In Country Training Programme under "Malé Declaration on Control and Prevention of Air Pollution and its likely Transboundary Effects for South Asia"

Jointly organized by MoPE/HMG-Nepal, ICIMOD, SEI, SIDA, SACEP and UNEP RRC.AP, with the financial support from Sida

Report on Nepal

Introduction

As a signatory to the Malé Declaration, Nepal has agreed to participate in the monitoring of long range transport of air pollution and its likely impacts. Accordingly, Nepal was recommended two monitoring stations by the United Nations Environment Programme (UNEP), one being a high altitude site. The International Centre for Integrated Mountain Development (ICIMOD) is the National Implementing Agency (NIA) for this programme. The work of sample collection and analysis was delegated to the Institute of Agricultural and Animal Sciences (IAAS), Rampur, Chitwan.

Monitoring Site

Site location: The IAAS campus was chosen to be first monitoring station. The IAAS campus is located about 15 km south of the Royal Chitawan national Park and about 25 km north of the Indian border.

The maps of the monitoring site and its surroundings are provided in Fig 1, 2 and 3. The site is bounded by two roads which lie outside the campus and which have some vehicular traffic on them. The campus has some internal roads, but with little vehicular traffic. The site is in the midst of experimental agricultural farms of IAAS.

Site type: The IAAS site is a deposition-monitoring site. The site for ecological monitoring was yet to be identified. This can be done easily as there are good forests and water bodies close to the IAAS campus.

The site met the following sitting criteria:

1. The site was close to the Indian border.
2. The site is in a broad downwind direction from major power plants in India.
3. There was no forest between the site and Indian border, nor was the forest too close to the site.
4. The site is not influenced by local meteorological conditions, eg, mountaintops, cols, coastal area.
5. The terrain between the site and the international border is flat land.
6. The site is secure and easily accessible.
7. Since sample analysis will be done on the IAAS campus, there will be little time gap between sample collection and analysis.

The site did not meet the following criteria:

1. The site receives local emissions from vehicles plying on the roads outside the campus, and from edaphic sources, eg, wind-entrained dust from the agricultural fields, fertilizers, pesticides, and anthropogenic sources, e.g., dirty cooking energy being used by the habitation around the site.
2. The site has some human habitation around it.

3. The site has no working meteorological station in its proximity.

The site is not a remote site. It is a rural site.

Monitoring and laboratory equipment

Equipment: The monitoring and laboratory equipment and glassware given in Annex 1 was handed over to ICIMOD during the training programme held in March 2003.

Installation: The PM_{10} sampler, Wet only collector, one bulk collector and diffusive samplers for SO_2 and NO_2 were installed on the roof of a one storied building inside the IAAS campus. The building had a power connection, but the location of the power socket outlet needs to be changed. Access to the roof of the building requires to be improved.

Training programme

An "In Country Training Programme under "Malé Declaration on Control and Prevention of Air Pollution and its likely Transboundary Effects for South Asia" was held in the Institute of Agriculture and Animal Sciences (IAAS), Rampur, Chitawan between 24-28 March 2003.

The training programme's objective was to build national capacity to provide hands on experience on sampling and analysis of transboundary pollutants.

The Ministry of Population and Environment of the Royal Government of Nepal and ICIMOD organized the training programme in collaboration with UNEP RRC.AP, SACEP and SEI.

The training Programme was started with the welcome address by the Dean of IAAS, Dr. Tej Bahadur KC, followed by remarks by Dr. Jigbar Joshi, Joint Secretary, MOPE. Mr Basanta Shrestha, Division Head, MENRIS, ICIMOD, Mr P.K. Kotta (SACEP), Dr. Kevin Hicks (SEI), and Mr M. Iyngararasan (UNEP RRC.AP). A short tour of the institute was conducted.

