

DEVELOPMENT OF FLOOD WARNING SYSTEM FOR AGARTALA AND KAILASHAHAR, TRIPURA

2025

MANUAL ON FLOOD FORECASTING & EARLY WARNING SYSTEM

A Guide to Using the FEWS Dashboard



Version 1.1

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&

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1 Introduction

A flood early warning system (FEWS) is a system designed to provide timely and effective warnings of impending or potential flooding, so that appropriate action can be taken to mitigate the impacts of the flood. The exact components and design of a FEWS will vary depending on the specific needs and resources of the area where it is being implemented. However, a typical FEWS might include the following steps:

1. Monitor and collect data: FEWS typically rely on a network of sensors and monitoring stations to collect data on factors that can affect flooding, such as precipitation, river levels, soil moisture, and groundwater levels. This data is collected in real-time and transmitted to a central hub for analysis.
2. Analyze and model data: The data collected by the monitoring network is analyzed and used to create computer models that forecast the likelihood and impact of potential flooding. These models take into account various factors that can affect flooding, such as the amount of precipitation, the rate at which it is falling, the capacity of rivers and other bodies of water to carry the water, and the vulnerability of the area to flooding.
3. Issue warnings: If the analysis and modeling indicate that there is a high likelihood of flooding, appropriate warnings are issued to the public and emergency response agencies. These warnings may be issued via various channels, such as social media, radio, and television broadcasts, sirens, and text messages.
4. Activate response plan: If a flood warning is issued, emergency response agencies and other organizations may activate their flood response plans. These plans may include evacuating residents from low-lying areas, sandbagging vulnerable buildings, and mobilizing rescue and recovery teams.
5. Monitor and assess impacts: During and after a flood event, the FEWS will continue to monitor the situation and assess the impacts of the flood. This information is used to update the warnings and response plan as needed, and to inform post-flood recovery and rebuilding efforts.

This Flood Early Warning System (FEWS) is a web-based application that has been developed to provide flood forecasting and early warning services for the state of Tripura, India. The system utilizes data from the Hydrologic Engineering Center's River Analysis System (HEC-RAS) model to provide flood forecasting information. The FEWS provides users with the ability to view flood forecasts in the form of maps, graphs, and tables, and generate detailed forecast reports on flood forecasts for Tripura State.

The FEWS has been developed to help stakeholders in Tripura State make informed decisions during floods and reduce the damage caused by flood events. This manual has been created to provide users with a detailed operating procedure for using the FEWS web application. The manual aims to guide users in accessing the system, interpreting the flood forecasting information, and generating reports. It is hoped that this manual will help users to understand the FEWS and utilize its capabilities to manage the impact of flood events in Tripura State.

2 Getting Started with the FEWS Web Application

2.1 System Requirements

- ✚ Operating System: Windows 10 or higher, Linux, or macOS
- ✚ Browser: Google Chrome, Mozilla Firefox, or Microsoft Edge
- ✚ RAM: 8GB or higher
- ✚ Processor: Intel Core i5 or higher
- ✚ Graphics Card: 2GB or higher
- ✚ Internet Connection: Broadband or high-speed internet connection

2.2 Accessing the FEWS Dashboard

To launch the web application, follow these steps:

- ✚ Open an internet browser such as Google Chrome, Firefox, or Internet Explorer.
- ✚ In the address bar at the top of the browser window, type in the URL for the application. The current URL for the application is <https://tripura-fews.in> ✚ Press the "Enter" key on your keyboard to navigate to the URL.
- ✚ Once the page loads, the home screen for the application will be displayed as in [Figure 1](#).

Note: If you are accessing the dashboard for the first time, you may be prompted to log in using your credentials. Please refer to section 2.3 for more information on logging in.

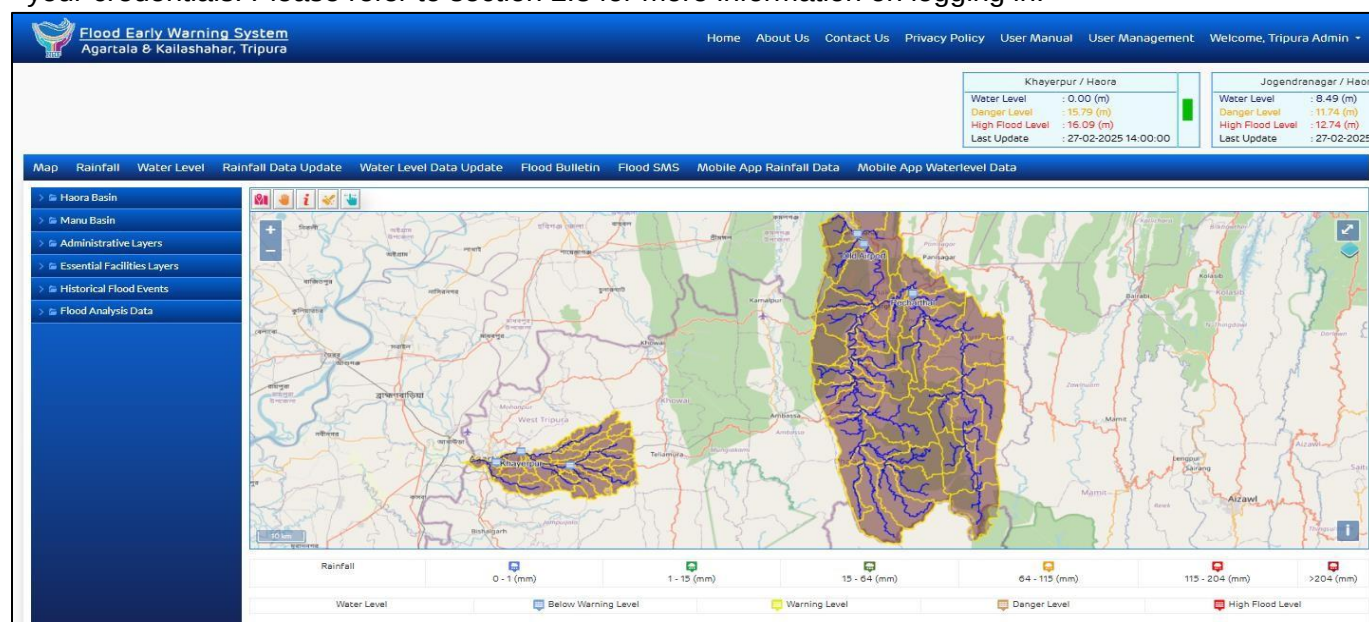


Figure 1 Home screen of the dashboard

2.3 Login Procedure

To log in to the application, enter your username and password on the login page. The login process is role-based, meaning that different users have different levels of access and permissions within the application. The following roles are available:

- ✚ **Administrator:** Administrator users have full access to the application and can manage user accounts, add, edit, view, and delete data in all modules of the FEWS.

Editor: Editor users have limited access to the application and can only access the modules for which they have been granted permission by the Administrator. Editor users do not have access to user management.

Guest User: Guest users have limited access to the application and can only view a restricted set of modules.

It is important to ensure that you have the correct login credentials and user role assigned to you before logging into the application. Here are the steps to log in to the FEWS application:

- ✚ Open the FEWS application URL in your web browser.
- ✚ Enter your username and password in the respective fields on the login page.
- ✚ Select the appropriate role from the dropdown menu.
- ✚ Click on the "Login" button.
- ✚ If the username and password are correct, the user will be logged in to the FEWS application.
- ✚ After successful login, the user will be directed to the FEWS dashboard page.

Note: If you forget your password, you can reset it by clicking on the "Forgot Password" link on the login page. You will be asked to enter your email address associated with your FEWS account, and then follow the instructions to reset your password.

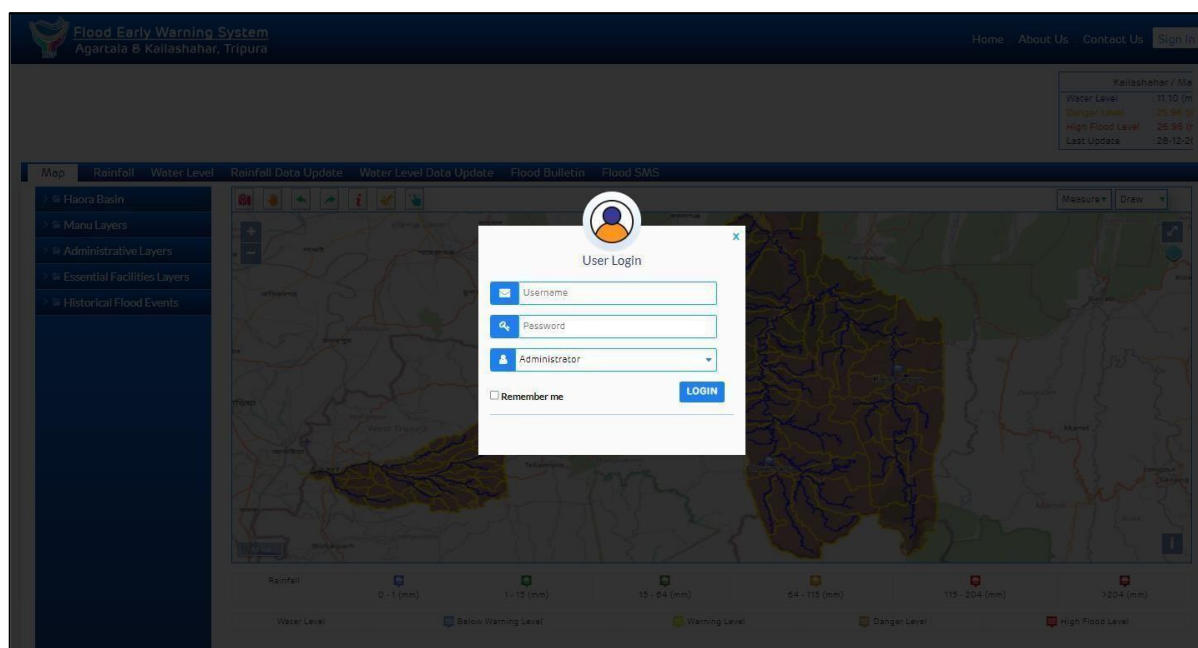


Figure 2 An example of the login window, displaying the dashboard screen of the Flood Early Warning System (FEWS)

3 Dashboard Overview

The FEWS dashboard provides a comprehensive view of water level, rainfall, and other hydrological data, allowing users to visualize and analyze data from various sources. The dashboard has been designed with an intuitive interface, making it easy to use for all levels of users.

