	1
GIS expert	1
Sub-Engineer	2
AutoCAD expert	1
Office Assistant	1

ii - Performance criteria :

Hills	25 ha/day
Terai	50 ha/day

c - Agriculture

i - Manpower required :

Agronomist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Minor	7 days
Major	7 days

d - Geology

i - Manpower required :

Geologist	1
GIS expert	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Command area (CA)	Days
<=500 ha	3
<=1000 ha	5
<=1500 ha	7
> 1500 ha	(7 + (hectarage more than 1500 ha)*(2/500))

e - Socio-Economy

i - Manpower required :

Economist	1
Socilologist	1
GESI expert	1
Office Assistant	1

ii - Performance criteria :

Command area (CA)	Days
<= 500 ha	7
<=1000 ha	8
<=1500 ha	9
> 1500 ha	(9 + (hectarage more than 1500 ha)*(1/500))

DESK STUDY FOR IEE

Environment Expert	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Command area (CA)	Days
<= 500 ha	5
> 500 ha	7

DESK STUDY FOR EIA

a. For Scoping and TOR

For Literature Review
Manpower Required:

Environment Expert	1
Sociologist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

	Days Required
Engineer/Environmental Expert	7
Sociologist	7
Assistant (Sub-Engineer)	7
Office Assistant	7

For Project Area Study
Manpower Required :

Environment Expert	1
Sociologist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Person	Days
Engineer/Environmental Expert	2
Sociologist	2
Assistant (Sub-Engineer)	2
Office Assistant	2

b. - After Scoping and TOR approval)

For Literature Review

Environment Expert	1
Sociologist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Person	Days
Engineer/Environmental Expert	15
Sociologist	7
Assistant (Sub-Engineer)	15
Office Assistant	15

For Project Area Study

Environment Expert	1
Sociologist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Person	Days
Engineer/Environmental Expert	7
Sociologist	7
Assistant (Sub-Engineer)	7
Office Assistant	7

MISCELLANEOUS - for Hills and Terai

a - Planning and Management (For construction)

i - Manpower required :

Engineer/Expert	1
Assistant	2
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	10 days

Note : Project type	Hills	Terai
I Minor	C.A. <=100 ha	C.A. <= 500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

b - Planning and Management (For construction) if the work is to be performed through consultant

i - Additional Manpower required :

Team Leader/Irrigation Management Expert	1
Procurement Expert	1
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	10 days

Note : Project type	Hills	Terai
I Minor	C.A. <=100 ha	C.A. <=500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

c - Rate Analysis

i - Manpower required :

Engineer	1
Sub-Engineer	2
Office Assistant	1

ii - Performance criteria :

Minor	6 days
Major	6 days

d - Economical Analysis

i - Manpower required :

Economist	1
Assistant	1
Office Assistant	1

ii - Performance criteria :

Minor	5 days
Major	7 days

e - Report Preparation

i - Manpower required :

Engineer/other Expert	1
Assistant	2
Office Assistant	1

ii - Performance criteria :

Minor	15 days
Major	25 days

Note : Project type	Hills	Terai
I Minor	C.A. <=100 ha	C.A. <= 500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

f – Report(FSR/Design) Preparation except environmental report; if the work is to be performed through consultant

i - Manpower required :

Team Leader/Irrigation Management Expert	1
Hydraulic Engineer	1
*Structural Engineer	1
Office Assistant	1

* Structural Engineer is required if design work is also included

ii - Performance criteria :

Minor	7 days
Major	10 days

Note : Project type	Hills	Terai
I Minor	C.A. <=100 ha	C.A. <=500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

g - Environmental Report Preparation

For IEE

i - Manpower required :

Engineer/other Expert	1
Assistant	2
Office Assistant	1

ii - Performance criteria :

Minor	15 days
Major	25 days

Note : Project type	Hills	Terai
I Minor	C.A. < =100 ha	C.A. <= 500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

For EIA (Including Scoping, TOR and EIA Report)

i - Manpower required :

Engineer/other Expert	160
Sociologist	30
Gis Expert	30
Assistant	160
Office Assistant	160

h - Office Equipment

ii - Performance criteria :

(Computer, Scanner, Photocopy, Printer, Plotter, Toner, Cartridge, Binder, Stationary) for Minor Project	NRs. 20,000
(Computer, Scanner, Photocopy, Printer, Plotter, Toner, Cartridge, Binder, Stationary) for Major Project	NRs. 25,000

Note : Project type	Hills	Terai
I Minor	C.A. <= 100 ha	C.A. <= 500 ha
II Major	C.A. > 100 ha	C.A. > 500 ha

Terms of Reference for Detail Feasibility Study and Detail Design of Irrigation Schemes, under Department of Irrigation

