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MARCH 12, 2020**

**Operations and Services
Water Resources Services Program, NWSPD 10-9**

WATER RESOURCES SERVICES PROGRAM MANAGEMENT

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SUMMARY OF REVISIONS: This directive supersedes NWS Instruction 10-901, “*Hydrologic Services Program Management*,” dated October 4, 2018. Changes made to this unscheduled issuance of policy reflect the Initial Operating Capability of the National Water Center’s Water Prediction Operations Division (WPOD). The following revisions were made to this instruction:

- 1) Modified Section 2.5 to better describe the role of the Office of Water Prediction (OWP), including the National Water Center (NWC) and the WPOD, in supporting and providing Water Resources Services.
- 2) Modified sections 2.10, 2.11, 2.13 (now section 2.12), and 2.14 (now section 2.13) to describe the respective roles of NWS Regional Headquarters offices, River Forecast Centers (RFC) and Weather Forecast Offices (WFO) in the provision of decision support services. Updated numbering so sections are continuous.
- 3) Modified Section 2.11 to accurately describe the Weather Prediction Center’s (WPC) hydrometeorological products.
- 4) Modified section 2.15 to describe NWC’s role in the operational relationship for hydrology.
- 5) Added NWC’s role to Advanced Hydrologic Prediction Service, river, flash flood, flood inundation mapping, and flood safety outreach programs into sections 3.1.1.4, 3.2.1.4, 3.3.1.4, 3.5.1.3, and 3.7.1.4 respectively.
- 6) Modified 3.4 and 3.6 to describe the role of NWC in water resources forecasting and Hydrologic Remote Sensing Program.
- 7) Modified Section 3.5 to clearly indicate the relationship between storm surge and tides in flood inundation maps.

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| Signed | 02/27/2020 |
| Andrew D. Stern | Date |
| Director | |
| Analyze, Forecast and Support Office | |

Water Resources Services Program Management

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1 Introduction

The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) Policy Directive 10-9 provides high-level policies for the Water Resources Services (WRS) Program. This instruction explains how NWS Policy Directive 10-9 is implemented by providing a more detailed description of headquarters and field office activities required to support and carry out the WRS Program.

2 Water Resources Services Program Activities

The WRS Program is managed in accordance with Department of Commerce (DOC), NOAA, and NWS policies. The Assistant Administrator for Weather Services has final management authority over the WRS Program, which involves various NWS organizational units. Roles and responsibilities for these units are identified in the following sections. Mission statements for these organizational units are provided in the NOAA Organizational Handbook.

2.1 Analyze, Forecast and Support Office (AFSO)

The AFSO is responsible for a wide variety of activities that support the NWS WRS Program. AFSO accomplishes these responsibilities through functions of its divisions and branches as described in the following sections.

2.1.1 Forecast Services Division (FSD)

The FSD provides oversight to the WRS Program by ensuring sustainment of current services, and coordination of the requirements and programmatic expertise that aids in the design and implementation of improved services. FSD ensures integration among the 11 NWS National Service Programs and the NWS Service Delivery Portfolios to coordinate ongoing scientific and technical advancements to enhance weather, water, and climate prediction and service provision. FSD is also responsible for recognizing and overseeing weather-climate-water linkages and integrating those linkages into improvement activities.

2.1.1.1 Water Resources Services Branch (WRSB)

In coordination with NWS regions, the AFSO WRSB manages the NWS WRS Program through the following activities:

- a. Service coordination – coordinate issues and activities related to water resources services with NWS Headquarters offices, NWS Regional Headquarters (RHQ), Office of Water Prediction (OWP), National Centers for Environmental Prediction (NCEP), NOAA, and Congressional offices.
- b. Interagency collaboration – coordinate technical, policy, and operational issues which impact water resources services with federal agencies having a complementary water mission, as well as water resource needs of other national, regional, state and tribal partners. Collaborate with these agencies to resolve multi-agency issues and work together with the OWP, NCEP, regional Water Resources Program Managers, River Forecast Centers (RFCs), and Weather Forecast Offices (WFOs) to enhance the water resources services in a nationally consistent manner.

- c. Outreach – conduct and participate in national-level outreach activities to increase external awareness on flood safety and the uses and benefits of NWS water resources services for decision making related to flood hazards and water resources.
- d. Service requirements – compile and evaluate requirements received through national-level outreach activities and integrate them into national policies, plans, and requirements specifications.
- e. Field office requirements – manage the WRS Program Team, comprised of representatives from NWS RHQ, WRSB, NCEP Weather Prediction Center (WPC), OWP, Office of Central Processing (OCP), and the NWS Employees Organization (NWSEO) to acquire, assimilate and vet field office requirements for water resources services and champion field requirements through the NWS governance process.
- f. Service and operations policy – develop and maintain water resources service and operations policy through the National Directives System and other mechanisms.
- g. Service and operations planning – develop strategic plans for the enhancement and evolution of NWS water resources services and operations. Support NWS and NOAA strategic development.
- h. Water resources data network services – work with other NWS entities and partners to maintain and expand the data network required for water resources services, including activities related to Automated Flood Warning Systems (AFWS).
- i. Training – assimilate water resources training requirements of field personnel and advocate for the development of needed national training. Also assist in the provision of water resources services-related training for field office personnel.
- j. National hydrologic information – compile, analyze, and provide flood loss statistics and national performance and effectiveness indicators.

2.1.1.2 Severe, Fire, Public, and Winter Services Branch (SFPWSB)

The SFPWSB supports the WRS Program by providing programmatic leadership for forecast, warning, and weather-support response services to the nation for convective hazards, wildland fires, winter weather and public weather information needs. SFPWSB works together with the WRS Program to ensure forecast and warning operations are consistent and integrated.

2.1.1.3 Climate Services Branch (CSB)

The CSB supports the WRS Program by managing NWS climate services issues as the primary link between the NWS and climate-sensitive industries. CSB also develops plans, policies, and procedures for climate operations and services which support water resources forecast and warning operations. CSB and the WRS Program work together to enhance coordination of linkages between water- and climate-related activities such as providing climate context of hydrologic events, and use of climate information in hydrologic water predictions.