The FEWS dashboard is divided into several sections, each displaying specific data and providing tools for analysis. These sections include:

3.1 Navigation Menu

The Navigation Menu is located at the top of the dashboard and provides easy access to different pages and functionalities. In this section, we will briefly explain each of the menu options available.



Figure 3 Visualization of options on Home Page

- ✚ **Home:** The Home page provides a brief overview of the dashboard and its functionalities. Users can access different sections of the dashboard from here.
- ✚ **About Us:** This page provides information about the developers of the dashboard, their mission, and objectives.
- ✚ **Contact Us:** This page provides contact information for the developers of the dashboard. Users can use this page to ask questions, provide feedback, or report any issues.
- ✚ **User Management:** This page provides tools and features for managing user accounts, permissions, and roles. Please refer to the 'User Management' section for more details.

3.2 Real-Time Water Level and Rainfall Information

The Real-Time Water Level and Rainfall Information feature displays a dynamic slider bar at the top of the dashboard homepage (Figure 3), which shows the current water level and rainfall data for the selected river basin. This data is updated every hour, providing users with up-to-date information on current conditions.



Figure 4 Visualization of moving slide on the homepage

detailed time-series graphs of the current day's water level and rainfall data. Users can also search for historical data for a specific date range.

This feature is especially important for users who need to monitor real-time water levels and rainfall data for flood forecasting and warning purposes. It allows users to quickly and easily access the most current data available, enabling them to make informed decisions based on the latest information.

Example:

To view the Rainfall Time Series Data, the user can click on any of the Rainfall Stations displayed on the dynamically moving slider. The user can select the Basin Name and Gauge Station, From Date, and To Date from the dropdowns. Once selected, the user can click on the search button highlighted with a blue box. Please follow the same procedure to view water level time-series data.

As an example, the user can select Manu as the Basin Name, Chawmanu as the Gauge Station, and 28-4-2023 and 28-04-2023 as the From Date and To Date, respectively (as shown in [Figure 4](#)).

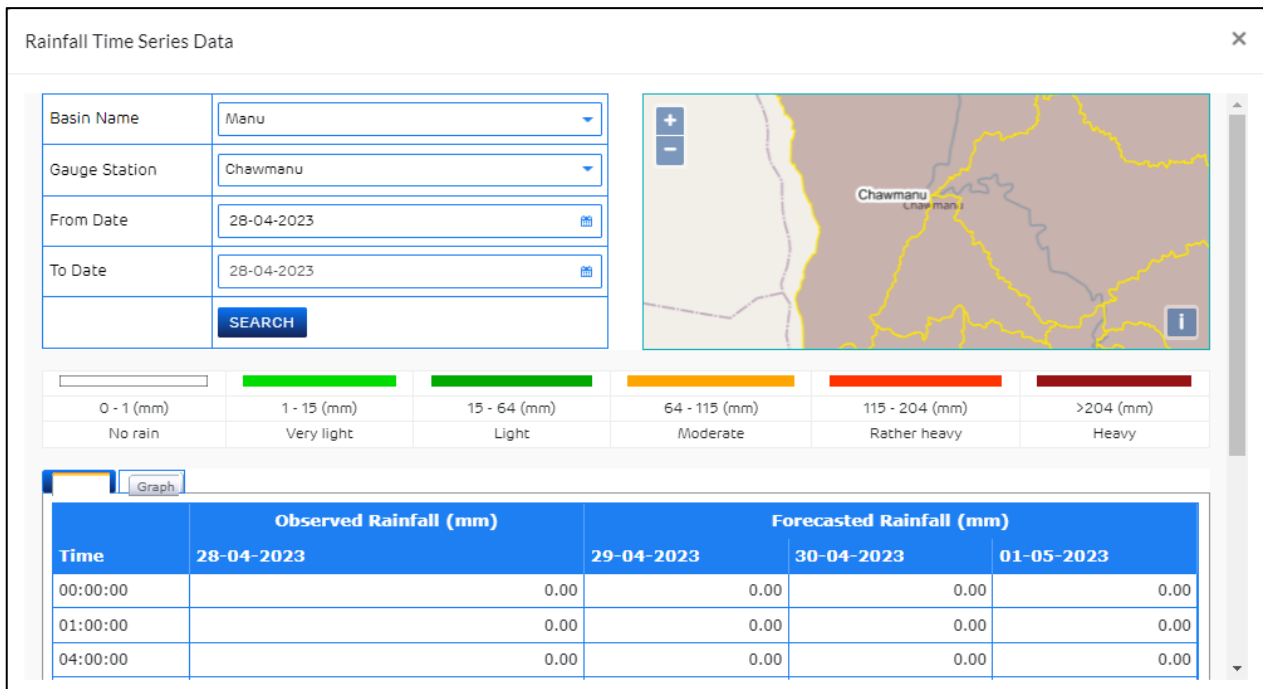


Figure 5 Window for viewing current and historical trends of rainfall time-series data

To display the Rainfall data in graphical form, the user can click on the Graph button. The user can hover the mouse point on the graph to display the values (as shown in Figure). The user can also download the graph and zoom in, zoom out, and reset the axes by clicking on respective buttons on the right (highlighted with a blue box) as shown in [Figure 6](#).

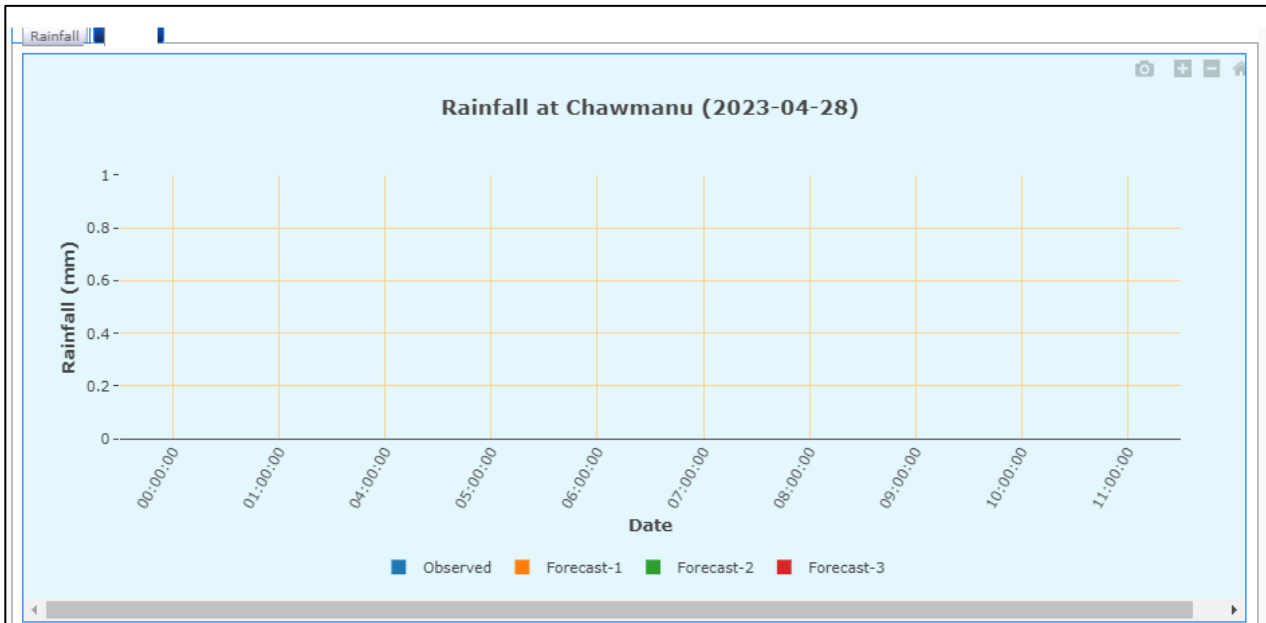


Figure 6 Rainfall graph at Chawmanu station

3.3 Flood Warning Signs

The flood warning signs are represented by different colours and symbols on the moving slide bars that depict the current water level and rainfall information. These signs are important indicators for the users to understand the severity of the flood situation and take appropriate measures to ensure their safety.

The following table shows the different flood warning signs and their corresponding meanings:

Symbol	Meaning
↓	Water level less than previous time step and below warning level
↑	Water level higher than previous time step and below danger level
↓	Water level less than previous time step and above warning level but below danger level
↑	Water level higher than previous time step and above warning level but below danger level
↓	Water level less than previous time step and above danger level
↑	Water level higher than previous time step and above danger level
	Water level same as previous timestep
↓	Rainfall less than previous time step and below threshold value
↑	Rainfall higher than previous time step and below threshold value
↓	Rainfall less than previous time step and above threshold value
↑	Rainfall higher than previous time step and above threshold value
	Rainfall same as previous timestep

3.4 Dashboard Data Menu

The Dashboard Data Menu is a collection of data tools that can be accessed directly from the dashboard. These tools include the ability to view maps, monitor rainfall and water levels, update rainfall and water level data, access flood bulletins, send flood-related SMS messages, and explore rainfall and water level data through the mobile app. These tools can provide valuable insights into current weather conditions and help users make informed decisions regarding flood prevention and management. Each tool within the Dashboard Data Menu provides a unique set of features and functionalities, making it an essential resource for users looking to stay up to date on weather and flood-related information. For more information on each component, refer to the 'Data Tool Menu' section in the manual.

