International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137

Volume – 11, Issue – 10, October 2026, PP – 36-52

Urban Flood Disaster Life-Cycle Management through an Integrated Flood Information System: A Case Study of Taichung City

Chung-Tien Huang[1], Mao-Jia Jian[2*], Yao-Min Fang[3]

[1]*Taichung City Government, Taichung, Taiwan*

[2]*PhD student, College of Construction and Development, Feng Chia University, Taichung, Taiwan*

[3]*Associate Professor, College of Construction and Development, Feng Chia University, Taichung, Taiwan*

**Corresponding Author*

Abstract: Urban flood management requires coordinated access to rainfall and hydrological information, preparedness records, and incident handling updates. When these data are distributed across agencies and operational units, retrieving information and consolidating response progress can place additional demands on coordination. This study examines an integrated flood information system in Taichung City, Taiwan, using a qualitative single-case analysis of the relationships between system functions and management processes. The analysis covers pre-disaster preparedness, response during flooding, and post-disaster case record management at citywide, administrative district, and individual case levels. It considers forecasts and monitoring data, access to closed-circuit television (CCTV) imagery, material inventories, reports from multiple sources, human verification, assignment to responsible units, response tracking, and review. Particular attention is given to the relationships among location, administrative district, time, and case identifiers, together with case history queries, statistical summaries, and emergency report compilation. The study focuses on existing system functions and information continuity across management tasks, with applications examined in relation to their operational context and data conditions.

Keywords: Case traceability, Cross-agency coordination, Disaster life-cycle management, Emergency reporting, Flood preparedness, Geographic information systems, Integrated flood information systems, Urban flood management

1. Introduction

Urban flood management requires the combined interpretation of meteorological information, local hydrological observations, and field reports to inform preparedness and response decisions. Municipal managers focus on the distribution of anomalies and support needs across the city; administrative districts and operational units focus on local resources and case progress; and field personnel require specific locations, descriptions of the problem, and response arrangements. These interrelated needs constitute a flood management challenge spanning different stages and management scales.

When meteorological data, hydrological observations, surveillance imagery, and local preparedness records are distributed across different sources, managers must consult multiple systems and confirm conditions by telephone. Although individual datasets may be accessible, they may not jointly explain the areas potentially affected by rainfall, local preparedness, and responsibility for handling reports. Retrieving and interpreting information may therefore increase the coordination workload, while fragmented records also affect continuity between operational stages. If pre-disaster material and equipment inventories cannot be consulted alongside district hydrological conditions, further inquiries may still be necessary during response. Similarly, storing report sources, assignments, and response records separately makes it difficult to reconstruct the sequence of an incident. Information integration therefore needs to preserve the temporal, spatial, and responsibility relationships among records to support continuity across management stages.

The Sendai Framework for Disaster Risk Reduction connects risk understanding, governance, preparedness, and response [1], while flood risk governance research examines the arrangements among actors, rules, and resources [2]. The World Meteorological Organization's Early Warnings for All framework emphasizes the coordination of monitoring and forecasting, warning dissemination, and preparedness and response [3]. These perspectives indicate that the value of flood information should be understood in relation to management actions, including how data are obtained, interpreted, verified, and used.

Using qualitative single-case analysis, this study examines how Taichung City's integrated flood information system connects hydrological information, preparedness records, a geospatial map interface, and

 2026 IJLERA – All Right Reserved

disaster case life-cycle operations. Citywide and district summaries provide an overview, while case queries and case-specific dashboards provide locations, sources, histories, and relevant hydrological information. Previously fragmented information can thus be consulted at different levels within a common context.

Disaster life-cycle management in this study focuses on pre-disaster preparedness, response during disasters, and post-disaster case record management. Before a disaster, management concerns material inventories, meteorological information, and monitoring data. During a disaster, alerts, reports, human verification, assignment to responsible units, and response tracking are connected. After a disaster, source records, response actions, and review histories are retained for case queries and statistical summaries. Information continuity links these stages into a management process, with verification and coordination by managers and responsible personnel throughout.

The study addresses three questions: how fragmented data can be incorporated into a continuous flood management process; how a citywide overview, district coordination, and individual case handling can be connected through shared information; and how source records and operational histories can remain available for queries and compilation after case handling has been completed.

2. Literature Review for the Past Five Years and Research Positioning

This section adopts a thematic narrative review. Studies directly relevant to the existing system functions are selected, covering street-level inundation monitoring, monitoring dashboards, cross-agency collaboration, command responsibilities, and data-sharing arrangements. Their contributions are considered in relation to sensor information integration, coordination between municipal and local levels, and case handling.

2.1 Integration of Sensor Data and Dashboards

FloodNet, presented by Mydlarz et al., uses a street-level ultrasonic sensor network in New York City to measure localized inundation depth and duration and presents observation locations, rainfall, and tidal information in a dashboard [4]. The study links sensing infrastructure with data consultation, allowing hydrological measurements to be understood in their local and environmental contexts. Its management relevance lies in specifying the observation target and time, while providing a route from an overview to locations of interest so that monitoring information can be related to local tasks.

The shared flood monitoring case in Texas examined by Adesina et al. connects local agencies, academic institutions, and platform administrators through a joint monitoring arrangement [5]. Compared with data collection at an individual location, sharing across jurisdictions requires continuity in observation, transmission, and access. Taken together, these studies indicate that the management uses of sensor measurements need to be understood in relation to observation locations and data availability, while dashboards provide a means for different users to consult and compare the information.

The integrated flood information system in Taichung City provides different observations through rainfall, water level, and inundation sensors, alongside CCTV imagery for personnel to view field conditions. Managers can compare observation locations, data timestamps, and reports through the geospatial map interface and proceed from district summaries to individual cases. This study examines how monitoring signals and access to imagery jointly support human interpretation and local verification within the same operational context.

2.2 Cross-Unit Collaboration and Assignment of Responsibilities

Li et al. use network analysis of official texts on flood disasters in China to compare organizational connections during preparedness and response. They find that the importance of horizontal and vertical collaboration changes with information and resource needs, and that connections outside the original plan can emerge during an incident [6]. The implication for flood management is that information support needs to reflect the management stage: pre-disaster inventories emphasize preparedness and verification, whereas response requires the connection of incoming information, local conditions, and handling responsibilities.

Wiedemann et al. report that different temporal structures and task logics at strategic and tactical levels may cause coordination difficulties in flood incident management in Germany [7]. This finding relates information sharing to operational needs. Municipal managers require an overview of conditions and support needs, whereas local and field personnel require specific locations, descriptions of the problem, and response arrangements. Different levels may use shared data while requiring different levels of detail, time horizons, and actions.

These studies examine organizational networks and command coordination, respectively. Their common implication for the present case is the need to maintain the relationship between information and responsibility. Once a report has been verified by personnel and converted into a case, assignment to responsible units,

 2026 IJLERA – All Right Reserved

response updates, and review should follow. The municipal overview should also retain routes to district and individual case details. Information integration therefore needs to present the problem, current progress, and responsible units together to support verification and communication among personnel.

2.3 Synthesis and Research Positioning

The studies reviewed above address complementary aspects of management. Field sensing and dashboards support an understanding of hydrological conditions, while research on collaboration and responsibility clarifies needs across stages and organizational levels. Together, their perspectives on information acquisition, consultation, and organizational use inform the management analysis of existing flood information functions. Their case contexts and methods nevertheless have distinct scopes. Table 1 summarizes the correspondence between these studies and the existing functions of the Taichung system.

This study focuses on integrated use within a single system. Temporal relationships connect pre-disaster inventories, monitoring and reporting, assignment and response, and history retention, while management-scale relationships connect municipal oversight, district coordination, and individual case actions. Fig. 1 presents this management framework. The analysis considers the information used at each stage, responsibility for interpretation, and the records available for consulting response outcomes, in relation to system functions and personnel tasks.