2.1.1.4 Marine, Tropical and Tsunami Services Branch (MTSSB)

The MTSSB supports the WRS Program by providing programmatic leadership for forecast, warning, and weather services for the marine, tropical, and tsunami services programs. The MTSSB also works with the WRS Program to ensure forecast and warning operations are consistent and integrated in the coastal zone.

2.1.2 Analyze and Mission Support Division (AMSD)

The AMSD supports the WRS Program across a number of areas to support water resources forecast and warning operations. These areas include the validation of new tools and innovations that help forecasters assimilate data for water resources forecasts and warnings, coordination with the NWS Dissemination Portfolio on web and other dissemination-based needs, oversight of policy regarding the National Digital Forecast Database, and Program-related support with outreach in conjunction with NWS Weather Ready Nation (WRN) initiative.

2.1.2.1 Analysis and Nowcast Branch (ANB)

The ANB supports the WRS Program by coordinating examination of, and providing recommendations with respect to, proposed new techniques for analysis of model and remote sensing data.

2.1.2.2 Decision Support Integration Branch (DSIB)

The DSIB supports the WRS Program by ensuring inclusion of Program requirements within NWS Decision Support Services policy. The DSIB also provides support for the national Service Coordination Hydrologist Program and other outreach activities. In addition, DSIB provides support to the NWS Program Management Office to coordinate inputs for national, cross-cutting projects such as Impact-based Decision Support Services Management System.

2.1.2.3 Digital and Graphical Information Support Branch (DGISB)

The DGISB supports the WRS Program by fostering adjudication of proposed requirements through the NWS Capabilities and Requirements Decision Support (CaRDS) process. DGISB personnel conveys web-based requirements to the Office of Dissemination for prioritization and adjudication, and coordination of Public Information Statement and Service Change Notice dissemination through the Products and Services Change Management governance process. The DGISB provides support to advance gridded and Geographical Information System (GIS) requirements as they relate to the WRS Program. In addition, DGISB provides support to the NWS Program Management Office to coordinate inputs for national, cross-cutting projects such as the National Blend of Models.

2.2 Office of the Chief Operating Officer (OCOO)

The OCOO manages the day-to-day mission execution units responsible for delivering NWS water resources products, services, and information. The OCOO also provides Headquarters-level support for the WRS Program through the provision of objective and impact-based performance metrics, monitoring forecast and warning consistency, facilitating communications between senior leadership, core Federal partners and the field, and supports Continuity of Operations (COOP).

2.2.1 NWS Operations Center (NWSOC)

The NWSOC supports the WRS Program by organizing and maintaining two-way communications between senior leadership and the field by coordinating with NWS Regional Operations Centers (ROC), NWS National Centers, and NOAA Homeland Security Program Office (HSPO) for significant hydrologic events.

2.2.2 Performance Evaluation Branch (PEB)

The PEB supports the WRS Program by conducting verification for river forecasts and flood/flash flood warning products. The PEB also supports hazard awareness activities for extreme hydrologic events and manages the service assessment process initiated after events causing substantial loss of life and/or property such as regional floods.

2.3 Office of the Chief Learning Officer (OCLO)

The OCLO supports the WRS Program by overseeing the annual process of executing training for water resources science, operations, and decision support services in support of the WRN initiative and in accordance with portfolio resource allocation. OCLO's components (Warning Decision Training Division, Forecast Decision Training Division, Decision Support and Communications Services Division, Electronics and Information Technology Division and the Leadership Academy) provide instructional resources and training management in support of operational water resources. The OCLO also manages the grant supporting the Cooperative Program for Operational Meteorology, Education and Training (COMET®), which provides instructional resources focused on water resources science as applied to operations and the WRN initiative. Close coordination occurs with the water resources components of the OCLO Divisions and COMET® to ensure the development and provision of water resources training materials meets the needs and requirements of the WRS Program. OCLO also facilitates the creation and maintenance of the Water Resources Professional Development Series (PDS) list of Professional Competency Units (PCU) and associated Instructional Components (IC). The Water Resources PDS is a means to identify and prioritize training for the WRS Program.

2.4 Office of Observations (OBS)

The OBS supports the WRS Program by overseeing the collecting of data owned or leveraged by NWS. OBS is responsible for the development, acquisition, management, maintenance and enhancement of observational systems. Additionally, OBS maintains standards, policies, procedures, and plans for NWS surface and upper air observing services. Many of these observing systems provide data used in water resources operations and services.

2.5 Office of Water Prediction (OWP)

The OWP is responsible for operations, development, and field support functions for the NWS WRS Program through a number of activities, including:

- a. Water resources operations – operationally support and deliver science-based, integrated, consistent, timely, reliable and accurate water resources monitoring, prediction and diagnostic information.
- b. Decision support services – deliver a set of water resource-related decision support services for NWS core partners that facilitate decision making associated with water supply planning and events ranging from flash floods to drought.
- c. Water resources development – develop and maintain models, systems, and procedures in response to requirements provided by the NWS Governance process.

- d. Web page administration – oversee the development and implementation of the national water resources web presence which provides access to Advanced Hydrologic Prediction Service (AHPS) and water prediction products and information.
- e. Hydrologic remote sensing – provide remotely-sensed and derived water resources data products used by WFOs, RFCs, NCEP, and other users.
- f. Research and operations planning – develop strategic plans related to the evolution of water resources science, and the transition of water resources science research to operations.
- g. Applied research – in collaboration with outside research institutions, cooperating agencies, RFCs, WFOs, RHQ and NCEP, conduct applied research and development activities needed to infuse new water resources science into the operational water resources systems at National Centers and field offices.

OWP accomplishes these responsibilities with five divisions distributed across three geographic locations; Silver Spring, MD, Chanhassen, MN, and the National Water Center (NWC) in Tuscaloosa AL. The functions of each division are described in the following sections.

2.5.1 Analysis and Prediction Division (APD)

The APD integrates science, software, and data components into operational water resources prediction systems for local, regional, and national implementation. It develops and maintains water-related integrated information systems and infrastructure, integrated models, modeling and data assimilation tools and systems, and integrated model calibrations and parameterizations. APD develops and produces systems architecture and decision support products at national scales. APD supports field operations, external partners, customers and stakeholders, and corporate knowledge management.