4 Data Tool Menu

The Dashboard provides various data visualization tools that can help you quickly understand the current status of different metrics related to your business. The following tools are displayed below the navigation menu bar:

4.1 Map Window

The Map window in the FEWS interface provides a visual representation of the area of interest, which is essential for flood monitoring and early warning systems. The map displays real-time data on rainfall, water levels, and flood extents, as well as other relevant information such as river basins, gauge stations, and infrastructure. This information is crucial for decision-making during flood events, as it allows users to quickly assess the severity and extent of the flooding and identify areas that are at risk. In addition to providing real-time data, the map window also allows users to interact with the data by zooming in and out, panning the map, and clicking on specific locations to view more detailed information. The map window is a vital component of the FEWS interface, as it enables users to make informed decisions and take timely actions to mitigate the impacts of floods.

The Map window has several components, which are described below:

Symbol	Name	Descriptions
	Fit to Extent	This button allows the user to fit the map view to the extent of the current layer
	Pan	This tool allows the user to move the map view to a different location.
	Information	This tool provides additional information about a particular feature on the map, such as its name, type, and attribute.
	Reset	This button resets the map view to its original position and zoom level.
	Layer Swipe Tool	This tool allows the user to compare two different layers by swiping between them.
	Zoom tool bar with +/- to zoom in or out button on the top Right side of the Map Window screen	This toolbar provides the user with the ability to zoom in or out of the map view.
	Toggle full screen	This button allows the user to toggle between full-screen mode and the standard mode of the Map window.
	Change Base	This button allows the user to switch between different base map layers, such as Open Street Map, Google Maps, or Bing Maps.

Under the Map Window, there are several toggle layers available on the left side of the screen. These toggle layers allow users to turn on or off various layers on the map, such as satellite imagery, topography, and other features. Users can select the layers they want to view by simply clicking on the corresponding toggle button. The available layers may vary depending on the area of interest and the data available. In the Section 0, we will provide more details on each of the toggle layers and their functionality.

4.2 Rainfall

The Rainfall tab provides the user with the ability to view both current and forecasted rainfall data for the next two days for respective basins and their stations. The page also displays a table of warning signs to help users understand the recorded rainfall severity, from no rain to heavy rain, along with their corresponding colours. The warning signs table is useful for understanding the severity of rainfall recorded, and it is shown in the following table:

Rain Level	Rain Severity	Colour
0-1 MM	No Rain	No Colour
1-15 MM	Very Light	Light Green
15-64 MM	Light Rain	Dark Green
64-115 MM	Moderate Rain	Dark Yellow
115-204 MM	Rather Heavy	Light Red
>204 MM	Heavy Rain	Dark Red

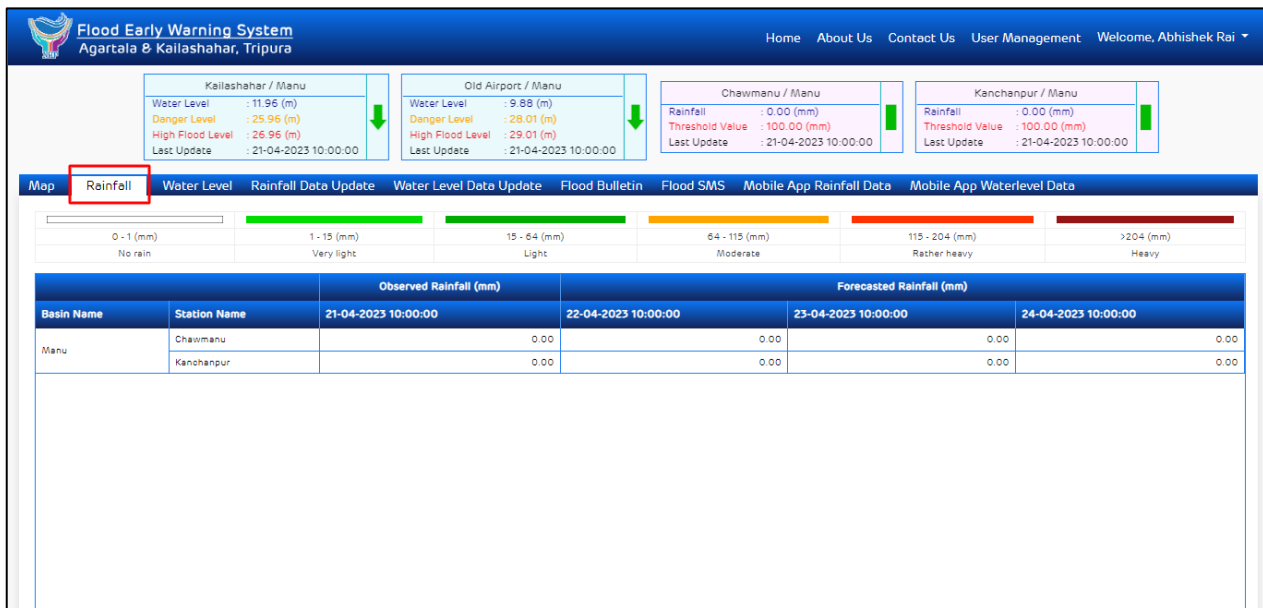


Figure 7 A screenshot of rainfall tab from the dashboard

4.3 Water Level

This tab allows users to view current and forecasted water level data for each basin and its stations. The page also displays a warning signs table that indicates the severity of the water level readings. The warning signs table uses different colors to represent the level of severity of water levels observed at each station. Light blue color is used to indicate water levels below the warning level, while light yellow is used to represent the warning level. Brown color is used to indicate danger levels, and red color is used to denote high flood levels. This color coding makes it easy for users to quickly identify the current situation and take necessary action. The Water Level tab is a useful tool for users who need to monitor water levels for flood forecasting and mitigation purposes.

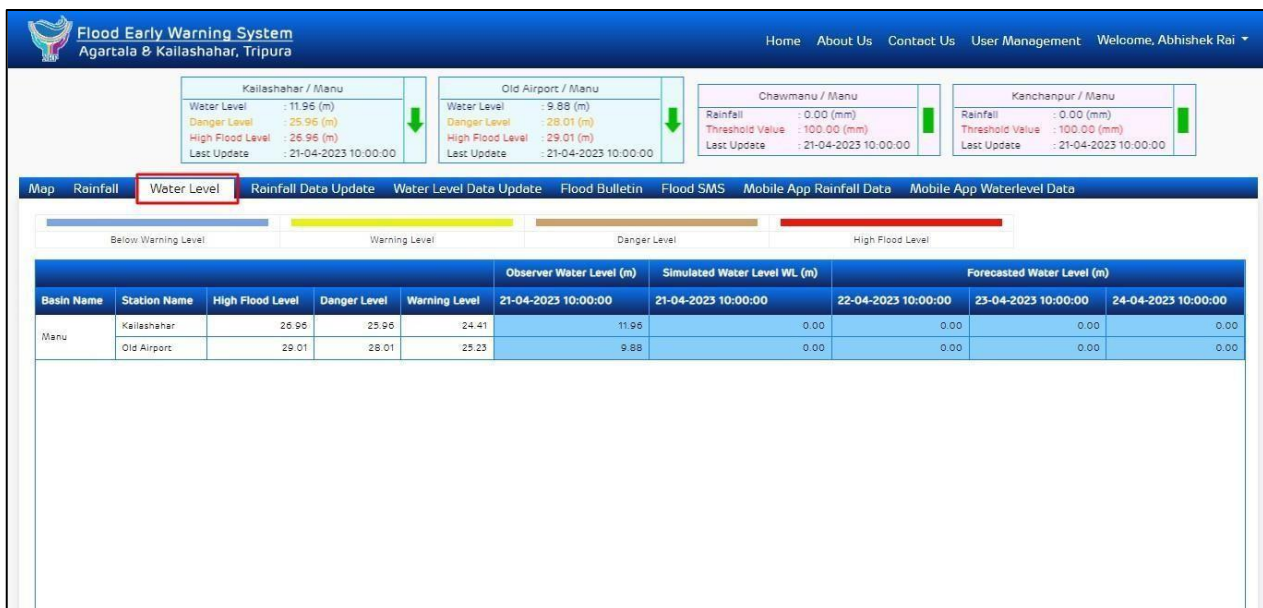


Figure 8 A screenshot of water level tab from the dashboard

4.4 Rainfall Data Update

In an unlikely scenario of the instrument malfunction or to test the model, the users with requisite permissions can change the rainfall data in the application. This helps the authorities to modify any erroneous data due to scenarios beyond human control. This can be done for multiple stations at once as the screen opens all the available stations in the basin and can be updated by clicking the update rainfall data button present in the bottom left corner of the screen.

Flood Early Warning System
Agartala & Kailashahar, Tripura

Home About Us Contact Us User Management Welcome, Abhishek Rai

Kailashahar / Manu
Water Level : 11.96 (m)
Danger Level : 25.96 (m)
High Flood Level : 26.96 (m)
Last Update : 21-04-2023 10:00:00

Old Airport / Manu
Water Level : 9.88 (m)
Danger Level : 28.01 (m)
High Flood Level : 29.01 (m)
Last Update : 21-04-2023 10:00:00

Chawmanu / Manu
Rainfall : 0.00 (mm)
Threshold Value : 100.00 (mm)
Last Update : 21-04-2023 10:00:00

Kanchanpur / Manu
Rainfall : 0.00 (mm)
Threshold Value : 100.00 (mm)
Last Update : 21-04-2023 10:00:00

Map Rainfall Water Level **Rainfall Data Update** Water Level Data Update Flood Bulletin Flood SMS Mobile App Rainfall Data Mobile App Waterlevel Data

Date: 21-04-2023 Time: 10:00:00 SEARCH

Date/Time	Basin Name	Station Name	Observed Rainfall
21-04-2023 10:00:00	Manu	Chawmanu	0
21-04-2023 10:00:00	Manu	Kanchanpur	0

UPDATE RAINFALL DATA

Figure 9 A screenshot of Rainfall data update tab from the dashboard

4.5 Water Level Data Update

In an unlikely scenario of the instrument malfunction or to test the model, the users with requisite permissions can change the water level data in the application. This helps the authorities to modify any erroneous data due to scenarios beyond human control. This can be done for multiple stations at once as the screen opens all the available stations in the basin and can be updated by clicking the update water level data button present in the bottom left corner of the screen.

