

USER MANUAL



Ministry of Rural

Development

इलोइतिरो 😹 वेलोइतिइ



Monitoring of Integrated Watershed Management Programme (IWMP) Watersheds Using Geospatial Technologies



National Remote Sensing Centre

Indian Space Research Organisation Department of Space, Government of India Balanagar, Hyderabad – 500 037

February 2015

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Monitoring of Integrated Watershed Management Programme (IWMP) Watersheds Using Geospatial Technologies

इलोइनेरो: Web GIS Portal on ISRO-BHUVAN वेलोइनेरो: ANDROID Smart Phone Application

National Remote Sensing Centre

ISRO, Department of Space, Government of India, Balanagar Hyderabad - 500037

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NATIONAL REMOTE SENSING CENTRE

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Abbreviations

- IWMP Integrated Watershed Management Programme
- DoLR Department of Land Resources
- MoRD Ministry of Rural Development
- DPR Detailed Project Report
- MWS Micro Watersheds
- NRSC National Remote Sensing Centre
- ISRO Indian Space Research Organization

संदीप दवे, भा.प्र.से. संयुक्त सचिव SANDEEP DAVE, IAS JOINT SECRETARY





भारत सरकार Government of India ग्रामीण विकास मंत्रालय Ministry of Rural Development भूमि संसाधन विभाग Department of Land Resources जी-विंग, एन.बी.ओ. बिल्डिंग, G-Wing, N.B.O. Building, निर्माण भवन, नई दिल्ली-110 011 Nirman Bhawan, New Delhi-110 011 फोन : 23062454 फेक्स : 23063568 Ph. : 23062454 Fax : 23063568

FOREWORD

Watershed is perceived to be the basic unit for achieving holistic development especially for rural India. The Integrated Watershed Management Programme (IWMP) aims to bring in various components of natural resource based activities in combination with soil and water conservation objectives. Satellite Remote Sensing data, coupled with the technology of Geographic Information Systems can be used to bring out qualitative as well as quantifiable evidence of developments that are taken up under watershed management.

In achieving better sustainability in development and reaching the grass root level, watersheds are increasingly being recognized as viable and effective management units.

With such a vision, Department of Land Resources (DoLR), Ministry of Rural Development, Government of India have in collaboration with the National Remote Sensing Centre, ISRO developed a real time Planning and Monitoring & Evaluation system through a geoportal for watershed activities. State Level Nodal Agencies, Watershed Cell cum Data Centres, Village Watershed Committees and Remote Sensing Centres of several States of India will be realizing the two-way information flow between planning and implementation. In addition, a Mobile App has also been developed that will integrate with the geoportal to provide citizens with a transparency tool that can used to monitor activities.

In keeping with the basic idea behind this portal, the two parts of the portal are appropriately named as '*Srishti*' and '*Drishti*'.

This manual brought out by NRSC conveys the project goals in brief and the utility of *Srishti*, the Bhuvan – IWMP portal towards visualization and uploading/editing of relevant data, by specific users with respective user accounts. The content and the method of explaining the usage of the portal is extremely user-friendly. I hope that all the stakeholders of the project will find the manual useful and hence will use the portal optimally.

(Sandeep Dave)

भारत सरकार अन्तरिक्ष विभाग राष्ट्रीय सुदूर संवेदन केन्द्र



Government of India Department of Space National Remote Sensing Centre Balanagar, Hyderabad-500 037, Telangana, India Telephone : +91 40 23878360 +91 40 23884000-04 Fax : +91 40 23877210

बालानगर, हैदराबाद-500 037, तेलंगाना, भारत टेलिफोन : +91 40 23878360 +91 40 23884000-04 फैक्स : +91 40 23877210

> Dr. V. K. Dadhwal Director



Foreword

Integrated Watershed Management Programme (IWMP) aims to enhance the judicious use of natural resources, particularly based on soil and water conservation measures. Satellite Remote Sensing coupled with Geographic Information System (GIS) and mobile technologies are promising approaches for monitoring watershed programmes. The present study aims at developing a web-based portal embedding specific evidences of development through a judicious blend of geoinformatics and web technologies.

National Remote Sensing Centre (NRSC), ISRO has designed and developed the required technological interventions (Srishti and Drishti) for monitoring and management of IWMP watersheds through the Bhuvan-Integrated Watershed Monitoring Programme (IWMP) web tool for Monitoring & Evaluation (M&E) of Watersheds across the country.

This manual brings out the use of web-portal and mobile applications in a lucid and user friendly manner and I am hopeful that it will meet the objectives of use of watershed monitoring through the use of geoinformatics and ICT technologies.

Ukdadhwal

V.K. Dadhwal

Date: Feb 18, 2015

भारतीय अन्तरिक्ष अनुसंधान संगठन Indian Space Research Organisation

Executive Summary

Monitoring & Evaluation (M & E) of Watershed activities using Geospatial technology, under the Integrated Watershed Development Program (IWMP) of Department of Land Resources (DOLR), is facilitated through Bhuvan GeoICT tools by National Remote Sensing Centre (NRSC), ISRO. The package facilitates Decision makers at National and State level to monitor program implementation at different levels, including at the local level on the geoportal, while State Level Nodal Agencies (SLNA) and Watershed Cell Development Centres (WCDC) are facilitated with necessary tools on the package to provide specific inputs on implementation of the program at micro-watershed level. NRSC has designed, developed and deployed the Bhuvan GeoICT tools in the name of *Srishti* and *Drishti* for IWMP in the form of Geoportal to help the stakeholders in the effective implementation of the program.

The objective of bringing out this User Manual is to provide step-by-step procedure to use the package by all stakeholders for effective use of the package. While the Web-based package (*Srishti*) provides facilities for online monitoring and upload of data from the field, options are also provided to download the Mobile Application (*Drishti*) to be used at field level to capture actual field realities of project implementation and sending the same to the Bhuvan Server. The Content of this user manual specially addresses the use of GeoICT tools by Administrators (DoLR/State) of the IWMP and also by the Data Provider (SLNA and WCDC) from the field. Access to the package is also provided to the citizen for viewing and simple queries.

It is earnestly hoped that this user manual would serve the purpose of effective use of the Bhuvan GeoICT tools by all stakeholders and hence help in optimal monitoring and evaluation of the IWMP.

Acknowledgements

This user manual has been prepared to enable the users of the Integrated Watershed Management Programme (IWMP) users to develop familiarity with Bhuvan GeoICT portal.

