NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# Managing Water in a Collaborative Community

Benefits of NOAA's Community Hydrologic Prediction System

**National Oceanic and Atmospheric Administration,**

**Office of Hydrologic Development**

USACE YCWA DWR

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# Agenda

- Increasing Importance of Water Management
- Example: California Flood of 1997
  - Challenges of California geography
  - Response from the community
  - One, linked forecasting system
  - Community-based partnership approach
- Business Models – Historical and Current Approach
- Community Hydrologic Prediction System (CHPS)
  - Business Model
  - Envisioned Architecture
  - Long-term Vision

# Managing water is becoming increasingly critical…

- Water is essential for the health and well-being of society. It serves many needs and offers many benefits that require careful, balanced management. Effective water management is critical to our society.
  - Public Safety (Flash Floods, Debris Flow)
  - Flood Control
  - Water Supply
  - Drought Mitigation
  - Power Generation
  - Agriculture
  - River Commerce
  - Recreation
  - Ecosystem Health

# Failure to manage water events effectively can lead to devastating outcomes and major economic losses

- Property damage
- Personal injury
- Power outages
- Groundwater contamination
- Agricultural losses
- Major economic losses due to drought
- Water shortage
- … and more.

# Water management requires…

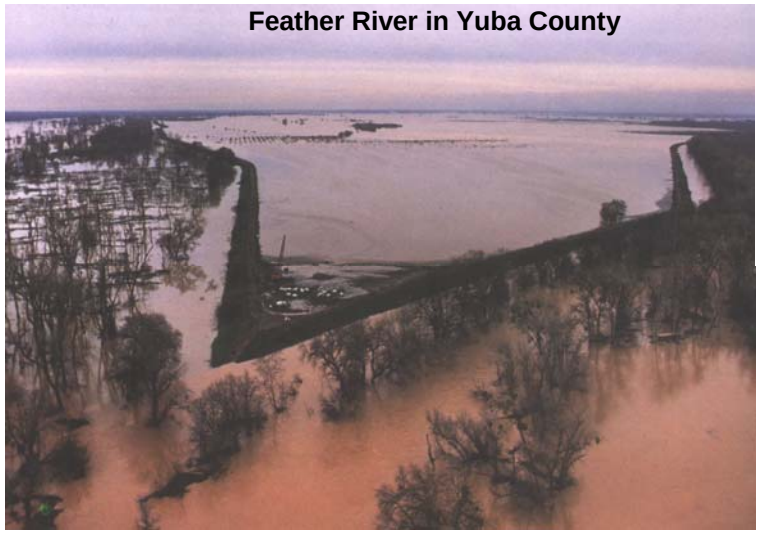
- Careful, coordinated planning for effective water use and averting disasters
- Rapid, real-time responses
- Integrated weather and water predictions of known reliability
- Increasing coordination and collaboration among organizations with common and complementary missions and goals:
  - Federal agencies (such as NOAA, USACE, etc.)
  - State government
  - Regional water authorities
  - Universities
  - Private water management organizations
- Teamwork across these agencies leads to improved public benefit for safety, the economy, and the environment

# Example: New Year's Day Flood of 1997 - California's Largest Flood on Record

- January 1997
- 30 inches of rain over three days, affecting more than 30 of the 58 counties in California
- Levee breaches in the Sacramento, Feather, and San Joaquin Rivers
- Over 120,000 people forced to leave their homes
  - 24,000 residences damaged or destroyed
- 2,000 businesses destroyed, resulting in 1,200 disaster unemployment claims
- Damages totaled over $2 billion, including:
  - $500 million to repair highways and public transportation
  - $200 million in public facilities damage
  - $300 million in flood control facilities
  - $300 million agricultural damage
- Among the river basins hit the hardest:
  - Feather
  - Sacramento
  - Yuba