INTRODUCTION

Background to ToR

Department of Irrigation (DoI) is a government organization, with a mandate to plan, develop, maintain, operate, manage and monitor different modes of environmentally sustainable and socially acceptable irrigation and drainage systems - from small to larger scale surface systems and from individual to community groundwater schemes. Its ultimate aim is to provide year round irrigation facilities and increase the irrigable area of the country to higher limits. This giving a primary input in increasing the productivity of the land and providing a major input to the Gross Domestic Product (GDP) and eventually improve the standard of living of the beneficiary farmers. Apart from this the DoI also has to carry out river training activities to protect the floodways, floodplains and agricultural lands in the form of river bank protection such that the loss of properties caused by flooding is reduced. The Detail Feasibility Study is the basis for the project implementation and is carried out by a team of experts having engineering, agriculture, environmental, and socio-economic professionals. This study normally forms the basis of financing by external funding agencies or by the Government. The study assesses the technical feasibility, friendly environment, economical viability and institutional suitability of the project implementation.

Normally the detail feasibility of Medium Irrigation Project (MIP) will consist of Detail Feasibility Study (DFS) and Detail Design (DD), however Identification Study (ID) will recommend, if more studies at different level are required for MIP; for the large irrigation projects, Prefeasibility Study (PF) and consequently based on PF recommendation, DFS will be carried out first; and if the project is feasible, DD will be carried out at a later stage.
Based on the appraised cost during feasibility study, the cost estimate may vary up to 10%, after DD.

A survey Norms was prepared and implemented in Oct 1988 to carryout ID, PF or DFS. With the introduction of new technologies, methodology and extended scope of work, it is felt necessary to revise above mentioned Norms, so the proposed Norms needs to be approved and implemented in order to facilitate different studies which will be carried out by department or individual consultant or firms.

Objective of the Study

The overall objective of the study is to formulate technically sound, environmental friendly and economically viable Irrigation System is to be designed for a design life of more than 25-years and with low maintenance cost. The canal & related structures must harmonize with the surroundings and present a pleasing appearance. The maximum possible use of locally available materials & technology in the feasibility study/design will be appreciated.

Scope of Works

Detailed Design (if ID/PF survey directly recommends for DFS, otherwise detailed design is not required)
Detail Cost estimate (if ID/PF survey directly recommends for DFS, otherwise tentative cost is required)

The detail survey team (here onwards "the team") will perform detailed technical, social and economical analysis (techno-socio-env-economical) along with related works herein to attain the desired objectives. The team will be responsible for accuracy, interpretation, analysis of all data received and for the conclusion and recommendations in their report. The mentioned scope of work to be carried by the team will broadly include but not limited to the following;

a) Desk study

A desk study will be carried out collecting all the data, maps and information relevant to the project and review of Identification/Pre-feasibility Report for planning of further field survey and investigation works as well as detailed design; this study needs to see generally two aspects.

- **List of outstanding matters to be studied, and**
- **Any possible scheme alternatives**

There may be several outstanding issues not touched during previous studies, which will be addressed during detail feasibility study (DFS). The scheme alternatives need to be reviewed in the DFS, which may include the following:

For New Schemes

i) Possibility of alternative water sources from different river, supply, ground water or supplementary rivers etc.

ii) Alternative intake site, canal alignment etc.

For Rehabilitation Schemes

i) Possibility of command area extension

ii) Combining several schemes

iii) Revised intake site/canal alignment

b) Field Survey Work

The field survey work may differ slightly based on the type of the scheme whether it is new or rehabilitation. The following are the main activities to be carried out during the field survey work:

i) Intake/Head Work site survey

ii) Discharge measurement

iii) Canal alignment survey

iv) Canal Profile Survey

v) Work Inventory

vi) Major structure site survey

vii) Command area survey (GPS Survey)

Intake/Head work Site Survey

- Site plan for an Intake/Head works to be investigated situated on the River Bank will be prepared (Covering total width of the river & at least 100 m both side from the firm bank (depending upon the site condition) or 5 meters above high flood level wherever possible or depending upon the site conditions).
- The profile and cross-section will be taken 1 km u/s and 1 km d/s of intake location (with at least an interval of 100 m, depending upon layout & topography, interval can be shorter). All the cross section and profile of the river must show the river bed level, high flood level mark and bank top levels.
- All mapping work will be performed using appropriate instrumentation and procedures for establishing control, field data acquisition, and compilation in accordance with the functional accuracy requirements to include all quality control associated with these functions.
- A surface model for the entire survey area (head work, canal alignment & command area) will be developed using CAD compatible Digital Terrain Modeling software, or its equivalent. The model file should have the .dtm extension.

- The digital terrain model will be developed from cross sections, spot elevations, and break lines (when applicable). Break lines will include ridges, drainage, road edges, surface water boundaries, top of bank and other linear features implying a change in slope.

- The surface model will be prepared of adequate density and quality to produce 0.25 m, 0.50 m or 1.00 m contour interval (as per requirement) derived from the original Digital Terrain Model (DTM) file.

