2007-08

Field Training Report

Report submitted to-

Superintending Engineer,

Directorate of Irrigation Research & Development, Pune

(21/01/2007-27/01/2008)

Directorate of Irrigation Research & Development, Pune

सरळ सेवा भरतीने सहाय्यक कार्यकारी अभियंता या पदावर नियुक्ती दिलेल्या अधिकाऱ्यांसाठी क्षेत्रीय प्रशिक्षण कार्यक्रम, जलसंपदा विभाग

Field Training for Direct Recruits as Assistant Executive Engineer of Water Resource Department.

कालावधी: २१–२७ जानेवारी २००८ (१आठवडा)

Duration: 21-27 January 2008 (1 week)

"क्षेत्रीय प्रशिक्षण अहवाल"

"FIELD TRAINING REPORT"

सादरकर्ता–

Submitted by-

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सहाय्यक कार्यकारी अभियंता,

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Executive Summary

Maharashtra Engineering Training Academy (META), Nashik organized training program for direct recruits - Assistant Executive Engineer & Assistant Engineer (Class I) of Water Resource Department (WRD), in accordance with Maharashtra Engineering Service Examination-2004. As per schedule of training program, we were directed to undergo training under the guidance of **Er. K.M. Shah Saheb,** Superintending Engineer and Director, DIRD[1], Pune to learn about the drainage.

The training program was scheduled for five working days, starting with Inauguration on 21st January 2008 at *Er. C.C. Inglis hall*, DIRD Pune. It was our pleasure to have nice introductory speech by **Er. K.M. Shah saheb**, Superintending Engineer and Director of DIRD, **Er. Giri Saheb**, Superintending Engineer, and **Er. Shivaji Rajale saheb**, Executive Engineer, IRD, Pune. We also had informative session with Shri. Anil Kapare, SDE, Thane and Shri. S.M. Amritkar, Soil Scientist, DIRD.

On 22nd January 2008, we enjoyed site visit- "Additional Madavgan Drainage Scheme", at Ghod RBC[2], Ganegaon, Tal Shirur, Dist-Pune with Er. Kiran Joshi Saheb, Sectional Engineer. After visiting site, we observed land and indentified problem of field salinity and water logging. We collected soil samples from 6 pits at four intervals of depth (0-20, 20-40, 40-80 and 80-100cm) and water samples from 2 wells by observing water levels of 18 wells as well as collected water sample from a drain and measured discharge.

On 23rd and 24th January 2008, we performed two tests on the soil and water samples, viz., Electrical Conductivity (EC) and pH under the guidance of Shri. Sham Naikade, Lab In charge. As per result of the tests, we concluded that the given area is completely saline and water-logging is major problem associated with that. From the data of sample collection, we mapped the affected area and proposed remedial action to reclaim the affected land. We tried our best to propose the design scheme and prepared the scheme plan.

[1] Directorate of Irrigation Research and Development.
[2] Right Bank Canal

Last day of the training session ended with the presentation and submission of report on 25th January 2008. I am pleased to say that the training session at DIRD Pune was a life time experience, since I could realize the importance of water management and subsequent drainage to avoid disadvantages of excess irrigation. It is the one of the prominent area to concentrate in future to minimize the wastage of land.

The research work and reference material at DIRD is of high quality and it helped us to learn about drainage. I take this opportunity to express my heartfelt gratitude to Er. Shah saheb, Er. Rajale saheb, and all the staff of the circle and division office for nice facilities and site visits arranged by them.

This report includes the day-to-day details of training program at DIRD, Pune. It also contains the study and observations performed by me. I learned valuable information regarding various Operation and maintenance of drainage work and collected reference materials and Technical Notes from the office.

Acknowledgement

I take this opportunity to express my gratitude to those whose active help and support make this report possible in the present form.

First of all, I express my sincere gratitude to **Er K.M. Shah Saheb**, Superintending Engineer and Director, DIRD, Pune and **Er. Giri Saheb,** Superintending Engineer for insisting in me the drive to work hard and for inculcating in me the discipline to think clearly.

It is the endless guidance and constant encouragement of Er. **Shivaji Rajale** saheb Executive Engineer, IRD, Pune and I would like to express my heartfelt gratitude to him and his staff for providing us necessary technical information along with the arrangement of field visits. He shared his valuable experiences with us and it was the most enjoyable part of training.

My special thanks to Sectional engineer- **Er. Kiran Joshi** Saheb, for his active help and valuable guidance during site visit of Additional Mandavgan Drainage scheme.

I am also indebted to Lab in charge **Shri. Sham Naikade** Saheb and his staff for providing in-depth knowledge about various tests performed on soil and water.

Definitely the knowledge, I received during this training session was a lifetime experience and it will serve as a foundation for my career.

Last, but not least, I wish to express my gratitude towards my parents- Shivaji and Rohini, my grandparents- Rangnath and Sitabai, my uncle Raosaheb and aunty Radhika who sacrificed a lot to give me a good education.

- Pravin Kolhe BE (Civil), MTech (IITK)
(Assistant Executive Engineer)

Content

Chapter 1 Introduction

1.1 Introduction

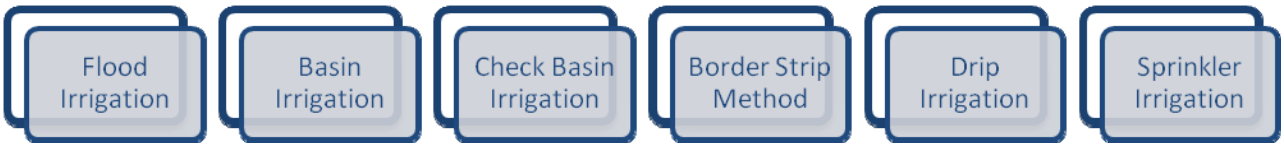
Irrigation is an artificial application of water to the soil for the following purposes

- Irrigation is needed for normal growth and yield of the plant.
- It is needed for metabolic processes of the plant.
- To reduce the soil temperature.
- For easy germination of the seeds from the soil.
- Irrigation water acts as a medium for transport of nutrients and photosynthesis in the plant system.
- To provide crop insurance against short duration drought.
- To washout dilute salts in the soil.
- To reduce the hazard of soil piping.
- To soften tillage pans.