The authors would like to acknowledge the initiative taken by the Department of Land Resources (DoLR), Ministry of Rural Development, Government of India in adopting the GeoICT for M&E of IWMP program, through the technical capabilities of NRSC. We are grateful to Smt. Vandana Kumari Jena, Secretary, DoLR and Dr Sandeep Dave, Joint Secretary, Neeranchal Administration and IWMP, DoLR for the keen interest and guidance. Thanks are also due to Shri Amit Kumar, Director, Watershed Management and Dr K Vijayakumar, Expert, IWMP, DoLR for their constant support and constructive feedback.

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Manual Preparation Team

Shankar Prasad
A Lesslie
Girish S Pujar
V V Sarath Kumar
M A Fyzee

P V Krishna Rao G Padma Rani B Shyamsunder Ananth Rao

Supervision and Technical Guidance

Dr. K. Mruthyunjaya Reddy, Head, RDWMD

Guidance

Dr. T. Ravisankar, Group Head, LRUMG Dr. M.V. Ravi Kumar, Group Head, ASG & CIG Dr. P.G. Diwakar, Deputy Director (RS AA & SDAPSA)

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Part I



(BHUVAN IWMP –

Monitoring and Evaluation Web Portal)

1. Introduction

Wide variety of projects and initiatives are implemented in the country for the improvement of quality of life in rural areas. Issue of this nature has complex dimensions due to pressures on land arising from urbanization, land degradation, environmental problems and so on. Watershed approach for development of a region is understood to help achieve harmony of natural resources such as water, soil and vegetation, in turn ensuring a better sustainability in development. A watershed is area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course. Watershed also conveys a strong sense of community of human beings settled in this unit. Challenges, sometimes of significant magnitude, appear, however, with the widespread use of the selection of watershed as an area unit to be developed. Equitable sharing of improvements among the population of the watershed region in question is a big challenge. Costs and benefits may be distributed unevenly between upstream and downstream areas.

Monitoring and evaluation of progress of developmental activities in an expeditious manner for watershed management requires array of state-of-the-art of geo-spatial technologies. Accomplishing such task at national level in turn demands a comprehensive and continuous compilation of spatial inputs accrued reflecting development themes, through a web enabled interface. Fine resolution satellite data available from satellite sensors such as Panchromatic and LISS III/IV can be successfully utilized for observing water use patterns, changes in cropped area, improvement in permanent vegetation, cessation of land degradation etc. In view of this, Ministry of Rural Development (MoRD), Government of India has desired that implementation of watershed development plans be monitored and evaluated using suitable remote sensing data.

Department of Land Resources, Ministry of Rural Development coordinates implementation of watershed management programme under the title "Integrated Watershed Management Programme (IWMP)". In view of the momentum built under IWMP in terms of allocations and the diversity of improvement activities carried out

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under various states, Ministry felt the need to have a centrally enabled monitoring mechanism for this programme. Successful monitoring instances witnessed in some states using geospatial information to monitor state funded projects acted as inspiration to take up the challenge at national level using similar technological paradigm.

NRSC is entrusted the responsibility of Monitoring & Evaluation of the development activities which take place in watershed. To meet the aims of the project, NRSC has initiated setting up of a web GIS portal for online assessments of impacts. Entire mechanism is envisaged as having two components of information management viz,, Interface for Image and theme service and Smart phone based field data collection connecting to server.

Web based interface providing GIS service in terms of image coupled with thematic mapping as well as analysis is termed as *SRISHTI*, which connotes the entirety of Natural Resource Management envisaged through Watershed Management Concept. While the field information collecting mechanism executed through ANDROID based smart phone application is aptly termed as *DRISHTI*, which refers to the ability of view everything on the field situation and reporting it. *Drishti* images, collects, geo-codes, archives and relays field information in terms of photographs organised under specific implementation classes.

In its current objective, about 42000 micro-watersheds (in 4660 projects) in Gujarat, Karnataka, Maharashtra, Madhya Pradesh, Nagaland, Rajasthan, Odisha, Telangana, Andhra Pradesh and Tamil Nadu are identified for monitoring the IWMP developmental activities under regular state-wise monitoring and evaluation. Under Special IWMP monitoring activity, about 10500 micro-watershed spread over 50 districts of entire nation are also considered for M&E studies. So essentially 52,500 microwatersheds are currently compiled for taking M&E activity and develop assessment on the implementation quality. In the future scope, M&E work may be extended to other states/districts of India as desired. In Special IWMP Monitoring, 50 districts have been identified for monitoring the IWMP activities and the identified districts are given in the table.

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S.No	State Name	Name of district	S.No	State Name	Name of district
1		Anantapur	28	PUNJAB	Hoshiarpur
2		Chittoor	29		Barmer,
3	TRADESH	Prakasam	30	RAJASTHAN	Jodhpur
4	BIHAR	Jamui	31		Udaipur
5	CHHATTIS	Jashpur	32	Тали	Tiruchirapalli
6	GARH	Kanker	33		Salem
7		BanasKantha,	34	N/20	Virudhnagar
8	GUJARAT	Kutch	35		Adilabad
9		SurendraNagar	36	GANA	Mahbubnagar,
10	HARYANA	Hisar	37	UANA	Nalgonda
11	HIMACHAL PRADESH	Shimla	38	UTTAR	Hamirpur
12	JAMMU &KASHMIR	Anantanag	39	PRADESH	Mahoba
13		Dhanbad	40	WEST BENGAL	Bankura
14	KHAND	Ranchi	41	UTTARA KHAND	Almora
15		Chitradurga	42	ARUNACHAL PRADESH	Upper subansri
16	KARNATAKA	Gulbarga	43		Karbi Anglong
17		Tumkur	44	ASSAIVI	Nagaon
18	KERALA	ldukki	45	MANIPUR	Churchand
19		Dewas	46	MIZORAM	Aizwal
20		Jabalpur	47	MEGHALAYA	E. Khasi
21	TRADEST	Sagar	48	NAGALAND	Zunheboto
22		Ahmednagar	49	SIKKIM	South
23		Amaravati	50	TRIPURA	West Tripura
24	NASITINA	Satara,			
25		Nuaparha,			
26	ODISHA	Mayurbanj,			
27		Phulbani /Kandamal			

Table 1. Districts covered in Special IWMP Project

1.1 Integrated Approach for Watershed Monitoring

IWMP aims to restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water. Watershed management attempts to achieve conservation of soil moisture, regeneration of natural vegetation, rain water harvesting and recharging of the ground water table etc. Such measures enable multi-cropping and the introduction of diverse agro-based activities, which will help to provide sustainable livelihoods to communities connected to the hydrological system.