- The contour data will be incorporated as a reference file into the final data set. The contours should be developed in the DTM. The contours should be provided in one or more master database DGN files attached as a reference file to all sheet files utilizing the clip bounds methods. Each contour will be drawn sharp and clear as a continuous solid line. Every index contour will be accentuated as a heavier line than the intermediate and will be annotated according to its actual elevation above datum. Labeling or numbering of contours should be inserted in breaks along the contour lines, so that the elevation is readily discernible. Labeling of intermediate contours may be required in areas of low relief.

- Topographic and planimetric feature detail maps will be compiled at a target scale of 1:1000 for the head works delineated on exhibits.

- Planimetric feature detail will be compiled in accordance with the horizontal accuracy.

- Contours will be developed at 0.25 m intervals for Terai and 0.5 m or 1.0 m intervals (for terrain slope < 10^0, contour interval 0.50 m and for terrain slope > 10^0, contour interval 1.0 m) for hill.

Discharge Measurement
The discharge measurement will be done at the headwork/intake location, using appropriate methods.

Canal Alignment Survey
Strip mapping of the Irrigation System main/secondary/sub secondary canals etc. originating from the Source River and off takes will be prepared.

Canal Profile Survey

- The profile of the canal/embankment shall be compiled in a horizontal scale of 1:1000 and vertical scale of 1:100, underneath the 100 m wide (or as per site condition) strip plan of canal/embankment.
- Cross sections along the alignment of the canal at an interval required but not limited to 50 m. (Cross sections will be based on actual survey along each cross section rather than interpolation).

Work Inventory
During Detail Survey, work inventory along the canal system will be prepared, i.e. number of major/minor structures and other physical features etc.

Major Structure Site Survey
Survey of the major structures like Siphon, Aquaduct, Bridge, Settling Basin, Escapes will be carried out independently (no interpolation)

Command area survey
Closed Traverse Survey of the command area indicating Gross Command Area, Cultural Command Area including minor canals network and other important physical features will be carried out.

Feature and terrain data should be delivered in both hard copy and digital format.
The detailed survey will be completed in four parts;

i) Benchmark Survey (Closed loop traverse)
ii) Topographic Survey
iii) Command Area Survey (Closed loop traverse)
iv) Profile and Cross-Section Survey

Bench Mark Survey
In the first step of the survey, Surveyor needs to start vertical & horizontal control point survey by closed traverse. All of the calculations for error adjustments and distribution of errors will be carried out properly; once the benchmark is finalized, the Surveyor should proceed with the second step. The benchmarks will be established every 0.50 km in hills and 1 km in Terai and at permanent structures or as per requirement. All benchmarks will be located in sites that should remain stable and undisturbed throughout project construction activities and will be constructed as per specifications.

Topographic Survey
Once control points (benchmarks) are fixed, the Surveyor will start topographic surveys that will also cover fixing of alignment (for new canal/embankments). The topographic map will be prepared in soft and hard copies. All of the readings (co-ordinate readings) will

be submitted in Excel Spreadsheet form or as per requirement. Interpolation for contours should comply with the actual site conditions and accurately reflect changes in slopes and ground configuration. Topographic surveys in structure locations should be detailed and complete, to accurately reflect conditions and elevations related to design requirements.

Command Area Survey

A closed loop traverse survey will be carried out to find the Gross Irrigable Command Area and Net Cultural Command Area. In the command area map all minor (secondary/sub secondary) canals and other important physical features should be shown.

Profile and Cross Section Survey

Along the finalized alignment, the profile and cross-section survey will be carried out independently to the topographic survey at an interval but not limited to 50 m. Whenever alignment crosses special features (Structures, Depressions or other geographical features etc.), the closer cross-sections of that portion(i.e. u/s and d/s of structure) must be taken. The plotted profile and cross section will be prepared in soft and hard copies along with data in excel spread sheets.

Detail cross section and profile for the cross drainage work will be carried out independently clearly indicating drain/river bed level and high flood level.

Field Data

All field survey data will be gathered by use of electronic field book.

1. Using a total station and an electronic data collector with Electronic Field Book Software, locate all topography, infrastructure, and natural features to five (5) meters outside the existing main canal and secondary canal rights of way or five (5) meters outside the existing main canal and secondary canal embankment break lines, if applicable.

2. Using a total station and electronic data collector with Electronic Field Book software, collect sufficient data to generate a Digital Terrain Model (DTM) to five (5) meters outside the existing main canal and secondary canal rights of way or ten (10) meters outside the existing main canal and secondary canal embankment break lines, if applicable.

3. Using a total station and electronic data collector with Electronic Field Book software, collect sufficient data to generate Digital Terrain Models (DTM) at the proposed intake/head works site to be investigated. The DTM should encompass the swath of topography measuring approximately 500 meters in length running along the bank of the River to an elevation approximately 5 meters above flood level. The topography coverage should facilitate the spatial requirements for the future design of canal head works and desilting facilities.