1.2 Development of Irrigation In Maharashtra

Practice of irrigation has been in existence since time immemorial. Large and small surface tanks have been used for irrigation since ancient times. Lifting of water or diverting the same from small streams and rivers was also pursued in the olden age. In the Western Maharashtra, the first large scale irrigation work was constructed in the year 1870 on Krishna river near Karad known as Khodshi Weir and Krishna Canal system. The storage work was completed on the Mutha River in the year 1875 known as Khadakwaala storage reservoir. Thereafter, the storage works at Bhatghar, Chankapur, Darna, Bhandardara were constructed in the British Regime. In the Vidarbha area small tanks were taken up near Ramtek, Ghorajhari, Asola-Mendha and Naleshwar. In the Marathwada area no such tanks worth mentioning were constructed. However since 1954, good impetus for the construction of irrigation works was given and quite a number of schemes got completed.

1.3 Methods of Irrigation



1.4 Sources of Irrigation

1.5 Problems of Excess Irrigation

- Excess irrigation causes several changes in the soil and plant resulting in reduced growth and in some cases death of plants.
- Germinating seeds are sensitive to water logging since they are totally dependent on the surrounding soil space for oxygen supply.
- Yield of cereals depressed if the excess irrigation given at panicle development stage. iv. Excess water causes injury to the plant due to low oxygen supply to the root system and accumulation of toxic substances in soil and plant.
- Wilting of tobacco takes place when bright sunshine occurs after a prolonged wet spell.
- Leaching of nitrates and gentrification occurs resulting in nitrogen deficiency.
- . Shoot elongation, senescence, abscission and production of adventitious roots takes place as a result of continuous excess irrigation.
- Respiration in the roots change from aerobic to anaerobic with the result, toxic substances accumulates in roots and damages the root system.
- Permeability of roots decreased due to shortage of O2. It results in decreases water and nutrient uptake.

1.6 About DIRD

The DIRD, Pune had been started in 1916 as **'Special Irrigation Division'** in Pune under leadership of **`Sir Claude Cavendish'** by the then Government. **Sir. C.C. Inglis** laid the foundation of Irrigation research and Development by studying the basic causes of drainage problem and provided

solutions. The guiding principles lay down by Sir C.C. Inglis o design and construct drainage schemes in deep black cotton soils are still a landmark. In the year 1927, 'Special Irrigation Division' had been enhanced Irrigation Research and Development Circle (IRDC).
After independence, the jurisdiction of IRDC was expanded to cover Maharashtra state under **'Directorate of Irrigation Research & development (DIRD)'** in 1969. Now it has 8 field divisions and 35 sub-divisions.

1.7 About Training at DIRD

Maharashtra Engineering Training Academy (META), Nashik organized training program for direct recruits - Assistant Executive Engineer & Assistant Engineer (Class I) of Water Resource Department (WRD), in accordance with Maharashtra Engineering Service Examination-2004. As per schedule of training program, we were directed to undergo training under the guidance of Er. K.M. Shah Saheb, Superintending Engineer and Director, DIRD[1], Pune to learn about the drainage. This report includes the day-to-day details of training program at DIRD, Pune through chapter 2 to 6.

The training program was scheduled for five working days as explained in following table, starting with Inauguration on 21st January 2008 at *Er. C.C. Inglis hall*, DIRD Pune.

Day	Program
21.01.2008	Inauguration, Theoretical aspects, group formation
22.01.2008	Introduction to study area/Scheme plan/Observations to be recorded, site visit, Problem identification, Sampling
23.01.2008	Laboratory work, Affected Area mapping, Presentation, Remedial Actions proposed
24.01.2008	Design Scheme, Prepare Scheme plan & Report writing
25.01.2008	Presentation of Report, Submission of Test and Quiz.

Chapter 3 provides brief introduction to the remarkable work done by Er. C.C. Inglis in Technical Paper No. 56- 'Land Drainage in the Deccan Canal Areas'

Chapter 4 explains site visit- "Additional Madavgan Drainage Scheme", at Ghod RBC[2], Ganegaon, Tal Shirur, Dist-Pune with Er. Kiran Joshi Saheb, Sectional Engineer. After visiting site, we observed land and indentified

[1] Directorate of Irrigation Research and Development.
[2] Right Bank Canal

problem of field salinity and water logging. We collected soil samples from 6 pits at four intervals of depth (0-20, 20-40, 40-80 and 80-100cm) and water samples from 2 wells by observing water levels of 18 wells as well as collected water sample from a drain and measured discharge.

Chapter 4 contains details of tests on soil and water samples, viz., Electrical Conductivity (EC) and pH under the guidance of Shri. Sham Naikade, Lab In charge. As per result of the tests, we concluded that the given area is completely saline and water-logging is major problem associated with that. From the data of sample collection, we mapped the affected area and proposed remedial action to reclaim the affected land. We tried our best to propose the design scheme and prepared the scheme plan.

The design scheme and action plan proposed as a remedy to the affected area included in chapter 6.