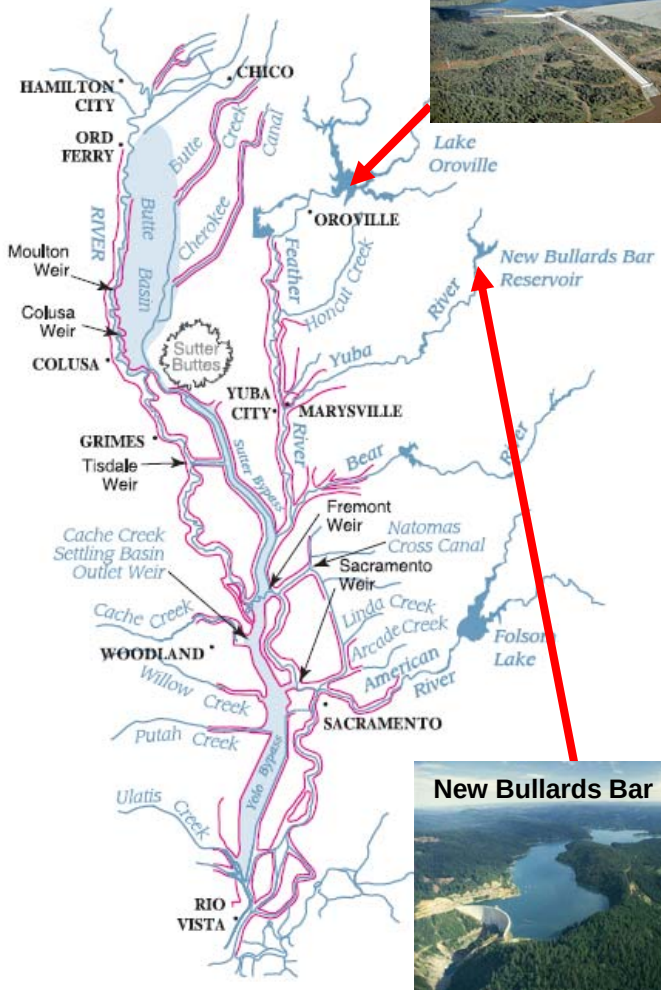
Flood statistics and response derived from the Governor's Flood Emergency Action Team, Final Report, May 10, 1997

**Feather River in Yuba County**



# California's Geographic Setting is Challenging to Manage

- Northern California
  - Sacramento River (26,000 sq. miles)
  - Feather River (5,923 sq. miles)
  - Yuba River (1,340 sq. miles)
- Water Management Challenges
  - Watersheds are large
  - Much unregulated flow
  - Significant rainfall and snowmelt
  - Long and variable water travel times
  - Combined natural and engineered systems
  - Several agencies involved in managing water

# Response to California's largest flood

- A Flood Emergency Action Team held meetings with hundreds of Californians affected by the flood and presented a final report to the Governor of California in May 1997
- Their findings recommended:
  - Improved emergency response capabilities emphasizing coordination among federal, state, and local agencies
  - Expanding support for computer-based flood event systems to ensure they are operational, with proper maintenance and staff, as well as extending access to local government entities currently without access
  - Improved flood plain management and flood control systems
  - Further studies and research
- The citizens of California demanded and voted for improvements
  - Costa-Machado Water Act of 2000

Flood statistics and response derived from the Governor's Flood Emergency Action Team, Final Report, May 10, 1997

# NOAA plays an important part in water management collaboration in California

- California voters are demanding improved water management capacities
- NOAA's California-Nevada River Forecast Center has created a collaboration to implement processes and forecasting technology to address this requirement
- The partners are creating:
  - Real-time, on-the-ground operational forecast environment
  - A united approach to managing information and forecasts during major flood events
- Key success factors associated with this approach include:
  - Public-private partnership
    - Federal, state, local, and private partners
  - Money allocated to engage outside advisors and partnerships
  - Integrated forecasting technology and systems

# Organizations Working Together on this Initiative

- Collaboration partners addressing the concerns include:

NOAA (NWS/CNRFC)