The training programme was facilitated by Mr Sagar Dhara. The technical sessions in the training programme were handled by Mr S.K. Gupta, Mr M. Iyngararasan, Mr Sagar Dhara, Dr Martin Ferm, Dr Rajendra Prasad and Dr Kevin Hicks. The training programme content is provided in Annex 2.

Participants: Faculty member and laboratory technicians from IAAS, senior meteorologists from Department of Hydrology and Meteorology (DHM), Ministry of Population and Environment (MOPE), attended the training programme. The resources persons were from IVL, Envirotech, SACEP, UNEP RRC.AP and SEI. A list of participants is enclosed in Annex 3.

The senior members of the team that was to do the monitoring had masters and doctorate level degrees in various science disciplines. The team was inherently very competent to do this work.

Equipment: Training was provided to handle the following equipment:

Envirotech International: High Volume Sampler– Envirotech APM 460NL—for TSPM, PM_{10}, gaseous sampling.
IVL: Passive Samplers for SO_2 and NO_2
MISU: Wet only collector, Bulk collector

No damage was noticed to the equpment or glassware when they were opened at IAAS.

Training programme experience: As a major portion of the training was hands-on, the trainees were enthusiastic and quick learners. Four dust samples and two gaseous samples were collected and analyzed by the trainees during the training programme. Knowing the results of their monitoring boosted the confidence of the trainees.

Recommendations

1. Diffusive samplers and bulk collectors may be placed at a temporary remote site. This can be done easily as no power and security is required for them. This will provide an estimate of the local interference at the permanent site.

2. The site for ecological monitoring needs to be identified. This is possible easily as good forest and water bodies exist close to the IAAS campus, in the Royal Chitawan National Park and its surroundings.

3. A dedicated meteorological station must be installed at the site. The parameters that require to be monitored are: wind direction and velocity, temperature, relative humidity and rainfall. Sensors for other parameters, e.g., solar insulation, may be added later.

4. A follow-up visit should be done by a technician-level person in the first year after equipment installation to help sort out any problems that may exist with, sample collection and analysis, and equipment handling.

5. A follow up visit by a UNEP representative (MoC-level or equivalent) may be done in the first year after monitoring has begun to sort out problems related to data management and reporting, QA/QC, further capacity building, site change, etc.

6. Theoretical aspects of the subject, e.g., basic chemistry and statistics, QA/QC need to re-covered in future refresher courses.

Annex 1

List of Equipments and Consumables

1 Site Equipment

No.	Description	No. of Unit	Remark
1.1	PM10 air sampler	1	Envirotech model APM 460(NL)
1.2	pH meter	1	Hand held WTW model pH 300i (pH meter)
1.3	EC meter	1	Electrical conductivity meter, hand held WTW model COND 330i
1.4	Thermometer	1	Best Indian Make (-20 to 15degree C, least count 0.1 degree)
1.5	Diffusive samplers	2	For measurements at 1 site on a monthly basis during one year
1.6	Bulk sampler	2	
1.7	Wet only Collector	1	Included solar panels, solar shunt regulator

2 Laboratory - Equipment

2.1	Spectrophotometer	1	U/V and Visible Best Indian Make, Elico SL 171
2.2	Oven	1	Best Indian Make (50 to 250 degree range, 220-240V, 0.5KW)
2.3	Balance	1	Electronic Balance, Sartorius Make. Model BL210S Capacity 210g. Readability 0.1 mg
2.4	pH meter	1	Hand held WTW model pH 300i (pH meter)
2.5	Electrical conductivity meter	1	Electrical conductivity meter, hand held WTW model COND 330i
2.6	Desiccator	1	Mark 'Duran' Size 300mm
2.7	Distallation Unit	1	
2.8	Magnetic stirrer 1 L	1	Though listed as being reqd for soil qlty analysis, would be preparing for preparing solutions for DD/WD sample analysis
2.9	pH electrode for low ion concentration	1	
2.10	Calibrators		
	a) Soap Bubble Meter (manual type) (Calibrator for Rotameter)	1	
	b) Top loading Flow Calibrator	1	