Bhuvan is a Spatial Data and image visualization portal of ISRO, evolving comprehensively to address various issues of online open GIS implementation for natural resource management. Bhuvan provides platform for the users to showcase their applications through spatial mash-ups. A Spatial mash-up enables integration of information from imaging, positioning as well as communication systems to help inventory, mapping and monitoring.

A BHUVAN Application "*SRISHTI*" (BHUVAN-IWMP) is developed with an objective of providing support to Administrators, Planners, Data Providers, Field Level Personnel and also for general public towards creating, visualizing, analyzing as well as assessing the watershed management process and its activities. The portal gives you access to Visualize IWMP programmes, monitor, statistics, summary of the current on-going and completed Watershed projects. The services and features are created for each of this stakeholder group depending on the role of the user.

The Portal enables access to three categories of users, viz., Administrator level, Data Provider level and Citizen level. At administrator level, provision is made to generate complete statistics, summary of ongoing and completed Watershed Programs. Data provider access provides support for online provision of data for partners and state agencies. 'Citizens' would be able to visualize the overall information about Watershed project with a backdrop of image service and available legacy thematic data with Bhuvan.

2. Invoking the Portal

It is assumed that your computer satisfies certain minimum system requirements such as Windows XP operating system, RAM of 1 GB and a network speed of 512 kBps. It needn't be emphasized that the more advanced system you have, the more the efficiency is yielded.

The description of operations that are to be carried out for viewing and/or updation of data through Bhuvan Web Service in this manual assumes that you are using a Microsoft Windows Operating System, for example, Windows XP or Windows 7 or 8.

- Go to Start>Programs and open an Internet Browser (for example, Microsoft Internet Explorer or Google Chrome or Mozilla Firefox).
- BHUVAN as such can be invoked through a simple search through any search engine and opened for visit to the website.
- The Current version of SRISHTI (Bhuvan IWMP) portal is placed as a link which can be used as address for accessing it. Steps are as shown below:



Fig. 1. Entry Point to SRISHTI (IWMP) site

• Type (or copy/paste) the following web address at the appropriate place in your browser

http://www.bhuvan.nrsc.gov.in/bhuvan_links.php#

Press Enter/Return on the keyboard and if the network connection is alright, you must be able to see the Fig. 2.

In the fig. 1, click on Rural and Watershed links. Then you will find
 Login as (fig. 2.)



Fig. 2. 'Login as': the two different types of account for login

There are actually three types of access levels: Administrator, Data Provider and Citizen.

Administrator account is mainly used for generation of reports. A Data Provider account is used for updation of data. The 'data' could be pdf/Excel documents, shape files, etc. You must have an appropriate user name and password to access the Administrator or Data Provider. The Citizen account doesn't require username/password and it is for viewing purpose only.

In case you are authorized to use an Administrator or Data Provider account, please do the following:

 Click on the appropriate button in the Administrator or the Data Provider, as the case may be (please see fig. 3). Supply your user name and password and click on the 'Login' button (fig. 3). Note, for example, that if you have rights of only the Data Provider, then it's not possible to enter the Administrative Account(s) of this website.

Central Auto Ceteway to Indian Earth Observation	nentication Service
🖞 Bhuvan-Single Sign On	Note:
Username:	Bhuvan is now using "Central Authentication Service (CAS)" to enable Single Sign-On(SSO), you can use the same log-in credential if you are already registered with Bhuvan.
Login	Registration is optional in Bhuvan. However, some features require registration. Registered users are having privilege to share the data, collaborate with other bhuvanites, Forum etc. If not registered, it only takes a few moments to register so it is recommended you do so.
Change Password? Forgot Password? New User? Didn't receive the account activation link?	

Fig. 3. Login

3. Administrator Access

For viewing details about Micro Watersheds (excluding those of Special Category), click on Microwatersheds. If you want to view about Special IWMP Watersheds, click on the relevant tab.

The Administrator account holder can login as DoLR to view the data of all the data that fall in the ambit of the programme or access data of a particular state. In the case of the latter, the account holders can click on the State button within the Administrator.

To display overall report on the status of implementation Login as DoLR. To exercise this option, please click on the DoLR button in the Administrator Module. The user and password combinations are already mailed to DoLR.

This display is designed to provide an overview and support brief document preparation if needed.



Fig. 4 (a) and (b). Content available at DoLR access level

You can view State-wise Statistics immediately (fig. 4b) if you click on the label 'Summary of Microwatersheds'. The column named Preparatory shows the number of micro-watersheds wherein work is in an initial stage. Ongoing column shows the work is in a 'middle phase' and consolidated column shows number of micro watersheds where the work is completed. You can close the view of statistics by clicking on the same label.

 You can do selection state wise, say, Karnataka. It will display complete map of state-wide micro watersheds are shown (please see Fig. 5). This selection is independent of year wise selection. The yearwise summary as in the Table 2 can also be viewed if you click on 'Summary of Microwatersheds'.

Table 2. An example of 'Statistics and Summary' for Karnataka

Statistics and Summary Year-wise Statistics State: KARNATAKA



Fig. 5. Map that shows spatial distribution of micro watersheds (Karnataka)

- On the other hand, if you are interested in the status of work that was carried out in a specific time, you can mention in the 'Year' Column.
- This option will appear only if you select a state.

For example, the tables 3(a) and 3(b) below show the summary district-wise statistics of Karnataka for the periods 2011-12 and 2012-13 respectively.

2011-12	2012-13
SNo. District Preparatory Ongoing Consolidated	SNo. District Preparatory Ongoing Consolidated

Table 3(a) and 3(b). District-wise statistics of work progress in Karnataka

• Likewise, one can view statistics for a particular district. Here, an example of *part of* Bellary for the period 2012-13 is shown.

SNo.	Project	Status
1	4D3C2A1a	Preparatory
2	4D3C2A1b	Preparatory
3	4D3C2A1c	Preparatory
4	4D3C2A1d	Preparatory
5	4D3C2B1a	Preparatory

Table 4. Status of part of work regarding development of micro-watersheds in Bellary.

In this table, the field (column) named Project indicates the micro watershed code.