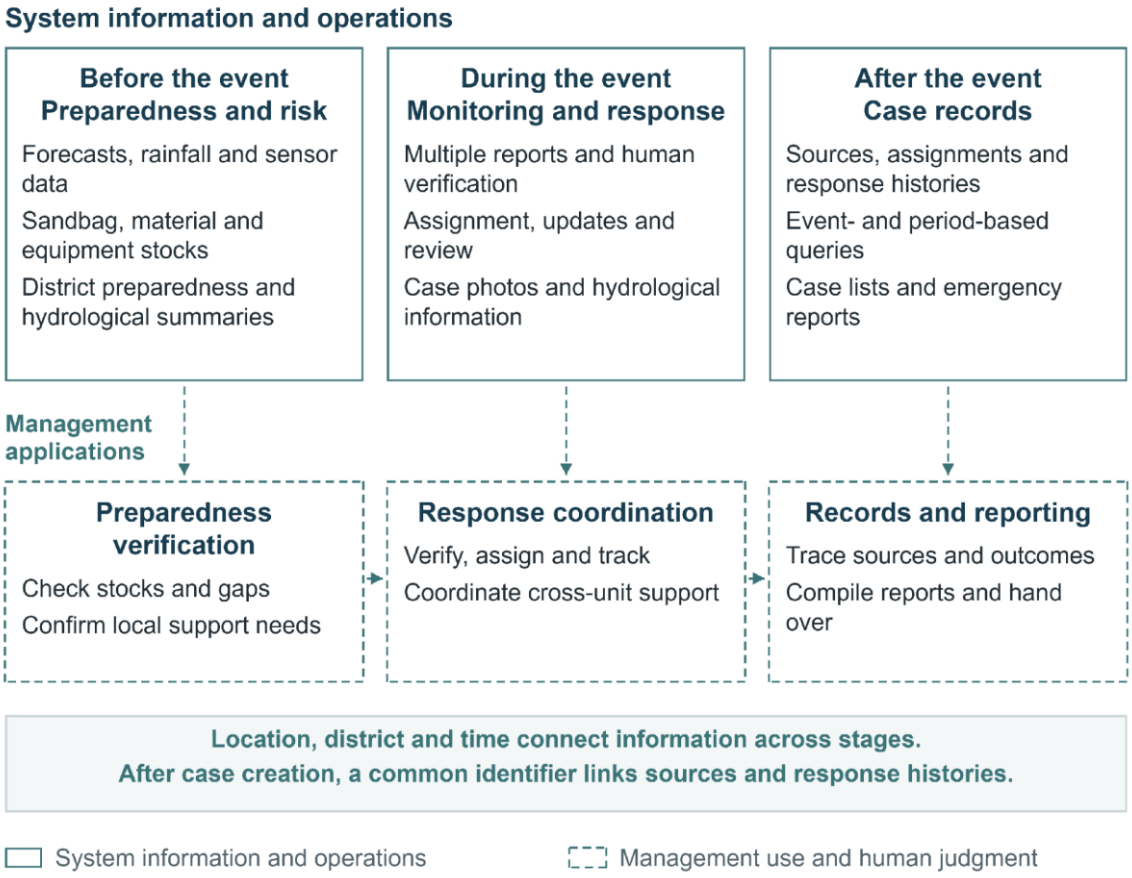

Fig. 1: Citywide framework for flood disaster life-cycle management

 2026 IJLERA – All Right Reserved

Table 1: Recent research and corresponding existing system functions

Research theme	Representative studies	Main contribution	Corresponding functions in this case
Sensing and dashboards	Mydlarz et al. (2024) [4]; Adesina et al. (2024) [5]	Observation locations, hydrological information display, and shared monitoring	Integration of rainfall, water level, and inundation observations
Collaboration and responsibilities	Li et al. (2023) [6]; Wiedemann et al. (2024) [7]	Needs across stages, coordination across levels, and continuity of responsibility	Citywide, district, and individual case handling
Sharing and operation	Adesina et al. (2024) [5]	Access rights, division of responsibilities, and maintenance	Shared data consultation and operational updates

3. Research Method and Integrated Flood Management Framework in Taichung City

3.1 Case Scope and Analytical Procedure

A single-case approach is adopted to examine the integrated flood information system in Taichung City and its management operations. Qualitative analysis focuses on the relationships between functions and processes. First, data sources are organized according to management needs, distinguishing meteorological forecasts, rainfall, water level and inundation observations, surveillance imagery, preparedness updates, and reported cases. Their spatial, administrative district, temporal, and event relationships are then examined. This step identifies which information can be consulted jointly and how previously fragmented content enters a shared flood management context while retaining the distinct meanings of its sources.

Second, the operational sequence is reconstructed through preparedness item creation, reporting and review, and through incident reporting, human verification, assignment, response, and review. The information used, participating roles, and subsequent tasks are examined at each step to identify where information continuity is required. The analysis then considers how these functions support municipal oversight, district coordination, and individual case actions.

Third, event queries, case histories, case-specific hydrological dashboards, and case list exports are compared to identify the data units and management questions associated with record retention, consultation, and statistical summaries. Source reports, verified cases, monitoring stations, and response records are distinguished. The analysis considers how events, administrative districts, statuses, and time support queries, and how compiled information can be traced back to individual case content. These uses are derived from the existing data structure, with their application depending on the query purpose and available data.

Finally, the relevant literature is used to examine the relationships among information and action, organizational responsibilities, and governance benefits, providing a basis for the synthesis of management benefits in the conclusion.

3.2 Relationships among Citywide, District, and Case Levels

The Taichung management framework has two analytical dimensions: the disaster life-cycle stages shown in Fig. 1, comprising pre-disaster, response, and post-disaster stages, and the management scales considered in this section, comprising citywide, administrative district, and individual case levels. The former concerns information continuity between operational stages, while the latter concerns information exchange across organizational levels. Sections 4 to 6 examine applications at these three scales in pre-disaster preparedness, response, and case record management. Section 7 synthesizes the research conclusions and management implications.

This framework addresses management needs arising from previously fragmented information. Meteorological information, hydrological observations, surveillance imagery, and district office material records originate from different sources or responsible units, requiring consultation and communication across sources. Following integration, the information can be consulted progressively at citywide, district, and individual case levels.

At the citywide level, managers use summaries of anomalies and preparedness conditions to determine which areas require attention. At the district level, summaries establish a scope for coordination and provide municipal and local personnel with information on the same area. At the case level, records describe the problem and response progress, including sources, locations, assignments, and handling status. These levels are connected through a shared geographical and administrative context. Users can move from an overview to

 2026 IJLERA – All Right Reserved

detailed records and relate field issues back to district conditions. Figs. 2 and 3 and Table 2 summarize these levels and their information relationships.

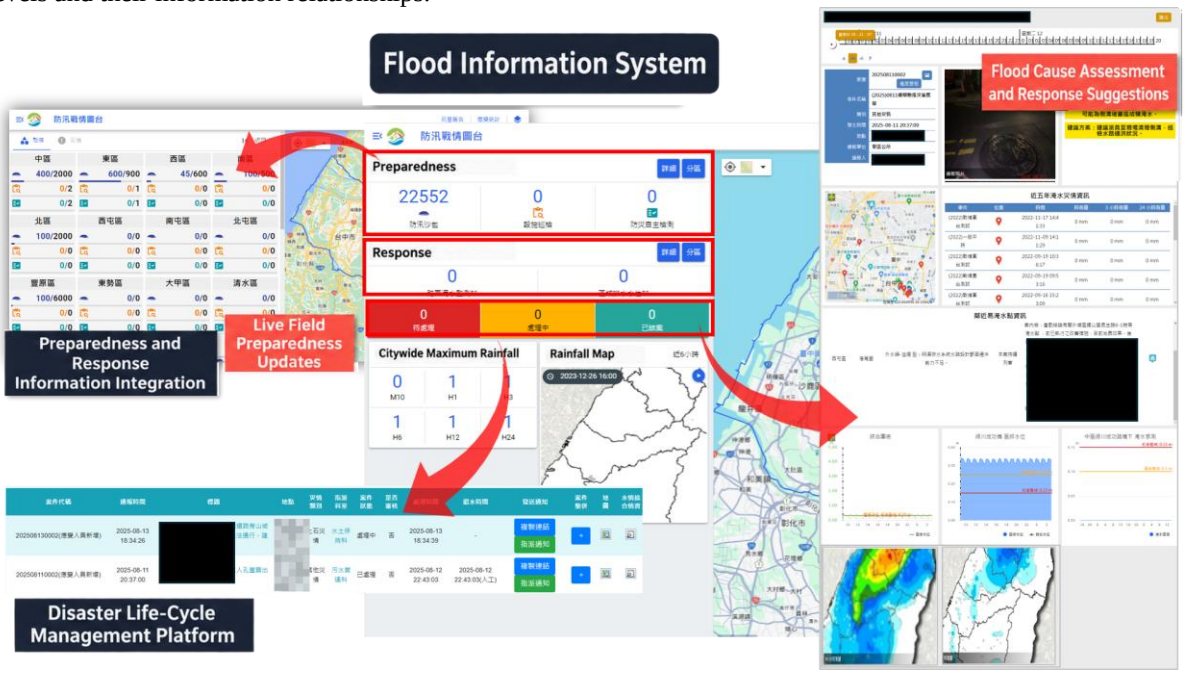

Fig. 2: Integration of preparedness, response, and case information in the flood information system (selected information masked)