3 Laboratory Consumables

A	***Glassware and other consumables***		
3.1	Washing bottle with ground glass stopper 500 ml	2	
3.2	Measuring cylinder 100 ml, 50ml, 25 ml. 10 ml	8	100 ml x 2 nos, 50ml x 2 nos, 25ml x 2 nos, 10ml x 2 nos
3.3	Glass tubes with ground-in stopper (Nessler's tubes)	12	
3.4	Volumetric flask 1000ml, 500 ml, 250 ml, 100 ml	7	1000ml x 2nos, 500 ml x 1 nos, 250 ml x 2 nos, 100 ml x 2 nos
3.5	Pipette 10 ml, 25 ml	4	10 ml x 2 nos, 25 ml x 2 nos

3.6	Filter paper Whatman 41, dia 47 mm	3	1 box = 100 nos
3.7	Bottle polypropylene 1 L, 500 ml	14	1 L x 6 nos, 500 ml x 8 nos
3.8	Beaker 100 ml, 250 ml	16	250 ml x 2 nos, 100ml x 12 nos
3.9	Regaent bottles 100ml	6	100ml x 6nos
3.10	Regaent bottles 250ml	6	250ml x 6 nos,
	Chemicals and other consumables		
3.11	2 monitoring kits		

4 Site Consumables

4.1	Filter paper Whatmans GF/A	2	Size 8"x10", in sealed pkt. Of 100 sheet
4.2	Impingers	4	35ml capacity, 4 will be supplied with hvs, 4 more are reqd as spare
4.3	Syringe 100 ml	2	5.00 each packet, in pkt. Of 10
4.4	Glass/inert plastic tubing	3	per meter, Silicon tube
4.5	Silicon grease	2	for 100 gm packet
4.6	Measuring cylinder 100 ml	2	each
4.7	Pipette 20 ml	3	10 ml x 2 nos, 20 ml x 1 nos
4.8	Polyethylene containers 20 ml	100	each - 60ml
4.90	Funnel	6	50 mm x 3 nos, 75 mm x 3 nos
4.10	Capped bottles 1 L	3	each (Tarson)
4.11	Ice box	2	each (medium size)
4.12	Power Cord 5 meter long	2	
4.13	Junction Box (Extension Board)	1	1 set
4.14	Burette (50 ml)	1	
4.15	Burette Stand	1	
4.16	Cleaning Brush for Glassware	2	
4.17	Printed paper envelopes to keep filters	1pkt	1 pkt. of 12 Nos.
4.18	Graph Pad	1 Pad.	
4.19	Iodine flask (250ml)	2	
4.20	Membrane Filtration Assembly	2	
4.21	Petridish	1	
4.22	Pipette (1 ml)	1	
4.23	Pipette (2 ml)	1	
4.24	Pipette stand	1	
4.25	Plier	1	
4.26	Pipetting Pump	1	
4.27	Silica gel (500 gm)	1	
4.28	Torch	1	
4.29	Tissue Roll	1	
4.30	Tweezer	1	
4.31	Sampling Bag	1	