2.5.2 Geospatial Intelligence Division (GID)

The GID provides centralized and consistent data services, geospatial analyses, and cartographic expertise to support science and engineering development, systems implementation, and water resources operations at local, regional, and national scales. GID has both developmental and operational functions. It develops water-related geospatial data, actionable intelligence derived from data, geospatial software applications, maps and graphics, new products and product improvements, spatial discretization techniques, and analytical methods. GID supports field operations, external partners, customers and stakeholders, and corporate knowledge management.

2.5.3 Interdisciplinary Science and Engineering Division (ISED)

ISED provides core science capacity, algorithm and software component development and operational decision support for local, regional, and national scales. It develops water-related core scientific knowledge, software applications, model components, new products and product improvements, skill evaluation techniques, and modeling and analytical methodologies and algorithms. It produces scientific publications; software applications; evaluations of algorithms, techniques, tools, products and services, product documentation; incremental improvements in scientific or technical maturity of algorithms, models and tools; and evaluations of skill and performance of models. It maintains scientific expertise, product documentation, and evaluation software. ISED supports field operations, external partners, customers and stakeholders, and

corporate knowledge management.

2.5.4 Service Innovation and Partnership Division (SIPD)

The SIPD provides geographic and socioeconomic sector-specific water resources information, risk, impact and economic assessments and decision support services. SIPD develops relationships with partners and stakeholders, decision support services, analyses of impacts and risks, requirements for improved information and services, and training and education programs. It develops and maintains socioeconomic hazards and impacts databases, models and information systems. It produces economic analyses, impact analyses, risk assessments, legal and policy assessments, outreach materials and scientific publications. SIPD supports community resiliency, field operations, external partners, customers and stakeholders, training and corporate knowledge management.

2.5.5 Water Prediction Operations Division (WPOD)

The WPOD serves as a collaborator across all levels of NOAA and with district or regional offices of federal partners that span territory greater than one NWS region to develop a common operating picture for water resources, support contingency planning, and facilitate reach-back access to the latest water resources intelligence when needed by field offices. WPOD operates airborne survey systems for snow and soil moisture; geographic information systems; mapping and graphics software, systems and tools; databases, models and geo-statistical analysis software. These functions reside in the Operations Center of the NWC. As such, for the purposes of operational coordination, the WPOD may be referred to as the NWC.

2.6 Office of Science and Technology Integration (OSTI)

The OSTI supports the WRS Program through the following activities:

- a. Science and technology management – provide funding and coordination for development activities for selected applications, maintaining overall responsibility for plans, programs, and development in NWS science and technology activities.
- b. Operational applications and systems development – plan and develop applications providing observed and forecast information used in water resources operations.
- c. Technology and applications integration – ensure that water resources technologies and applications are integrated into operational NWS systems. Process requirements for system upgrades to accommodate water resources needs.

2.7 Office of Dissemination (ODIS)

The ODIS supports the WRS Program through the following activities:

- a. Portfolio management – provide portfolio management to support the NCEP Central Operations (NCO) operation and maintenance of NWS dissemination systems, infrastructure and services supporting the WRS Program including the NWS Web and Information Technology infrastructure and the OneNWS Network.
- b. Dissemination management – ensure, through program planning, that policy, procedures and backup systems are in place to sustain dissemination systems operational capability to support the WRS Program.

- c. Web page management – manage development of the web presence of the Water Resources Services Program using output of software applications delivered by the OWP, NCEP, RFCs, and WFOs.

2.8 Office of the Assistant Chief Information Officer for Weather Services (OACIO)

The OACIO supports the WRS Program through the following:

- a. Provide key information technology (IT) policy oversight, analysis, planning, and execution within the NWS, including coordination and implementation of all NWS IT security and critical IT infrastructure activities.
- b. Manage a comprehensive program of IT systems investment, planning, and review to ensure high quality, cost-effective IT initiatives.
- c. Oversee the development of data architecture/strategic data management plans for increased accessibility, interoperability, and stewardship of data including implementation of geospatial information services (GIS).
- d. Provide overall planning and policy oversight for the NWS use of the Internet, and development of NWS telecommunications policies and guidance.

2.9 Office of Central Processing (OCP)

The OCP supports the WRS Program through the following:

- a. Provide system engineering, software management, facilities engineering, communications, maintenance, and logistical services to sustain operational systems.
- b. Water resources systems support services – provide on-call support services for hydro-meteorological forecast systems used by field offices.

2.10 Regional Headquarters (RHQ)

Regional Directors assign water resources program responsibilities for the region to regional Division Chiefs, RFC Hydrologists-in-Charge (HIC) and WFO Meteorologists-in-Charge (MIC). Each RHQ has staff managing a regional water resources program. Alaska Region is assigned water resources program responsibilities for the Pacific Region. Regional water resources program responsibilities include but are not limited to:

- a. Water resources service delivery oversight – monitor and assess the practices, local policies, and performance of the WRS Program at each RFC and WFO in the region. This includes support for Service Hydrologist program leadership activities.
- b. Forecast improvement – direct and support improvements to RFC and WFO water resources modeling and forecast operations. This includes supporting hydrometeorological operations such as those for quantitative precipitation forecasts (QPF) and flash flood, as well as overseeing routine WFO/RFC interactions and longer-term collaborative activities.
- c. Decision support services – support field offices in large-scale hydrologic events utilizing the Incident Command System (ICS) structure or similar operational structure. Report significant event information to the NWSOC. Deliver water resource-related decision support services for NWS regional and/or state level core partners that facilitate decision making associated with water supply planning and events ranging from flash floods to drought.