4. Take independent cross-sections at a maximum of fifty (50) meter intervals to verify the Digital Terrain Model (DTM).

5. Locate all above ground evidence of underground water conveyance facilities.

6. Locate and obtain invert elevations on all pipelines, side drains, cross drains, etc.) within the prescribed limits of the project. NOTE: In all cases when an appurtenant facility falls outside these limits but is needed to determine grade and location of a hydraulic feature, pipeline or culvert within these limits, it should be located and inverts obtained.

Horizontal Control

Horizontal control should refer existing project area control. Control points will be occupied as a station within a closed traverse, 1:10,000 accuracy mapping standards. The traverse will initiate and close upon acceptable control monument used to establish the existing project grid system. All grid coordinates shown on the map products will be expressed in or converted to meters. Coordinates should be referenced to the local UTM zone.

Vertical Control

Vertical Control will be referenced to a datum. Controlling points will be established within a closed level loop, 1:5000 for vertical control accuracy, as established for mapping standard. Elevations will originate and close on acceptable benchmarks to be established in the project area.

Existing Project Network Control

a. The Surveyor will perform the necessary surveys to connect existing project control to assure that such control has sufficient relative accuracy to adequately control the overall project. The Surveyor will furnish appropriate data indicating a deficiency in network control.

b. Suitable control monument will be set as required to adequately control during construction phases. All monumentation will be constructed as per requirements and should be in locations that will remain stable and unchanged throughout the construction period.

c. At each station, angle and distance measurements will be made between a network station and reference and azimuth marks established in accordance with the requirements. All observations will be recorded in a standard bound field book or comparable electronic notebook.

Map Compilation Scale

The surveyor will produce strip maps and profiles at a scale of 1:1000 plotted on A3 – size sheets.

Topographic and Planimetric Features

The maps will contain all topographic and planimetric features encountered within the project limits. The maps will properly depict the existing site conditions as necessary for the proper use of their intended purpose. The final mapping product generated by the surveyor will comply with and contain but not be limited to the following:

a. Terrain features/contour development. The contour interval will be 0.5 m or 1.0 m (for terrain slope $< 10^0$, contour interval 0.50 m and for terrain slope $> 10^0$, contour interval 1.0 m) for hill and 0.25 m for Terai. Contours will be legible and drawn sharp and clear as solid lines. Every second contour will be accentuated as a heavier line than the intermediate contour. Half-interval or 0.25 m supplemental contours will be added as designated. Labeling or numbering of contours will be placed so

the elevations are readily discernible. Labeling of intermediate contours may be required in areas of low relief.

(1) Turning points that define drainage channels, ditches, etc., will be consistent in depicting correct alignment and direction of drainage.

(2) Spot elevations will be established and shown on the maps at water surfaces on shorelines of rivers, lakes, reservoirs, ponds, canals and like high and low points at hilltops and depressions; at intersections and along center lines of linear elements and, where applicable, on canal embankments; at top and bottom of vertical walls and other structures and at center lines of ends of bridges. Ground spot elevations should sufficiently supplement contoured elevations. Spot elevations shown on the map sheets will be accurate to 1.0 m or 0.5 m/0.25 m designated contour interval.

(3) Digital Terrain Model (DTM) generation. Digital Elevation Models (DEM) should be generated by grid or trace methods on a network of random points supplemented with break-line points to properly establish the terrain model. Contours will be generated using standard DTM/CAD application software.

b. Planimetric feature data detailing. The strip maps should contain all planimetric features encountered within the project limits and compatible with the objectives of conceptual planning through final design and construction. Features should include all infrastructure, but not be limited to hydraulic structures, buildings, walls, roads, pipelines; surface and subsurface utility and irrigation facility systems including all appurtenances, such as water supply pipelines, overhead power lines, storm drainage features, and structures, bridges, culverts, ramps, waste ways, channel systems; forest areas, landscapes and individual trees that are recognized as such; water supply access areas; cemeteries; etc. Features should be sketched in detail and shown on the map sheet(s) properly indexed in relation to location.

(1) **Surface utility data:** Locate and identify all hydraulic structures, irrigation turn-outs, culverts (pipes or box drains – dimensions, end points crowns and inverts), water systems including valves and flow measuring devices, catch basin inlets and outlets, manholes, meter/valve boxes, overhead power pole location and type, low wire heights, overhead towers, and transformers. Obtain photographs and/or sketches as designated.

(2) **Roads and cart tracks:** Obtain names, descriptions, classifications; center-line profiles or sections as designated; route classification; pavement width and type and condition of surface. Where applicable, show curb and gutter and joint layout for concrete pavement.

(4) **Bridges and culverts:** Obtain dimensions and structural type and condition; measure deck, flow line, and clearance elevations; horizontal clearances between abutments and piers, if any; and width of piers. Include detailed plan and elevation sketches, obtain photographs upstream and downstream.

Final Site Plan Map and/or Digital Data Contents.