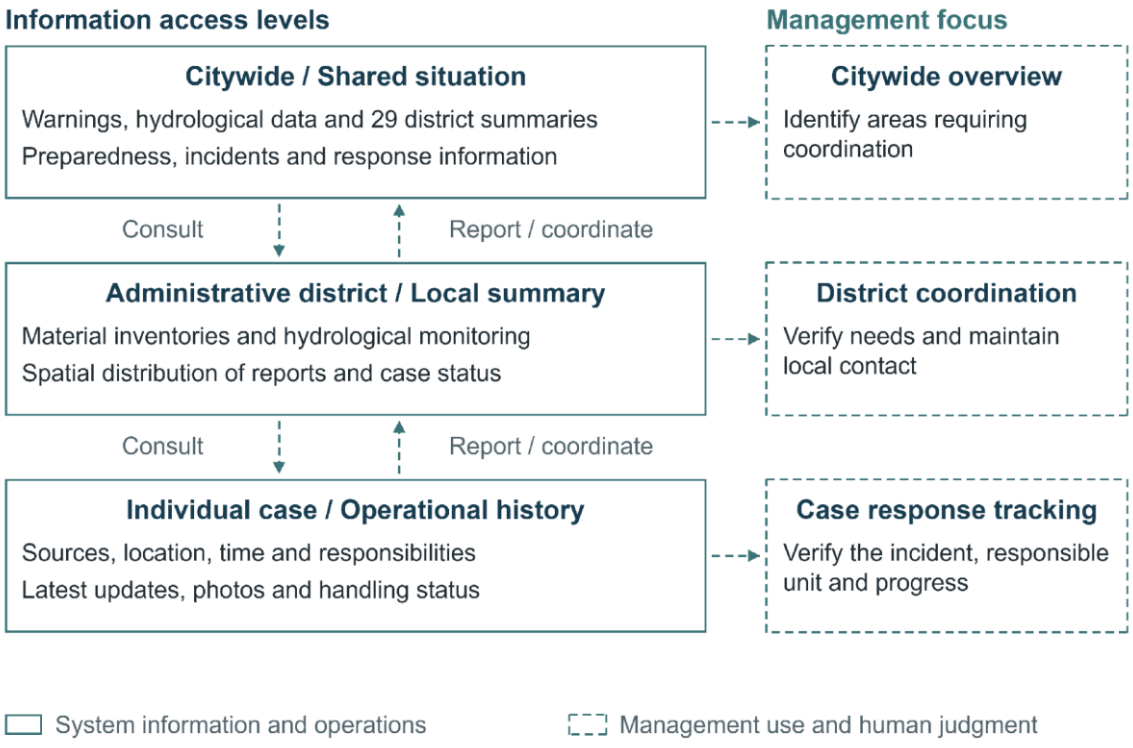

Fig. 3: Citywide, district, and case management scales

 2026 IJLERA – All Right Reserved

Table 2: Management questions and applications at three scales

Management scale	Management question	Main information	Application focus
Citywide overview	Where anomalies occur and where support is needed	Warning, preparedness, and response summaries	Areas requiring attention and cross-district coordination
District coordination	Local preparedness and case status	District material inventories, hydrological information, and reports	Verification of needs and local communication
Individual case handling	What has occurred and which unit is responsible	Sources, locations, assignments, and response updates	Verification, response, and progress tracking

The geospatial map interface provides a shared spatial context across the three levels. Rainfall, water level, street inundation, CCTV imagery, and relevant water management geospatial data can be consulted according to management questions, allowing information from different sources to be compared. Flood cases retain related reports and response histories under a common case identifier through report verification, assignment to responsible units, response updates, and review [8]. The relevance of pre-disaster information to case content still needs to be assessed according to location, time, and source.

3.3 Research Limitations

The main limitations concern the single-case design and the scope of the available data. This study qualitatively analyzes functions, processes, and management applications. Complete event logs, workload data, and public impact data were not obtained for quantitative causal estimation; consequently, no estimates are made of improvements in time, cost, or flood losses. Management applications of case queries and statistical summaries still require examination against event data and actual operations. Application in other cities would also require adjustment to institutional arrangements, monitoring conditions, and reporting practices.

As event and preparedness records accumulate, the information relationships identified in this study can guide examination of how preparedness, verification, assignment, response, and query operations vary under different conditions. Such an extension could relate the management roles identified through qualitative analysis to operational outcomes while accounting for the influence of rainfall, resources, and organizational arrangements.

4. Pre-Disaster Preparedness and Risk Awareness

Pre-disaster management requires an understanding of potential impacts, existing preparedness, and matters requiring verification. Rainfall forecasts indicate possible developments, current rainfall and water levels describe observed conditions, and resource and equipment records show reported preparedness. Joint consultation of these data helps relate resource inventories to district-level risks and potential needs, providing a basis for readiness checks and support coordination.

4.1 Rainfall Conditions and Local Risk Awareness

Rainfall forecasts indicate potentially affected periods and areas, while observations support the monitoring of subsequent developments. The system integrates weather, rainfall, warning, and map information, enabling case officers and managers to consult forecasts and observations together and consider local conditions when arranging checks and preparations. The forecast extent and intensity of rainfall may change as forecasts are updated, and local needs also depend on timing, use conditions, and existing problems. Managers should use this information to arrange early preparations and subsequent verification, adjust areas of concern as new information becomes available, and distinguish forecast scenarios from actual flood conditions.

Forecasts and district summaries also require interpretation across spatial scales. A forecast area may extend across several districts, while observations and previous experience may vary within each district. City-level managers can first examine broader developments and then verify needs at district and case locations. Interpretation across these levels supports early preparation while allowing local differences to be checked.

4.2 Resource Inventories and Preparedness Tracking

Inventories of sandbags and other resources provide a practical link between city-level oversight and local preparedness. Citywide summaries show resource distribution, district information helps district offices and responsible staff verify local conditions, and detailed records provide quantities and submitted updates.

 2026 IJLERA – All Right Reserved

Centralized reporting and consultation allow managers to share information that previously required separate inquiries.

Inventory records can also support checks across management levels before an emergency response. City-level summaries identify areas requiring attention, district details support local checks of individual items, and case officers supplement the records with recent use, replenishment, or matters requiring verification. Relatively stable information remains available for consultation, while follow-up communication can focus on discrepancies and consequential changes. This approach makes preparedness information a starting point for operational checks.

Recorded remaining and total quantities of each resource (Fig. 4) can be consulted alongside district and risk information to inform discussions of where replenishment or support may be needed. These quantities describe recorded preparedness. Actual deployable capacity still requires verification by responsible staff and local personnel, considering location, operating requirements, and conditions of use.

Resource comparisons must retain item categories and units of measurement. Sandbags, flood barriers, and pumps of different specifications serve different purposes; their combined count should not be treated as a measure of support capacity. Even resources of the same type require interpretation in relation to their locations and the needs involved. Total quantities indicate the recorded inventory, while remaining quantities reflect recorded use and replenishment. Managers should check the reporting time, quantity changes, and submitted information together, distinguishing actual replenishment needs from records awaiting updates before arranging further communication and support.

Preparedness reporting includes defining reporting items, notifying personnel, submitting information, confirming completion, and reviewing submissions, with the associated histories incorporated into statistical summaries. Submitted reports, items awaiting verification or supplementation, and changed information entail different follow-up needs; completion counts alone do not adequately describe preparedness. Organizing follow-up matters by district, item, and responsible person allows summaries to show the work awaiting verification and supports subsequent management communication.