Chapter 2. Inauguration and Lectures [Day 1]

2.1 Introduction

Maharashtra Engineering Training Academy (META), Nashik organized training program for direct recruits - Assistant Executive Engineer & Assistant Engineer (Class I) of Water Resource Department (WRD), in accordance with Maharashtra Engineering Service Examination-2004. As per schedule of training program, we were directed to undergo training under the guidance of Er. K.M. Shah Saheb, Superintending Engineer and Director, DIRD[1], Pune to learn about the drainage. This chapter presents the details of First Day of training session at DIRD.

2.2 Inauguration

Date: 21.01.2008, Time: 11:30 AM
Venue: Sir. C.C. Inglis Hall, DIRD Pune
Hon'ble Guest: Er. K.M. Shah Saheb, Superintending Engineer and Director of DIRD, Er. Giri Saheb, Superintending Engineer and Er. Shivaji Rajale, Executive Engineer, IRD.

Hon'ble dignitaries on the dice

[1] Directorate of Irrigation Research and Development.

Er. K.M. Shah Saheb introduced us about the history of DIRD and the sort of research work undertaken by this circle. He explained about water logging and drainage problem and stressed on the need of monitoring of command, to improve the irrigation efficiency. Er. Giri saheb also guided us.

2.3 Topic: Land Drainage and Reclamation Technology
-By Er. Shivaji Rajale,
Executive Engineer, IRD, Pune

Presentation by Shri. Rajale Saheb.

Crop faces four types of stresses-

- Due to excess water as a result of surface stagnation.
- Due to high amount of sodium.
- Due to excess salt in root zone.
- Due to high water table.

Diagnostic criteria of salt affected land and water-

USDA Criteria
DIRD Criteria
ICAR Criteria

Following two tests are performed on soil sample-

1. Electrical Conductivity
    a. Dilution Method
    b. Saturation Extract method
2. pH

Remedies on water logging-

I. Preventive measures

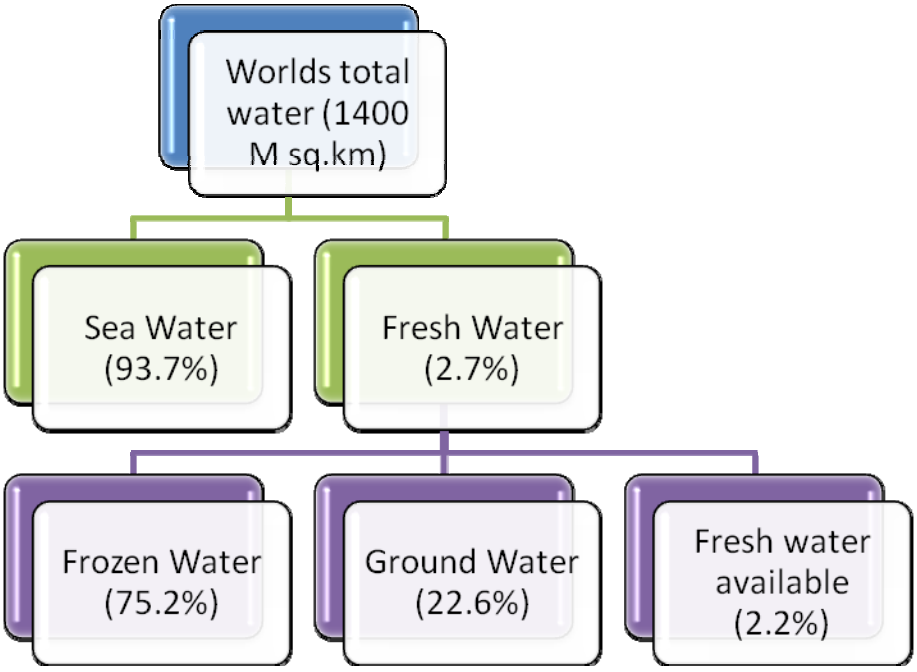
1. Irrigation as per crop water requirement
2. Preventing leakages from canal
3. Adopting appropriate cropping pattern
4. Proper land slope and field drainage

II.Curative measures

1. Controlling water table and soil moisture
2. Soil amendment
3. Salt leaching
4. Bio-drainage

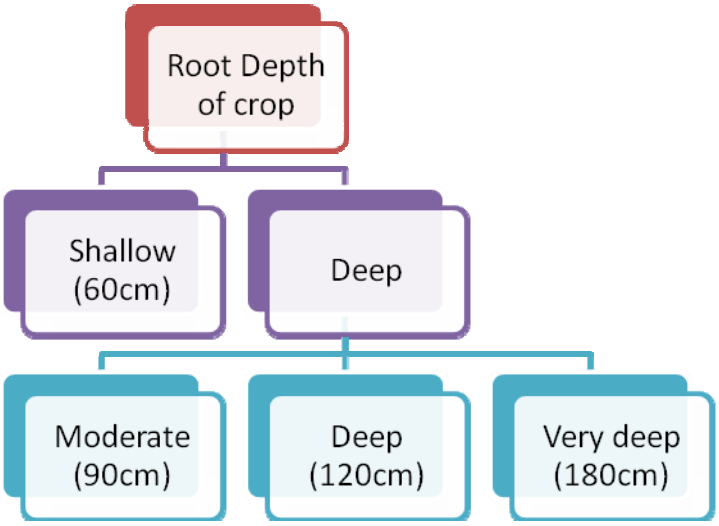
2.4 DIRD Procedure and Practice
By Shri. Anil Kapare,
SDE, Thane

Presentation by Shri. Kapare Saheb.

