

Training on Planning, Development and Management of Groundwater with special reference to Watershed Management Practices

Madanapalle; August 2008

A five day training on '**Planning, Development and Management of Groundwater with special reference to Watershed Management Practices**' was conducted by SPWD in collaboration with ACWADAM, Pune and Krushi Samstha in Madanapalle, Andhra Pradesh from 11th to 15th August, 2008.

This training comprised of members from civil society and organisations working on water governance issues in three states with the motive of discussing groundwater significance in watershed management, as well as seeking feedback and training trainers in the hydrological model being used for the WGP project. Twenty representatives from CSOs of three different states, Andhra Pradesh, Maharashtra and Madhya Pradesh participated in the training. The organisations were: ARTS, Vizag; Chaitanya REDS, Anantapur; Dharamitra, Wardha; FES, Madanapalle; GJSS, Madanapalle; GORD, Madanapalle; GVS, Punganur; REDS, Kadiri; RIDS, Anantapur, Samavesh Society, Bhopal; Spandana, Palamaner; and Vikasa, Vizag. The trainers comprised of the team from SPWD, New Delhi; ACWADAM, Pune; SOPPECOM, Pune; FES, Madanapalle; Samavesh Society, Bhopal and Krushi Samstha, Madanapalle. The training team had attended the same training course conducted by ACWADAM in Pune.

The training module has been developed by ACWADAM, Pune under their training of trainers programme on groundwater management. All the presentations retained the original version of ACWADAM's module. The training was a mix of theoretical concepts in the class as well as practical demonstration in field and this was followed in the everyday training exercise. The last day of the training was given solely for the field work and then discussing the usefulness of the training for future activities. Dr. Himanshu Kulkarni from ACWADAM, Pune and Amita Bhaduri from SPWD, New Delhi welcomed everyone for their participation in the training. Dr. Kulkarni briefed on the importance of groundwater in maintaining the surface flows, the increasing dependency on groundwater resource due to emerging demands and technology and their consequences on groundwater. He also explained the need to develop an understanding of actual groundwater components amongst the civil society organisations involved in watershed activities.

DAY 01:

The presentations made on the first day of the training on the varied components of groundwater with reference to watershed management were:

i) Importance of Groundwater by Amit Gaumat, Samavesh Society, Bhopal

Amit started with a generalised view on the global water balance and informed the composition of groundwater and surface water in the fresh water stock. In the Indian context, he cited Shah and Roy's (2002) findings on increasing productivity per hectare

over the last two decades. He then explained the concept of hydrogeology and its importance for watershed management practices as it helps in understanding the common groundwater problems, both in terms of quantity and quality. He emphasised on the two distinct processes: hydrological cycle at the global level and drying river beds, wells, groundwater pollution etc on the local level. He further dealt with the concept of watershed geology for a clear perception of groundwater in the watershed management and cited examples from different parts of India. Towards the conclusion, he stressed on the processes involved in the geological framework of rocks as the determining factor of water flow and accumulation in the subsurface.

ii) Earth Sciences in Watershed Management including the Concept of a Simple Water Balance by *Surya Prakash, SPWD, New Delhi*

Surya described the beginning of earth as a planetary body and various frameworks like structure, process and time over certain scale in the ongoing activities. He emphasised on the constructive and destructive forces that have shaped the earth and it was at the micro scale where the current training would discuss various activities. Moving towards the water balance concept, he mentioned the various environmental components and their interactions. Giving a general introduction of water balance, he explained it as a concept involving water for quantification, management, estimation for various uses, etc. Towards the need of water balance, he gave an example to quantify the volume of water generated by a unit rainfall over a unit surface area. He then explained the various inputs and outputs with respect to water balance for watersheds and groundwater and elaborated on the methodology for a simple water balance calculation. The presentation also included a cyclic representation of various sources of water in different seasons with respect to groundwater contribution and concluded with the possibilities for conducting water balance for various units.

iii) Introduction to Geology: Types of Rocks by *Alok Deshpande, SOPPECOM, Pune*

Alok introduced rocks with respect to their tendency to store and transmit water as per the knowledge required for the watershed works. He elaborated the three distinct rock types: igneous, sedimentary and metamorphic, their classification and properties in terms of formation, porosity, ability to transmit water etc. He then discussed the origin of various rock types and the processes involved and concluded with the distribution of various rock types in different regions of India.

iv) Rock Structure: Processes that Shape the Earth by *Divakar Reddy, FES, Madanapalle*

Divakar explained the common perception of hills and valleys as high and low grounds respectively, and their formation as a result of the long term processes of wear down and building. He mentioned that the strength of the structure as a resultant of tectonic movements and climate. He then explained the twin processes of construction as a result of tectonics and destruction as a result of weathering and erosion. The two distinct types of processes i.e the mechanical as a result of extreme climate and chemical as a result of composition of rocks was then elaborated along with the agents of these processes. He then mentioned a general dictum on the relationship between relief and erosion as, when the relief is high, the rate of erosion is high and weathering is low, while if the relief is

low, then the weathering is high and erosion is low. Further, towards conclusion he attributed the development of landforms to the combination of both the processes.

v) Practical: Study of Common Rock Samples by Devdutt, ACWADAM and Diwakar Reddy, FES

Devdutt and Diwakar Reddy explained the rock properties by looking the various rock samples, comprising all the broad rock types. Emphasis was given on judging the nature of rock towards the flow and storage of water in it.