Annex II

Training Programme

Day	*Topic*	*Contents*	*Venue*	*Instructor*
24.3.03 Morning	Introduction and basic meteorology for air quality (T)	Introduction to the Malé Declaration (30min) Basics of air pollution (30 min) Acid gas deposition and their impacts (30 min) Objectives of wet deposition and air concentration monitoring (15 min)	Class room	MI SKG KH SD
24.3.03 Afternoon	Basic of metrology for AAQ monitoring Equipment installation & handling (P) Preparation for AAQ monitoring (P)	Parameters that influence AAQ—winds, RH, temperature, atmospheric stability, lapse rate, precipitation, etc. and Measurement of these parameters (including visit to the nearest met station) (1 hr) Use of bags, bubblers, dust fall jars, bio-indicators -HVS, spectrophotometer, passive samplers, etc -HVS: preparation & weighing of filter paper, preparation of absorbing reagents, sample identification	Lab/class room	SD RP
25.3.03	Sample collection (P) Passive sampling (T&P)	-HVS: field calibration of HVS, gaseous sampling attachments, sample collection. -PS: Precautions to be taken Passive samplers (PS): sample identification.	On site	RP MF
26.3.03	Wet deposition monitoring (T&P) Sample handling and shipping (P) Sample analysis (P)	Wet only collector -HVS: Sample preservation, sample transport -PS: Sample transport -Gravimetric analysis of TSPM and PM10 -Preparation and standardization of solutions, preparation of calibration curves, colorimetry. -Precautions to be taken during analysis	Site/lab	MF RP RP
27.3.03 morning	Sample analysis (Cont…)		Lab	RP
27.3.03 afternoon	Basic equipment maintenance and troubleshooting (P)	-Clearing & servicing the HVS, checking for leaks, troubleshooting	Lab	RP
28.3.03	Data control & reporting and QA/QC	-Data reporting formats -QA at site and in the lab, calibration of flow metering systems-top loading calibrators, soap bubble calibrators. -QA/QC on sample measurement & analysis -Data quality assessment—sampling precision, QC of lab measurements (analytical precision & accuracy), site performance audit. -Quality assurance of data sets, external QA programme	Class room	MI RP
28.3.03	Data control & reporting and QA/QC	-Data reporting —site, sampling conditions, sample history, instruments & laboratory conditions. -Data checking—statistical tests, data completeness, data flags.	Class room	RP

End of day 2, 3, and 4: HVS sampling; Beginning of day 3, 4, and 5: sample analysis

KH: Kevin Hicks, SEI MF: Martin Ferm, IVL MI: Mylvakanam Iyngararasan, UNEP/RRC.AP
RP: Rajendra Prasad, Envirotech SD: Sagar Dhara, MoC SKG: S. K. Gupta, Envirotech

Annex III

Participant list

1. Krishna Kumar Pant IAAS, Rampur	2. Sahdeo Choudary IAAS, Rampur
3. Lal Prasad Amgain IAAS, Rampur	4. Ramchandra Basnyat IAAS, Rampur
5. Arjun Karki, IAAS, Rampur	6. Som Bahadur Pakhrin Lama IAAS, Rampur
7. Rajendra Prasad Pandit IAAS, Rampur	8. Mekh Bahadur Pakhrin IAAS, Rampur
9. Raju Lamichhane IAAS, Rampur	10. Bhim Bahadur Kunwar IAAS, Rampur
11. C.P. Shrivastav IAAS, Rampur	12. Keshab Raj Pandey IAAS, Rampur
13. Arjun Kumar Shrestha IAAS, Rampur	14. Bhagwan Das Manandhar IAAS, Rampur
15. Martin Ferm, IVL	16. Sagar Dhara MoC
17. Dr. Kevin Hicks SEI	18. Harry William Vallack SEI
19. M. Iyngararasan UNEP RRC.AP	20. Pradyumna Kumar Kotta SACEP
21. Dr. Rajendra Prasad Envirotech International	22. S. K. Gupta Envirotech International
23. Lokendra Upaddhaya Envirotech International	24. Pradeep Shah, DHM
25. Puroshottam Kunwar MOPE	26. Mani Ratna Chitrakar DHM
27. Bidya Banmali Pradhan, ICIMOD	

IAAS	:	Institute of Agriculture and Animal Sciences
DHM	:	Department of Hydrology and Meteorology
MOPE	:	Ministry of Population and Environment
IVL	:	Swedish Environmental Research
SEI	:	Stockholm Environmental Institute
SACEP	:	South Asian Cooperative Environment Programme
UNEP RRC.AP	:	United Nations Environment Programme, Regional Resource Centre, Asia Pacific
ICIMOD	:	International Centre for Integrated Mountain Development