- Forecasts flow throughout the watershed, including inflow to reservoir

US Army Corps of Engineers

- Sets policy for flood operations and oversees operator performance

California Department of Water Resources (DWR) Operations Control Office

- Operates the Oroville Reservoir

DWR Division of Flood Management

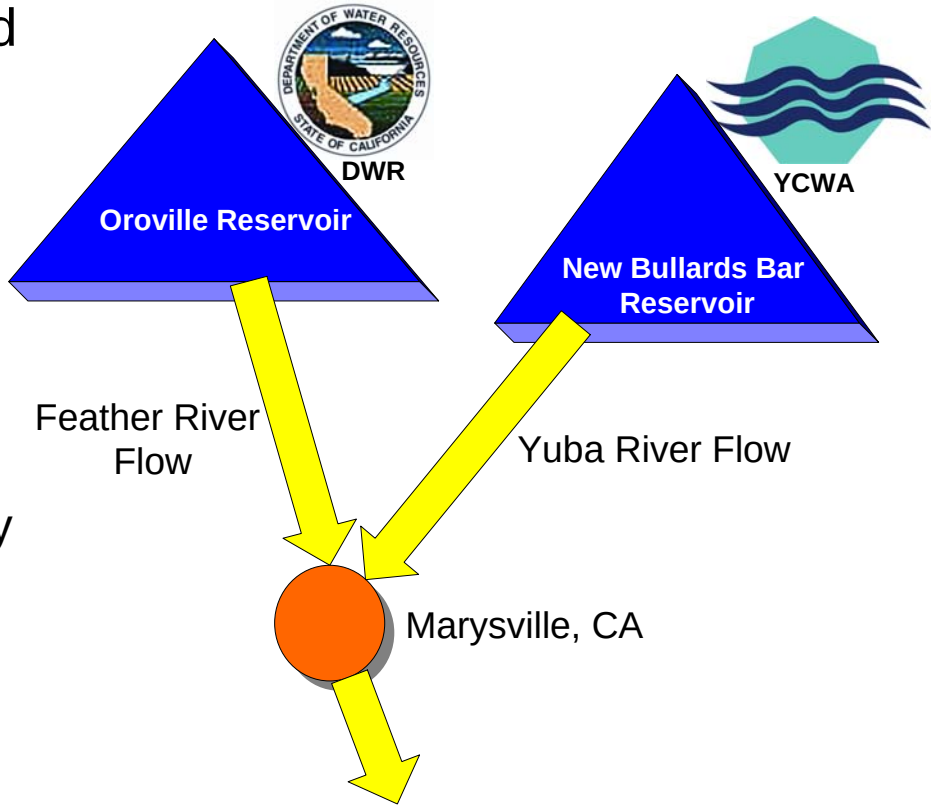
- Works cooperatively with CNRFC in forecasting, collects and manages data

