CONTENTS

Page No.

CHAPTER 1 – General

1.1 Introduction 1

1.2 Hydroelectric Potential 1

1.3 Perspective Planning for Harnessing Hydro Potential 5

1.4 Incidences of Flooding 5

1.5 Analysis of Flooding Incidents 7

1.6 Review of Preventive Measures 8

1.7 Need for a Manual on Prevention Against Flooding of Hydro Power Stations 8

CHAPTER 2 – Hydro Power Projects Types and Major Components

2.1 Type of Hydro Power Projects 9

2.1.1 Run-of-River Projects 9

2.1.2 Storage Projects 9

2.1.3 Pumped Storage Projects 9

2.2 Classification of Hydro Power Stations 9

2.2.1 Surface Power House 9

2.2.2 Semi Underground Power House 9

2.2.3 Underground Power House 9

2.3 Major Components of Hydro Power Projects 10

2.3.1 Water Conductor System 10

2.3.1.1 Dams 10

2.3.1.2 Barrages 10

2.3.1.3 Water Intake Structure 10

2.3.1.4 Head Race Tunnel/Channel 10

2.3.1.5 Surge Shaft 10

2.3.1.6 Penstock Protection Valve 10

2.3.1.7 Penstock/Pressure Shaft 10

2.3.1.8 Tail Race (Tunnel/Channel) 10

2.3.2 Hydro Mechanical Equipment 11

2.4 Power House 11

2.4.1 E&M Equipment in Power House 11

2.4.1.1 Main Inlet Valve (MIV) 11

2.4.1.2 Turbine 11

Page No.

2.4.1.3 Draft Tube 12
2.4.1.4 Governor 12
2.4.1.5 Generator 12
2.4.1.6 Excitation System 12
2.4.1.7 Bus Duct 12
2.4.1.8 Generator Step up Transformer 12
2.4.1.9 High Voltage Switchgear/Gas Insulated Switchgear (GIS) 13
2.4.1.10 Outdoor Pot Yard Equipment/Outdoor Switchyard 13
2.4.1.11 Control, Metering & Protection System 13
2.4.1.12 AC Power Supply 13
2.4.1.13 DC Supply System 13
2.4.1.14 EOT Crane 14
2.4.1.15 Fire Protection System 14
2.4.1.16 Cooling Water System 15
2.4.1.17 Drainage & Dewatering System 15
2.4.1.18 Ventilation & Air Conditioning System 15
2.4.1.19 LP and HP Compressed Air System 15
2.4.1.20 Public Address System 16
2.4.1.21 Power House Lift 16

CHAPTER 3 – Case Studies

3.1 Kulhal Power Station (3 × 10 MW), Uttarakhand, UJVNL – O&M Stage 17
3.1.1 General Description of the Project 17
3.1.2 Salient Features 17
3.1.3 Incident (Dated 27.06.2008) Details 17
3.1.4 Cause of Flooding 18
3.1.5 Action for Restoration 18
3.1.6 Restoration Activities 19
3.1.7 Loss of Revenue 19
3.1.8 Preventive Measures to Avoid Similar Incident 19
3.2 Dehar HE Project (6 × 165 MW) – Punjab, BBMB - O&M Stage 20
3.2.1 General Description of the Project 20
3.2.2 Incident (Dated 27.08.2006) Details 20
3.2.3 Status of Generating Units Prior to Flooding Incident 21
3.2.4 Cause of Flooding 21

Page No.