The Surveyor should incorporate the following criteria into the final site plan maps and digital data contents:

a. Coordinate grid. The grid system will be established on the Universal Transverse Mercator (UTM). Grid ticks will be placed on the map sheets at 125 mm intervals with coordinate values properly annotated and shown at the top and right edge of each map sheet.

b. All horizontal and vertical controls will be plotted on the maps to accuracy relative to their true position. Primary control set to control construction phases shall be labeled as such.

c. Multiple map sheets should contain an index of the sheet layout oriented north on each sheet. Clear dashed lines/match grid will be provided and properly labeled such that each sheet may be joined accurately to adjacent sheets.

d. Symbols used on the map sheets will be in accordance with CAD standards.

e. The title block, sheet index, and legend should be placed on the map sheets to the designated size and arrangement per CAD standards

f. All design files with supporting data will be furnished on transferable media. The format specified will be dependent on the operating system of the design workstation [dxf] [dgn] other.

Master DGN Files

1) The survey data (DTM data points) points will be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods.

2) The contours will be provided in one or more master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods.

3) The control and baselines will be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods.

4) The planimetric detail, canal prescribed limits, and alignments will be provided in master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods.

5) The break lines will be provided in master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods.

6) The cadastral data will be depicted in one or more master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods. Label bearings and distances on Section lines.

7) The Survey Data and Deliverables finished products will be delivered in CAD (*.dgn) and *.dtm format, or equivalent.

OTHER ACTIVITIES ON THE FIELD

Geological Study & Geomorphologic study (Optional)

In this study the following points related to river, its catchment area and all the considered head work/canal alignment/command area will be studied in detail.

i) Topography

ii) Nature and structure of the surface soil

iii) Nature and structure of local as well as regional geology

iv) Possibility of change of catchment

v) Nature, size and quantities of debris carried by the river

vi) Intensity, duration and distribution of rain in the catchment

vii) Vegetation, cultivation etc. of the catchment

viii) Existence of reservoirs, lakes etc in the catchment

ix) Existing and/or existed head work/intake/canal alignment or other hydraulic structures across the river/drainage in the vicinity of the proposed head work site with their details as much as possible. If the proposed head work/canal is suggested to build in lieu of the existing/damaged structure, the salvage value of the same must be worked out and provided in the report

x) Other information as per need

Seismological Study (Optional)

Nepal being a seismic prone zone, a seismic consideration needs to be taken into account while designing a major hydrauic structure. To workout the seismic coefficient – the design standard and criteria RRRSDP (recently proposed by BS) or IRC: 6-1966 (Reprint 1985) may be followed.

Subsurface Exploration (Optional)

After the selection of proposed headwork/major structure site with alternatives and preparation of toposheets, the surveyor along with the hydrological data and the following points will consider to carry out the soil exploration.

- Design discharge
- Scour depth, maximum scour depth
- Waterway
- Anticipated soil condition for foundation
- The most feasible proposed site
- River training and access roads
- Type of proposed foundation, sub-structures and superstructure

The soil investigation will be carried out including relevant required tests etc. as mentioned hereunder

1) No. of bore holes (depending upon the river) each to a depth as explained in preferably at a possible locations of abutments and piers with conduction of Standard Penetration Test (SPT).

2) No. auger holes in the river to a depth of ……m for determination of mean particle size of riverbed materials in each layer.

3) The depth of soil exploration from existing ground level must not exceed as mentioned below (unless otherwise necessitated by the type of structure):

- In the silty sand and other sand strata – 4 times of the designed scour depth
- In strata of gravel and boulders – 2.5 times of designed scour depth
- In soft rock – a maximum of 8m, and
- In hard rock – a maximum of 3 m

4) Depth of soil exploration carried out must be certified by the concerned authority for each bore hole and should be submitted in plastic bags duly labeled for further testing.

5) Determination of bearing capacity including other engineering properties of each layer of soil with respect to assumed factor of safety and proposed type of foundation

6) Recommendation of type of headwork/structure, and its foundation, depth of foundation

7) Other necessary soil survey as found essential for design and construction of the headwork/structure

Hydrological Study

Beside collection of hydro & meteorological data from DHM, For determination of all design data the hydrologist will carry out a detailed hydrometrical survey and hydrological study of the river along with the headwork/intake site which will include but not limited to the following:

i) Catchment area of the river up to head work/intake site

ii) Length of the river from origin up to head work/intake site

iii) Slope of the river from the critical point (origin) of the river up to head work/ intake site

iv) Cross-sections covering 100 m beyond flood lines/firm bank (depending on site condition) of the river at proposed head work/intake site, at about 1000 m up-stream and 1000 m down-stream wherein High Flood Level (HFL), Low Water Level (based on local enquiry, LWL), Lowest Bed Level (LBL), area of cross-section, and geological profile with silt factor of each strata (at proposed head work/intake site only) shall be indicated. However, the scale of the drawing for horizontal and vertical should be the same.