Yuba County Water Agency

- Operates the New Bullards Bar Reservoir

# California forecast-coordinated water management is critical

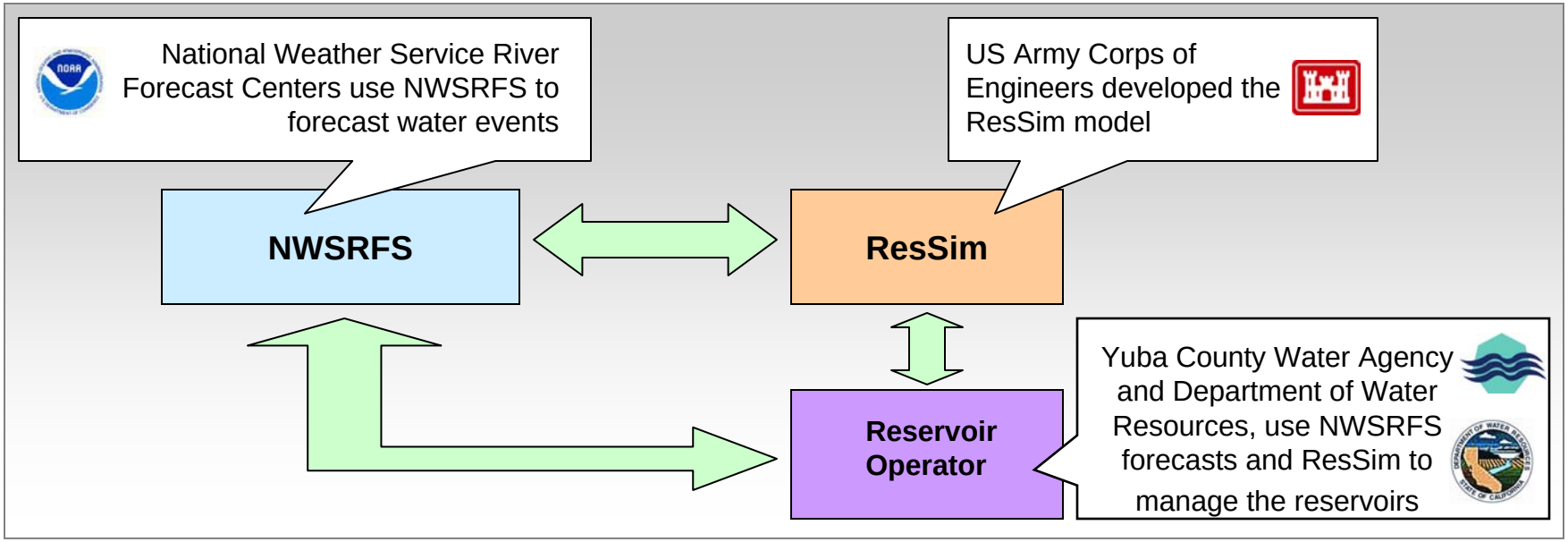
- River basins are interconnected
  - Water management decisions are felt throughout the system
- Greatest benefit occurs when water management operations are coordinated
  - The best decisions for managing 300,000 cfs capacity at the confluence take into account the current and future states of both basins.




These rivers have produced flows above the channel capacity of the leveed stream between Yuba City and the confluence with the Sacramento. This section breached in both 1986 and 1997.

# Participants creating one linked forecasting system, achieving real-time forecast coordination

- Each participant uses already existing components, including the National Weather Service's River Forecast System (NWSRFS) and the Army Corps' reservoir simulation model ResSim
- Forecast coordination is achieved by linking NWSRFS and the ResSim model into one operational environment, and integrating communication processes of all participants



# Benefits of a Community-based Partnership Approach

- **Leveraging** partner capabilities leads to vast systemic improvements
- Interagency collaboration yields a **cost-effective** outcome for the public
  - Increased public safety
  - Increased level of flood protection
  - Optimized water management
- Gaining a common understanding and improving communications
- Delivering well-applied technology allows for a higher degree of real-time interagency collaboration
- Linking organizations that are advancing hydrologic research
- Demonstrates the improved productivity of a **One Government** approach

## Reflections on the New Community-Oriented Approach

- "This is a chance for true collaboration for people who have historically not sat down and talked about substantive issues,"
  - Janet Cohen, Executive Director of the South Yuba River Citizens league (SYRCL)
    - SYRCL has become California's largest and most effective single-watershed organization
- "They've been honest and open and sincere in the process. If you have those qualities, then you have an opportunity to reach real solutions. What we're looking for is flood protection as soon as [possible]."
  - Yuba County Water Agency General Manager, Curt Aikens, speaking of the organizations working together

