## CONTENTS

## Foreword

| .• | The need for drainage   |    |
|----|---|----|
|    | PERMEABILITY  |    |
|    | PLANT GROW  |    |
|    | Irrigation  | 3  |
|    | SOIL CONSERY TION   | 4  |
|    | Temperature   | 4  |
|    | PRACTICAL BI  | 4  |
| 2. | Methods of draining   |    |
|    | OPEN CHANNELS   |    |
|    | SURFACE DRAINS  |    |
|    | SUBSURFACE DRAINS   | Q  |
|    | Pipe drainage – Mole drainage Comt mol pipe Irainage – Subsoiling                                       |    |
|    | CHOIC OF METHOD   | 12 |
|    | Underdrainage layout  |    |
|    | FACTORS AFFECTING THE LAYOUT  | 14 |
|    | Types of drain patterns   | 15 |
|    | Ditch-to-ditch systems – Regular parallel systems – Herringbone   |    |
|    | systems – Regular downhill systems – Random systems – Intercepting systems – Combined mole-pipe systems |    |

| 4. | Materials   | 20 |
|----|---|----|
|    | OLD FORMS OF CHANNEL  | 20 |
|    | Faggot drains - Stone culvert drains - Timber box drains - Turf drains - Stone-filled trenche's |    |
|    | CLAYWARE PIPES  | 24 |
|    | Development - Manufacture - Quality   |    |
|    | CONCRETE PIPES  | 28 |
|    | Manufacture   |    |
|    | BITUMINIZED FIBER PIPES   | 29 |
|    | PLASTIC MATERIAL  | 30 |
|    | OTHER MATERIALS   | 31 |
|    |   |    |
| 5. | Tools and machines  | 33 |
|    | HAND TOOLS  | 33 |
|    | Machines  | 35 |
|    | Trench excavators - Back-filling machines - Haulage and other machines                          |    |
| 6. | Drain installation  | 46 |
|    | STANDARD OF WORK  | 46 |
|    | HANDWORK  | 49 |
|    | Machine work  | 54 |
|    | Continous cutting machines - Back-acting machines - Plow-<br>type machines                      |    |
|    | OTHER METHODS   | 58 |
|    | Adapted mole plow - Plastic drains - In situ concrete   |    |
|    | GRADING   | 64 |
|    | Sighting target method - Spirit level method - Water level method - Running water method        |    |

| CI     | ON | TE  | 983   | TO  |
|--------|----|-----|-------|-----|
| 27 447 |    | 4.4 | 12.70 | 1.0 |

|     | CONTENTS  | 13  |
|-----|---|-----|
| 7.  | Junctions and outfalls  | 72  |
|     | JUNCTIONS   | 72  |
|     | Special pipes - Cut pipes - Inspection chamber junctions      |     |
|     | OUTFALLS  | 76  |
|     | Number of outfalls - Construction - Outfalls to deep channels |     |
|     | SURFACE INLETS  | 83  |
| 8.  | Mole drainage   | 86  |
|     | Son.  | 86  |
|     | SURFACE UNDULATIONS   | 88  |
|     | LAYOUTS   | 89  |
|     | OUTFALLS  | 89  |
|     | Direct to ditch - Mole channel mains - Pipe mains             |     |
|     | MOLE DRAINAGE MACHINES  | 93  |
|     | Beam type - Tractor-mounted                                   |     |
|     | Installation  | 97  |
|     | PERMEABLE FILLING   | 99  |
| Bil | bliography  | 101 |
|     |   | 1   |