The Administrator account facilitates three 'views' apart from the Map View. They are Sat (Satellite Data View), Hyb (Hybrid) and Ter (Terrain). These can be accessed simply by clicking on the relevant tab. A brief description of these kinds of view is given in the context of Fig. 8. Similar choice of background layer is available in Data Provider domain also.

As has already been said, the interface for Special IWMP MicroWatersheds is very similar to that of IWMP's Microwatersheds tab. The number of micro watersheds and other details of the special monitoring are different from what has been discussed above.

(a) Login as 'State'. Click on the 'State' button in the Administrator Module

Select a state of interest. You can immediately view the micro watersheds in the so chosen state. Also, you may view tabular details of micro watersheds by clicking on 'Summary of Microwatersheds'. You may also switch to a different state simply by clicking on another state name in the State drop down box located just above the Summary of Microwatersheds.

3.1 Displaying Thematic Layers

The user is not limited just to examine maps of (micro) watersheds tables in the IWMP portal. If spatial layers such as land use, soil depth etc. are already 'published' for the area of interest in Bhuvan's portal, you may examine those layers too. For example, in the Fig. 6 a, the layers of land use/land cover (LU/LC), erosion and soil texture have been added to the display. To do so, the check boxes for the relevant layers have been made ticked after selecting a micro watershed.



Fig. 6(a) and (b) Thematic Layers and Swiping.

When multi-thematic information is required to be visualised, different layers can be visualised for each of the micro-watershed using legacy layer list as shown in the interface. These layers can be individually loaded in the frame and compared with each other. It is possible to use 'swipe', facility here, if more than one layer is displayed at a time. To swipe, please click on the 'Activate Swipe' button (shown in

red dotted box) in the left pane and move the mouse in the display window. You can come out of the swiping mode simply by clicking on the Deactivate Swipe button. This facilitates digital comparison of the database, for instance, comparison of land use land cover with satellite imagery etc.

4. Data Provider

A data provider is the node where in data on various activities in the form of a report, plan map, photograph, image, vector database or any other specific and key information as simple text files would get uploaded to state level database at microwatershed level.

This is the key data input interface wherein all the stakeholders at implementation level will be able to upload the databases, observations, remarks as well as other contents essential for monitoring and evaluation procedure at the current level of understanding of the process. This level is going to be improved/modified in stages, as the overall understanding of the process progresses, over initial phase of the project, so that complete comprehension of the uploading and archiving is accomplished.

In case you wish to upload data, this is the option to be used. The Data Provider(Fig 7(a)) can login as an SLNA (State Level Nodal Agency) or as WCDC (Watershed Cell Development Centre). The SLNA button is to be clicked to access/upload data of a state. The WCDC button is to be chosen if you want to access data of a district in a state. As discussed previously in the context of fig. 2, please supply your user name and password. The options you see will be quite different from what was dealt with in the above since the accounts of Administrator and Data Provider have been created for different purposes (though the former has more data 'rights' and hence can accomplish what an SLNA can, SLNAs are normally expected to upload/edit data). An Administrator account holder can accomplish what *all* SLNA and WCDC account holders can, but not vice versa.

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Fig 7 (a) Login interface for Data Provider



Fig. 7(b). A view of Data Provider Account (Map View)



Fig 7(c) Legend for the Stage of MWS works

You can switch over between map and satellite data by clicking on 'Map' or 'Satellite' which enables backdrop of either IRS high resolution natural color composite of 2.5

m resolution or digital terrain model derived by Cartosat-1 stereo orthorectified imagery. Background variants help for understanding the setting of micro watersheds with respect to differing land cover, vegetation context or simply the terrain pattern so as to support any of the decision to be taken .

You can also view the standard legend in for preparatory, ongoing ('work') and consolidated (click on Legend in fig. 8(a)) to see the figure below. The outlines of micro watersheds are drawn, depending on the status of progress, with the relevant colour. For example, all the watershed activities in the preparatory stage are drawn using the red colour.

The Data Provider account holder has to choose between IWMP Micro-Watersheds (carried out for 10 states) or Special MWS (50 Districts), as the case may be. Further, the interface for SLNA and WCDC in the Data Provider Module is common; as of the current version, there is no need to describe the two options independently.

Access is limited by user level by login jurisdiction (SLNA for a state and WCDC for a district). Therefore there is no need to explicitly select, for example, your state while you start browsing after logging in.

One can notice the following main options in this account (see, for example, the Fig. 7b):

- 1. Upload Base/DPR/Action Plan (DPR: detailed project report)
- 2. Field Data
- 3. Activity Planning
- 4. User Added Layers

4.1 Upload Base/DPR/Action Plan

 Please select the relevant Year, District and Microwatershed. The latter two drop-down boxes will pop up once an item from the higher box is under selection.



Fig. 8(a). An Area selected in Data Provider Account



Fig 8(b) Drop down list of MWS codes in a district

 Click on a micro watershed of your interest in the Micro Watershed list box which displays the codes for the micro watersheds in the selected region (please see the left pane of fig. 8). Also click on Upload Data button.The micro-watershed's information can be noticed (fig. 9(a).

Micro	watershed Details	Microv	vatershed Details
Microwatershed Code	4D3B7B1a	Microwatershed Code	4D3B7B1a
Project Name	4000/014	Project Name	
State	KARNATAKA	State	KARNATAKA
District		District	BELLARY
District	BELLARY	Block	
Block		Year	2009-10
Year	2009-10	Area Total (Ha)	0
Area Total (Ha)	0	Area Treated (Ha)	0
Area Treated (Ha)	0	Status	Preparatory
Status	Working	Executing Agency	Preparatory
Executing Agency		Data Available	Working
Data Available	0	DPR Uplink	0
DPR Uplink	0	Baseline Data	0
Baseline Data	0		
Edit the Microwatershed Detail	Save Details	Edit the Microwatershed Details	s: Edit MWS Details Save Details st Data: Upload Data List Data

Fig. 9 (a) and (b). Information about a Micro Watershed

The account holder can modify the table noticeable in fig. 9 (a). To do so, please click on the Edit MWS details button and modify the field(s), as in the fig. 9 (b). After ensuring that the modifications are correct, save the details by clicking on the relevant button.

4.1.1Uploading Data

You can submit/upload data. Please click on Upload Data button as in fig. 9 (a)/(b) to see fig. 10. In this dialog box, click on 'Browse' to choose a file.



Fig. 10(a). Choosing a file for an upload

In Category Type (fig. 10 a) you can choose, depending on the type of data you wish to load, Documents, Maps, DPR (detailed project report), Action Plan and others. It is always advisable to select a **correct category type**. A representative example is given in the said figure.