3.2.5 Action for Restoration 21

3.2.6 Resources Utilized for Restoration 21

3.2.7 Bottlenecks in Restoration 21

3.2.8 Proposed Action to avoid Future Flooding 22

3.3 Rangit HE Project (3 × 20 MW), Sikkim, NHPC – O&M Stage 22

3.3.1 General Description of the Project 22

3.3.2 Incident (Dated 11.07.2006) Details/Cause of Flooding 22

3.3.3 Action for Restoration 24

3.3.4 Resources Utilized for Restoration 24

3.3.5 Recommendations 25

3.4 Nathpa Jhakri HE Project (6 × 250 MW), Himachal Pradesh, SJVNL 25

3.4.1 General Description of the Project 25

3.4.2 Incident A – O & M Stage 26

3.4.2.1 Incident (Dated 04.09.2005) Details 26

3.4.2.2 Cause of Flooding 27

3.4.2.3 Action for Restoration 27

3.4.2.4 Resources Utilized for Restoration 27

3.4.2.5 Bottlenecks in Restoration 28

3.4.2.6 Recommendations 28

3.4.3 Incident B – Construction Stage 28

3.4.3.1 Incident (Dated 01.08.2000) Details/Cause of Flooding 28

3.4.3.2 Action for Restoration 29

3.4.3.3 Resources Utilized for Restoration 30

3.4.3.4 Recommendations 30

3.5 Ghatghar HE Project (2 × 125 MW), Maharashtra, MSEB - Construction Stage 30

3.5.1 General Description of the Project 30

3.5.2 Incident (Dated 28.06.2005) Details/Cause of Flooding 31

3.5.3 Status of Works Prior to Flooding 32

3.5.4 Extent of Damage 32

3.5.5 Relief and Rescue Operation 32

3.5.6 Action for Restoration 33

3.5.7 Recommendations 34

3.6 Urgam SHP (2 × 1500 kW), Uttarakhand, UJVNL – O&M Stage 34

3.6.1 General Description of the Project 34

3.6.2 Project Features 34

Page No.
3.6.3 Incident (August 2004) Details/Cause of Flooding 35
3.6.4 Restoration/ Reconstruction 35
3.7 Indira Sagar HE Project (8 × 125 MW), Madhya Pradesh, NHDC – Construction Stage 35
3.7.1 General Description of the Project 35
3.7.2 Incident (Dated 26.07.2003) Details 35
3.7.3 Status of Work Prior to Flooding 36
3.7.4 Cause of Flooding 36
3.7.5 Action for Restoration 37
3.7.6 Resources Utilized for Restoration 37
3.7.7 Recommendations 38
3.8 Periyar HE Project (4 × 35MW), Tamil Nadu, TNEB - O&M Stage 38
3.8.1 General Description of the Project 38
3.8.2 Incident A – O&M Stage 39
3.8.2.1 Incident (Dated 04.06.2003) Details 39
3.8.2.2 Status of Generating Units Prior to Flooding 39
3.8.2.3 Cause of Flooding 39
3.8.2.4 Action for Restoration 39
3.8.3 Incident B – O&M Stage 39
3.8.3.1 Incident (Dated 30.06.1995) Details 39
3.8.3.2 Cause of Flooding 39
3.8.3.3 Action for Restoration 39
3.8.4 Resources Utilised for Restoration 39
3.8.5 Bottlenecks in Restoration 39
3.8.6 Recommendations 40
3.9 Maneri Bhali HE Project (3 × 30 MW) Stage- I, Uttarakhand, UJVNL - O&M Stage 40
3.9.1 General Description of the Project 40
3.9.2 Incident (Dated 12.04.2001) Details 40
3.9.3 Status of Generating Units Prior to Flooding 41
3.9.4 Cause of Flooding 41
3.9.5 Action for Restoration 41
3.9.6 Resources Utilized for Restoration 41
3.9.7 Bottlenecks in Restoration 41
3.9.8 Recommendations 41

Page No.
3.10 Chilla HE Project (4 × 36 MW), Uttarakhand, UJVNL - O&M Stage 41
3.10.1 General Description of the Project 41
3.10.2 Incident (Dated 28.08.2000) Details 42
3.10.3 Status of Generating Units Prior to Flooding 42
3.10.4 Cause of Flooding 42
3.10.5 Action for Restoration 42
3.11 Sobla – Small Hydro Project (2 × 3 MW), Uttarakhand, UJVNL - O&M Stage 42
3.11.1 General Description of the Project 42
3.11.2 Project Features 43
3.11.3 Incident (Dated 06.06.2000) Details 43
3.11.4 Safe Reconstruction of Project 44
3.11.5 Action for Restoration and Recommendations 44
3.12 Vaigai HE Project (2 × 3 MW), Tamil Nadu, TNEB – O&M Stage 44
3.12.1 General Description of the Project 44
3.12.2 Incident (Dated 11.12.1998) Details 45
3.12.3 Status of Generating Units Prior to Flooding 45
3.12.4 Cause of Flooding 45
3.12.5 Action for Restoration 45
3.12.6 Resources Utilised for Restoration 45
3.12.7 Bottlenecks in Restoration 45
3.12.8 Recommendations 45
3.13 Srisailam Right Bank HE Project (7 × 110 MW), Andhra Pradesh, APGENCO – O&M Stage 45
3.13.1 General Description of the Project 45
3.13.2 Incident A – O&M Stage 47
3.13.2.1 Incident (Dated 3.10.2009) details 47
3.13.2.2 Causes of Flooding 47
3.13.2.3 Extent of Damages 57
3.13.2.4 Action for Restoration 48
Srisailam Left Bank Hydroelectric Scheme (SLBHES) 48
3.13.3 Incident B – O&M Stage 48
3.13.3.1 Incedent (Dated 15.10.1998) Details 48
3.13.3.2 Cause of Flooding 48
3.13.3.3 Extent of Damages 48
3.13.3.4 Action for Restoration 49
3.13.3.5 Resources Utilized for Restoration 49
3.13.3.6 Recommendations 50
3.13.3.7 Proposed Action to Avoid Future Flooding 50