Flood Early Warning System
Agartala & Kailashahar, Tripura

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Old Airport / Manu
Water Level : 9.88 (m)
Danger Level : 28.01 (m)
High Flood Level : 29.01 (m)
Last Update : 21-04-2023 10:00:00

Chawmanu / Manu
Rainfall : 0.00 (mm)
Threshold Value : 100.00 (mm)
Last Update : 21-04-2023 10:00:00

Kanchanpur / Manu
Rainfall : 0.00 (mm)
Threshold Value : 100.00 (mm)
Last Update : 21-04-2023 10:00:00

Map Rainfall Water Level **Water Level Data Update** Rainfall Data Update Flood Bulletin Flood SMS Mobile App Rainfall Data Mobile App Waterlevel Data

Date: 21-04-2023 Time: 10:00:00 SEARCH

Date/Time	Basin Name	Station Name	Danger Level	Observed WaterLevel WL (m) 21 -04-2023	Simulated Water Level WL (m) 21 -04-2023	Forecasted Water Level (m) 22 -04-2023	Forecasted Water Level (m) 23 -04-2023	Forecasted Water Level (m) 24 -04-2023
21-04-2023 10:00:00	Manu	Kailashahar	25.956	11.96	0	0	0	0
21-04-2023 10:00:00	Manu	Old Airport	28.008	9.88	0	0	0	0

UPDATE WATER LEVEL DATA

Figure 10 A screenshot of water level data update tab from the dashboard

4.6 Flood Bulletin

One of the major outputs to be obtained from the application is the Flood Bulletin, which can be created automatically in the application. It can be generated at any specified interval from the application and stored or shared with decision makers. The bulletin consists of the current and predicted rainfall and water levels in the basin and are saved with date and time of the bulletin specified along with the basin name. The bulletins can be searched by year, basin name, date and time. The flood bulletin can be sent automatically to specified users via email. Also, it can be downloaded or can be sent through the application to specified users for better decision making.

Flood Early Warning System
Agartala & Kailashahar, Tripura

Home About Us Contact Us User Management Welcome, Abhishek Rai

Kailashahar / Manu
Water Level : 11.95 (m)
Danger Level : 25.95 (m)
High Flood Level : 26.95 (m)
Last Update : 21-04-2023 10:00:00

Old Airport / Manu
Water Level : 9.88 (m)
Danger Level : 28.01 (m)
High Flood Level : 29.01 (m)
Last Update : 21-04-2023 10:00:00

Chawmanu / Manu
Rainfall : 0.00 (mm)
Threshold Value : 100.00 (mm)
Last Update : 21-04-2023 10:00:00

Map Rainfall Water Level Rainfall Data Update Water Level Data Update Flood Bulletin Flood SMS Mobile App Rainfall Data Mobile App Waterlevel Data

Year: 2023 Basin Name: Manu

Sr No.	Basin Name	Date	Flood Bulletin	Action
1	Manu	21-04-2023 10:00 AM	Flood_Bulletin_Report_2023042100505	VIEW DOWNLOAD
2	Manu	21-04-2023 09:00 AM	Flood_Bulletin_Report_20230421090505	VIEW DOWNLOAD
3	Manu	21-04-2023 08:00 AM	Flood_Bulletin_Report_20230421080505	VIEW DOWNLOAD
4	Manu	21-04-2023 07:00 AM	Flood_Bulletin_Report_20230421070505	VIEW DOWNLOAD
5	Manu	21-04-2023 06:00 AM	Flood_Bulletin_Report_20230421060505	VIEW DOWNLOAD
6	Manu	21-04-2023 05:00 AM	Flood_Bulletin_Report_20230421050505	VIEW DOWNLOAD
7	Manu	21-04-2023 04:00 AM	Flood_Bulletin_Report_20230421040505	VIEW DOWNLOAD
8	Manu	21-04-2023 03:00 AM	Flood_Bulletin_Report_20230421030505	VIEW DOWNLOAD
9	Manu	21-04-2023 02:00 AM	Flood_Bulletin_Report_20230421020505	VIEW DOWNLOAD
10	Manu	21-04-2023 01:00 AM	Flood_Bulletin_Report_20230421010505	VIEW DOWNLOAD
11	Manu	21-04-2023 12:00 AM	Flood_Bulletin_Report_20230421000505	VIEW DOWNLOAD
12	Manu	20-04-2023 11:00 PM	Flood_Bulletin_Report_20230420230520	VIEW DOWNLOAD
13	Manu	20-04-2023 10:00 PM	Flood_Bulletin_Report_20230420220519	VIEW DOWNLOAD
14	Manu	20-04-2023 09:00 PM	Flood_Bulletin_Report_20230420210505	VIEW DOWNLOAD
15	Manu	20-04-2023 08:00 PM	Flood_Bulletin_Report_20230420200505	VIEW DOWNLOAD

No of User Send: ALL User SEND FLOOD BULLETIN

Figure 11 A screenshot of Flood Bulletin tab with a list of generated Flood Bulletins

Flood Early Warning System
Agartala & Kailashahar, Tripura

FLOOD BULLETIN
2022-01-19 07:00 PM

Legend:
 <= 0.25 m (Blue)
 0.25 m > And <= 0.5 m (Yellow)
 0.5 m > And <= 1.2 m (Orange)
 > 1.2 m (Red)

Flood Warning at Gauge Locations

(1) Severe Flood Warning
station: 25

(3) Flood Warning
station: 15, station: 16, station: 17

Map Rainfall Water Level Rainfall Data Update Water Level Data Update Flood Bulletin Flood SMS Mobile App Rainfall Data Mobile App Waterlevel Data

Year: 2022 Basin Name: Haora

No of User Send: ALL User SEND FLOOD BULLETIN

Figure 12 A screenshot of Flood Bulletin view

4.7 Flood SMS

Apart from a Flood Bulletin an SMS can also be generated via the application, which can be sent to multiple people automatically to help in decision making during a flood. The admin can create the list of users for whom the SMS can be sent by providing the name and phone number of the users.

Flood Early Warning System
Agartala & Kailashahar, Tripura

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Location	Water Level (m)	Danger Level (m)	High Flood Level (m)	Last Update
Khayerpur / Haora	0.00	15.79	16.09	27-02-2025 14:00:00
Jogendranagar / Haora	8.49	11.74	12.74	27-02-2025 14:00:00
Jirania / Haora	23.32	29.15	30.15	27-02-2025 14:00:00

Map Rainfall Water Level Rainfall Data Update Water Level Data Update Flood Bulletin **Flood SMS** Mobile App Rainfall Data Mobile App Waterlevel Data

Sr No.	Name	Designation	Mobile No.	Action
1	Anjan Debbarma	Executive Engineer	9436540317	Select
2	Biswajit Saha	Executive Engineer	9436135789	Select
3	Chandan Sen	Ass. Engineer	9612096390	Select
4	Jahir Debbarma	Engineer	8974613754	Select
5	Kalendra Reang	Executive Engineer	9402161903	Select
6	kamil	Engineer	9760079136	Select
7	Maitreyee Majumder	Engineer	8257865212	Select
8	Pankaj Kumar Bhowmik	Executive Engineer	8917206254	Select
9	Santanu Sarkar	Engineer	9436452608	Select
10	Subhrendu Bikash Datta	Executive Engineer	9436476352	Select
11	Sujit Gupta	Engineer	7005518500	Select

Name: _____ Designation: _____ Mobile No: _____ **ADD CLEAR**

Flood SMS Language: English **SEND ADVISORY**

Figure 13 A screenshot of Flood SMS tab

4.8 Mobile App Rainfall Data

The users also have a facility to update the rainfall data from the mobile app. The rainfall can be captured via image and a video and that can be uploaded to the application. Admin or any registered user with privileges can download the image and video from the application. The data obtained from the mobile app can be seen from the mobile app rainfall data tab in the below screenshot. This helps in obtaining data from the community and involve the community in the process of data assimilation.

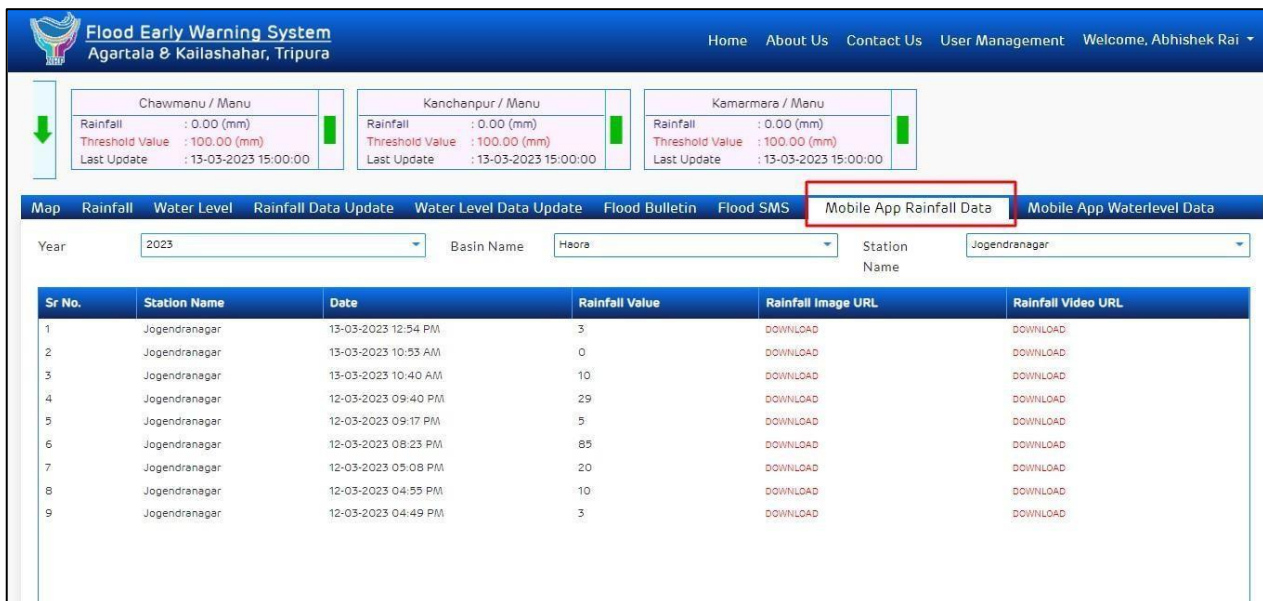


Figure 14 A screenshot of Mobile App Rainfall Data tab

4.9 Mobile App Water Level Data

The users also have a facility to update the water level data from the mobile app. The water level can be captured via image and a video and that can be uploaded to the application. Admin or any registered user with privileges can download the image and video from the application. The data obtained from the mobile app can be seen from the mobile app rainfall data tab in the below screenshot.