# Business Models – Historical and Current Approach

Historically, organizations and groups

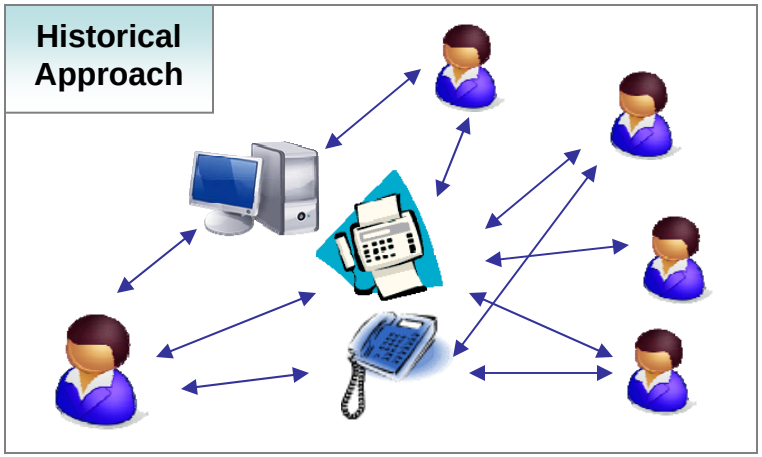
- Worked independently
- Shared data via phone, email, fax, ftp
- Had a lack of timely information
- Developed their own unlinked systems
- Duplicated efforts
- Used disparate tools and processes

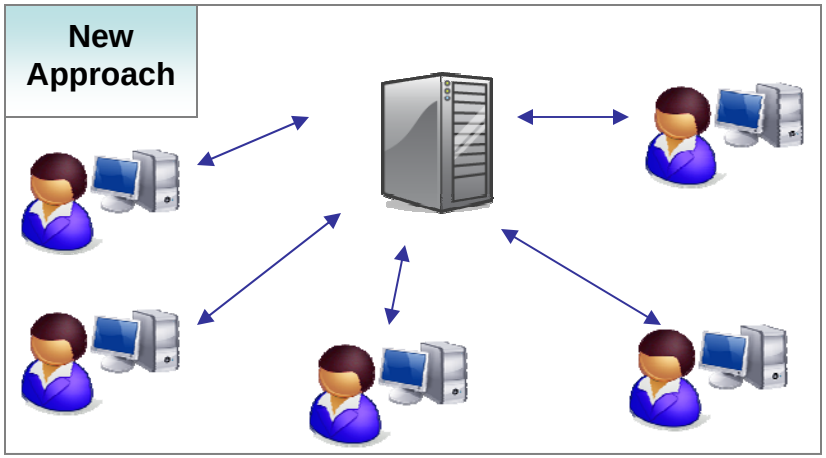
This approach did not allow for fluid integration of data into each other's forecasting processes and options were limited

The new approach strives for

- Data flowing among linked algorithms across organizational boundaries
- Open architecture that is flexible enough to utilize existing applications and services

This approach is an example of the Community Hydrologic Prediction System (CHPS)