Fig. 4: Sandbag and resource inventories by administrative district (selected information masked)

4.2 Monitoring Checks and Response Preparation

Before an event, sensor information can support continuing awareness of water conditions and the verification of anomalies. Observation locations and measurements describe conditions at particular times, whereas missing or outdated data require further checks. Combining different types of water information with maps, imagery, and local information helps personnel distinguish changing conditions, insufficient data, and the need for additional field reports, and assess whether monitoring data are applicable to current preparations. Fig. 5 presents the distribution of flood-monitoring sensors and station information, allowing personnel to consult monitoring conditions by location, data time, and water-level measurements.

Alternative reporting and observation arrangements may be considered for areas with insufficient monitoring data. Nearby sensors, imagery, and local communication cover different areas and can supplement

 2026 IJLERA – All Right Reserved

one another without being fully interchangeable. Managers should first identify the missing information and its potential implications, then select an appropriate verification approach so that areas with less data remain within the scope of pre-disaster oversight.

Historical flood records and information on flood-prone locations provide contextual experience for local preparations. Previous occurrence times, response actions, and current conditions at a location can help case officers identify places requiring early checks. A previous flood does not establish that the same conditions will recur, but it can inform reporting and support arrangements when interpreted alongside current forecasts and field conditions.

Updates to pre-disaster data should also correspond to management needs at different times. Routine inventories establish baseline conditions, while checks before an event reflect recent changes. When resources have been used, equipment locations have changed, or records still require verification, subsequent users should be informed of the relevant timing and limitations. This provides a basis for interpreting preparedness information during the response and connects data maintenance with operational use.

Changes in preparedness records affect different users. Following local resource use, city-level information on remaining stocks needs to be updated; when city-level managers request support, local personnel also need to confirm its purpose and timing. Resource inventories and support coordination therefore require continuously updated records to reflect current preparedness.

Joint consultation of preparedness and monitoring information allows managers to adjust work priorities as conditions change, first examining preparations in areas of concern and then checking outstanding resource needs and field requirements. Moving from the citywide overview through districts to individual items can support subsequent work arrangements, while local reports supplement city-level awareness.

An illustrative management scenario demonstrates this application. City-level managers first select areas of concern using forecasts and warnings, then consult local resources and previously recorded problems, while local personnel verify currently available capacity and outstanding matters. As new observations or reports arrive, existing preparedness becomes background information for subsequent coordination. This scenario illustrates the use of information continuity; specific arrangements remain dependent on conditions at the time.

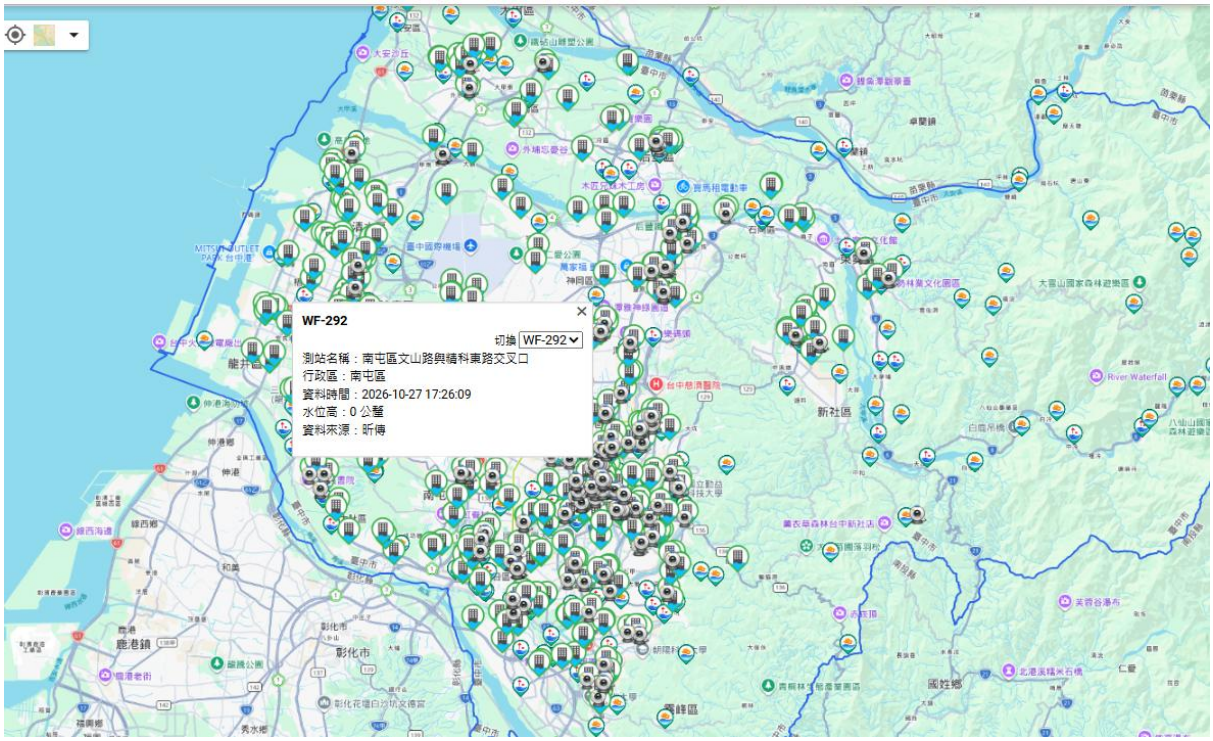

Fig. 5: Distribution of flood-monitoring sensors and station information in Taichung City

5. Monitoring, Reporting, and Coordinated Response During Events

During an event, management focuses on translating water information and reports into response tasks that can be tracked. The citywide overview shows the distribution of anomalies, district information supports local verification, and case records preserve sources, locations, and response details. Continuity across these

 2026 IJLERA – All Right Reserved

three management levels allows managers to distinguish information awaiting verification, cases with assigned responsibility, and matters requiring further coordination, linking situational awareness with response actions.

5.1 Reports from Multiple Sources and Human Verification

Monitoring alerts, citizen reports, and agency disaster information have different meanings. Sensors describe conditions at observation locations, citizen reports indicate experienced impacts and needs, and agency records provide the context of receipt and verification. Each source may warrant attention, but its provenance must be retained and the event scope and management needs verified before a decision is made to include it in case management. Taichung's 1999 service is a municipal service and work-dispatch reporting channel that receives reports of flooding and other matters [9]. EMIC belongs to the disaster-response information management framework and is associated with the preparedness and response responsibilities of the National Fire Agency [10]. These channels have different institutional roles. Under existing procedures, the case system incorporates their data and sensor alerts into disaster-event handling [8], allowing response personnel to consult information from multiple sources in a common management environment.

During emergency response, the system receives EMIC disaster reports, 1999 service requests, and inundation sensor alerts, compiles the reported information, and notifies managers. Personnel then decide whether the information should become a case within life-cycle management. Figs. 6 and 7 and Table 3 illustrate the relationships between source information, verification, and case handling. Data integration supports information acquisition, while human verification establishes the location, extent, credibility, and subsequent responsibility as a basis for case creation and response.