DAY 02:

vi) Hydrogeology-The Science of Groundwater by Alisha Vasudev, SPWD, New Delhi

Alisha defined the terms groundwater and hydrogeology. After explaining the origin of groundwater, she discussed the distribution of world water resources with special emphasis on freshwater resources. She concluded with a description of the characteristics of groundwater like the transmission, quality and temperature.

vii) Vertical Distribution of Subsurface Water by Amita Bhaduri, SPWD, New Delhi

Amita emphasised mainly on the openings of the rocks. She elaborated on the characteristics, nature and types of the zone of the rock fracture (opening zones) and further discussed the specifics and particularities of the zones of aeration and saturation, which are a major part of the zone of fracture. She also mentioned the similarities between zone of saturation and water table and concluded with explanations and characteristics of water table and deeper groundwater.

viii) Hydrologic Properties of Rocks by Alok Deshpande, SOPPECOM, Pune

Alok attributed the accumulation and movement of groundwater in rocks to two main characteristics: porosity and hydraulic conductivity. He then explained the types of rock openings attributing these characteristics and the variation in these characteristics with different rock types. The conceptual aspects of porosity, specific yield and specific retention were clarified with suitable examples and practical manifestations.

ix) Weather Properties: Data Collection and Analysis by Surya Prakash, SPWD, New Delhi

Surya gave a background on the weather parameters and the determining factors over time. The need to study weather as a local phenomenon was emphasised for an overall idea of inputs and outputs in a watershed with respect to water. Various techniques and instruments used for estimating the weather parameters were discussed and the analysis of this data for various purposes was explained.

x) Practical: Reading Toposheets and Maps; Weather Data in Hydrology / Hydrogeology-Rainfall, Evaporation etc by SPWD & ACWADAM team

Participants were explained the basic characteristics and features in a toposheet. Features like toposheet numbers, scale, index, theme, map type etc were explained. They were also explained to generate a hydrograph with some available data.

xi) Practical: Drainage Analysis in Planning Watershed Management, especially with respect to Locating Structures *by SPWD & ACWADAM team*

Participants were explained to demarcate a watershed on a toposheet and mark the streams of various orders. Further, they were explained some crucial concepts like bifurcation ratio, drainage density, stream frequency etc and based on these, the plan for watershed management could be executed.

DAY 03:

xii) Types of Aquifer *by Amita Bhaduri, SPWD, New Delhi*

Amita defined an aquifer and then mentioned the two main types of aquifer: confined and unconfined. Giving a detailed description on unconfined aquifers, she explained the concepts of water level and saturated thickness. Further explanation was given on confined aquifer and the need of deep drilling to tap water from this. She concluded by referring the relation between unconfined aquifer and the ground surface and baseflow as link between them.

xiii) Aquifer Characteristics *by Surya Prakash, SPWD, New Delhi*

Surya discussed the functions of an aquifer and its major properties: storage and conductivity. He elaborated the concept of aquifer storage as storativity and the importance of its major component, specific yield, in the quantification exercise- especially for recharge and discharge estimation. The other property of conductivity was explained with the concept of transmissivity, where hydraulic conductivity and gradient were explained.

xiv) Accumulation and Movement of Groundwater *by Alisha Vasudev, SPWD, New Delhi*

Alisha explained the processes of accumulation of groundwater owing to the rock types and its property to store or transmit water. Regarding the movement of groundwater, she elaborated through the means of water table contours, which may be dependent or independent of the topography of the watershed. The water level information can be obtained through these contours and the ground water lines, reflecting the direction of flow, and as a result identify the recharge and discharge areas.

xv) Field Visit to Saragundlapalle

The visit to Saragundlapalle was aimed towards geological and hydro-geological mapping and the study of geological features using a reference map. Participants were explained the use of instruments like clinometer and GPS. They were demonstrated to prepare simple geological maps for applications in watershed management and were explained the relevance of geology in context to hydrogeology.