 Click on Choose File to select a file. The Upload button should become enabled.Currently data up to the size of 20 Mega Bytes can be submitted. The file will be loaded into the Bhuvan Server at NRSC. However, it will not be made public unless a validation is carried out at NRSC.

You can verify the submission of file(s). Please click on 'List of Files Uploaded' in fig. 9 to see the following.

oser manner	MWS_CODE	State	District	File Name	Uploaded	Time	Category	Delete Option
ka_slna 4	4E6C3B1a	KARNATAKA	BIDAR	activity planning.JPG	2014-12-25	13:50:58.39	Actionplan	Delete
ka_slna 4	4D5A3F2c	KARNATAKA	GULBARGA	activity planning.JPG	2014-12-25	13:52:01.265	Actionplan	Delete
iwmp1 4	4D3D4I1d	KARNATAKA		iwmp_screens.pptx	2014-09-16	12:13:30.671	Documents	Delete

This facilitates the **data provider to check** whether the uploaded material are of correct file/data type etc. and delete the wrong file(s), if any. The List Data button in fig. 10 (a & b) also serves a similar purpose.

Detailed Project Report (DPR)s are available for download from the following link (highlighted in the fig. 11 a) as shown below.



Fig. 11 (a).

You will be taken to a respective state websites (fig. 11 b) from which the actual downloading can be carried out.

		-				
		WATERSHED (Integrated Watersho Department of Rural D	DEVELOPN ad Management Progr Development, Andhre	IENT amme) Pradesth		(MAR)
Home >> DPR R	leports					
DPR R	EPORTS					
			DPR Files			
Batch	2012-13 🔻	District	Select v	Mandal	Select 🔻	
Project	Select v	Micro Watershed	Select •			
			Download DPR Report			
)

Fig. 11 (b) Statewise IWMP page showing DPR repository

4.2Field Data

To view the field data collected using the Android App (Refer Part –II, *Drishti*, Section 5), click on Field Data.

Depending on the developmental profile, please click on Select Profile to select amongst:

Agronomic Measures, Vegetative Measures, Structural Measures, Ponds/ Tanks, Nala Channels, Bunds, Livestock, Livelihood, and Other Activities

Under the mode of field work being carried out one can select the State followed by the 'Day' or 'Period' of field work. (Fig 12)



Fig. 12. Entering field data

If the activity is relevant for a single day, select 'Day' and select the relevant date for the activity. Or else choose 'Period' in fig. 12 and select an appropriate range of dates. Again you can click on the relevant area in the view.

The already submitted points can be viewed by clicking on the view button in the

above figure. This button facilitates viewing purpose only and not for uploading new points.

4.3 Action Plan Preparation

From this menu, one can access tool to build the activity plan to update action plan or create one to be uploaded for monitoring purpose. The interface used BHUVAN Mapper tools customized for IWMP objectives and another Internet window/tab (Bhuvan Mapper) appears for digitization. It provides scope to build point, line and area features on a background of image or any of the legacy layers. Each category has customized feature with it so that quick mapping is possible with error free attribution.



Fig 13 a. Action Plan Preparation link

Once an action plan map is prepared and uploaded to Bhuvan IWMP, the submitter may examine it and delete if wrongly done. Please refer to the discussion on Uploading Data.

Following interface indicates the way mapping can be taken up.

← → C 🗋 bhuvan-mapper.nrsc.gov.in/iwmpnew/ed	lit#map=14/15.1545/76.9128	☆ =
Solution Sateway to Indian Earth Observation	Action Plan Preparation: IWMP National Remote Sensing Centre	इसरो ।इन्व
Welcome to ka_sina, Logout Enter Place Name		
Select feature type 🗙	♥ Point 🖌 Line 🛱 Area 5 C Save 1	Bart Bhurs
Q Search		. [/ [+
Common Land		
Private Land		
Point		
		Powered by ID

Fig. 13(b). Action Plan Mapper

To digitize, it is necessary to give a click on Zoom in to Edit button. This mapper gives options of mapping either a point feature, line feature or a polygon feature.

- Point. This is useful for small features such as position of check dam, borewell, huts etc.
 - Click on point tab (fig. 14).
 - Place the 'point' at suitable location and select from a list of the categories of point features. As per standard list large variety of point features is available for selection (Annexure I). The features are placed in domains such as Common Land OR Private Land. This classification ensures pointing of different activities implemented in respective ownership units. If point feature is placed at a wrong place mistakenly, select the point and remove it by pressing together Ctrl and backspace keys from your keyboard. Unlisted features may be entered as new category in Others.
 - Assuming that there is a check dam at the location, choose check dam from list of features from the list available in common land (and likewise, choose the appropriate icon).



Fig. 14 (a) and (b)

- o Observe that an icon of check dam appears now as a graphic
- Area (Polygon)
 - Click on Area tab (fig. 13 or 14 (a/b)).
 - Place the initial point at suitable location and start clicking to enclose an area. Double click to end the sketch of the polygon (please the fig. 15). If the area is 'involved', several clicks are required to accurately copy the shape of the area. If it is at a wrong place or if you discover an error in creating it, select the feature and you can remove it by pressing together ctrl and backspace keys from your keyboard.

To add a description about a polygon:



• Click on Area in the select feature type

Fig. 15. Polygon and its description

• In the Remarks, key in a suitable description

Similarly you can add a line feature, for example, check dams. The method of adding a description is similar to that of a polygon. If you digitize a line feature and close it properly, technically, it will not be 'treated' as a polygon, that is, for a line feature, the area is nil.

You can save your digitization into your login account, following the interface after clicking the Save button in the above fig. This feature may be modified, however.

Following list shows all the options of attribute categories built in to IWMP monitoring.

- AM Agronomic measures
- VM Vegetative measures
- SM Structural measures
- PT Pond-Tanks
- NC Nala-Channels
- BN Bunds
- LS Live Stock
- LH Livelihood
- OM Others

4.4 User Added Layers

Users can add layer to *SRISHTI* interface using 'Add Layer' (Tools>Add Layer) facility in generic Bhuvan interface frame. This layer can be either visualized or cleared during visualization. This is a quite useful tools for checking the Bhuvan based spatial layers with any legacy layer (Any land cover or infrastructure layers) available with User agency (WCDC/SLNA).