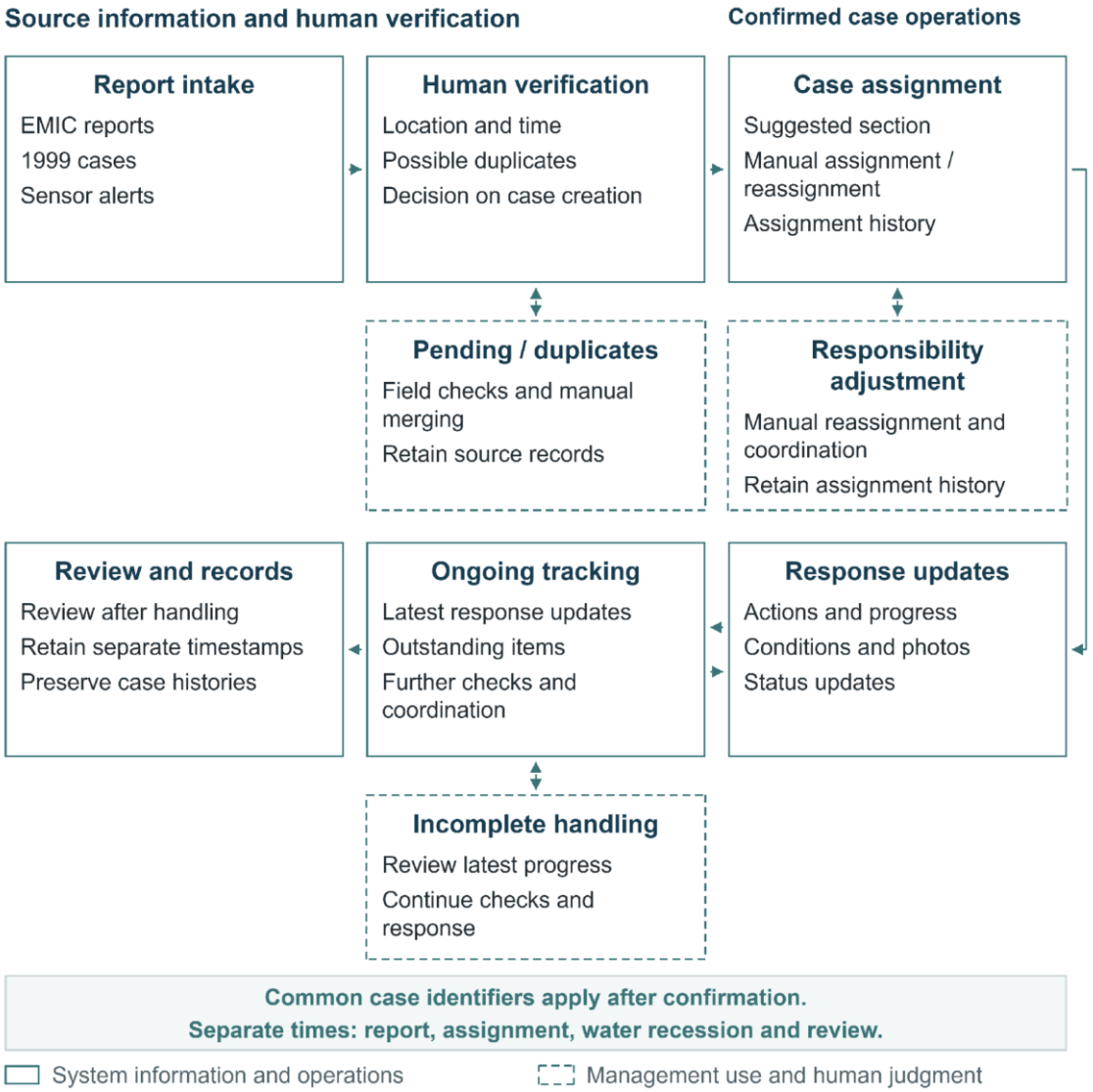

Fig. 6: Report verification, assignment, and response tracking during flood events

 2026 IJLERA – All Right Reserved

Table 3: Management implications of incoming information and case status during events

Activity	Information conveyed	Items to verify	Subsequent work
Monitoring signal or incoming report	Receipt of a signal or description	Location, time, and potential impacts	Verification or continued monitoring
Human verification and case creation	Inclusion in case management	Event extent and source relationships	Confirmation of responsibility and response
Assignment of the responsible unit	Identification of the response and contact unit	Actual responsibilities and coordination needs	Field response and reporting
Updates during response	Current measures and progress	Changes in field conditions and support needs	Follow-up or additional coordination
Review after response	Verification of updates and case conditions	Response results and outstanding matters	Status update and history retention

Human verification first establishes the conditions to which a report refers. A reported location may represent a described point, an affected area, or a monitoring station, and the reporting time may be later than the occurrence itself. Managers can consult maps, water information, imagery, and local field reports together, preserving known conditions and matters requiring further checks as a basis for subsequent assignment. Different sources do not necessarily provide independent evidence: a citizen report may be forwarded through another channel, and agency information may cite the same message. Comparing source relationships and content helps avoid treating repeated transmission as multiple independent confirmations, while preserving the basis for the assessment and the field information still required.

Verification work also requires follow-up. Unverified information may still involve transport safety or residents' needs; managers should therefore keep track of the personnel conducting checks, the next verification time, and necessary precautionary arrangements. The study recommends organizing pending matters by source, area, and time awaiting verification to support human judgment, rather than treating unverified information as requiring no action. When several reports arrive together, personnel can consider potential public impacts, location, changing conditions, and ongoing response actions when deciding the order of attention. Pending information and verified cases should be tracked separately to distinguish verification progress from field response and avoid treating all messages as an equivalent workload.



Fig. 7: Flood case list, handling status, and spatial distribution (selected information masked)

 2026 IJLERA – All Right Reserved

5.2 Responsibility Assignment and Response Tracking

Once a case has been created, the system suggests the responsible division using the district and existing responsibility relationships; response personnel may adjust or change the assignment (Fig. 8). This arrangement links case location with organizational responsibilities and provides a reference for assignment. Actual jurisdiction, case details, and coordination needs remain subject to human judgment, and assignments can be revised when the location is corrected or the problem is reassessed.

Confirmation of the responsible unit supports communication and continuity of work. Managers need to know which unit currently handles communication and response; case officers need to understand the case scope and available information; and supporting units need to establish how their tasks relate to the case. Assignment histories preserve the responsible unit and changes in responsibility for later consultation and interagency communication. Reassignment may follow a corrected location, a revised assessment, or clarification of the division of work; the reasons and times provide a basis for tracing responsibility. Compared with retaining only the final responsible unit, a complete history shows earlier assignments and response actions, helping managers and incoming personnel establish how responsibilities changed and which unit should continue the work.

A case may simultaneously require local field reporting, checks of site safety, and interpretation of water conditions. The responsible unit assumes primary responsibility, while supporting work is arranged according to actual needs. City-level management coordinates the understanding of the problem and support needs across units, reducing differences in the information available to them. The common case identifier and location context provide a shared basis for discussing the same event and coordinating response.

Response updates incorporate field conditions into the common management view. The system retains information from before, during, and after response actions and provides a review procedure; the spatial distribution of case statuses can be consulted on the map. Managers can move from an area overview to outstanding cases to check field measures and subsequent progress.

The management value of response updates lies in explaining current conditions, actions taken, and outstanding support needs. Case status provides a summary, while text, timestamps, and photographs supply context. Updates can support coordination when conditions change, support needs increase, or an earlier assessment requires revision. Case histories retain the sequence of actions and changing conditions.

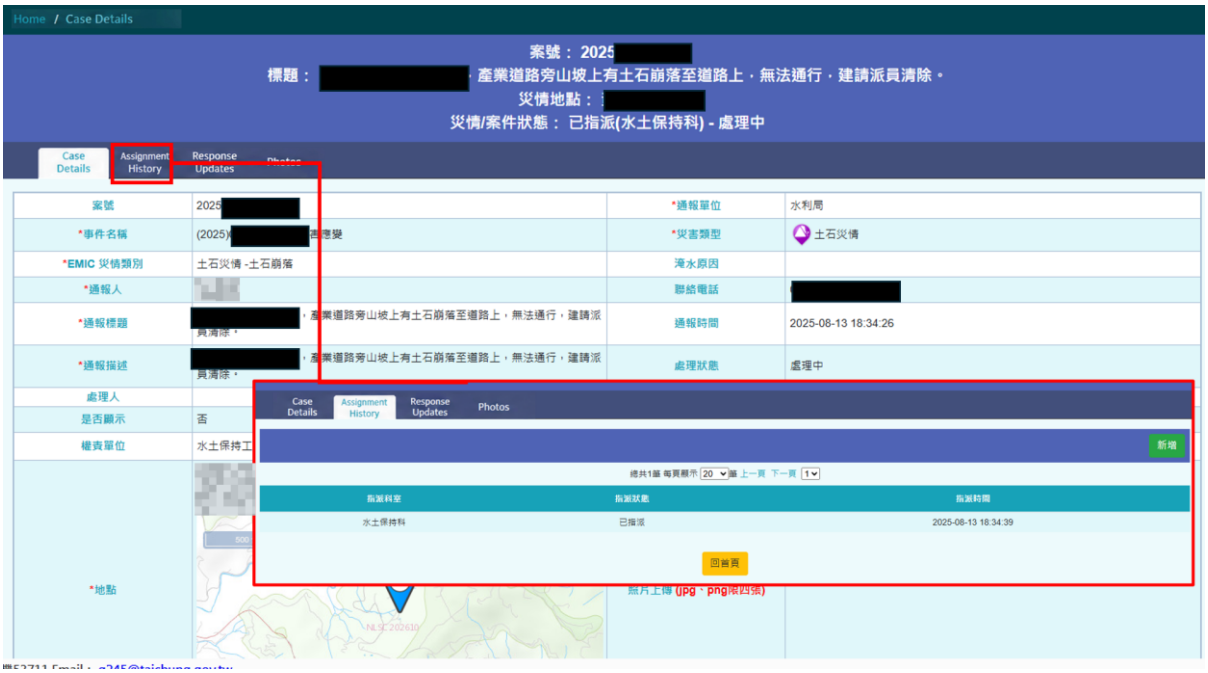

Fig. 8: Case assignment and assignment history (selected information masked)

5.3 Interpretation Supported by Multiple Information Sources

The case-specific hydrological dashboard links cases with surrounding information. A common case identifier allows users to consult basic details, progress, and maps and compare hourly rainfall, 10-minute rainfall, flood records from the preceding five years, and nearby flood-prone locations. Fig. 9 summarizes how these sources support human interpretation, placing new reports in the context of current rainfall and existing location information.