- d. Training – facilitate training activities specific to local field office requirements and hydroclimatologies in the region.
- e. Policy/procedure implementation – develop Regional Supplements to National Directives for the WRS Program. Ensure WFO and RFC compliance with National Directives and Regional Supplements on WRS Program operations.
- f. Service, science, and operations planning – develop strategic plans for water resources service and science improvements within the region consistent with national level plans and improvements.
- g. Outreach – represent NWS, NOAA, and DOC in regional intra-agency, interagency, and river basin commission activities. Seek out, receive, and assimilate service requirements from partners and other stakeholders in the region.
- h. National requirements – assimilate water resources systems and services requirements from WFOs and RFCs, conduct intra-regional coordination, and provide requirements to appropriate National Headquarters divisions per the established process. Coordinate regional data requirements and resolve data problems affecting water resources operations in the region’s WFOs and RFCs.
- i. Regional requirements – work with WFOs, RFCs, and other regional staff to establish and meet regional requirements (e.g., for data, hardware, etc.) for provision of water resources services.
- j. Information exchange – work with WFOs, RFCs, other RHQs, National Centers, and National Headquarters as appropriate to facilitate the sharing and exchange of information, procedures, software, and related items between field offices and regions.
- k. National Headquarters interactions – represent WRS Program concerns of the regional director and field offices to the NWS Headquarters and provide regional input to procedures, plans, proposals, training, and other products developed by NWS Headquarters. Communicate national concerns/issues to the regional director and field offices as appropriate.
- l. Service assessment – provide assessments of field office performance during significant water resources events to the regional director and/or NOAA/NWS management as appropriate.

Other RHQ functions support the WRS Program in areas such as training, observation/data collection, climate, verification, and system operations.

2.11 National Centers for Environmental Prediction (NCEP)

The NCEP collects global meteorological data and uses it to generate a wide variety of environmental forecast and guidance information. NCEP delivers a set of water resource-related decision support services for national NWS core partners that facilitate decision making associated with events ranging from flash floods to drought. Relevant NCEP products and services are described in NWS Instruction 10-930, *National Hydrologic Products Specification*. Individual national centers support the WRS Program through activities briefly summarized as follows:

- a. NCEP Central Operations (NCO) – execute the numerical analysis, atmospheric forecast models, and ensembles of models, used in everyday hydrometeorological and water resources analysis at OWP, RFCs and WFOs. NCEP Central Operations (NCO) operates and maintains NWS dissemination systems, infrastructure, and services supporting the

WRS Program, including the NWS Web and IT infrastructure and the OneNWS Network, and ensure security for all relevant NWS dissemination systems. Specifically, NCO operates the Meteorological Assimilation Data Ingest System (MADIS) and provides support for Hydrometeorological Automated Data System (HADS) and Automated Flood Warning Systems (AFWS), as well as SNOwpack TELEmetry (SNOTEL) through MADIS.

- b. WPC – produce national Quantitative Precipitation Forecasts (QPF) and probabilistic QPF (PQPF) products for all types of weather systems. These gridded QPF products are used as guidance by WFO and RFC forecasters, and after possible editing to account for local hydrometeorological conditions, serve as input to RFC models. The WPC also produces other products which assimilate hydrometeorological information on a national basis, including a flood outlook product, excessive rainfall outlook product, and a mesoscale precipitation discussion product.
- c. Environmental Modeling Center (EMC) – develop, maintain, and improve the environmental models which produce the graphical and numerical output (e.g., forecast precipitation and temperature) used in short- and medium-range AHPS products.
- d. Climate Prediction Center (CPC) – provide products quantifying how precipitation and temperature is expected to deviate from climatic averages through the long-term forecast period.
- e. National Hurricane Center (NHC) – provide official NWS forecasts for the movement and strength of tropical weather systems and associated storm surge and inundation.

2.12 River Forecast Centers (RFC)

Each RFC conducts water resources modeling of river basins, provides water resources forecasts and guidance for one or more major river basins, and carries out decision support and liaison activities with NWS core partners. RFCs assimilate data and forecasts from multiple sources including the NCEP, OWP, WFOs, and other partners. This information is used in real-time modeling and forecast operations and to create a wide variety of products for distribution to WFOs, partners and other users. Each RFC supports multiple WFOs. RFCs deliver a set of water resource-related decision support services for regional, state, and local NWS core partners that facilitate decision making associated with water supply planning and events ranging from flash floods to drought. RFC operations are described in [NWS Instruction 10-911, River Forecast Center Operations](#) and RFC products and services are described in [NWS Instruction 10-912, River Forecast Center Products Specification](#).

2.13 Weather Forecast Offices (WFO)

Each WFO provides water resources forecasts, warnings, and related products and decision support services to partners and other users for its local area of responsibility. WFOs also provide gridded temperature and precipitation forecasts that can be used in RFC water resources models and forecasts. Service Hydrologists and hydrology focal points serve as the Hydrology Program Manager (HPM) at each WFO. As part of an integrated mode of operations, the entire WFO operational staff participates in water resources activities, including issuing event-based and routine water resources products and collecting/quality controlling the data. WFOs deliver a set of water resource-related decision support services for state, and local NWS core partners that facilitate decision making associated with water supply planning and events ranging from flash

floods to drought. WFO hydrologic operations are described in [NWS Instruction 10-921, *Weather Forecast Office Hydrologic Operations*](#) and WFO hydrologic products and services are described in [NWS Instruction 10-922, *Weather Forecast Office Hydrologic Products Specification*](#).

2.14 WFO, RFC, NWC, and NCEP Operational Relationship

WFO, RFC, NWC, and NCEP staffs work as a team to provide water resources forecast and warning services from floods to droughts to minimize the loss of life and property and to meet the growing water resources service needs of our Nation. Managers at WFOs, RFCs, NWC, and NCEP ensure effective operational interactions through a team effort of their operational staffs while recognizing the uniqueness of each entity's operations.

NWS water resources forecasts in the short-term (out to 7 days), medium-term (7 out to 14 days), and long-term (2 weeks out to 3 months or more) time scales are heavily dependent on the effective coupling of hydrologic and meteorological observations, analyses, and forecast information from WFOs, RFCs, NWC, and NCEP. Quantitative precipitation estimates (QPE) from radar, satellite, and ground-based observations; snowpack information; QPF; temperature forecasts; and forecasts for other hydrometeorological variables serve as critical input to the hydrologic modeling process for all time scales. Extended-range meteorological forecasts and predictions from global climate models are important input to long-term hydrologic forecasts. Other key inputs include data provided by partner agencies.