Page No.
3.14 Doyang HE Project (3 × 2 5 MW), Department of Power, Nagaland – Construction Stage 50
3.14.1 General Description of the Project 50
3.14.2 Incident (Dated 17.08.1998) Details/ Cause of Flooding 51
3.14.3 Status of Construction Activities 51
3.14.4 Action for Restoration 51
3.14.5 Resources Utilized for Restoration 52
3.14.6 Bottlenecks in Restoration 52
3.14.7 Recommendation 52
3.15 Servalar HE Project (1 × 2 0 MW), Tamil Nadu, TNEB – O&M Stage 52
3.15.1 General Description of the Project 52
3.15.2 Incident A – O & M Stage 53
3.15.2.1 Incident (Dated 13.11.1992) Details 53
3.15.2.2 Status of Generating Units Prior to Flooding 53
3.15.2.3 Cause of Flooding 53
3.15.2.4 Action for Restoration 53
3.15.2.5 Resources Utilised for Restoration 53
3.15.2.6 Recommendations 53
3.15.3 Incident B – Construction Stage 53
3.15.3.1 Incident (Dated 25.06.1985) Details 53
3.15.3.2 Status of Generating Units Prior to Flooding 53
3.15.3.3 Cause of Flooding 53
3.15.3.4 Action for Restoration 54
3.15.3.5 Resources Utilised for Restoration 54
3.15.3.6 Bottlenecks in Restoration 54
3.16 Salal HE Projct (3 × 115 MW) Stage-1, Jammu & Kashmir, NHPC 54
3.16.1 General Description of the Project 54
3.16.2 Incident A – O & M Stage 54
3.16.2.1 Incident (Dated 10.09.1992) Details 54
3.16.2.2 Cause of Flooding 54
3.16.2.3 Extent of Damage 54
3.16.2.4 Action for Restoration 54
3.16.2.5 Resources Utilized for Restoration 56
3.16.3 Incident B – Construction Stage 56
3.16.3.1 Incident (Dated 27.07.1986) Details 56
3.16.3.2 Cause of Flooding 56

Page No.

3.16.3.3 Extent of Damage 56

3.16.3.4 Action for Restoration 56

3.16.3.5 Resources Utilized for Restoration 56

3.16.3.6 Recommendations 56

3.17 Pillur HE Project (2 × 50 MW), Tamil Nadu, TNEB – O&M Stage 57

3.17.1 General Description of the Project 57

3.17.2 Incident (Dated April 1991) Details 57

3.17.3 Status of Generating Units Prior to Flooding 58

3.17.4 Cause of Flooding 58

3.17.5 Action for Restoration 58

3.17.6 Resources Utilised for Restoration 58

3.17.7 Bottlenecks in Restoration 58

3.17.8 Recommendations 58

CHAPTER 4 – Recommendations

4.1 General 59

4.2 Design Stage 59

4.2.1 Civil 59

4.2.2 Hydro-Mechanical 60

4.2.3 Electro-Mechanical 60

4.3 Construction Stage 60

4.3.1 Civil 60

4.3.2 Hydro-Mechanical 60

4.3.3 Electro-Mechanical 61

4.4 O&M Stage 61

4.4.1 Civil 61

4.4.2 Hydro-Mechanical 61

4.4.3 Electro-Mechanical 61

4.5 Restoration of Hydro Power Plant after Flooding 62