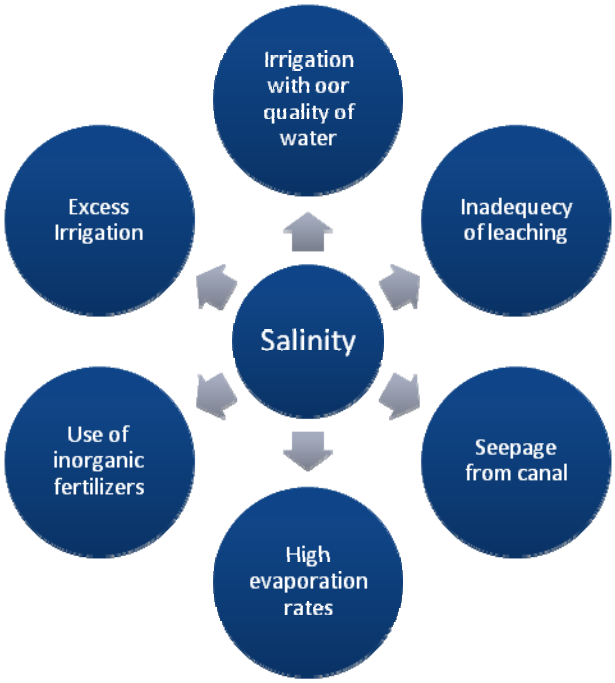


Activities of DIRD

- Pre irrigation soil survey
- Monitoring the health of the command of various canal systems.
- Survey and preparation of plans and estimates of drainage schemes
- Construction and maintenance of drainage schemes
- Research in irrigation and ground water management studies
- Monitoring of water user's societies
- Participation in various agricultural exhibitions on behalf of WRD
- Fixation of 'X Limit' (i.e. extent to which sugarcane can be sanctioned for each outlet of the project)
- Publication of quality magazine- 'Maharashtra Sinchan Vikas'



The causes of salinity of land is due to following reasons-



Classification of salt affected area-

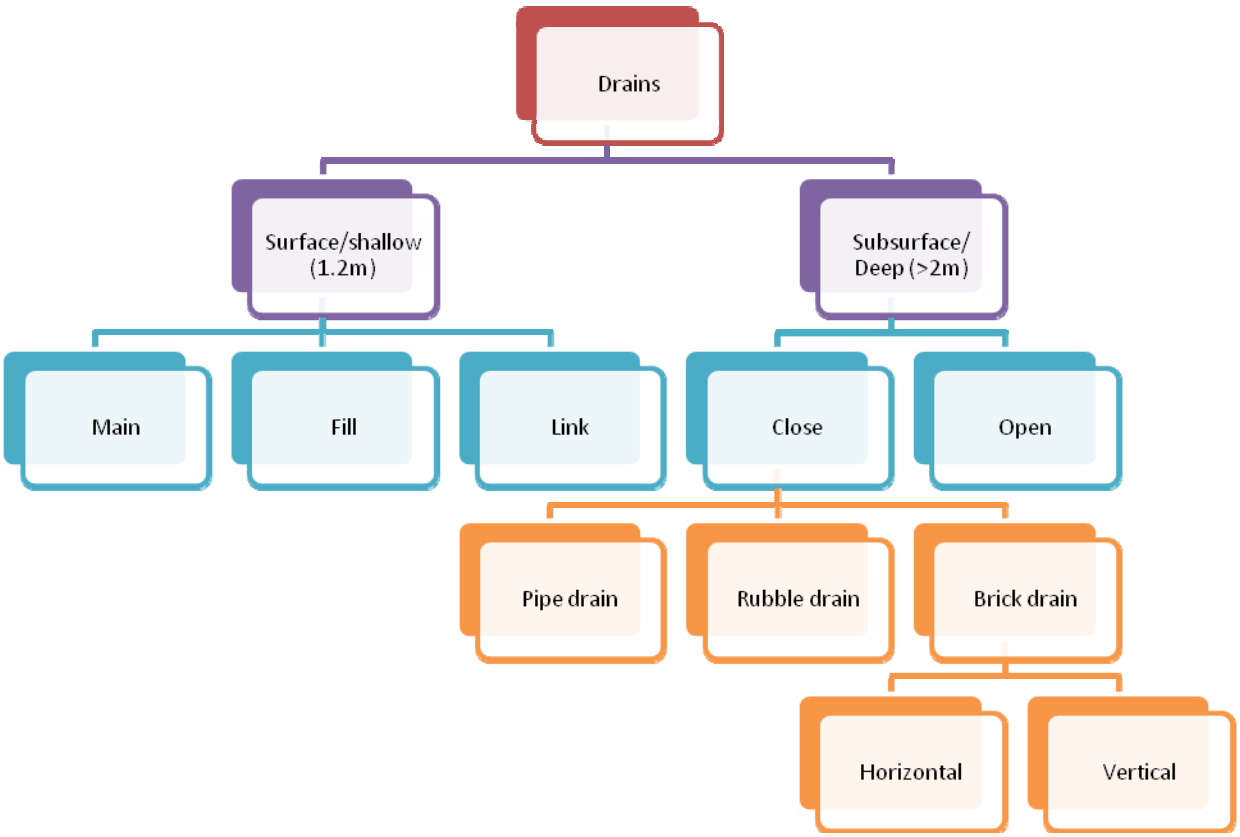
Class	**EC (dS/cm)**
Non saline	EC<1
Slightly saline	1<EC<3
Fully saline	EC>3
Monitoring of salt affected area is done in Feb-April	