Figure 15 A screenshot of Mobile App Waterlevel Data tab

5 Toggle Layers

Toggle layers are a feature in the FEWS dashboard that allows users to toggle on or off different layers of data on the map. These layers include things like basins boundary, river network, rainfall stations, water level stations, administrative boundaries, historical flood maps, etc. By toggling these layers on or off, users can customize the map view to display the data that is most relevant to their needs. The toggle layers feature can be accessed by clicking on the layer's icon in the map window.



Figure 16 Toggle layers highlighted in red colour box.

5.1 Database Layers

Database Layer window displays the following sub-layers as given below. The Database Layers section allows users to display various map layers on the Map Viewer page. The following sub-layers are available under this section:

-  Haora Basin
-  Manu Basin
-  Administrative Layers
-  Essential Facilities Layers
-  Historical flood event
-  Flood Analysis Data

5.1.1 Haora Basin & Manu Basin

The Haora and Manu Basins layers contain multiple sub-layers that can be accessed by clicking on the respective layer in the table of contents (TOC) and selecting the desired sub-layer from the drop-down menu. The sub-layers for both basins include:

- A. Sub-Basin:** This layer displays the boundaries of sub-basins within the Haora and Manu River basin. Users can turn on this layer to view the sub-basin boundaries on the map.
- B. River Line:** This layer displays the rivers and streams within the Haora and Manu River basin. Users can turn on this layer to view the river and stream network on the map.

C. Rainfall Station: This layer displays the locations of rainfall stations within the Haora and Manu River basin. Users can turn on this layer to view the rainfall station locations on the map.

D. Water Level Station: This layer displays the locations of water level stations within the Haora and Manu River basin. Users can turn on this layer to view the water level station locations on the map.

E. Water Depth: The water depth sub-layer, available under both Haora and Manu basin database layers, displays a 2D map of the current water depth in the respective river basin. The map is color-coded to represent different water depth levels, with each color indicating a different depth range. Additionally, the sub-layer also shows the forecasted water depth map, which helps users to plan their actions accordingly.

By viewing the water depth map, users can understand the level of risk in the region and take necessary precautions. It is especially important during the flood season when the water levels can rise rapidly, leading to dangerous situations. The water depth sub-layer can be toggled on or off using the checkbox available under the respective basin's database layer in the TOC.

Users can zoom in or out of the map to get a better view of the water depth levels. They can also download the water depth map for further analysis or future reference.

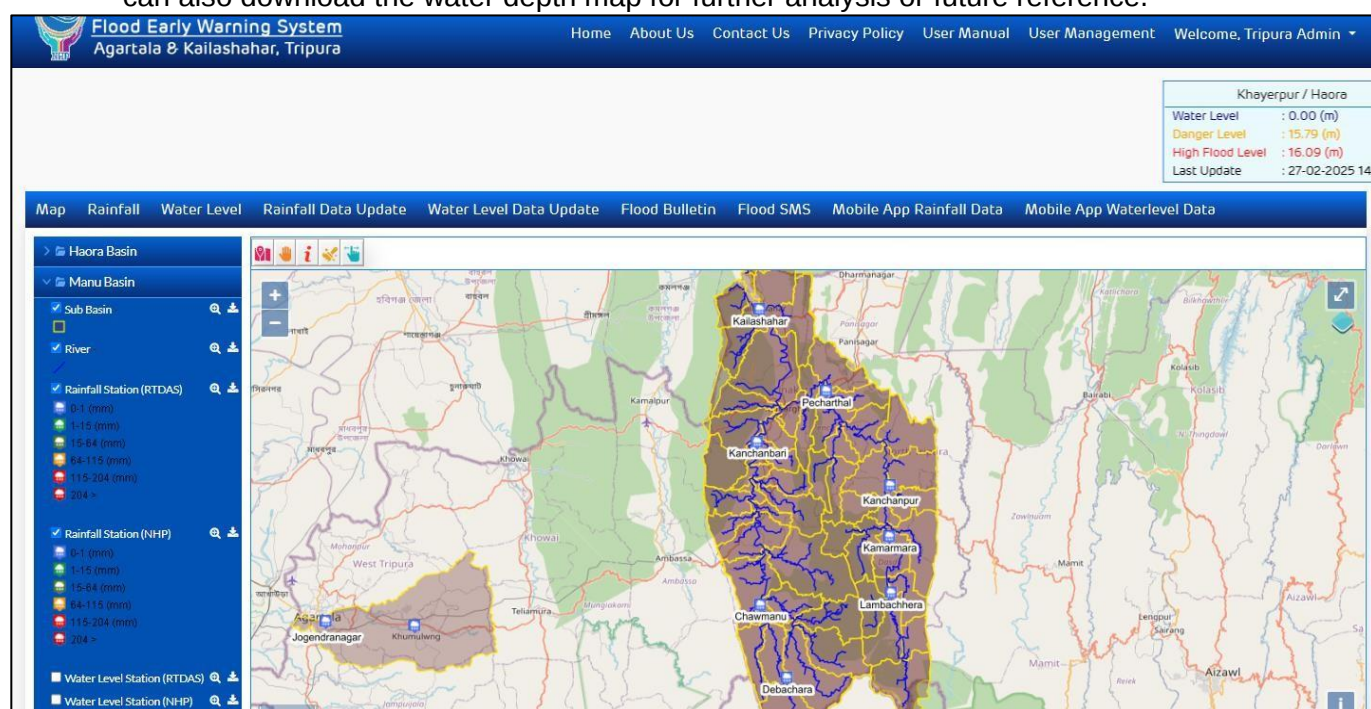


Figure 17 Visualization of a water depth map of Haora River Basin

To display a layer on the Map Viewer page, simply click on the checkbox next to the desired layer. The zoom icon can be used to zoom in on a particular layer. Additionally, registered users can also download a selected layer as a map by clicking on the download icon.

By using the toggle layers feature, users can easily visualize and analyze different layers on the map viewer, allowing for better decision-making and analysis.

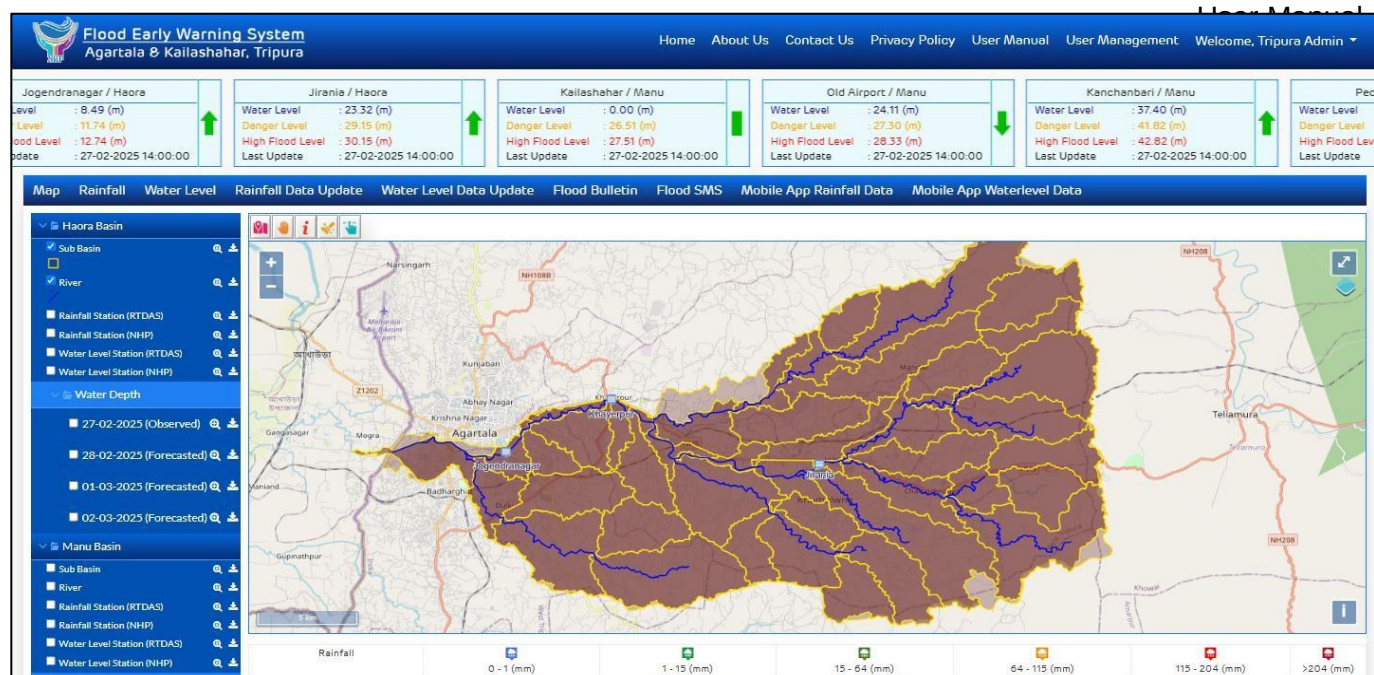


Figure 18 Visualization of Haora basin's sub-basin and river network layers on the map

5.1.2 Administrative Layers

Administrative Layers refer to the layers that display the political and administrative boundaries of a region. In the context of the FEWS dashboard, the Administrative Layers sub-layer is available under the Database Layers option. The following sub-layers are available under the Administrative Layers section:

-  State Boundary
-  District Boundary
-  Tehsil Boundary
-  Village Boundary

To display the corresponding map of the sub-layer on the Map Viewer page, click on the checkbox of the Admin Boundary layer. For instance, to view the district layer, click on the checkbox of the District Boundary layer, and then click on the Zoom icon (highlighted with a blue box) to zoom in on the layer. Additionally, you can download the layer map by clicking on the download icon.