Fig 16(a) Bhuvan Tools

In this Bhuvan based "Tools" drop down, in addition to Add Layer, options such as Draw Tool, Measure area, Measure Length are available. These tools help in measurements and discussions on the spatial database. Web based Map Service (WMS) interface helps to enable standard Bhuvan Legacy layers such as Land use Land Cover database to be opened in WMS facility of Commercial or Open Source GIS suites.



Fig 16(b) WMS Manager in Bhuvan Tools

Bhuvan Store available in *SRISHTI* enables link to legacy databases placed in the Bhuvan. Users can make variety of uses of the same. Home button takes user to the landing Bhuvan page.

5. Citizen Access

Please click on the blank area in the left/right part of the fig. 2 to see content as in the Fig. 17. You may please click on the blank area in the following figure.



Fig. 17. The Citizen Access

In the citizen account too, one can have the four types of views: Map, Satellite, Hybrid and Terrain (please see Fig. 6(a) - (d)) for discussion. This interface enables common public facility for viewing the information and add some user content.

Annexure I. Activities Taken up in Watershed Development

Code	Activity	Sym	Code	Activity	Symb
		bol			ol
	Gabion		LS	Animal Health Camp	<u>ی</u>
BN	Gabion2	2	VM	Bamboo Plantation	<u>#</u>
VM	Grass _Veg_Bund		AM	Bench Terracing	**
VM	Grass Turfing	,	VM	Block Plantation	2
	Grass Turfing2		SM	Bore Well Recharge	Ŧ
NC	Gully Check	-380	BN	Boulder Bund Repair	ż.
LH	Chaff Cutters		BN	Boulder Bund	2240 C
LH	Hay-Silage Making		SM	Boulder	~
LH	Horticulture	11	SM	Cattle Proof Trench	×.
ОМ	Integrated Pest And Disease Mgmt(Ipdm)	*	PT	Check Dam	
			PT	Check Dam Repair	Lui
ОМ	Jungle Clearance(Medium)	1	SM	Coconut Split Way	<u>11</u>
ОМ	Jungle Clearance(Thin)	**		Compost	Cantor .
	Kalyani	4	AM	Contour Bund	-
LS	Kitchen Garden	2	AM	Crescent Bund	4.8÷
BN	Marginal Bund	w	BN	Diversion Bund	<u>* *</u>
РТ	Mini Percolation Tank	₩	NC	Diversion Channel	5°
	Mini Percolation Tank 2	1	PT	Dried Up Open Well Recharge	
LH	Organic Farming	**	SM	Dug Out Pit	
NC	Pipe Outlet	#	PT	Dug Out Sunken Pond	~
SM	Removal Of Stones	<u>81</u>	PT	Dugout Pond-Seepage Pond	Ì.

VM	Road Side Plantation	<u>.</u>	BN	Existing Bund	4%-
РТ	Rock Filled Dam	<u>.</u>		Existing	**
LH	School Garden	28	VM	Farm Forestry	*
LS	Shelter For Cattle	ins.	LH	Fisheries	8
SM	Slab	₩		Floriculture	99
SM	Rrs -Srs		LH	Floriculture2	111
PT	Sunken Pond	1		Fodder Mini Kits	<u></u>
OM	Urea Treatment Of Straw	U	LH	Fodder Nursery	16
VM	Vegetative	-		Fodder Nursery / Mini Kits	₩.
PT	Vented Dam	*	LH	Fodder Development	8
NC	Water Ways	5	ОМ	Agro Service Centers	₫
VM	Crop Border-Bund Plantation		SM	Boulder Outlets	11
BN	Earthen Bund	6	AM	Bucket Irrigation	*
BN	Field Bund		AM	Drum Irrigation	<u>81</u>
OM	Dry Rubble Fluma	5		Tree – Type 1	*
LH	Sericulture	0	VM	Tree – Type 2	•
NC	Nala Training	26		Tree – Type 3	**
SM	Silt Application	35	BN	Nala Bund	dh.
VM	Crop Border-Bund Plantation(H)		VM	Crop Border-Bund Plantation	-
VM	Crop Border-Bund Plantation (F)	700		Crop Border-Bund Plantation (Ls)	**
LH	Graded Bund	\$	AM	Graded Bund	- <u>4.67</u> 7777
LH	Vermi Compost		PT	Roof-Rain Water Harvesting	۵.
SM	Rows	-	AM	Agro Forestry	24
BN	Bunding		BN	Bund-Repair	<u>&</u>

NC	Nala Deepening	M2	OM	Farming System Demonstration(Annual Cost)	Æ
NC	Nala Rivetment	- - - - - - - - - - - - - - - - - - -	OM	Farming System Demonstration(Estab Cost)	Æ
VM	Vegetative Bund	14 1	VM	Grass Outlets	*
			NC	Nala Diversion	X
			PT	Recharge Pits	%
			VM	Vegetative Filter Strips Of 3 Rows	ada. Ban Ata

Part II

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Manual for Field Data Collection using Smart phone application using ANDROID

Mobile Software Application for Field Data Collection -Monitoring IWMP activities

1. Overview:

The watershed development programme is multi-disciplinary in nature with integration of many inter-related activities to achieve restoration of ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water. Understanding and monitoring the different stages of numerous watershed development activities covering a huge area on regular basis is a big challenge. Remote sensing technology can play a major role in monitoring such activities. The high resolution satellite data (images) gives large perspective view of the ground situation and it can be monitored at periodic time intervals. Monitoring with satellite data at short time intervals may not be an optimal method to adopt. For such projects, field data collection using smart phone can be a good complementary solution. The collected field attributes with photographs information can be overlaid over the satellite data to give a good perspective of activities in the field.

The field data collection for monitoring activities was traditionally done using a manual approach like visiting field with hard copy form entry, consolidating the collected data at later date involving substantial delay. The recent technological advances in field of mobile devices, web solutions, and network connectivity have made it possible to design and develop innovative smart phone based solutions for field data collection to replace traditional methods and enhance productivity and data management.

2. Modernized Field Data Collection:

Towards realizing the objective of modernizing the field data collection process for monitoring watershed activities, the smart phone based application was suitably designed and developed. The application effectively utilizes free and open source technologies and leverages the power of geo-visualization and data management capabilities of the existing Bhuvan platform.

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The requirements of the solution were envisaged in two parts. 1) A device based software solution to collect field data and send to central servers. 2) A server side software solution to archive received data in centralized storage system, geo-visualization of archived data, provision to review each observation by technical experts on existing Bhuvan platform.