The operational coupling of hydrologic and meteorological observations and forecasts for all time scales requires effective real-time and non-real time coordination between the RFCs, WFOs, NWC, and NCEP. Key hydrometeorological coordination activities of these four partners can be summarized as follows:

- a. NCEP – provide discussions and related products on current/forecast meteorological conditions and hosts coordination conference calls during significant weather events.
- b. NWC – provide discussions and related products on current or forecasted water resources conditions including snowpack and inundation and hosts coordination conference calls during significant hydrometeorologic and hydrologic events.
- c. RFCs – collaborate with WFOs, NWC, and NCEP on forecast parameters such as QPF, produce discussions on current/forecast hydrologic conditions, and notify WFO forecasters of important changes in current or forecast streamflow conditions. RFC coordination activities also include supporting WFO hydrologic modeling operations, coordinating changes in radar parameters, providing technical expertise on hydrologic events and other water-related issues, and hosts coordination conference calls during significant hydrometeorologic and hydrologic events.
- d. WFOs – notify RFCs when changing hydrometeorological conditions, observations, or meteorological forecasts indicate the need for updated hydrologic forecasts and when data quality problems have been identified such as with specific gage readings, or precipitation estimations, and hosts coordination conference calls during significant hydrometeorologic and hydrologic events.

Other joint coordination activities between these partners that managers encourage include: pre-event conference calls, optimization of the hydrometeorological data network, site visits, joint training, workshops, collaborative research projects, flood drills, and collaborative preparation of long-term outlooks.

2.15 Hydrometeorological Development Relationships

WFOs, RFCs, RHQ, NCEP, and OWP collaborate in the development of hydrometeorological applications such as flash flood models, precipitation processing algorithms, and QPF techniques. Hydrologic modeling and hydrometeorological data techniques developed by the OWP and other NOAA and NWS entities are vital in supporting these interactions. The goals of these interactions are to further the NWS mission by:

- a. Integrating interrelated aspects of hydrologic and meteorological sciences into WFO, RFC, OWP, and NCEP operations.
- b. Encouraging hydrometeorological collaboration activities between WFOs, RFCs, OWP and NCEP.
- c. Supporting integrated operations, where appropriate, within field offices.

3 Interdisciplinary and Partnered Water Resources Programs for a Weather-Ready Nation

The special hydrometeorological relationships and interdisciplinary programs described in this section require the support of all managers participating in the WRS Program. Strategizing, planning and prioritization for these interdisciplinary programs are provided by the Hydrology Leadership Team, which is led by the OWP Director and jointly coordinated by the OWP Chief of Programs and the WRSB Chief. The Hydrology Leadership is comprised of HICs from each of the 13 RFCs, representatives from NWS RHQ, WRSB, WPC, and OWP. Coordination is conducted through monthly calls and if resources permit an annual face-to-face meeting. The NWS has the primary responsibility among federal agencies to provide forecasts of hydrologic conditions via flood warnings and river forecasts in the United States. The provision of these water prediction and warning services are significantly influenced by anthropogenic activities associated with water management and water use/regulation (e.g. reservoirs, diversions, withdrawals). In order to provide these important water resources services, collaboration with other federal agencies, as well as state, tribal, and local partners, is crucial.

3.1 AHPS

AHPS is a national effort to provide enhanced hydrologic information and products through the infusion of new science and technology. The goal of AHPS is to improve river forecasts and flood warnings nationwide to meet the diverse and evolving needs of partners and other users.

3.1.1 Office Roles

3.1.1.1 WFOs

WFOs coordinate AHPS-related forecast services with local, county, and state partners and relay new requirements to RFCs and RHQ. WFOs assimilate and update much of the metadata that accompanies AHPS products, such as the location information for forecast points.

3.1.1.2 RFCs

The forecast information output from RFC water resources modeling systems serves as the foundation for AHPS products. RFCs coordinate AHPS-related forecast services with partners having comparable areas of responsibility such as river basin commissions and district or regional offices of Federal agencies, and relay new requirements to RHQ.

3.1.1.3 RHQs

Managers of water resources programs across all NWS RHQs oversee AHPS activities of their field offices, participate in coordination meetings with partners in state or regional agencies with comparable levels of responsibility, and relay requirements for AHPS products and services to NWS headquarters.

3.1.1.4 NWC

The NWC coordinates AHPS-related forecast services with partners having comparable areas of responsibility such as national Federal agencies, and relays requirements for AHPS products and services to NWS headquarters.

3.1.1.5 NWS Headquarters and OWP

The AHPS program is managed by OWP. The Chief Program Officer in OWP conducts planning, administers the budget, and guides and tracks implementation for the program. Working with the Water Resources Services Team in the NWS Governance structure, WRSB assimilates service, science, and operational requirements for AHPS and provides prioritized requirements to OWP. WRSB also develops general operations concepts for AHPS as well as other plans for specific AHPS components.

3.2 River Forecast Program

WFOs, RFCs, NCEP, and NWC work as a team to provide river forecast and warning services from floods to droughts to minimize the loss of life and property and to meet the growing water resources service needs of our Nation. NWS river forecast products and services support decision makers from a spectrum of service sectors including emergency management, agriculture, hydropower, reservoir and watershed management, river commerce, municipal and industrial water supply, and recreation.

3.2.1 Office Roles

3.2.1.1 WFOs

WFOs assess and monitor the threat of river flooding 24 hours a day, 7 days a week to provide timely and accurate life-saving flood forecasts, watches, and warnings. Toward this end, WFOs integrate a spectrum of RFC, NCEP and NWC guidance and hydrometeorological data to provide routine river forecast services and critical, event-based warning and decision support services. In addition, WFOs work with dam operators to provide timely warnings for floods that result from infrastructure failure such as dam break and levee breaches. In coordination with RFCs and RHQs, WFOs assess the adequacy of the river and precipitation gage network, coordinate the need for new forecast services with local, county, and state partners and relay new requirements to RFCs and RHQs.

3.2.1.2 RFCs

RFCs routinely generate short-range (deterministic) through long-range (probabilistic) river and water resources analyses and forecasts. Information and forecasts from the RFCs serve as the basis for local flood warnings, watches, and advisories issued by the WFOs. These RFC products typically incorporate guidance from WPC, CPC, NWC, and the WFOs, and emphasize flooding impacts from meteorological events based on geographic area, land use, time of the year, and other factors.