5.1.3 Essential Facilities Layers

The Essential Facilities Layers is a sub-layer under the Database Layers section in FEWS dashboard. It displays the location of important facilities such as schools, hospitals, police stations, fire stations, and other essential facilities that are relevant during a flood or any other natural disaster.

In the event of a flood, the Essential Facilities Layers can be used to identify the locations of these critical facilities and help in the coordination of emergency services. Users can easily toggle the layer on or off in the TOC Layer section and view the facilities on the Map Viewer page. Additionally, the Essential Facilities Layers can be used to plan evacuation routes, assess the impact of a flood on essential services, and aid in the decision-making process during a disaster response.

The location data displayed in this layer is sourced from various reliable government and public sources and is updated regularly to ensure accuracy. The Essential Facilities Layers are an

essential tool for users to visualize and assess the impact of a flood on the critical infrastructure and facilities in a region.

To view or add Essential Facilities Layers, follow the steps given below:

- ✚ Click on the Database Layers button on the Map Viewer page.
- ✚ Click on the Essential Facilities Layers checkbox to display the sub-layers.
- ✚ Select the checkbox of the sub-layer you wish to view on the Map Viewer page.
- ✚ The selected Essential Facilities Layer will now be displayed on the Map Viewer page.
- ✚ Use the Zoom icon to zoom in or out of the map.
- ✚ Click on any point of interest on the map to display the name of the facility.

It's important to note that the availability of Essential Facilities Layers depends on the data sources used in the FEWS dashboard. If the data for a particular layer is not available, the checkbox for that layer will be disabled. Additionally, users with appropriate permissions can add or remove Essential Facilities Layers from the dashboard to tailor it to their specific needs.

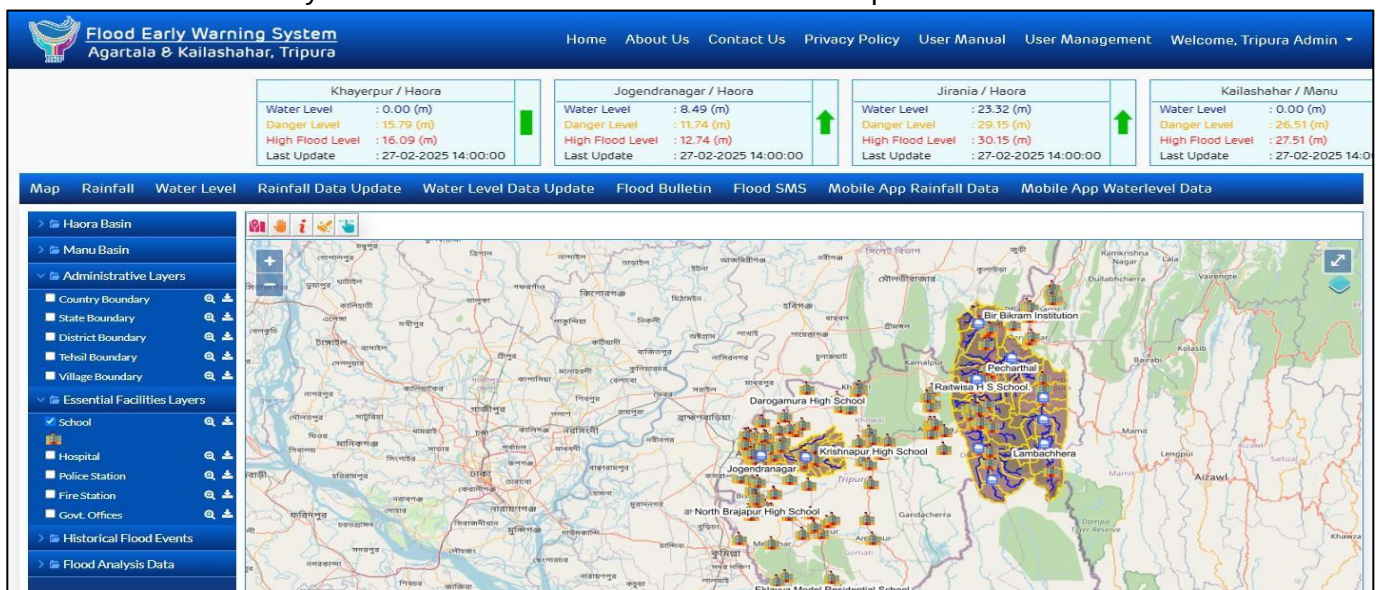


Figure 19 Mapping of school locations in Haora and Manu River basins for visualization

5.1.4 Historical Flood Events

This layer provides access to the historical flood event maps for the Haora and Manu basins. Users can view the flood events that occurred in the past by selecting this layer from the Database Layers window. The following sub-layers are available under this layer:

1. Harora Return Period Map
2. Manu Return Period Map

These sub-layers provide information about the historical flood events for both basins based on the return period. As an example, Users can select the Harora Return Period Map layer to view the flood events for different return periods, such as 2 Years, 5 Years, 10 Years, 25 Years, and 100 Years. The return period is a statistical measure that represents the frequency of a flood event of a certain magnitude or greater occurring in a given time period. By viewing these flood events, users can gain insights into the flood-prone areas and the extent of damage caused by floods in

the past. The Harora Return Period Map can be accessed by clicking on the checkbox of the layer in the Database Layers window and then zooming in on the map to view the flood events.

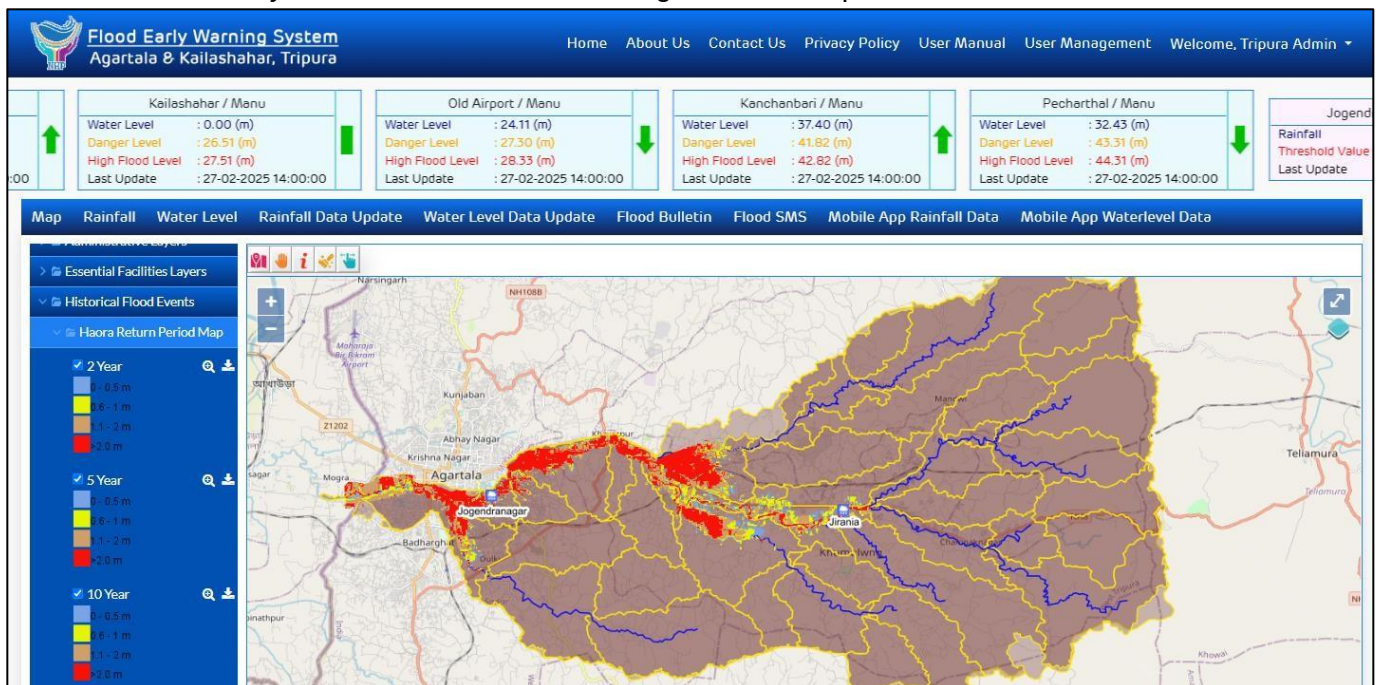


Figure 20 Map visualization of flood return period for 2, 5, 10, 25, and 100 years in the Manu Basin.

6 User Management

User Management is a powerful feature of the system that allows the Administrator to manage user accounts. The User Management page can be accessed by logging in with Administrator rights. It is not accessible to Editor and Guest users.