3. Description of developed solution:

The developed software is deployed on Android OS based smart phone. The rich and user friendly Graphical User Interfaces (GUI), which facilitates observer/user to collect data with ease, predominantly reduces data entry errors, reduces data organization and data retrieving difficulties. The collected information can be sent in near real time using GPRS / WiFi facility for analysis at office at near real time. The captured photograph enables user at office to understand and analyze the ground condition in pictorial form. The facilities are provided to send collected data in near real time if internet connectivity is available in field. There is provision to send it later in case of no internet connectivity on field.

4. Operating Procedure

The following are screenshots representing the features in the mobile application and step by step working procedure to collect field data using the software.



4.1 Download the app using browser in the android mobile:

Figure 1: Open the browser and type URL to download the app.





The above screenshots in figure 1 and 2 indicate procedure to open browser and entering URL for downloading the smart phone application from Bhuvan Portal.

- Step 1: Indicates icon of browser to open the browser in the smart phone.
- Step 2: Entering URL in the browser and click on Go button.
- Step 3: Tap top of smart phone screen and swipe down to open and visualize downloading of app.
- Step 4: Once the download completes, Click on apk file to initiate installation.

4.2 Install the downloaded application in the android mobile:



Figure 3: Installing the app.





The above screenshots indicate procedure to install the android application in the smart phone.

- Step 1: Starts installation.
- Step 2: Completes installation procedure.

4.3 Open the app and setting up user profile (One Time Activity - OTA):



Figure 5: Open the IWMP app

Field Data Collection for IWMP	Field Data Collection for IWMP
Your Profile	Your Profile
User ID	User ID
Enter here	TeamA_1
Your Name	Your Name
Enter here	lesslie
Your Mobile Number	Your Mobile Number
Enter here	9573488277
Your Organisation	Your Organisation
Enter here	nrsc
Save Home	4 Save Home

Figure 6: Entering user profile and save

lesslie	lesslie
Your Mobile Number	Your Mobile Number
9573488277	9573488277
Your Organisation	Your Organisation
5 OK	Exit
FDC.app - FDC XMMP version 1.1 © National Remote Sensing Centre / ISR0 - 2014 //////	FDC.app-FDC.IVMP version 1.1 6 National Remote Sensing Centre / 1380 - 2014 / ///3/C

Figure 7: Save the user profile and go to collection page

The above screenshots 5 to 7 indicate steps to open the IWMP app, enter the user profile and save.

- Step 1: Click on IWMP app icon to open the smart phone app.
- Step 2: Open the app with provision to enter user's profile.
- Step 3: There are 4 user profile parameters to enter. i) User ID (User can define his / her own identification code (Alf- numeric

code), ii) User's name, iii) User's phone number and iv) Organisation of the user.

- Step 4: Save the entered parameters.
- Step 5: Alert shown once it is saved successfully in the database.
- Step 6: Go back to collection page.

5. Data collection and Sending to Bhuvan Server:

The collect page has provision to i) Select watershed activity, ii) Capture location information, iii) Take photographs (2 nos), iv) Enter attribute values, v) Provision to send collected data, vi) Provision to send it later (in case of unavailable internet connectivity), vii) Provision to access datasets and viii) Edit user profile. When the user clicks on IWMP app icon the s/w opens and the process directly takes to collection page, if the user already provided user profile parameters.

There are 85 watershed activities. These watershed activities are arranged in two levels. The first level represents 9 categories such as Agronomic measures with 7 parameters in second level, Vegetative measures with 14 parameters, Structural measures with 11 parameters, Pond Tanks with 11 parameters, Nala Channels with 8 parameters, Bunds with 11 parameters, Live Stock with 3 parameters, Livelihood with 12 parameters and Other measures with 8 parameters.

i) Watershed activity: The process of collecting field data starts with selection of the watershed activity. The observer must choose appropriate watershed activity in the field.

Collect Data
Select the Activity :
Vegetative Measures O GPS Lation Position Accuracy:-990 meters
Capture Location Picked GPS location accuracy
Take Photo
Select from here
Select from here
Send Send Later
15 💩
Exit Data typicaded (sent data): 0 mos.

Figure 8: Select appropriate watershed activity

The user must select watershed activity from the drop down menu. Once it is selected, the buttons below select option gets activated and additional GUI options with provision to enter appears.

- Step 1: Click on "Select the Activity"
- Step 2: Select any one activity from drop down menu. Here example: "Vegetative Measures".
- Step 3: Click on "Done" button. Here Capture Location feature activates and additional fields appears.

ii) Capture location information:

The user must switch on the GPS / Location as shown in figure 2 and go to Setting >> Location and security >> Enable use GPS satellite and choose location accurate to street level / High accuracy.

To capture the location, the user must go to the centre of the structure / feature under the open sky. Wait till GPS lat-Lon position accuracy is displayed (in blue colour text above "Capture Location" button). If the mobile has GPRS / 3G connectivity, initial tracking of GPS will be fast. The accuracy of the position slowly improves with the time. The user must wait till the value reaches **10 meters** or below and click on "Capture Location" button. After Capture Location, a text message appears in textbox below with "GPS location captured with 10 meters of Accuracy".

	Captu	re l	Location	
	⊕ % all ■ 15:46 Field Data Collection for TWMP Collect Data		● 🐮 📲 🔒 15:46 Field Data Collection for 1WMP Collect Data	
Wait till GPS Accuracy info appears and Its value reaches 10 meters or below	Select the Activity : Vegotative Measures GPS Lat-Lon Position Accuracy-10 meters Capture Location Picked GPS location ecoracy Take Photo		Select the Activity : Vegetative Measures O GPS Lat ton Discisles Accurace 10 meters Capture Location GPS Location captured with 10 meters of accuracy Take Photo	Location captured can be updated by click on Capture location button before sending
	Vegetative Activity : Celest from here		Vegetative Activity : Select from here	

Figure 9: Capturing location information

iii) Take photographs:

The "Take Photo" button in the application uses native camera application of the android mobile. This enables user to capture photograph and save. Along with photographs, it also captures latitude, Longitude, accuracy, orientation and time stamp. The user also will be provided with textbox to key-in about the photo captured. A preview of captured photo is display in the collection page.