Classification of water logged area-

Water logged areas are classified and demarcated on the basis of following norms

Class	Remark
Fully water logged	Water level at Ground level
Slightly Water logged	Water level below 1.2m (DIRD Norms)
	Water level below 2m (CWC[1] Norms)
Post monsoon well observations (Nov-Jan) is used for water logging observations and water level testing is performed at every leap year	

Classification of drain



Future strategy

- Identification of damage area with remote sensing
- Fixation of 'X limit' in new canal command area
- Maintenance of completed drainage schemes
- Cleaning of natural nalla
- Construction of pipe drains instead of open surface drains
- Involvement of farmers

[1] Central Water Commission

2.5 Soil Survey Techniques for irrigation projects
By Shri. S.M. Amritkar,
Soil Scientist, DIRD

Purpose of Soil Survey:

Soil survey provides comprehensive information about soil and soil resources of the area. They consist in study and recording important characteristics of soil in field and laboratory.

Objective-

1. Fundamental: Genesis, development, classification and nomenclature
2. Objective nature: Planning, land use development under irrigation and management.

Types of soil survey

I. Reconnaissance: Scale: 1:1mile or 1:63360 or 1:50,000 (toposheet)
II. Detailed Survey: Scale: 1:10,000 or 1:20,000

For major and medium projects, 400m grid for one augur pit
For minor project, 200m grid for one augur pit

Soil Series:

The soil series are established by DIRD to classify the soil, based on various parameters such as, Place, Surface texture, IAR[1] norms for depth, DIRD norms for depth slope and erosion.

1. **Soil Texture:** It is obtained by performing Mechanical Analysis and classifying the texture from 12 classes of clay, silt and sand.
2. **IAR Depth norms**

Class	Depth (cm)
D1- Very shallow	0-7.5
D2- Shallow	7.5-22.5
D3- Moderate deep	22.5-45
D4- Deep	45-90
D5- Very deep	Above 90

3. **DIRD depth norms**

[1] Indian Council for Agricultural Research

Class	Depth (cm)
MI1- Very shallow	0-20
MI2- Shallow	20-40
MI3- Medium I	40-100
MI4- Medium II	100-250
MI5- Deep	>250

4. Slope classes

Class	Slope (%)
A- Nearly Level	0-1
B- Very Gently Sloping	1-3
C- Gently sloping	3-5
D	5-10
E	10-15

5. Erosion classes

Class	
e1	Non to slight
e2	Moderate
e3	Severe
e4	Very Severe

In Western Maharashtra there are five series as-

Series	Depth (cm)
Vir	0-20
Shirol	20-40
Ghumari	40-120
Anagar	120-250
Barshi	Above 250

Soil Irrigability classes

Class	Norm
Class A	Non to slight soil limitation for sustainable use of under irrigation
Class B	Moderate soil limitation
Class C	Severe Soil Limitation
Class D	Very severe soil limitation
Class E	Not Suitable for irrigation

Land Irrigability classes

Class	Norm
Class 1	Land that have few limitations for sustainable use of irrigation
Class 2	Moderate land limitation
Class 3	Severe Land Limitation
Class 4	Land that are marginal for sustain use of under irrigation because of severe limitation
Class 5	Temporary not suitable, pending further investigation
Class 6	Land that are not suitable for sustain use under irrigation

Discussion with Executive Engineer- Shri. Shivaji Rajale saheb.

Chapter 3 Land Drainage in Deccan Canal Areas

3.1 What is drainage

As per definition of 'Drainage' given in Technical Note No. 56, "Land Drainage in the Deccan Canal Areas", it consists in providing an outlet for the excess water in the sub-soil. The succeeds of drainage scheme depends on-

1. The possibility of a free outfall from the natural line of drainage according to the topological features of the area.
2. The existence of a pervious stratum at such a depth that the drain which will cut into it, will be deep enough fro the root zone of the crops to be grown, yet not so deep as to be uneconomical.

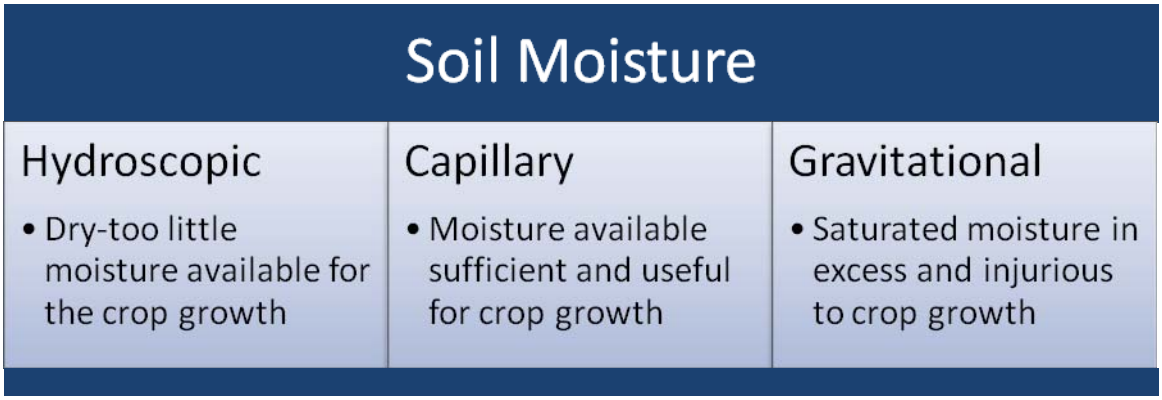
3.2 Properties of the soil

Class of soil	Effective diameter of the soil particle (mm)	Percentage of ore space	Effective surface area per cubic feet of soil particles in sq. ft.
Clay and loam	Below 0.05	44 to 53	9,100 to 173,300
Sandy soil	Between 0.05 to 2.00	About 35	8,380 to 15,870