In order to provide objective simulations of future river flows, RFCs calibrate, operate, and verify numerical hydrologic models based on temperature, rainfall, snowpack, soil characteristics, QPFs, water use/reservoir regulation data, and several other variables. The modeling system the RFCs use is known as the Community Hydrologic Prediction System (CHPS). CHPS builds on existing modeling capabilities, standard protocols, and open data exchange standards to develop a common suite of tools for making water predictions.

CHPS facilitates the sharing of data and algorithms between government, university, and private sector research groups. CHPS may be used to develop and infuse new science to produce a new suite of high-resolution forecasts (including estimates of uncertainty) for streamflow, soil moisture, soil temperature, water quality, and many other variables directly related to watershed conditions.

In addition, RFCs provide forecast information, advice, training, and expertise on dam break analysis to WFOs. Some RFCs, especially those in mountainous regions, also provide water-supply volume and peak-flow forecasts based on snow pack in high elevations. These water supply forecasts are used by a wide range of decision makers, including those in agriculture, hydroelectric dam operation and electricity generation, and water resources management. RFCs routinely coordinate with their associated WFOs, federal water partners, stakeholders, OWP, and the WPC.

3.2.1.3 NCEP / WPC

The WPC produces high-resolution precipitation and temperature forecasts, information and decision support services over the CONUS as a value-added, viable starting point for both WFO and RFC quantitative precipitation forecasting operations. The WPC also serves as a lead for collaboration between the NWS operational units that comprise the river forecast program team, primarily during the lead-up to heavy rain events.

3.2.1.4 NWC

The NWC provides holistic monitoring of observations of current and forecast conditions to assess potential riverine flooding. The NWC serves as a lead for collaboration between NWS operational units that comprise the river forecast program team, primarily before and during significant hydrologic events.

3.2.1.5 RHQs

RHQs manage the RFC and WFO river forecast and flood program for their region, providing appropriate regional procedures and policies. They collect and monitor verification statistics. They also play a supportive role for large scale and/or long term significant events where field

office resources can become overtaxed. This support is typically in the areas of media response, partner briefings, coordination, and administrative assistance.

3.2.1.6 NWS Headquarters and OWP

NWS Headquarters manages the national River Forecast and Flood Program and provides appropriate national procedures and policies. NWS Headquarters and OWP develop river forecast and flood applications and transitions appropriate tools and techniques from the research to operational environment. The OCOO PEB supports the software and databases used in river forecast and flood warning verification and WRSB monitors and reports on verification statistics.

3.3 Flash Flood Program

The NWS Flash Flood Program was originally implemented in 1970. According to Operations Manual Letter 74-8, *Management of the Flash Flood Program*, dated March 21, 1974, the program was implemented to provide a flood warning service when timely stage forecasts cannot be provided by RFCs. This led to a program based largely on watch/warning products for areas, issued by weather offices and supported by RFC products known as Flash Flood Guidance (FFG), as well as the national scale Excessive Rainfall Outlook based on predicted FFG exceedance and issued from the WPC. Because heavy precipitation from convective weather systems is the primary cause of flash floods, and flash flood watches and warnings are most often handled on a defined area basis like other weather events, a meteorological perspective has historically prevailed in the Flash Flood Program.

Collaborative efforts to improve flash flood guidance, short-term QPF, and Quantitative Precipitation Estimation (QPE) have led to more timely flash flood products. This includes research to operations efforts within the Hydrometeorological Testbed, including the annual Flash Flood and Intense Rainfall Experiment (FFaIR). However, forecasting technologies that improve the site-specificity and information content of warning products are allowing flash flooding to be increasingly addressed from a hydrologic perspective. These technologies include:

- a. The Flash Flood Monitoring and Prediction (FFMP) function, which provides the ability to pinpoint individual basins threatened by flash flooding.
- b. The Site-Specific Hydrologic Prediction (SSHP) function, which allows products to include stage/flow forecasts for specific locations in small stream basins.
- c. The Flood Locations and Simulated Hydrographs (FLASH) function, which couples precipitation and a hydrologic model to provide surface water fluxes and derived products at 1 km/5 min resolution.
- d. High-resolution rainfall-runoff models, which allow hydrologic processes to be more realistically simulated in stream basins of all sizes.

AHPS supports these and other technologies used in the Flash Flood Program. National Headquarters, RHQ, and field offices account for the application of GIS, hydrologic science, and computer modeling in determining the decision support infrastructure for the Flash Flood Program.

3.3.1 Office Roles

3.3.1.1 WFOs

WFOs assess and monitor the threat of flash flooding 24 hours a day, 7 days a week to provide timely and accurate life-saving flash flood forecasts, watches, and warnings. Toward this end, WFOs integrate a spectrum of RFC, NCEP and OWP guidance, Dual Polarization weather radar Next Generation Radar (NEXRAD)-based precipitation estimates, satellite National Environmental Satellite, Data, and Information Service (NESDIS)-based precipitation estimates, and real-time telemetered precipitation and stream gage observations to provide critical decision support services. In addition, WFOs work with dam operators to provide timely warnings for flash floods that result from infrastructure failure such as dam break or over-topping and levee breaches. WFOs are the point of issuance for flash flood watches, warnings and associated follow-up products. WFOs use applications such as the Flash Flood Monitoring and Prediction: Advanced (FFMPA) and SSHP in their flash flood operations and provide on-station upkeep of these systems. Some flash flood applications are developed at local WFOs and may eventually be utilized at other WFOs.

3.3.1.2 RFCs

RFCs provide the gridded guidance used in WFO flash flood operations. This guidance is an estimate of the amount of rainfall required over a given area during a given duration to cause small streams to flood. These estimates are based on the current soil moisture and streamflow conditions for the area. Some RFCs partner with the U.S. Geological Survey (USGS) in developing flash flood guidance for burn scar areas and debris flows. In addition, RFCs provide forecast information, advice, training, and expertise on dam break analysis to WFOs.

3.3.1.3 NCEP / WPC

The WPC assesses and monitors the threat of heavy rainfall that may cause flash flooding over the CONUS on a 24 x 7 basis to assist RFC and WFO operations and ensure situational awareness toward heavy rainfall threats. This role includes rainfall-related decision support services to national partners such as the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE). The WPC will at times also serve as a lead for collaboration between the NWS operational units, particularly during the lead-up to heavy rain events.