v) The drawing should include the slope of the river at the proposed head work/

intake axis which should be extended 1000 m U/S and 1000 m D/S along the thalweg (lowest level) of the river

vi) Maximum discharge shall be calculated by established formulas with 50 yr/100 yr return periods

vii) The peak discharges calculated for a returned of 50/100-years shall be taken as a maximum discharge

viii) Area of flow, velocity and depth of the flow at the time of survey (for Discharge Calculation)

ix) Study of horizontal & vertical shifting of the river

x) Other information required for river control, design, construction and/or maintenance of the head work/intake

After the selection of proposed head work/intake site with alternatives and preparation of toposheets, the surveyor must evaluate along with the collected hydrological data and the following points to carry out the soil exploration and design of the head work/intake:

- Design discharge
- Scour depth, maximum scour depth
- Waterway
- Anticipated soil condition for foundation
- The most feasible proposed site
- River training and approach roads
- Type of proposed foundation, sub-structures and superstructure

Soil Test (Optional)
Soil exploration will be carried out (for command area sample from a 90 cm depth will be collected whereas for head work depending on site requirements). Soil sample will be collected from head work site and different location of command area (head, middle & tail);

Generally Following Tests will be carried out

Head Work/Intake Site

a) Natural moisture content

b) Sieve analysis

c) Hydrometric analysis

d) Atteberg's limit

e) Specific gravity

f) Unconfined compression test

g) Direct shear test

h) Consolidation test

i) Tri-axial tests

j) Other tests as per need

Command Area

a) Infiltration Test

b) Percolation Test

Environmental Study

The most suitable site for the headwork/canal alignment based on the above characteristics of the site as well as the catchment area will be selected. The selected site will be clearly indicated in the map and all the characteristic features of the chosen head work site/ canal alignment will be given, in order to facilitate easy reference while designing the head work/canal. The environmental study will be carried out i.e. identifying the environmental changes due to the proposed structures and the outcomes of the study need to be presented clearly in the form of recommendations and subsequently be considered in detail design. DOI Environmental Safeguard Guideline is to be followed.
Vulnerable area of landslide/soil erosion will be evaluated & mitigation measures will also be proposed.

Socio-Economic Study

The socio-economic survey will be carried out to determine the social structure of the community and its economic status. The survey includes the collection of quantitative and qualitative data and information on social structure, socio-cultural institutions, and economic activities of the farmers of the scheme command area. Some of social and economic indicators of the community are as follows:
Social indicators:

- Willingness/commitment- verbal request, formation of committee, submission of request form;
- Social composition- homogeneity, diversity;
- Education- literacy, school and college, awareness about irrigated agriculture, prior experience on irrigation;
- Rural organization- Parma, Guthi, etc;
- Family size- male/female, economically active members,
- Migration- temporary, permanent, foreign/urban areas;
- Economic indicators:
- Land holding size- land less, marginal land holding (for Terai < 1 ha & for hills < 5 ropani), land lords (for Terai> 10 ha & for hiils > 2 ha);
- Main occupation- agriculture, service, labor, foreign service, business;
- Source of income- agriculture, service, remittance etc;
- Standard Formats will be used
- Expenditure- food, cloth, schooling, festivals, livestock, agriculture

Social Safeguard(SS) Studies & Gender Equality and Social Inclusion (GESI) studies will be carried out complying Social Safeguard & GESI guidelines prepared for Department of Irrigation.

With reference to above guidelines, Indigenous People (IP) inventory & Involuntary/

voluntary Resettlement (IR) plan, and Gender Action Plan (GAP) will be prepared.
An assessment of activities of WUA will be made, if exists; if a WUA doesn't exist, what is the possibility of creating a viable WUA ?
With interaction with beneficiary farmers/VDC/DDC records, the number of beneficiary households/population, woman headed HH/population and presence of marginalized farmers, disadvantage group, landless population, land holding size, land use will be evaluated.
With interaction with beneficiary farmers/VDC/DDC , the average income of the project area & other economic parameters will be assessed, including seasonal migration/permanent migration, education level & other source of income than agriculture, percentage of population involve in agriculture, gross income from agriculture & other business.

Agriculture Survey

For Irrigation schemes agricultural survey will include data and information regarding the soil type, land use and agriculture practices of the command area to be proposed. The soil survey will include the assessment of the type of soil in the command area and its suitability for irrigated agriculture. The soils may be alluvial, sandy, gravel and boulder mixed.
The land use survey will include the general assessment on land use in the command area which may classify in percent the agricultural land, forest land, grazing land, wetlands, National Parks and reserve forest area.