# CHPS - Community Hydrologic Prediction System

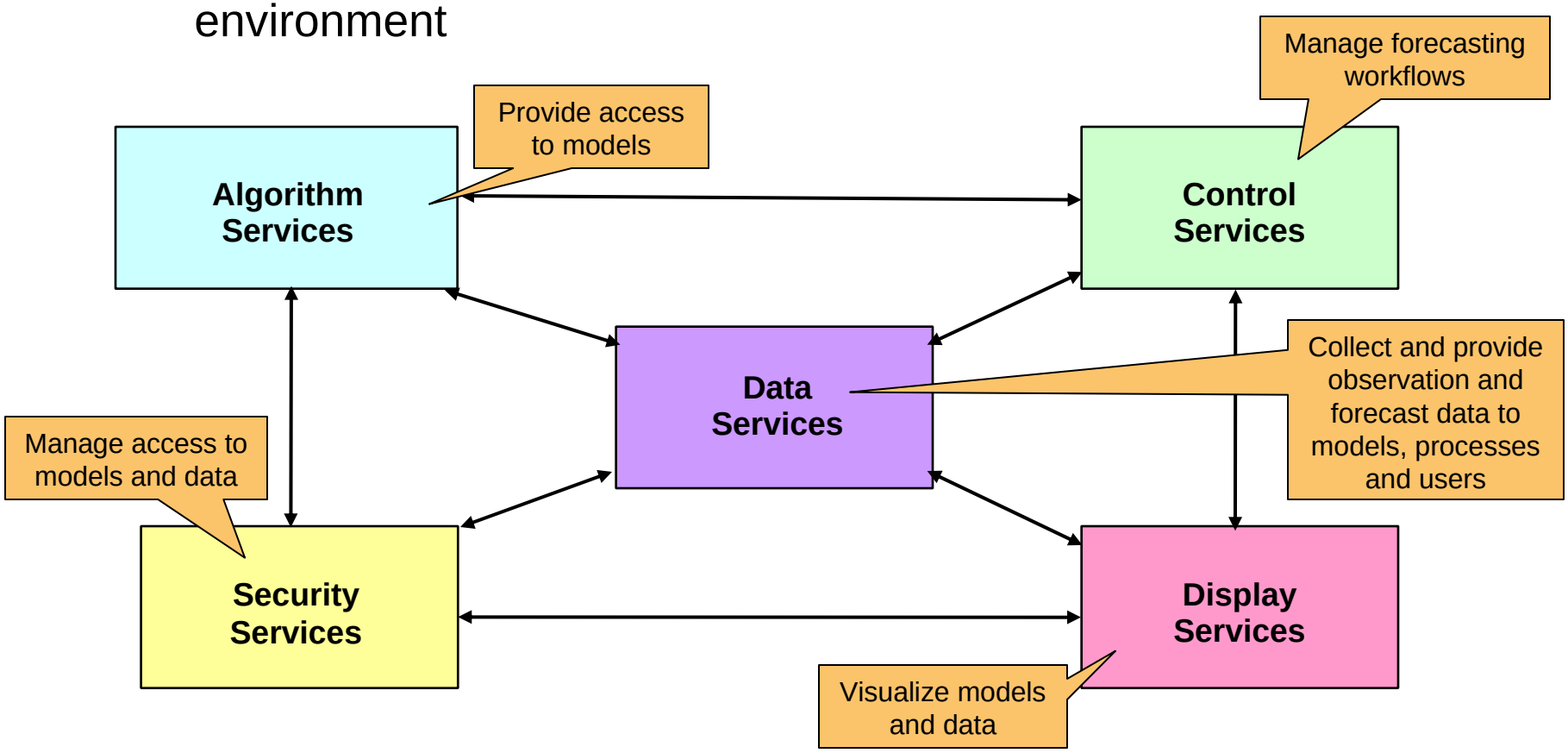
- CHPS is
  - A new collaborative way of doing business in the hydrologic community
  - An open system architecture that can easily accommodate the addition of new models and procedures into any one of the forecast system components
  - Taking advantage of a technical forecasting architecture to speed the development and research-to-operations process
- With CHPS, the National Weather Service (NWS) is creating
  - An opportunity for government, commercial and academic organizations to collectively improve water forecasting
  - A testing ground for new forecasting technology and a pathway for integration of such technology into operations

# The CHPS Business Model for Water Forecasting

- CHPS enables collaboration among the hydrologic community
- Information, research, and evolving technology are shared among:
  - Federal agencies
  - State, regional, and local cooperators
  - Universities
  - Private sector companies
  - International organizations
  - Trade groups and consortia

# Envisioned Architecture of CHPS

CHPS uses a service-oriented architecture allowing a more modular design than any existing forecasting environment



## The CHPS effort is showing results in its early steps. CHPS will continue to…

- Develop flood forecasting capabilities
  - ResSim demonstrates the first implementation of CHPS
- Help to meet growing customer needs
- Enable more efficient and effective water management activities
- Enable spin-off benefits to collaborations between NOAA and other government agencies
- Enable the hydrologic community to expand services, improve quality and turn-around time
- Enable better forecasting to protect life and property during flood events