The User Management button is displayed in the Header section. Clicking on the User Management button will display the User Management page. This page contains two buttons: Search User and Add New User. By default, the Search User button is selected.

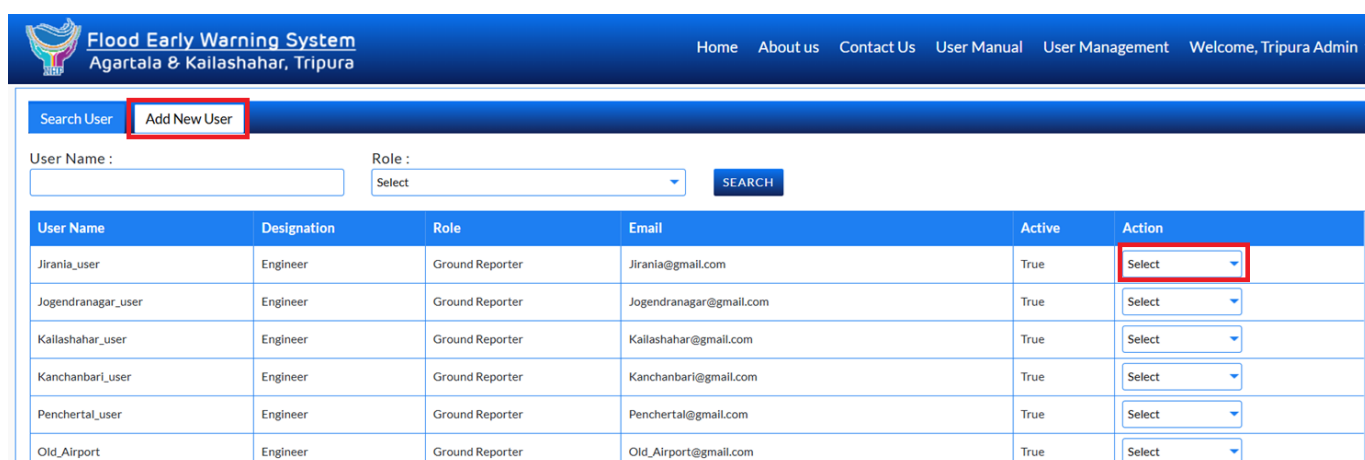
6.1 Search User Tab

Under the Search User tab, the Administrator can search for a user by typing the user's name in the Username textbox or selecting the designation from the Designation dropdown, or by doing both. Once the search is complete, click the Search button to display the user details.

To search for a user, follow these steps:

1. Click on the Search User button in the User Management page.
2. Type the user's name in the User Name textbox or select the designation from the Designation dropdown or do both to filter the search.
3. Click on the Search button to display the user details.

The user details that are displayed include the full name, email, designation, and current status (i.e., active or inactive).



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Search User **Add New User**

User Name : Role :

User Name	Designation	Role	Email	Active	Action
Jirania_user	Engineer	Ground Reporter	Jirania@gmail.com	True	Select
Jogendranagar_user	Engineer	Ground Reporter	Jogendranagar@gmail.com	True	Select
Kailashahar_user	Engineer	Ground Reporter	Kailashahar@gmail.com	True	Select
Kanchanbari_user	Engineer	Ground Reporter	Kanchanbari@gmail.com	True	Select
Penchertal_user	Engineer	Ground Reporter	Penchertal@gmail.com	True	Select
Old_Airport	Engineer	Ground Reporter	Old_Airport@gmail.com	True	Select

The Administrator can perform several actions on the user, including View User, Edit User, and Delete User.

A. View User: To view the user, select the user from the list and choose View from the Action

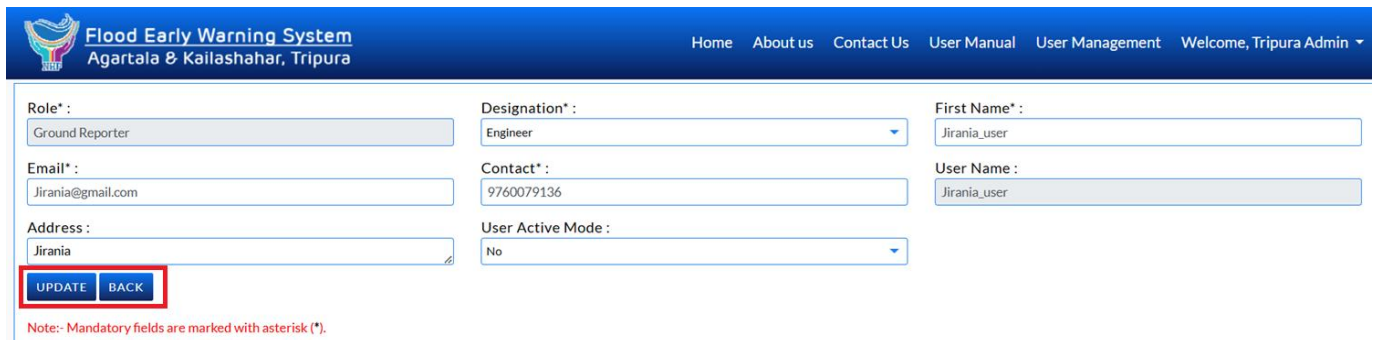
Figure 21 User Management page displaying all user details after searching.

dropdown. The user's details will be displayed, and the Administrator can go back to the previous screen by clicking the Back button.

B. Edit User: To edit a user's details, select the user from the list and choose Edit from the Action dropdown. The user's details will be displayed, and the Administrator can edit the textboxes accordingly. After making the necessary changes, click the Update button to save the changes and go back to the previous screen by clicking the Back button.

To edit a user's details, follow these steps:

- ✚ Select the user from the list of search results.
- ✚ Select Edit from the Action dropdown.
- ✚ The user's details will be displayed.
- ✚ Edit the details by editing the textboxes.
- ✚ Update the user details by clicking on the Update button.
- ✚ Go back to the previous screen or view by clicking on the Back button.



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Role* :
 Designation* :
 First Name* :

Email* :
 Contact* :
 User Name :

Address :
 User Active Mode :

Note:- Mandatory fields are marked with asterisk (*).

C. Delete User: To delete a user account, follow these steps:

- ✚ Select the user from the list of search results.
- ✚ Select Delete from the Action dropdown.
- ✚ A confirmation window will be displayed asking the user to confirm deletion.

Figure 22 Page displaying user details required for editing/updating an existing user.

- ✚ Click Yes to delete the user.

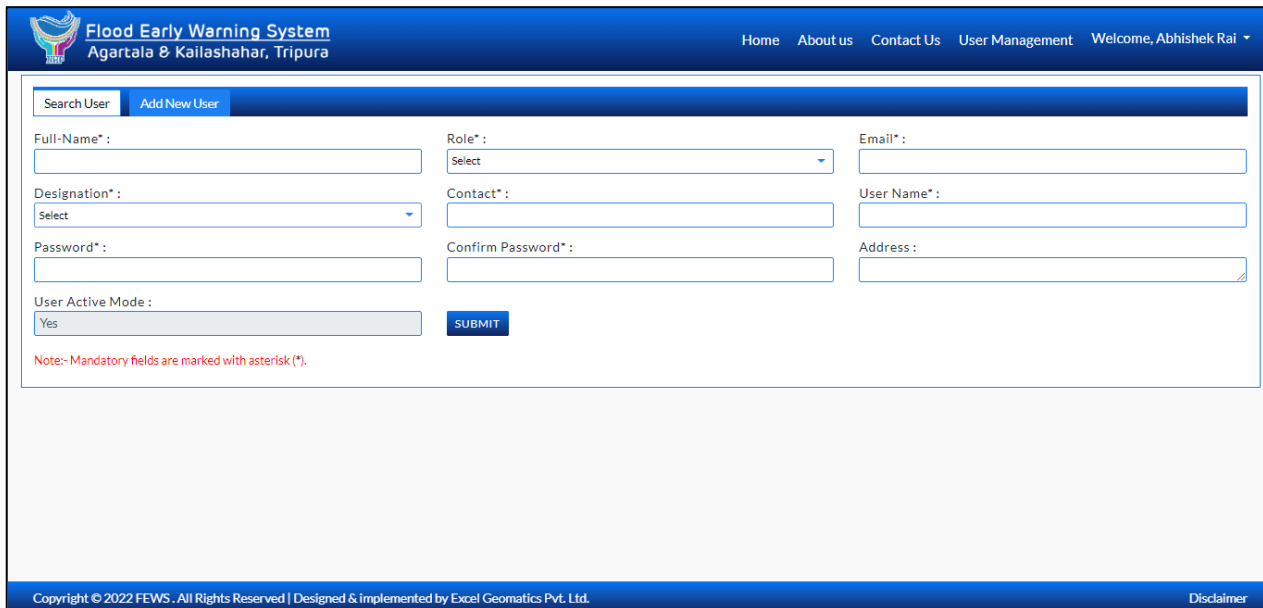
6.2 Add New User

Under the Add New User tab, the Administrator can create a new user by clicking on the Add New User button. This will display the Add New User page.

To add a new user, follow these steps:

- ✚ Click on the Add New User button in the User Management page.
- ✚ The Add New User page will be displayed.
- ✚ Enter the following details: Full Name, Role, Email, Designation, Contact No, User Name, Password, Confirm Password, Address
- ✚ User Activation/De-activation

Click on the Submit button to create the user account.



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Search User Add New User

Full-Name* :

Role* :

Email* :

Designation* :

Contact* :

User Name* :

Password* :

Confirm Password* :

Address :

User Active Mode :

SUBMIT

Note:- Mandatory fields are marked with asterisk (*).