3.3 Soil Moisture

The capacity of the soil to retain moisture bears a very close relation to its textural and structural characteristics, but it is difficult, if not impossible, to test this capacity without destroying the original structure. Whenever a sol is saturated with water for a considerable period of time, any structure, it may have possessed breaks down. Soil moisture is divided on three forms-

1. Hydroscopic moisture
2. Capillary or film moisture
3. Gravitational moisture



3.4 Protected Area

Protected area is the area considered to protect the irrigated lands against water logging by providing drains.
The percent protected area is considered to be-

- For medium soil: 350 to 400 m on either side of drain
- For deep soil: 200 to 250 m on either side of drain

Medium soil generally comprise murum at depths between 18'' to 8'' below ground. In other words it is the area lying between 18" and 8 feet MIB[1]. The type of soil above murum is black soil, chopan line kankar and murum etc. below. Drains in medium soil are fairly economical.
Deep soil is known as to be having murum at depths more than 8 feet below ground. One drains having depths more than 8' to 3m are found uneconomical fro maintenance.
Considering the sub-strata in the catchment of a drain the area that will be protected by drains depends on the pervious stratum in the catchment area.
As the area of depths of these different porus stratum (i.e. sand, kankar and murum) is different in different locations, the above norms for protected area are found suitable as per general experience and practice.

3.5 Demarcation of waterlogged area

Water logged areas are identified by observing water levels in the existing wells in canal command area and also by water levels in 10 cm diameter augur holes taken, if the number of wells in area is insufficient and as per requirement of field condition.
In addition to water level observations such areas are identified where water level has reached the ground surface. Indication of slightly waterlogged

[1] Murum Iso Bar

areas is also possible on the basis of growth of vegetation like Bull rush, Pankanis (Typha) Kubabhul, Kunda etc.
On the basis of these water level observations 1.2m and 3.0m HIB[1] are marked on the command map. The area where sub-soil water table is up to 1.20m (2m as per CWC norms) requires immediate attention and remedial measures; this area is known as **danger zone**.
The area where SSWT is between 1.20 to 3.0 m is kept under careful watch and is termed as **alarming zone**.

3.6 Soil Salinity

Soil salinity as observed at Ganeaon, Tal-Shirur

The water rises from below the ground by capillary action in soils bring with it soluble salts in solution. The soluble salt contained commonly in soil in Maharashtra state are $NaCO_3$, K, $CaCO_3$, $CaSO_4$, MgCl, Na2, So_4, $CaCl_2$, $MgSO_4$, $NaHCO_3$
When this saline solution approaches ground surface and comes under influence of wind or air and sun, water evaporates and salts are seen deposited at or near the ground surface.
Salts usually found in Deccan are sulfates and Chlorides of sodium and calcium and carbonates of soda in rare cases.

[1] Hydro Iso Bath: Line joining the points of equal sub-soil water depth

3.7 Demarcation of Salt Affected Area

Soil samples in the damaged area are tested for its electrical conductivity and pH values. The norms are as follows-

Non-saline	**EC is up to 1 Mmhos/cm**
Slightly saline	EC is between 1 and 3
Fully Saline	EC more than 3

The salt affected areas are identified on ground by visual inspection and local inquiry.
Full salt affected areas are marked where salt concentration is seen on ground surface. Slight salt affected areas are demarcated where there Assistant Engineer few crops or with poor conditions of crops.

Salts affected the growth of crop

On the basis of crop growth, patches of salt in that area, the area is roughly demarcated and samples of affected soil at different depths are collected and tested for EC and pH values.

Various depths at which samples of soil are tested are as below-

1. 0 to 20 cm
2. 20 to 40 cm
3. 40 to 80 cm
4. 80-120 cm

These soil samples are tested in soil testing laboratory fro 1:2 soil water suspension and EC pH values are determined with the help of conductivity meter and pH meter.

The relation between Soil classification and drainage system or depth of drain.
MIB: A murum ISO bath is a line along which murum lies at a constant depth.
HIB: Hydro ISO bath denotes the points at which the sub-soil water level is same.

3.8 Shallow Pits:

The 18'' MIB depth is the limit of shallow soil suitable for cane under normal conditions. This area limited by 18'' MIB is shown as shallow soils. However this shallow soil is not suitable for drain as if cane is planted in these shallow soils more water is required and delay in watering will damage the crops.
Hence irrigation of cane is risky and no cane blocks are approved. Also extra water required finds its way into substrata and then percolates to low-lying area causing water logging to lands.

3.9 Medium Soils

Formerly, 10 feet MIB was considered to indicate the economical limit for depth for drains. But considering additional data from year to year of greater knowledge of sub soil and experience gained on the early constructed drainage schemes, it was found that 8 feet MIB was economical depth for drains (except in rare cases) Also line of demarcate between fine black and chopan black soil closely agrees with the and feet MIB. Therefore area between 18'' and 8 feet MIB is suitable for cane and drain purpose.

3.10 Deep Soils

The area between line of 8 feet MIB and nalla or river is termed as deep soils. This area having murum at depths more than 8 feet is generally not suitable for planting cane. As this soil contains chopan black soils which are not suitable for drainage purpose.

The pre-irrigation soil survey of command area under Khadakwasala Project was carried out during 1960. For asserting 18'' MIB and 8 feet MIB one auger bore and one open pit per sq. km of command are ahead been taken prior to 1970. As data collected seems random and hence 18'' MIB and 8 feet MIB information does not fairly tallies with the strata collected during the survey work of the proposed drain.