Figure 10: Take photo using mobile native camera



Figure 11: Save the photo, preview and addition of text tag to the photo

Note: The user can also reduce the resolution to the lowest possible for optimizing the data transfer load from mobile to Bhuvan server.

iv) Enter attribute values:

The appropriate attribute values are selected from drop down menu for watershed activity and its status, remarks of observations are key-in.





v) Provision to send collected data:

The send feature of the IWMP app enables user to send collected data to Bhuvan server. This send requires internet connectivity in the field through GPRS/3G/WiFi. The sent data consist of information depicted in figure 12 and users profile information is also tagged such as user id, observer name, phone number and organisation. An alert is displayed once the data is received at Bhuvan server.

	Photo1 Text: grass trufing south Photo2 Text: grass trufing north
Status Of Activity : Completed	Vegetative Activity :
Remarks : Do not use any special text characters Send 2 Send Later Datasets Your Profile	Grass Turfing O Statu: Of Activity Data Saving Remarks : Do not use any special text characters

Figure 13: The Collected data is initialized to send it to Bhuvan server

Photo1 Text: grass truling south	Vegetative Measures O
Vegetative Activity :	Confirm
Grass Turfing O Status Of Activity Data Uploading	Data Sent Successfully Click on "OK" to collect next observation Click on "Cancel" to exit
Remarks : Do not use any special text characters	2 OK Cancel
🗠 Send 🖂 Send Later	and the second

Figure 14: An alert message after data reaching the server

vi) Provision to send it later:

The Send later feature of the IWMP app allows user to store collected data in send later location of the mobile. This feature is generally used when internet connectivity is not available in the field. The collected data can be sent when internet connectivity is available in the mobile.

Vegetative Activity :	aft 🖬 16:10	Grass Turfing	16:58 O
Grass Turfing	0	Status Of Activity :	
Status Of Activity :		Completed	۲
Completed	•	Remarks :	
Remarks :		Do not use any special text ch	haracters
Do not use any special text o	characters		
		Data Saving	
🛎 Send 🖹 Send	Later		
		N. 💦	
ML 🖉	8		
	2	Datasets Your Pro	file

Figure 15: The collected data is stored to send it later

Vegetative Activity :	16:57	getative Activity :	¢ % al 🔒	16:57
Grass Turfing	0	Grass Turl	fing	•
Status Of Activity :	Sta	atus Of Activity :		
Completed	•	Complete	ed	۲
Remarks : Do results and set of the set of t		Alert Data saved for Sen 2 OK	iding Later	
N 🐠				
Datasets Your Profi	le	Datasets	Your Profile	

Figure 16: The Data stored to send it later

vii) Provision to access datasets:

The datasets feature of the software allows user to access all collected data. The datasets are organized in 3 categories (a. Send later data, b. Sent failed data and c. Sent data). If the user chooses to send data immediately to Bhuvan server and data successfully stored in the server then these datasets are reflected in view send data component. In case, if it fails to reach server due to communication problem (internet connectivity failure) then it reflects in sent failed component. If the user chooses to send later component.

In send later and sent failed components, the user can select an observation and send it to Bhuvan server, this requires internet connectivity (through GPRS/3G/4G/WiFi). The user also has facility to edit observed attribute values before sending or can be deleted, if it is not required in the mobile.



Figure 17: GUI to view collected dataset in smart phone

	두 교환 을 18:20 Field Data Collection for TWMP	
%. all @ 18:19 Field Data Collection for XWMP Upload Send Later Data @ Send List Observations: 3	Edit Send Later Data Name of the Activity : VegetativeMeasures Photo-1 Photo-2	٦
Image: State of the state	Status DJ Activity : Completed Remarks : Do not use any special text characters K Cancel Save 6 FDCapp - FDC TWMF version 1.1 C National Remote Sensing Centre / JBR0 - 2014 7/75C	5. Only attribute value can be changed and saved

Figure 18: The selected dataset to Edit, Send and Delete

The View option of sent datasets enable user to visualize the attribute value of the observation with photographs taken. This is an un-editable feature since it is already sent to Bhuvan server.



Figure 19: View sent datasets

두 배 🔒 18:21 Field Data Collection for IWMP	
Detail View Sent Data	
Photo-1 Photo-2	
Vegetative Activity :	
Grass Turfing	
Status Of Activity :	
Completed 🥥	
Remarks :	
Do not use any special text characters	
4 × Close	
FDCapp - FDC IWMP version 1.1 (D. National: Remote Sensing Centre / ISBO - 2014 - DPSC	



viii) Edit user profile.

The user profile is mandatory fields feature in the software, without which user will not be allowed to enter into data collection page. The editing of user profile is enabled to change in User id, observer name, phone number and organization name of the observer.

User	profile editing	
Co not use any special text characters Co not use any special text characters Send Send Send Send Later Cour Profile Cour Profile Exit Data uploaded (sent data): 1 nos. FFC quy- FFC FINIT version: 11 Network Remote Sensing Course / 1500 - 2014 / 1725	Field Data Collection for TWMP Your Profile User ID TeamA_1 Your Name lesslie Your Mobile Number 9573488277 Your Organisation msc 3 Software Maintenance Activity Focure: Foc towP version 14	2. User profile info can be changed and saved

Figure 21: Editing of user profile

Android tool hence enables a comprehensive field truthing of the microwatershed activities. It can expedite vast field information collection and real time updating on the web portal. This would help decision makers to assess the condition of implementation at the earliest. Further improvements possible in the tools can be planned and discussed so that much more detailed content in project phases to come may be realised.

6. Conclusion

Overall deliberation of this manual is focused on two processes viz., satellite image based monitoring using online web tools (*Srishti*) and ANDROID Mobile based tools for field truthing protocol (*Drishti*). The first part gives the information on the usage of Bhuvan IWMP portal for varieties of data creation and monitoring aspects. The focus is on the use of technology for effective planning, monitoring and management of watershed development projects and the roles played by Government Departments and Agencies. The rationale for choosing watershed or its sub sets as a developmental unit is also addressed. The three levels of monitoring modules, Administrator, Data Provider and Citizen, under the geoportal provides specific roles and responsibilities of users respectively. Various methods of data upload are discussed in detail to facilitate the data providers to uplink required data on a regular basis.

Mobile Smartphone application, *Srishti*, brings out the importance of precise field data collection for watershed monitoring. Software tools are specially developed to address this aspect as part of monitoring under the project.

Information collection when beamed to central server turns in to a value added service and builds a comprehensive database for evaluation. Satellite image based change detection, coupled with field information helps to evaluate the progress on ground. Integration of 3 streams of information, namely, Satellite imaging, Mobile smartphone based field information and Geospatial technology would help in unbiased and reliable monitoring of watersheds across the country, continously.

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