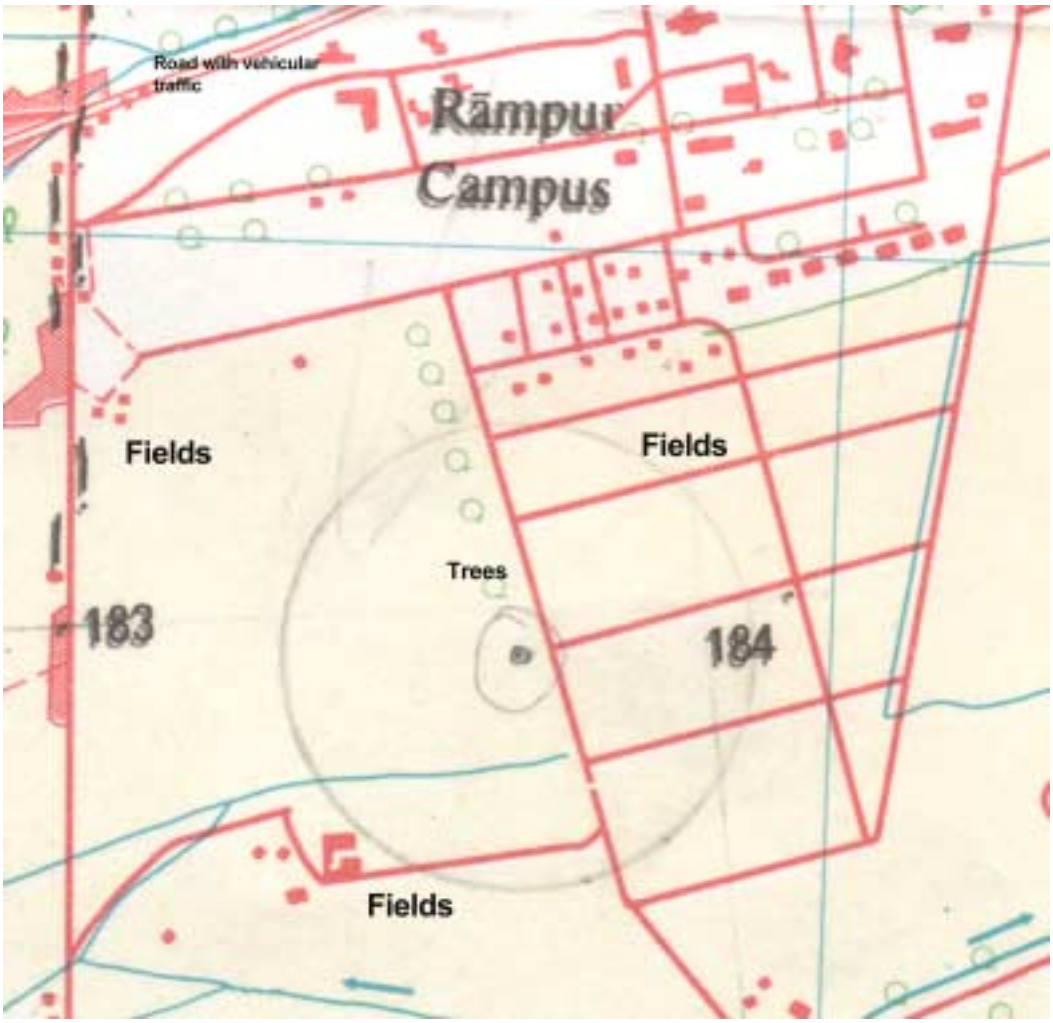

Road with vehicular traffic
Rāmpur
Campus
Fields
Fields
Trees
183
184
Fields

Figure 1