3.3.1.4 NWC

The NWC provides holistic monitoring of observations of current and forecast conditions to assess potential flash flooding including dam/levee failure analysis and support.

3.3.1.5 RHQs

RHQs manage the Flash Flood Program for the region, providing appropriate regional procedures and policies. RHQs monitor and report on verification statistics.

3.3.1.6 NWS Headquarters and OWP

NWS Headquarters manages the national Flash Flood Program and provides appropriate national procedures and policies. NWS Headquarters and OWP develop flash flood applications and transitions appropriate tools and techniques from the research to operational environment. The

OCOO Performance Evaluation Branch supports the software and databases used in flash flood warning verification and WRSB monitors and reports on verification statistics.

3.4 Water Resources Forecasting

The Water Resources Forecasting activity builds on AHPS, the River Forecasting Program, the Flash Flood Program and other NOAA services and delivers new services at higher resolution (down to the neighborhood scale) with more information; such as soil moisture, soil temperature, snow pack, and surface runoff volume. It enables NOAA to provide nationally consistent water quantity and quality condition forecasts via an advanced modeling system which brings the current state of science to NWS hydrology.

The advanced modeling system known as the National Water Model (NWM) is a high spatial and temporal resolution, continental-scale model of the nation's river and stream network. The underpinning technology for the NWM is a community-based, Earth System Modeling Framework (ESMF)-compliant, WRF-Hydro modeling framework. The NWM augments and expands NOAA's current water quantity forecasts, delivered for approximately 4000 river locations with stream gages across the country (primarily operated by the USGS), to streamflow forecasts for 2.7 million streams nationwide, and high-resolution gridded forecasts of soil moisture, evapotranspiration, runoff, and other parameters. Future services, enabled by the NWM, will strengthen the nation's water forecast capabilities for floods and droughts, improve preparedness for water related disasters, and inform high-value water decisions at the local, state and national levels.

3.4.1 Office Roles

3.4.1.1 WFOs

WFOs coordinate services that can be provided through the water resources forecast activity with local, county, and state partners and relay new requirements to RFCs and RHQ.

3.4.1.2 RFCs

RFCs monitor and analyze water resources modeling systems under the AWIPS architecture and develop visualization, evaluation, and data management capabilities following AWIPS standards in collaboration with entities in the larger water community. RFCs coordinate services that can be provided by the water resources forecast activity with partners having comparable areas of responsibility (e.g., river basin commissions, district or regional offices of federal agencies, and State and Local agencies) and relay new requirements to RHQs.

3.4.1.3 NCEP / WPC

The WPC serves as advisors to and partners with the WFOs, RFCs, and the OWP in matters of heavy rainfall and its associated impacts, and in related research, development, and testing. This includes rainfall-related decision support services to national partners such as FEMA and USACE. This partnership also includes research to operations efforts under the auspices of the Hydrometeorological Testbed, which hosts the annual Flash Flood and Intense Rainfall experiment (FFaIR), and providing operational feedback as to the performance and integration of the NWM.

3.4.1.4 NWC

The NWC operates and maintains the numerical water resources analysis and forecast modeling and data assimilation systems in collaboration with NCEP, RFCs, Federal water partners, academia and stakeholders.

3.4.1.5 RHQs

Managers of hydrology programs in the RHQs oversee their field office's efforts in the water resources forecast activity and relay state/regional partner's requirements to NWS Headquarters.

3.4.1.6 NWS Headquarters and OWP

The water resources forecast activity is managed by the OWP in conjunction with and through the same structure as the AHPS program. WRSB assimilates service, science, and operational requirements for water resource forecast services, and provides prioritized requirements through the NWS governance process to OWP.

3.5 Flood Forecast Inundation Mapping Program

The NWS has undertaken an expanded effort to provide information on the spatial extent and depth of flood waters in the vicinity of NWS river forecast locations. The key product of this program is a web-based flood forecast inundation mapping interface which allows users to display maps for various levels of flooding including observed and forecast stages, user-selected stages, and established flood categories. The maps can be used to show if roadways, streets, buildings, airports, and other structures are likely to be impacted by floodwaters. Combined with river observations and NWS forecasts, these maps enhance the communication of flood risk and provide users additional information for mitigating the impacts of flooding and building communities that are more resilient. Flood inundation maps near NWS river forecast locations may account for tides and storm surge in certain instances.

There are four critical phases in the implementation of flood forecast inundation maps: (1) Planning/Scoping – identifying users who need such maps for NWS forecast locations and are willing to partner with the NWS in their development, (2) Hydrologic/Hydraulic/Geospatial Analyses – performing the engineering, scientific, and technical analyses necessary to produce a map, (3) Implementation – making the map available through the interface in the NWS's WRS Program web presence (AHPS web pages), and (4) Maintenance – providing changes and updates necessary to keep a map current.

The high spatial and temporal resolution capabilities of the NWM coupled with high resolution hydrography datasets allows NWS to provide real-time freshwater flood inundation mapping capabilities at neighborhood-level in a more consistent and timely way. These techniques may be driven by official streamflow forecasts or by NWM guidance to provide the spatial extent of flood waters. OWP has demonstrated this capability for Texas and is incrementally expanding this capability to over 5 million miles of streams and rivers nationwide. This mapping technique does not account for coastal flooding or storm surge at this time.

3.5.1 Office Roles

Since the development of flood forecast inundation maps involves significant financial resources, human capital, data requirements, and data analysis, NWS leverages the capabilities, expertise, and resources of partners who can contribute towards the development of flood forecast inundation maps for new areas. Offices at all levels of the NWS contribute to the process. For each river location or group of locations for which maps will be developed, a project team is formed consisting of WFO, RFC, and RHQ personnel and the technical mapping partner.

3.5.1.1 WFOs

WFOs demonstrate the benefits of flood forecast inundation maps to local and state partners and identify those who want to work with the NWS to develop flood forecast inundation maps. WFOs assist in evaluating the feasibility of creating flood forecast inundation maps for specific locations in their areas of responsibility. They coordinate with partners to acquire the supporting data required to develop flood forecast inundation maps and provide these data to the project team. WFOs review the final flood forecast inundation maps and use them to review and revise the impact information associated with local forecast locations which they provide through the NWS hydrologic web presence and in flood products.