DAY 04:

xvi) Groundwater Recharge, Discharge and Water Balances by *Amita Bhaduri, SPWD, New Delhi*

Amita explained the concepts of infiltration, recharge and discharge, their various types and sources. Further, she clarified on the water balance for aquifers at varying depths and gave a simplified water balance equation. While concluding, she justified that the change in aquifer storage is related to recharge and discharge.

xvii) Accumulation and Movement of Water in a Watershed by *Divakar Reddy, FES, Madanapalle*

Divakar started with the basic definition and features of a watershed and the process of water flows, both on the surface and beneath the ground after the rains. He then explained the role of a check dam in understanding the flow of water in a watershed and the various measuring techniques. He concluded by referring the role of groundwater in ensuring the surface flows.

xviii) Movie

The movie highlighted the demands of water by civilizations but at the same time the ignorance towards the natural resources which are responsible for generating the huge volume of water. It reflected on the overall processes that take place after the rains and the contribution of groundwater in ensuring the flow of streams, which ultimately result into large rivers.

DAY 05:

xx) Field Visit to Bahuda Medium Irrigation Project

Participants were trained to identify specific geological features like dykes, lineaments, vertical and horizontal openings in rocks etc which are the major parameters to predict the flow of groundwater. The field visit at Musturu village was aimed to train the participants to know the nature of an unconfined aquifer by conducting pumping test. Various parameters like the changing water levels were measured during and after the pumping. This helped them to know various aquifer properties like storativity, transmissivity, specific yield etc. They were also trained to conduct the water quality analysis using specific instruments.

Towards the end, participants were asked to reciprocate their experience of the training. Most of them were very enthusiastic of the content and the extent of the training and appreciated the concern of SPWD and ACWADAM towards a value addition in their skills. The participants also emphasised on the need of such specific trainings at grassroot level and urged for further simplification so that this can be spread to farmers, who are the actual beneficiaries.

List of Participants

**Planning, Development and Management of Groundwater with Special Reference to
Watershed Management Practices**

11th to 15th August '08, Madanapalle

Organised by: ACWADAM, Pune and SPWD, New Delhi

Name	Organisation	Contact No.	Email ID
Devdutt Upasani	ACWADAM	09763806187	dev_thedemon@yahoo.co.in
Harshvardhan Dhawan	ACWADAM	09423570466	harshvardhandhawan@gmail.com
Himanshu Kulkarni	ACWADAM	-	acwadam@vsnl.com
L . Madhuri	ARTS, Vizag	09490446657	artssanyasirao@yahoo.com
P .Narasimha Raddy	Chaitanya REDS, Anantapur	09441576695	chaitanya_reds@yahoo.com
Sandeep	Dharamitra, Wardha	-	khadsedm@rediffmail.com
Shankar	Dharamitra, Wardha	-	khadsedm@rediffmail.com
Anjana . M.V.	FES, Madanapalle	-	madanapalle.fes@ecologicalsecurity.org
Divakar Reddy	FES, Madanapalle	-	madanapalle.fes@ecologicalsecurity.org
Nirakar Pradhan	FES, Madanapalle	-	madanapalle.fes@ecologicalsecurity.org
Ram Sourav Adhikari	FES, Madanapalle	-	madanapalle.fes@ecologicalsecurity.org
Subhabruta Das	FES, Madanapalle	09479634325	Subhabruta . ds@gmail.com
C .Narayanaiah	G.J.S.S., Madanapalle	09440995179	gjsmpl@rediffmail.com
M.Yugandhar	GORD	09000714821	-
P . RAMANA	GORD, Madanapalle	09490097140	-
S .Subhaprada	GVS, Punganur	09490620536	-

Nanadagopal	Krushi Samstha, Madanapalle	-	krushi_samstha@rediffmail.com
Sudhakar	Krushi Samstha, Madanapalle	09346636769	krushi_samstha@rediffmail.com
K.Adinarayana	REDS Kadiri	09701041077	bhanureds@yahoo.com
Kristappa	RIDS, Anantapur		ridsgirl@yahoo.com
Amit Gaumat	Samavesh Society, Bhopal	09229833979	amitgaumat@rediffmail.com
Jitendra Saxena	Samavesh Society, Bhopal	09993182891	jituday@rediffmail.com
Alok Deshpande	SOPPECOM, Pune	09730958285	alok_desh@yahoo.co.in
K . Murali	Spandana, Palamaner	-	-
Alisha Vasudev	SPWD New Delhi	09953203283	alishavasudev@gmail.com
Amita Bhaduri	SPWD New Delhi	09350276876	amita_bhaduri@hotmail.com
Surya Prakash Rai	SPWD New Delhi	09868007482	suryaprakash.rai@gmail.com
K. Prasada Rao	Vikasa, Vizag	09440423939	sujala_prasad@rediffmail.com
V .Srinivasa Rao	Vikasa, Vizag	09963385117	vikasaindia@yahoo.com