 2026 IJLERA – All Right Reserved

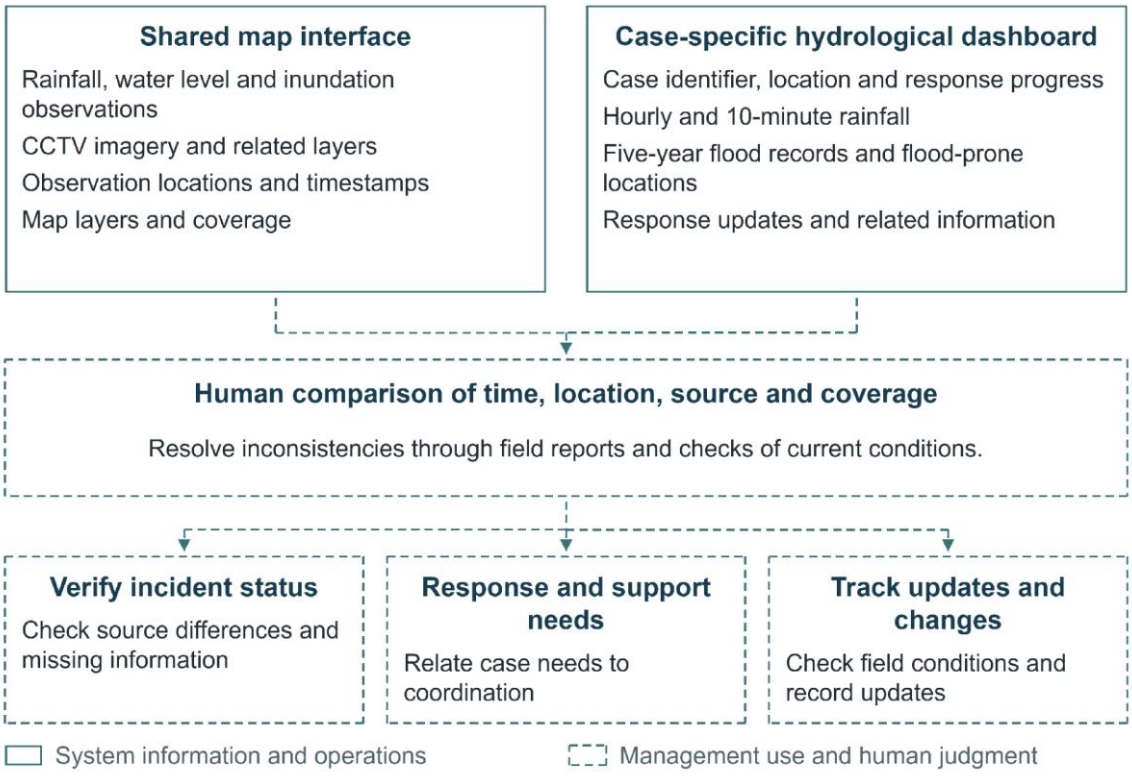

Fig. 9: Rainfall, sensors, imagery, and historical records supporting human interpretation

Rainfall, sensors, and imagery provide different forms of evidence. Rainfall indicates the context for possible developments, water-level or inundation signals reflect changes at observation points, and CCTV allows personnel to view conditions within camera coverage. Imagery in the map interface and case-specific water information can complement one another, but camera coverage, timing, and correspondence with the case still require checks before use in current assessments.

Joint interpretation must account for the coverage of each source. Imagery may cover only part of an intersection, a sensor represents a particular observation point, and a report may describe a wider area. When information differs, managers can compare times and locations again and request local checks where necessary. Multiple sources supplement different observation perspectives; they are not expected to produce identical conclusions immediately.

Ten-minute and hourly rainfall represent different accumulation periods and can indicate short-duration intense rainfall and longer-period accumulations, respectively. Managers can compare these measurements with case reports, sensor changes, and update times to interpret developments. When source times differ, the original timestamps should be retained and field reports used to supplement information on current conditions.

Historical flood records and flood-prone locations provide spatial context, complementing the risk information discussed in Section 4.3. Case officers can use this context to understand the location referenced by a current report and consider rainfall, sensor observations, and response updates together when deciding how to verify conditions or arrange communication.

In practice, city-level managers can first examine the distribution of reports and response activities in areas showing anomalies, obtain local verification through the districts, and then consult case-specific water conditions and the latest updates through the dashboard (Fig. 10). When field support is needed, specific constraints and requirements can be referred for coordination; verified conditions and response results can then be reflected in district summaries. A consistent consultation and reporting context connects city-level oversight, district coordination, and case-level response.

 2026 IJLERA – All Right Reserved

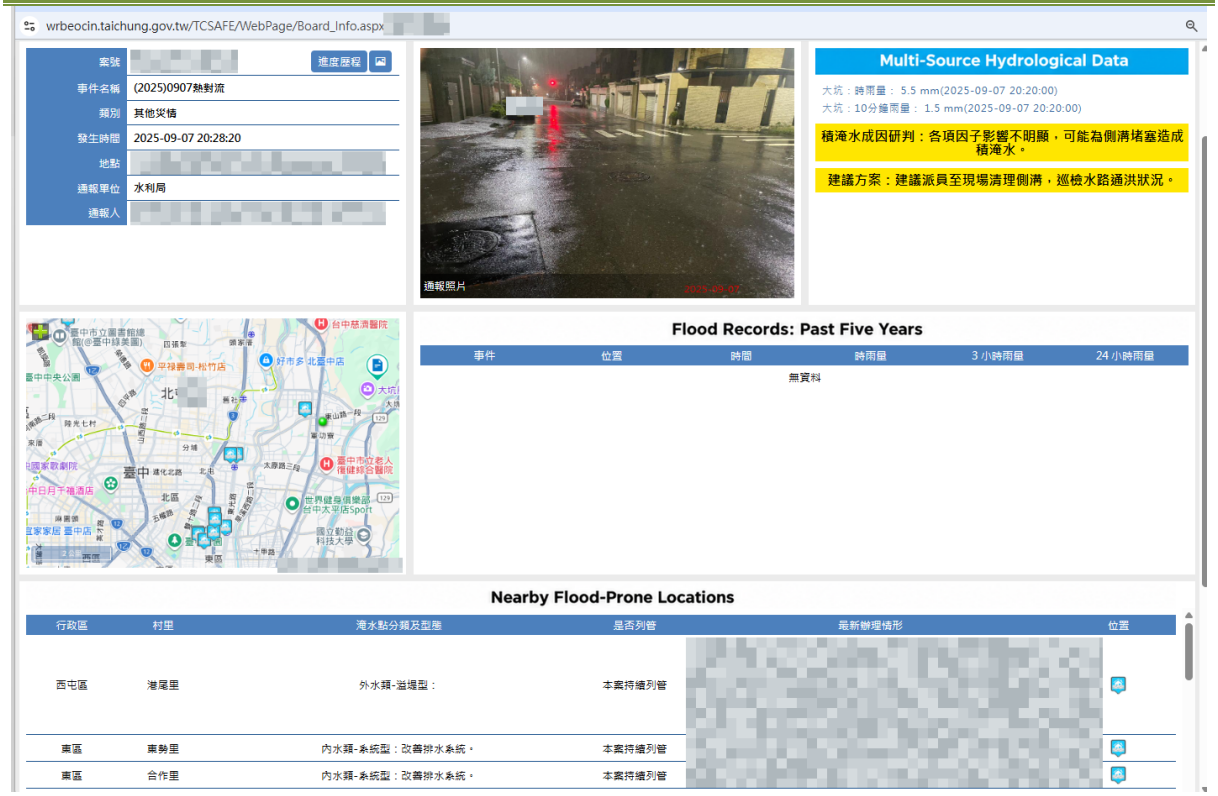

Fig. 10: Integration of case, rainfall, and location information in the case-specific hydrological dashboard (selected information masked)

6. Retention of Case Histories, Queries, and Statistical Summaries

Source, location, time, assignment, response updates, photographs, and review information retained in the system form important records for urban flood management. These records show how an event was received and verified, how responsibility was assigned, and how response results were established. After response actions have been completed, records remain available by event, district, and case, helping managers reconstruct the handling process and respond to subsequent queries and reporting needs.