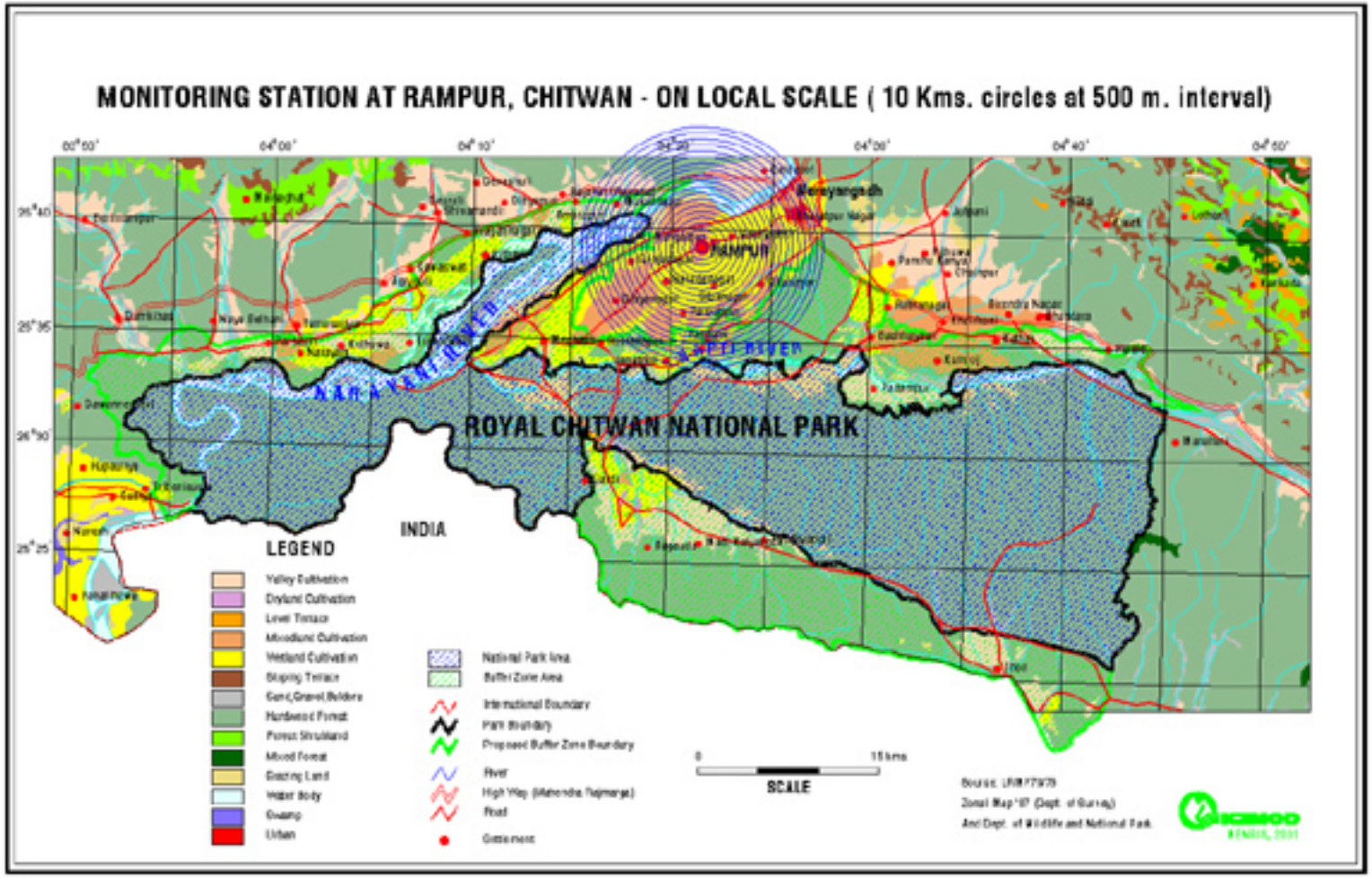
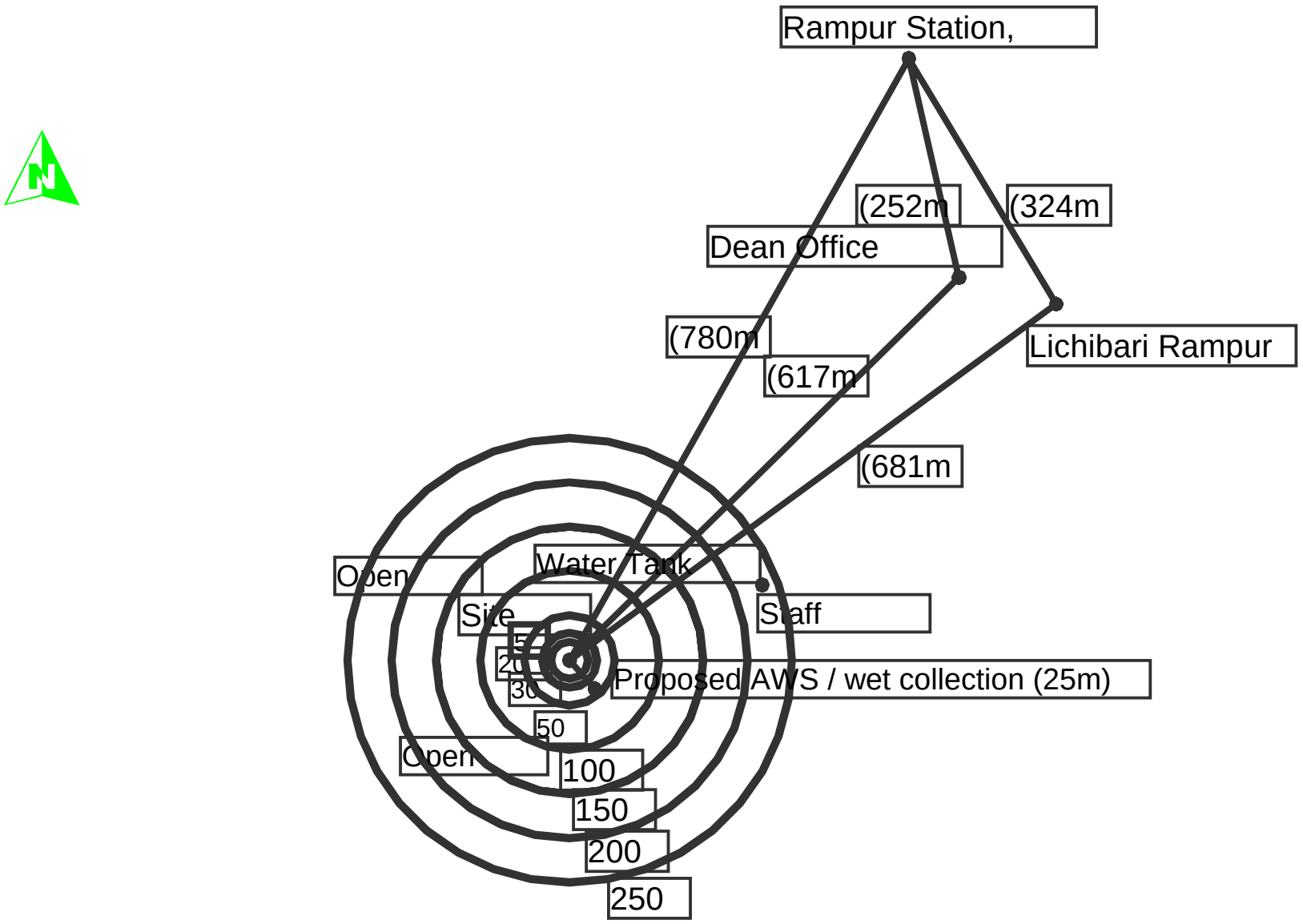

MONITORING STATION AT RAMPUR, CHITWAN - ON LOCAL SCALE (10 Kms. circles at 500 m. interval)
RAMPUR
ROYAL CHITWAN NATIONAL PARK
INDIA
LEGEND
SCALE

Figure 2

Figure 3: On Site Scale (5m-250m)



Some Photographs from the Training Programme