3.11 Design of drain

Design of drain includes-

1. Main drain
2. Sub-drain/branch drain
3. Out fall
4. Bed gradient of drain
5. Drain discharge

1. Main Drains:

Main drains ate intended to serve the combined purpose of subsoil drain and carrier drain, for several branches.

General, main drain is located through damage area after due consideration of sub soil stratum, cutting the previous strata to have efficient drainage.

In case of perennial irrigation over a large area the damage and subsoil water table will show major and minor sub soil valleys and 8' MIB.

Drain at Ganegaon, Tal- Shirur

2. Sub drains/Branch drains:
All such major and minor valleys will require drains known as branch darns or sub drains, for reclamation of overlying damaged area and protection against are a where sub soil water table has risen.

3. Out Fall:
Downstream of the point where damage terminates, the drain will usually be a carrier drain, this portion carrying the drain water safely without any obstruction is known as out fall. The depth and grade of out fall will be such as it will not cause any heading up of water and no consideration for perviousness of the subsoil, with non silting velocity.

4. Bed Gradient of Drain
The bed gradient of open trenches should be as far as possible uniform. The depth of drain should be taken at such depth as bed cuts the pervious strata viz., sand, man, or murum sufficiently. If it does not cut a porus sub-strata it will act as a carrier drain only, which is not useful to lower down the sub soil water table.
The bed slope of drain should be as far as possible having non-silting and non-scouring velocity. But it is generally been found that non scouring velocity is not important as drain mostly cut into murum or chopan and do not therefore scour easily. Silting and obstructions generally occur on flat gradient where drainage is most needed.

6. Drain Discharge:
The discharge through drain is considered mainly from discharge due to percolation from perennials and seasonal combined, amounting to 1.0 cusecs per 250 acres (100 hectares) of land for perennial irrigation.
This has been worked out from-

1. Canal percolation at ½ cusecs per mile or per 1.6 km
2. Percolation from distributor and outlet channels at 5 % of discharge at dy. Head per 1.6 km and
3. Percolation from cane irrigation at 1 cusecs per 100 Acres (40 hectares) or 250 acres (100 hectares)

Chapter 4. Study Area Site Visit [Day 2]

4.1 Introduction

On 22nd January First group of Assistant Executive Engineer's along with Er. Kiran Joshi, Sectional Engineer, visited 'Additional Mandavgan Drainage Scheme', located at Ganegaon, Tal-Shirur of Pune District.
We had the catchment map, sample bags, two plastic bottles for collecting water samples, data sheets, Auger, measuring tape at site.

4.2 Problem Identification

We first sight, we noticed the water logged area and water level in the well was just below the ground level as shown in following photograph

Water Level in the well

We observed 18 such wells and collected water samples from 2 representing wells fro EC and pH testing at laboratory.
We also noticed that the crop was highly damaged due salinity and following photograph shows the saline land

Saline land and damaged crop

4.3 Soil Sampling

Then we selected six locations for taking samples with auger. We collected 4 samples representing 0-20, 20-40 cm 40-80 and 80-120 cm depth.

Sample collection by auger

4.4 Discharge through drain

We also measured the discharge of the existing drain, which is found to be 10 lit/sec.

The discharge measurement is at very crude level, since we measured the dimensions of the section of drain (i.e. top and bottom width), which is a straight stretch of more than 10 m long. Then we obtained the cross-sectional area of water flow and multiplied that with velocity of water to get the discharge through drain.

At site

Chapter 5. Laboratory Tests and results [Day 3]

5.1 Tests conducted on soil

EC: Electrical Conductivity
PH
Hydraulic Conductivity
Maximum Water Holding Capacity
Mechanical Analysis

5.2 Water Samples

We have following observations of water levels with us. As per DIRD norms, The area where sub-soil water table is up to 1.20m (2m as per CWC norms) requires immediate attention and remedial measures; this area is known as **danger zone**.
The area where SSWT is between 1.20 to 3.0 m is kept under careful watch and is termed as **alarming zone**.

Observation of Water levels in well

Sr.No.	Name of village	S.N.	Date	Water Level	Remark
1.	Ganegaon	45A	22.01.2008	3.8	Safe zone
2.	Ganegaon	77A	22.01.2008	2.3	alarming zone.
3.	Ganegaon	77B	22.01.2008	2.3	alarming zone.
4.	Ganegaon	80A	22.01.2008	1.5	alarming zone.
5.	Ganegaon	81	22.01.2008	2.5	alarming zone.
6.	Ganegaon	45B	22.01.2008	1.0	danger zone
7.	Ganegaon	75	22.01.2008	3.2	Safe zone
8.	Ganegaon	76	22.01.2008	2.6	alarming zone.
9.	Ganegaon	43	22.01.2008	0.9	danger zone
10.	Ganegaon	77C	22.01.2008	2.5	alarming zone.
11.	Ganegaon	80B	22.01.2008	2.0	alarming zone.
12.	Ganegaon	79A	22.01.2008	2.0	alarming zone.
13.	Ganegaon	57B	22.01.2008	2.2	alarming zone.
14.	Ganegaon	78A	22.01.2008	3.0	Safe zone
15.	Ganegaon	78B	22.01.2008	3.2	Safe zone
16.	Ganegaon	79B	22.01.2008	2.3	alarming zone.
17.	Ganegaon	55A	22.01.2008	0.7	danger zone
18.	Ganegaon	55B	22.01.2008	1.6	alarming zone.