This section examines the retention, consultation, statistical summarization, and response-report compilation of existing case data. Case details describe the event, handling histories show the sequence of work, and case lists and district summaries support an overall view. Fig. 11 summarizes the relationships between record retention, queries, report compilation, and shift-handover follow-up. Table 4 lists the data, review focus, and uses associated with different management questions.

 2026 IJLERA – All Right Reserved

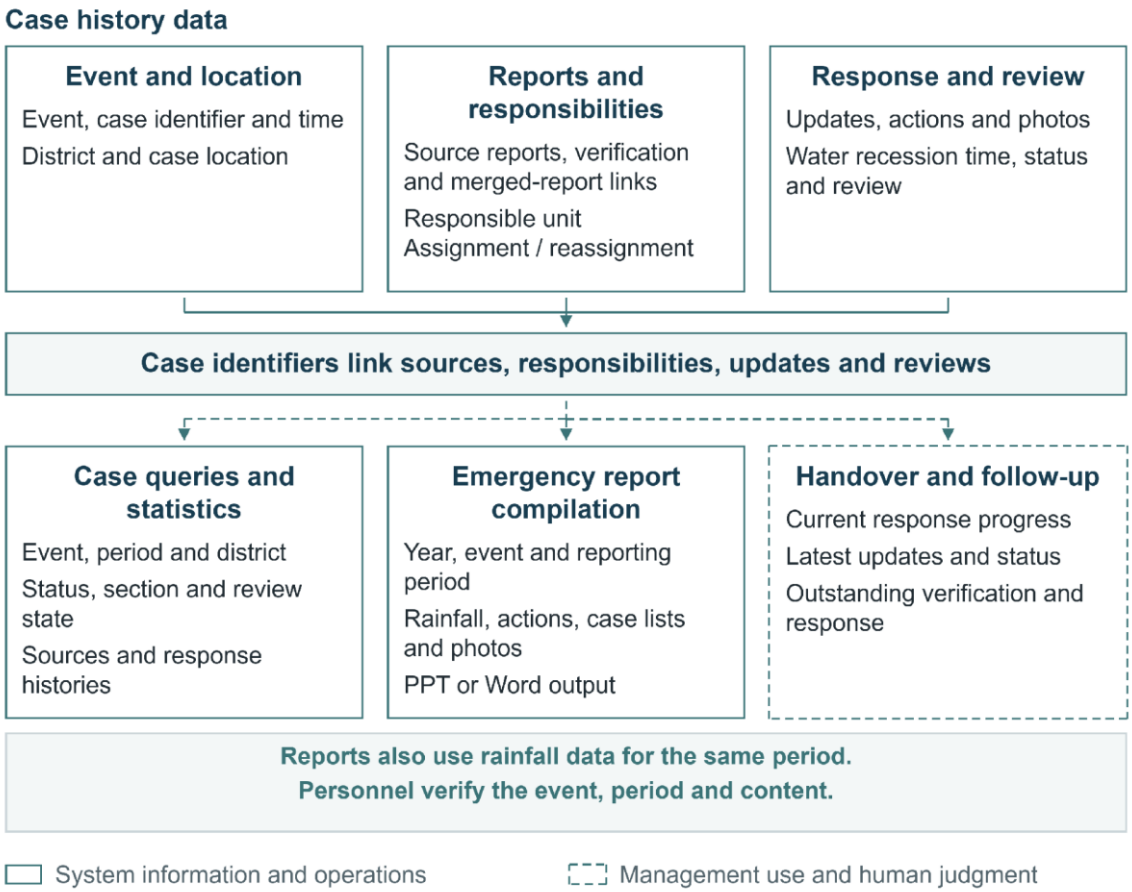

Fig. 11: Retention of flood case histories and their use in queries

Table 4: Queries and statistical uses of flood case histories

Management question	Records consulted	Focus of consultation	Management use
Conditions at case occurrence	Event, time, district, and location	Extent and source content	Preparation of event and district overviews
How source information became a case	Relationships between reports, verification, and merging	Links between original messages and the case	Tracing receipt and verification
Responsibility for handling	Assignment, reassignment, and response history	Changes in responsibility and the latest updates	Identification of contact and follow-up units
Status of response completion	Response, photographs, and review records	Field results and outstanding matters	Checking the basis for case status
How cases are compiled	Case lists, statuses, and district records	Counting unit and data reference time	Preparation of reports and query records

6.1 Case Record Retention and History Tracing

Case records use a common case identifier to connect report sources, locations, times, and response details, creating a retrievable history across receipt, verification, and response. Fig. 11 presents the relationships between three groups of records: event and location, reporting and responsibility, and response and review. These relationships allow the handling process to be traced from receipt to outcome.

A case may contain reports from different channels or times. Retaining sources and their relationships helps distinguish original messages from verified cases. If reports are merged, their original times and locations

 2026 IJLERA – All Right Reserved

remain available for consultation, helping prevent repeated transmission from being treated as additional incidents and maintaining correspondence between earlier and later records.

Assignment, reassignment, and response updates show changes in responsibility and case handling. Managers can consult the current responsible unit and earlier assignments, while case officers can verify completed measures and the latest updates to support continued communication and shift handover. This avoids interpreting the handling process solely from the final case status.

Photographs, text, and timestamps jointly describe field and operational conditions, while review information supports status updates. Retaining histories links case outcomes to specific response records and supports later queries, data checks, and follow-up of outstanding matters.

6.2 Event Queries and Response-Report Compilation

Event queries first define the data by event and time range, then filter cases by district, status, division, and review status. The presentation export module shown in Fig. 12 also provides settings for year, event, presentation subtitle, and the start and end of the reporting period, placing event data within a defined response context and reporting interval.