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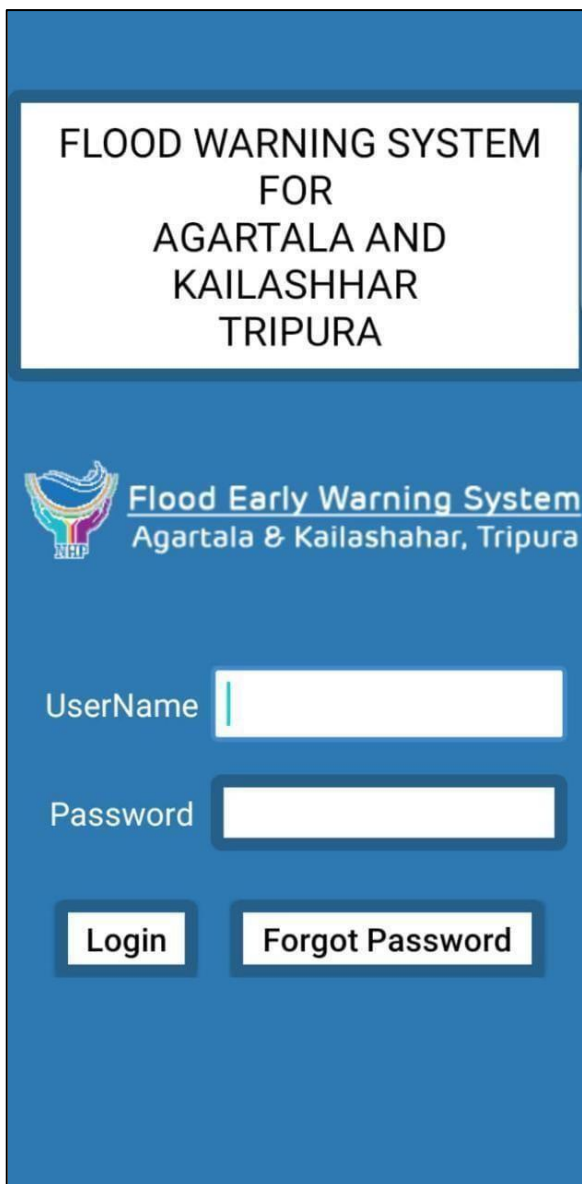
Figure 23 Page displaying user details required for adding a new user

7 Mobile Application

The FEWS web application has a paired Android based mobile application that can be downloaded on mobile devices, such as smartphones and tablets. The mobile application offers similar features and functionality as the web application, but with the added benefit of being accessible on-the-go. Users can access the application from anywhere at any time, allowing them to stay connected and productive while away from their desktop or laptop.

7.1 Application Login

The login screen for the mobile app is presented in the below figure. It has the name and logo of the application, with fields for username and password along with buttons for Login and Forgot Password. Users can login by entering their username and password in the respective fields and then click on the login button.

The image shows a mobile application login screen with a blue background. At the top, a white box contains the text "FLOOD WARNING SYSTEM FOR AGARTALA AND KAILASHHAR TRIPURA". Below this, there is a logo on the left and the text "Flood Early Warning System Agartala & Kailashahar, Tripura" on the right. Further down, there are two input fields: "UserName" and "Password". At the bottom, there are two buttons: "Login" and "Forgot Password".

FLOOD WARNING SYSTEM
FOR
AGARTALA AND
KAILASHHAR
TRIPURA

 Flood Early Warning System
Agartala & Kailashahar, Tripura

UserName

Password

Login Forgot Password

Figure 24 Mobile Login Screen

7.2 Forgot Password

In case of a user forgetting their password, they can click on the forgot password button, which opens the following screen on the app. The user will have to give the username and the email ID in the respective fields and click on Reset password button. The application will then verify the username and registered email and in case they match with the available information, the password is sent to the email, in case they do not match, the password is not sent.



Figure 25 Mobile forgot password screen

7.3 Dashboard

On successfully logging in to the application, the following screen opens with the dashboard. The dashboard contains the following icons

-  Rainfall
-  Water Level
-  Rainfall and Water level data upload
-  Profile Management



Figure 26 Mobile dashboard Screen

7.4 Rainfall

This tab lets the users see the observed and forecast rainfall at various stations. On clicking on rainfall tab, the following screen opens where the users have to select the basin name, station name, date and time to see the rainfall values of observed and forecasted.

Type	Date Time	Value (mm)
Observed	NA	NA
Forecast-1	NA	NA
Forecast-2	NA	NA
Forecast-3	NA	NA

Figure 27 Mobile Rainfall Screen

7.5 Water Level

This tab lets the users see the observed and forecast water level at various stations. On clicking on water level tab, the following screen opens where the users have to select the basin name, station name, date and time to see the water level values of observed and forecasted, along with the warning, danger and high flood levels for the station

←

WATER LEVEL FORECAST AL...

Below Warning Level

Warning Level

Danger Level

High Flood Level

LAST UPDATE : Monday Mar 2023-03-13 16:00:00

Select Basic Name

Manu

Select Station Name

Old Airport

Select From Date

2023-03-11 16:00:00

Station Name :- Old Airport

Type	Date	Value (m)
High Flood Level	2023-03-11	29.008
Danger Level	2023-03-12	28.008
Warning Level	2023-03-13	25.234
Observer WL	2023-03-14	9.8
Simulated WL	2023-03-15	0.0
Forecasted WL-1	2023-03-16	0.0
Forecasted WL-2	2023-03-17	0.0
Forecasted WL-3	2023-03-18	0.0

Figure 28 Mobile Water level Screen

7.6 Rainfall and Water Level Data Upload

The following screen opens on clicking the Rainfall and Water Level data upload. Here the users can upload the rainfall and water level data using the mobile application. They need to select the basin name, station name and add the data, image and video of the observation.

← DATA ENTRY TAB

RAINFALL ENTRY

WATERLEVEL ENTRY

LAST UPDATE : Friday Feb 2025-02-28 14:00:00

Select Basin Name

Manu

Select Station Name

Kanchanpur

Rainfall Value:-

Rainfall Image:-

Rainfall Video:-

Add

Back

Date Time	Value (m)
2025-02-28 14:00:00	2.0

✓ Data inserted successfully.

Figure 29 Mobile data entry Screen

7.7 Profile Management

On clicking the Profile Management icon, the following screen will be opened. It has 2 major tabs

- ✚ User Profile
- ✚ Change Password

User profile tab has all the basic data of the user including the name, email ID, Role, address, mobile number and username.

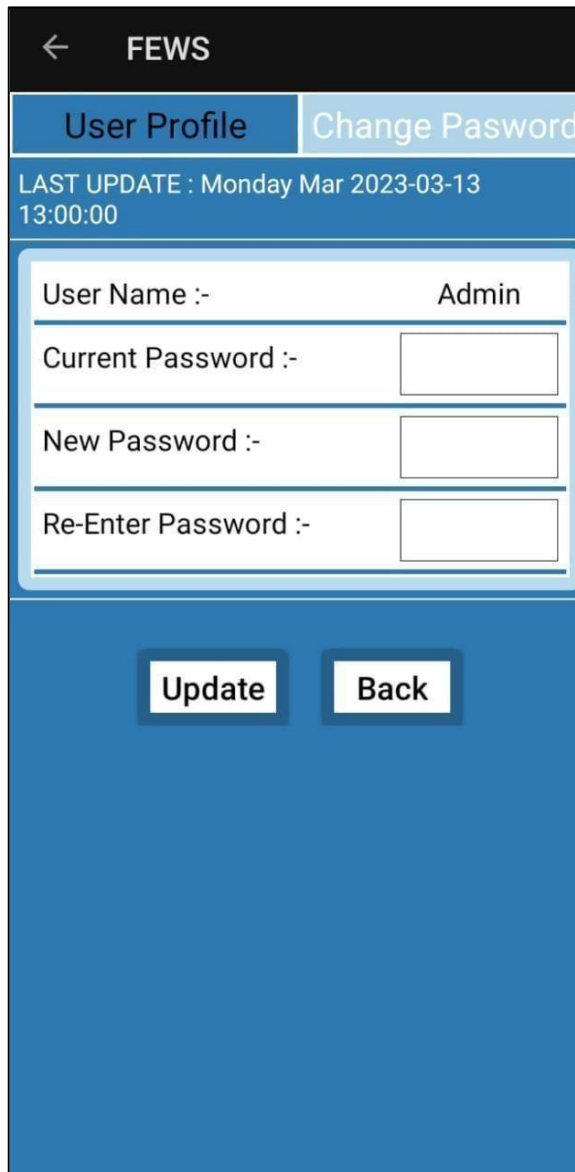
The screenshot shows a mobile application interface for 'FEWS'. At the top, there is a navigation bar with a back arrow and the text 'FEWS'. Below this, there are two tabs: 'User Profile' (which is selected) and 'Change Password'. A status bar indicates 'LAST UPDATE : Monday Mar 2023-03-13 12:00:00'. The main content area displays a list of user details in a table-like format:

Name :-	Jirania_user
Email Id :-	Jirania@gmail.com
Mobile No :-	9760079136
Designation :-	Administrator
Address :-	Jirania
User Name :-	Admin
Role :-	Administrator
Is Active :-	true

At the bottom of the screen, there is a blue bar with a white button labeled 'Back'.

Figure 30 Mobile User Profile Screen

The change password tab has the following screen with fields for Username, Current password, new password and to re-enter password. By filling the fields appropriately and by clicking on the update button, the password can be changed.



The image shows a mobile application screen for changing a password. At the top, there is a black header with a back arrow and the text 'FEWS'. Below this is a blue bar with two tabs: 'User Profile' and 'Change Password'. Under the 'Change Password' tab, it says 'LAST UPDATE : Monday Mar 2023-03-13 13:00:00'. The main form area has three input fields: 'User Name :-' with the value 'Admin', 'Current Password :-', 'New Password :-', and 'Re-Enter Password :-'. At the bottom, there are two buttons: 'Update' and 'Back'.

User Name :-	Admin
Current Password :-	
New Password :-	
Re-Enter Password :-	

Update **Back**

Figure 31 Mobile Change Password Screen