5.3 Soil Samples

Following table shows the Soil Samples collection. The EC and pH tests were conducted in the Soil Testing Laboratory located at Swargate, Pune under the guidance of Shri. Sham Naikade and lab staff. As per DIRD norms,

Non-saline	**EC is up to 1 Mmhos/cm**
Slightly saline	EC is between 1 and 3
Fully Saline	EC more than 3

Sr. No.	Village	SV. No.	Pit No.	Depth (cm)	EC (dS/cm)	pH	Remark
1.	Ganegaon	55	1	0-20	17.86	7.98	Fully Saline
2.				20-40	16.63	8.18	Fully Saline
3.				40-80	8.33	7.90	Fully Saline
4.				80-120	8.90	7.90	Fully Saline
5.	Ganegaon	54	2	0-20	13.42	8.37	Fully Saline
6.				20-40	10.84	8.28	Fully Saline
7.				40-80	10.12	8.06	Fully Saline
8.				80-120	8.12	7.91	Fully Saline
9.	Ganegaon	44A	3	0-20	15.41	8.35	Fully Saline
10.				20-40	10.23	8.28	Fully Saline
11.				40-80	8.27	7.98	Fully Saline
12.				80-120	7.48	7.94	Fully Saline
13.	Ganegaon	43	4	0-20	19.61	8.70	Fully Saline
14.				20-40	15.34	8.50	Fully Saline
15.				40-80	8.42	8.42	Fully Saline
16.				80-120	5.41	8.22	Fully Saline
17.	Ganegaon	44B	5	0-20	17.45	8.73	Fully Saline
18.				20-40	13.58	8.45	Fully Saline
19.				40-80	11.02	8.44	Fully Saline
20.				80-120	8.90	8.09	Fully Saline
21.	Ganegaon	45	6	0-20	18.03	8.66	Fully Saline
22.				20-40	13.48	8.47	Fully Saline
23.				40-80	11.21	8.41	Fully Saline
24.				80-120	8.74	8.11	Fully Saline

5.4 Drain Water

As stated above, the discharge measured at drain=10 lit/sec. The EC value of drain water is 5.72 and pH is 7.99, which indicates that water is saline.

Chapter 6. Design Scheme and Remedial actions proposed for Affected Area [Day 4]

6.1 Area mapping

After getting results of EC and pH on soil and water sample, the affected area is mapped on a given map. For this, the contours of EC are plotted and the affected area is shown on the sheet with different colors. Since we have limited number of test data, it is not possible to accurately demarcate the affected area. If number of samples increased, better accuracy can be achieved.
New techniques like Remote Sensing can be used to avoid such obstacle. A project already undertaken by IRD division in co-operation with University of Pune to demarcate the affected area in the command of Krishna. This is one of the effective tools, which gives quite accurate results.

6.2 Remedial Actions Proposed

a. Preventive

The land adjoining to affected area should be prevented from water logging, and salinity and hence following preventive measures are proposed-

1. Sprinkler and Drip Irrigation
2. Crop Pattern and crop rotation
3. Leakage Prevention from canal
4. Proper land slope and drainage arrangement

b. Curative

For the affected land following curative measures are proposed-

1. Cross drains
2. Controlling Water Table and Soil moisture
3. Soil Amendment
4. Soil leaching
5. Bio drainage
6.

6.3 Sprinkler Irrigation

Sprinkler irrigation system conveys water from the source through pipes under pressure to the field and distributes over the field in the form of spray of 'rain like' droplets. It is also known as over head irrigation.
Different types of sprinkler systems namely portable, semi-portable, semi-permanent and permanent are in vogue. But due to increased labour costs and energy costs, different types of sprinklers are developed.

Centre-pivot system is largest sprinkler system with a single machine can irrigate up to 100 ha. A centre - pivot sprinkler consists of a series of sprinklers mounted on a lateral pipe, 50 - 800 m long, mounted or carried by a row of five or more mobile towers.

One end of the lateral is fixed on a pivot pad. The unit rotates around a centre pivot where water is pumped into the pipe, and water is distributed through sprinkler fitted on lateral. The limitations of this system are,

10 - 20 % of area is not irrigated at the corners of square or rectangular plot.

High energy requirement and Huge cost of the equipment.

Now lateral - move systems are developed to overcome the draw backs in centre-pivot system for irrigating square or rectangular plots. This irrigation system consists of lateral - move systems which move up and down the field.

Sprinkler irrigation can be advantageously chosen in the following situations-

- When the soil is too shallow eliminating the possibility of leveling of lands.
- When the land is too steep (> 1% slope).
- When light (< 5 cm) and frequent irrigations are to be given.
- When soils are very sandy (rapidly permeable coarse textured soils) and
- When supplemental irrigation is to be given to dry land crops during prolonged dry spells, without any land preparation.

Conclusion

One week training session at DIRD, Pune started on 21st January 2008 and ended on 25th January 2008. One of the most important aspects of irrigation is to recultivate the affected land. The first phase is to identify affected land with the help of various techniques. Once affected land is identified, area mapping is done and preventive and curative measures are suggested.

I enjoyed the training and learned various practical and theoretical aspects of irrigation drainage. Water logging, salinity, soil series, area mapping etc aspects were discussed by the officers during training. The research work and reference material at DIRD is of high quality and it helped us to learn about drainage. I take this opportunity to express my heartfelt gratitude to Er. Shah saheb, Er. Rajale saheb and all the staff of the circle and division office for nice facilities and site visits arranged by them.

This report includes the day-to-day details of training program at DIRD, Pune. It also contains the study and observations performed by me. I learned valuable information regarding various Operation and maintenance of drainage work and collected reference materials and Technical Notes from the office.

I am thankful to all the staff of the DIRD Pune for giving me an opportunity to learn about drainage system.

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