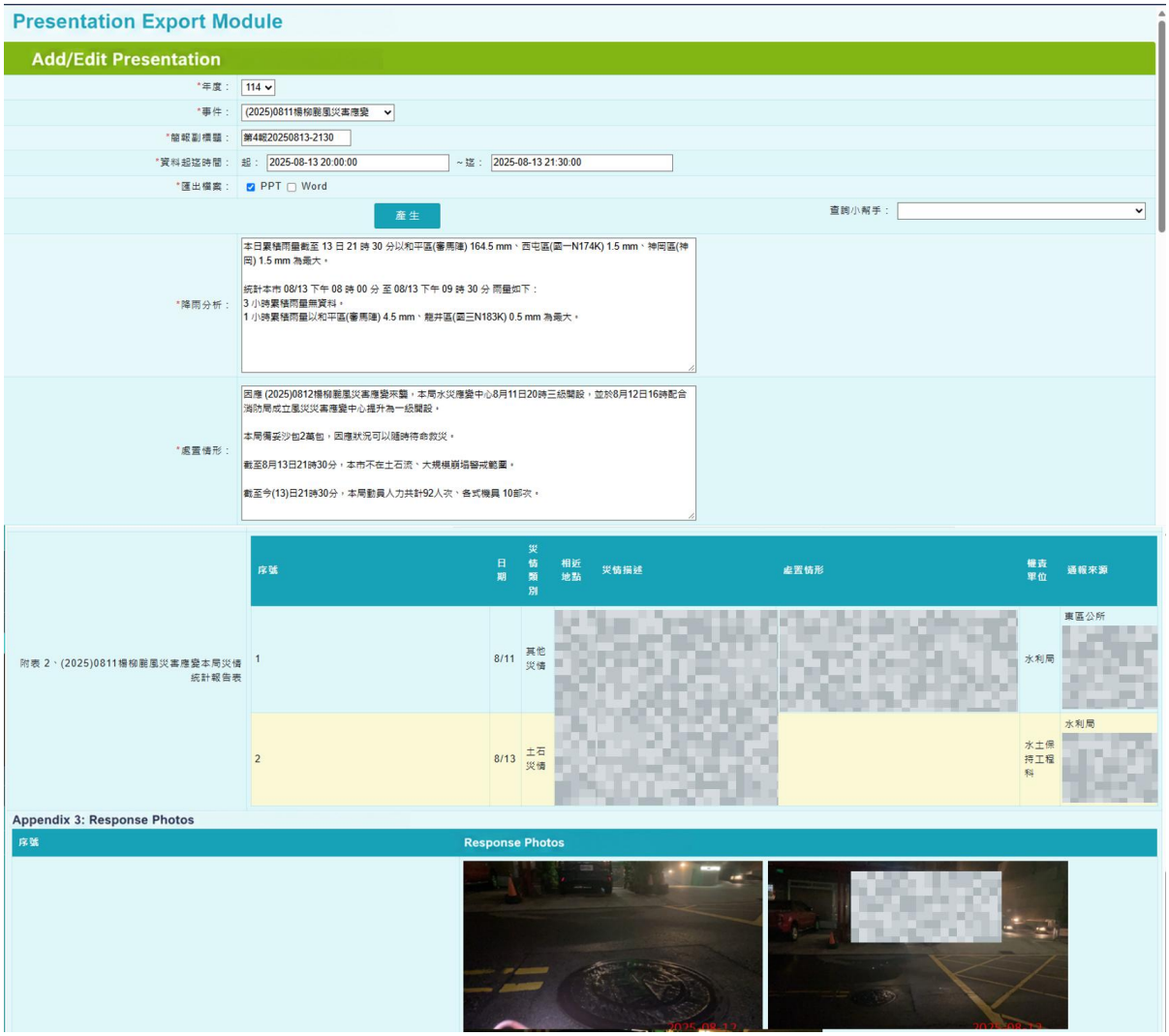

Fig. 12: Compilation of rainfall, response, and case information for emergency reports (selected information masked)

Case lists provide a basis for checking identifiers, times, locations, and handling status, while the map supports examination of spatial distribution. Before compilation, the list should be checked against the same event and time range to ensure that the included records meet the reporting purpose. Output can then be selected in PPT or Word format as needed.

 2026 IJLERA – All Right Reserved

Reports contain rainfall analysis, response information, case lists, and related photographs, allowing managers to describe the situation and response progress. Case officers still need to check the content against rainfall data, response updates, and photographs to ensure consistency with the original records. Data compilation does not replace human interpretation.

Reporting, assignment, floodwater recession, and review have distinct temporal meanings. Reports should state the start and end of the data period and check the periods represented by case and rainfall records, distinguishing the sequence of physical conditions, operational actions, and data updates and maintaining temporal consistency between summaries and detailed records.

Outstanding cases and matters awaiting verification should be included in reports together with the latest progress and pending actions; the end of a response period should not imply that every case has been closed. Clearly specified data coverage and status information support city-level reporting, interagency coordination, and shift handover, providing a basis for subsequent follow-up.

7. Conclusion

This single-case study of Taichung City examined how an integrated flood information system supports the management of urban flood disasters across operational phases and administrative scales. The analysis shows how rainfall, water conditions, images, preparedness records, and reports from different sources can be consulted through a shared context of location, administrative district, and time. Once a case is established, a common case identifier connects the source reports with the handling history. This arrangement provides continuity between the citywide overview, coordination at district level, and the records used for individual cases.

Across operational phases, preparedness reporting and review of risk information provide a basis for response. During an event, personnel review monitoring information and reports from multiple channels to decide whether to create a case. Confirmed cases are then assigned to responsible units for handling and follow-up. After handling, the system retains the sources, assignments, responses, and review records. Queries, case lists, and response-report compilation allow these records to be traced by place, time, responsibility, and action taken. The relevant connection is therefore the continuation of information from preparedness through response to case-record management.

At the citywide scale, information supports decisions on which areas require attention. At district level, it supports coordination of local preparations and cases; at case level, it supports verification and field handling. Shared spatial and event contexts provide a reference for communication among roles. CCTV imagery and hydrological data support staff interpretation, while direct communication helps clarify data limitations and current field conditions. Handling reports then update the broader situation. These exchanges explain how information displays can support specific management work through continuing consultation, judgment, and reporting.

The management value described in this case concerns preparedness awareness, joint interpretation of information, responsibility tracking, and access to case histories. Its practical use depends on the units involved and their working conditions. Continuing data updates, clear responsibilities, and an appropriate reporting workload are necessary to sustain these uses. The findings are qualitative and concern system functions, workflows, and management applications. Complete event logs, workload data, and public-impact records were not obtained for quantitative causal analysis; consequently, the study does not quantify time savings, cost reductions, or reductions in flood losses. Information provision must be accompanied by rules for its use.

The practical implication is to organize flood information around work phases and management scales so that each function addresses a defined operational need. Users can navigate from the citywide overview to individual case records, field responses can inform district and citywide summaries, and event-level compilations can retain links to the original histories. In this way, the integrated system provides an information basis for city-level managers, districts, and responsible units to consult information within a shared context, coordinate their work, and handle urban flood matters.

References

[1]. United Nations Office for Disaster Risk Reduction. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030.

[2]. Hegger, D. L. T., Driessen, P. P. J., Dieperink, C., Wiering, M., Raadgever, G. T. T., & van Rijswick, H. F. M. W. (2014). Assessing stability and dynamics in flood risk governance: An empirically illustrated research approach. *Water Resources Management, 28(12)*, 4127–4142. https://doi.org/10.1007/s11269-014-0732-x.

 2026 IJLERA – All Right Reserved

[3]. World Meteorological Organization. (2023, May 5). Overview of the Early Warnings for All: Executive Action Plan 2023–2027. *WMO Bulletin, 72(1).* https://wmo.int/resources/wmo-bulletin/wmo-bulletin-vol-72-1-2023/overview-of-early-warnings-all-executive-action-plan-2023-2027.

[4]. Mydlarz, C., Sai Venkat Challagonda, P., Steers, B., Rucker, J., Brain, T., Branco, B., Burnett, H. E., Kaur, A., Fischman, R., Graziano, K., Krueger, K., Hénaff, E., Ignace, V., Jozwiak, E., Palchuri, J., Pierone, P., Rothman, P., Toledo-Crow, R., & Silverman, A. I. (2024). FloodNet: Low-Cost Ultrasonic Sensors for Real-Time Measurement of Hyperlocal, Street-Level Floods in New York City. *Water Resources Research, 60(5)*, e2023WR036806. https://doi.org/10.1029/2023wr036806.

[5]. Adesina, M., Brake, N., Haselbach, L., & Hariri Asli, H. (2024). Interagency deployment of a shared low-cost flood monitoring system to improve flood resilience across Southeast Texas: A case study. *Journal of Flood Risk Management, 17(1)*, e12940. https://doi.org/10.1111/jfr3.12940.

[6]. Li, Z., Liu, L., & Liu, S. (2023). The dynamics of interorganizational collaboration in disaster management: A network study based on flood disasters in China. *International Journal of Disaster Risk Science, 14(6)*, 979–994. https://doi.org/10.1007/s13753-023-00525-7.

[7]. Wiedemann, M., Schütte, M., Loer, K., Gerdes, A., & Thate, S. (2024). Evaluation of the incident management system of a bigger city during the winter flood 2023/24 in northern Germany: Organized (ir)responsibility in the pre-disaster phase. *International Journal of Disaster Risk Reduction, 113*, 104821. https://doi.org/10.1016/j.ijdrr.2024.104821.

[8]. Final report on the 2025 commissioned information services for the management of Taichung City's flood operations and hillside information systems (revised version, disaster prevention) [in Chinese]. (2026, January). Project report.

[9]. Taichung City Government. (n.d.). Introduction to the 1999 Taichung Citizen Hotline [in Chinese]. Retrieved October 27, 2026, from https://talk.taichung.gov.tw/Home/Citizen1999.

[10]. National Fire Agency, Ministry of the Interior. (2023, September 23). Preparedness and Response Division: Responsibilities [in Chinese]. https://www.nfa.gov.tw/pro/index.php?code=list&ids=1756.

 2026 IJLERA – All Right Reserved