The agriculture survey includes the collection of data and information on:

- Existing cropping pattern,
- Existing crop yields,
- Inputs used and its availability,
- Marketing facility and labor situation
- Food Security
- Existing & Anticipated Irrigation/Water Management Practices
- Accessibility

Existing cropping pattern

An assessment of existing cropping calendar/pattern interacting with beneficiary farmers/ nearby Agriculture Service Center/DADO & other related offices will be made, Based on above interaction, assessment will also be made for anticipated cropping calendar/pattern & possibility of commercial agriculture (introduction or extension of cash crops)

Existing crop yields

An assessment of existing crop yield interacting with beneficiary farmers/nearby Agriculture Service Center/DADO & other related offices will be made.

Inputs used and its availability

An assessment of agriculture input interacting with beneficiary farmers/nearby Agriculture Service Center/DADO & other related offices will be made.

Marketing facility and labor situation

An assessment of market facilities for selling of agriculture products, buying of seeds, fertilizer etc., in case of implementation of the project availability of construction materials will be made.

Food Security

Assessment of the Food Security Situation of the project area will be made with DDC/ WFP-list of food unsecured areas/VDSc with Higher Index & it will be clearly mentioned whether the project area has excess food to supply or shortage to import (if yes ! for how many months)

Existing & Anticipated Irrigation/Water Management Practices

With existing users' group or beneficiary farmers' interaction, existing Irrigation/Water Management Practices will be carried out if any?
With the proposed intervention and assessment of anticipated cropping pattern will evaluate possible Water Management Plan

Accessibility

Find the distance of the project area from the nearest road head, cost of construction material at site, district rates for labor, materials & equipment

Report Preparation

To analysis of Irrigation System Area, system background information, location & accessibility, geological and environment along with the layout of the system will be explained in detail.

Technical Survey

Location and condition of Water Source(s) and Assessment will be explained in detail with the description of the proposed structures, availability of construction materials and labors and rate of construction materials/equipments.

Environmental Survey

Initial Environmental Examination/Environmental Impact Assessment as per TOR prepared (TOR for IEE/EIA will be prepared separately), Environment Management Plan (EMP) based on Environment Safeguard Guideline (ESG) will be prepared.

Socio-economic and Agricultural Survey

Social, Economic and Agricultural Situation of the project area will be assessed that will also include existing and proposed command area, cropping pattern and intensity. An assessment of availability and linkage to agricultural service providers, willingness of the farmers for providing land for developing system, willingness of the farmers towards cost contribution as per Irrigation Policy/Regulation will be made. With Social Safeguard Analysis, Indigenous People Plan, Involuntary/Voluntary Resettlement Plan and Gender Action Plan (GAP) will be prepared.
If it is an existing system, brief inventory of the system will be prepared.

Detail Cost - Estimate

Approved District Rates for labor and materials at the project sites will be collected or analyzed. Detail rate analysis, detail quantity & cost estimates along with bill of quantity (BOQ) will be prepared.

Economic Analysis

Crop Budget without and with Irrigation System will be prepared and Benefit/Cost Ratio and Economic Internal Rate of Return (EIRR) will be evaluated; Conclusion and Recommendation will be made based on economic & other indicators.

Annexes

Annexes will include details of compiled data, designs and calculations, bidding drawings, minutes of community meetings and consent letters of land donation, besides that photographs of sites/location (Intake, command area, alignment, community meeting) will be included. Total station/GPS data will be presented in hard copy.

Terms of Reference for Detail Design of the Irrigation Project

Lay out the system on suitable base maps will be prepared.
The preparation of comprehensive base maps by ground control from aerial photograph is not economic or practical for medium level schemes; therefore other slightly less accurate methods must be used; however it should be used for larger schemes.
If necessary, new features such as roads and houses will be added from field survey. Cadastral maps or ALOS Satellite Imagery can also be used for base mapping
The location of the headwork, canal layout, major structures' locations, land slide or other vulnerable zone and command area will be shown in base map; beside base map, irrigation infrastructures should also be shown on GIS/Google map

Hydrological Analysis and Water Requirement Assessment

The criteria for the selection of maximum design discharge are based on technical and economic considerations. The major criteria for the selection of design flood are:

- Importance of structure to be constructed,
- Effect of overtopping of the structure,
- Potential loss of life and downstream damage, and
- Cost of the structure
- Climate Change effect on flood hydrograph hence design flood

Flood Frequency Analysis
The flood frequency analysis is a statistical method to show that flood events of certain magnitude may on average is expected once every n year. It is generally carried out to estimate the design flood from the recorded flow data of more than 10 years. The most commonly used methods for frequency analysis are:
Gumbel's distribution,
Log Pearson Type III distribution, and
3 parameter Log Normal distribution
The details of these methods are available in the chapter 5 of updated PDSP Planning and Design Manual Volume I or chapter 6 of PDSP Design Manual M3. Hydrology and Agro-Metrology, beside above analysis; climate change risk should also be given due consideration (if such analysis is available with DHM or other agencies)
Regional Analysis
When the recorded hydrological data of the river is absent or too short a regional analysis is adopted to estimate the flood flow, and low flow of required return periods. In this method a hydrological homogeneous region is considered from statistical point of view. There are various methods of estimating flood flow of given return period based on regional analysis. In Nepal following methods are used to estimate the flood flow:
WECS/DHM (1990) Method- based on regression analysis,
Tahal et al (2002) Method – based on Index Flood Method,

Sharma and Adhikari (2004) – based on regression analysis

In addition, there are rational method and empirical methods such as Modified Dickens method, Ryve's method. The most commonly used methods in Nepal is Sharma and Adhikari Method based on regional analysis and Rational Method as empirical method; if available, analysis based on climate change risk will be given due consideration.

Besides above methods Design Flood will be evaluated using appropriate method/software which includes climate change effects

Evaluation of Stage Discharge Curve will be made at Intake/Head Work location with appropriate method/software

Water Availability for Irrigation

The assessment of water availability for irrigation is carried out on 80% reliability of full supply. This means 80% of the time there is at least enough water available to meet full demand of irrigation. For gauged river the reliability assessment is carried out by frequency analysis while for ungauged river regional regression analysis for long term mean flow is adopted in Nepal. if available, DHM's evaluation of 80% reliable flow considering climate change impact will be taken as reliable flow.

The details of these methods are available in the chapter 5 of PDSP revised Planning and Design Manual Volume I or chapter 3 of PDSP Design Manual M3. Hydrology and Agro-Metrology

Effective Rainfall

The total crop water requirement is met from two sources: rainfall and irrigation. However, not all rain falling on the field will be "effective" in terms of crop growth; some percolates to depths below the root zone, some is lost to evaporation, and some runs off to contribute to stream flow. For calculation of effective rainfall (Pe), 80% homogeneous reliable rainfall values based on DHM's new climate change parameter will be used.

Irrigation Water Requirement & Water Balance

Calculation of Irrigation Water Requirement should follow the steps mentioned in the chapter 5 of CMIASP/PDSP revised Planning and Design Manual Volume I but the evaluation will be based on irrigation scheduling & crop arrangements using CROPWAT8 or appropriate software (mentioned in FAO-56 or FAO-66); hence finalizing water balance with optimization of water use and irrigation efficiency

The diversion requirement should be evaluated based on above mentioned water balance

Design of canal & related structures should be carried out based on bottom up approach, hence the pond level will be fixed

Selection of type of head work/intake and design will be carried out using standard hydraulic & structural engineering concepts

Sensitivity analysis of hydraulic design of head works & other hydraulic structures will be carried out using available software (WINFLUME/HEC-RAS or other softwares)

Detail Cost Estimation of the project making sure that proper allocation has been made for Resettlement Plan (RP), Environment Management Plan (EMP)

Detail Economic Analysis and Evaluation of EIRR & BC ratio will be made.

Assumption/Basis of Norms

- If the assignment is to be performed through the consultant, the estimation should be done based on rate for the different expert approved by DOI & evaluated salary per day shall be based on considering 30 days of a month.
- Field Survey allowance per day for GON employee = ((Basic Monthly Salary + Monthly Remote Area Allowance of the field location) x 1.5)/30
- Daily allowance shall not be provided for the employee who is receiving survey allowance; however other allowances (except daily allowances) shall be provided as per GON rules
- for the desk study Daily allowance for Departmental Employees, considering the over/extra time (rather than normal office hours) to be given for desk study and report preparation, is provisioned at a rate 50% of ((Basic Monthly Salary + Monthly Remote Area allowance at the location of report preparation) x 1.5/30)
- Lodging and Travel allowance will not be provided to the locally hired personnel
- Rates for the material required for the field survey, desk study and report preparation will be based on the general market available rates.

Mode of Payment

a) To Departmental Employees :

The amount shall be paid to the employees as advance assigned for the study as follows;

- For mobilization and Field work 40% of the total amount
- Upon Submission of brief field report 30% of the total amount
- Upon Submission and acceptance of Final Survey Report 30% of the total amount

The final payment shall not be made if the above mentioned work is not completed as per TOR, and the assigned team will be fully responsible ensuring the quality of report as per requirement.

b) To Consultant (if employed) :

- The amount shall be paid as per agreement to the consultant assigned for the study. However, the consultant can claim the payment either in a single installment after submission and acceptance of final report as per TOR or in installment as follows;
- First Installment (if necessary), 10% of the total amount upon submission and acceptance of desk study/inception report;
- Second Installment, 40% of the total amount upon submission and acceptance of field study report;
- Third Installment, 25% of the total amount upon submission and acceptance of draft final report;
- Final Installment, remaining of the total amount upon submission and acceptance of final report complying with TOR;
- 20% of the total amount may be provided as an advance payment on submission and acceptance of bank guarantee and such payment shall be recovered within third installment

Government of Nepal

Ministry of Irrigation

Department of Irrigation

Jawalakhel, Lalitpur

Tel. 01-5537136, 5537313, Fax: 977-1-5537169

Email: irrigation@wlink.com.np