3.5.1.2 RFCs

RFCs demonstrate the benefits of flood forecast inundation maps to their partners with regional responsibilities, such as river basin commissions and district offices of Federal agencies, and identify those who want to work with the NWS in this effort. RFCs assist in evaluating the feasibility of creating flood forecast inundation maps for specific locations in their areas of responsibility. They implement and maintain the modeling infrastructure necessary to support new forecast locations as necessary. RFCs evaluate the GIS shapefiles and the hydraulic model output used in the development of flood forecast inundation maps. They also participate in the final review of flood forecast inundation maps.

3.5.1.3 NWC

NWC in coordination with NOAA field offices and other federal water agencies (e.g., USGS and USACE) provide timely, consistent state-of-the-science inundation information and guidance to inform emergency management and water resources decision making.

3.5.1.4 RHQs

RHQs oversee WFO and RFC efforts to seek out partners interested in establishing flood forecast inundation maps for specific locations. Once partners have been identified, they notify NWS Headquarters and begin coordinating the next steps in the development process with the partners and NWS Headquarters. RHQs manage flood forecast inundation mapping projects, serving as the central point of coordination. They coordinate requests for various types of supporting data with WFOs and RFCs. They communicate quality control and quality assurance (QA/QC) standards for supporting data and sign off on final QC reviews (note: RHQs may designate an RFC to perform some of these functions).

3.5.1.5 NWS Headquarters and OWP

Funding support for enhancement of the NWS AHPS flood forecast inundation mapping web interface, updates to the NWS AHPS flood forecast inundation mapping guidelines, and training is determined through the Water Resources Services Team and managed by OWP. The National

Flood Forecast Inundation Mapping Services Leader within WRSB leads the national effort to implement flood forecast inundation maps and enhance this program. He/she leads a team of representatives from RHQs, WFOs, and RFCs which performs the following functions:

- a. Collect and prioritize requirements for development and enhancement of flood forecast inundation maps.
- b. Provide program management support to regional managers, WFOs, and RFCs.
- c. Advise RHQs and partners on the collection and QA/QC of required supporting data.
- d. Prioritize and schedule map development with the AHPS program.
- e. Monitor the actual development of maps and reports status to the AHPS program.
- f. Work with regions to ensure quality of the final product.
- g. Ensure that required training is provided to WFOs, RFCs, and RHQs personnel.

OWP is responsible for developing models, methods and techniques to deliver new and improved flood inundation mapping.

3.6 NWC Hydrologic Remote Sensing Program

RFCs and WFOs serving areas where seasonal snow cover is a significant hydrologic variable use products and services provided by NWC when developing a variety of hydrologic products such as spring flood outlooks, water supply outlooks, river and flood forecasts, and reservoir inflow forecasts. Additionally, OWP provides and supports GIS data sets and applications used by the RFCs in generating automated hydrologic forecast basin boundaries.

3.6.1 Information Sources

NWC maintains an airborne snow survey program that provides airborne snow water equivalent data for much of the U.S. and Canada. NWC ingests a broad variety of point, gridded, and modeled data sets from various sources within NOAA including: NESDIS; NCEP; the Global Systems Division (GSD); and the NWS Advanced Weather Interactive Processing System (AWIPS). NWC ingests Landsat and near-real-time, Advanced Very High Resolution Radiometer (AVHRR), MODerate resolution Imaging Spectroradiometer (MODIS) satellite data via the internet. Additionally, NWC receives data sets from other Federal, state, and Canadian cooperators.

3.6.2 Operations

Remotely sensed and simulated snow cover products, provided through the four NWC programs described in this section, support the WRS Program.

3.6.2.1 Airborne Gamma Radiation Snow Survey Program

The NWC uses low-flying aircraft to make near real-time, airborne surveys of snow water equivalent over large regions of the country where snow is a significant hydrometeorological variable. The same technology is used to survey soil moisture conditions.

3.6.2.2 Satellite Hydrology Program

The satellite hydrology program uses data from polar orbiting satellites to map areal extent of snow cover, river ice, and flood inundation, in near real-time, over the coterminous U.S. and Alaska. Satellite-based products are produced and made available in image format in a

reasonable time frame after satellite overpass. Satellite derived areal extent of snow cover is assimilated into OWP's snow model.

3.6.2.3 Snow Data Assimilation Program

The snow data assimilation program simulates gridded snow water equivalent and other snow pack properties for the continental United States using a distributed energy-and- mass-balance snow model known as the SNODAS (SNOW Data Assimilation System). Output from a mesoscale atmospheric model is used to force the snow model. All available ground-based, airborne, and satellite-derived snow observations are assimilated by the SNODAS to produce a "best" gridded-field estimate of snow water equivalent and other snowpack properties.

3.6.2.4 Geographic Information System Support Program

The NWC uses high-resolution GIS databases in carrying out its mission to produce remote sensing and simulated gridded snow pack products. OWP provides GIS-based applications and data sets to RFCs and WFOs in support of hydrologic modeling and flash flood operations, such as the Integrated Hydrologic Automated Basin Boundary System (IHABBS) and associated data sets, which are used by RFCs when generating, updating, modifying, or editing hydrologic basin boundaries. RFCs provide their finalized basin boundaries to the OWP, which makes them available for use in AWIPS, NEXRAD, and other applications.

3.6.3 Products and Services

The NWC generates products and data sets in a resolution, format, and time frame required to support the NWS Water Resources Services Program. Products are distributed, in near real-time, over AWIPS to NWS users and over the Internet to all users at: <http://www.nohrsc.noaa.gov> or via an FTP-based data subscription service. Information on OWP products and links to these products are provided in [*Hydrologic Information on the Web: A Manual for Users*](#).

3.6.4 Office Roles

In carrying out its mission, the NWC interacts with NWS offices and external entities according to guidelines in the following sections.

3.6.4.1 RFCs

The NWC coordinates operational snow pack modeling and assimilation, airborne snow survey, and satellite data collection schedules and activities with appropriate RFCs. These RFCs incorporate NWC-assimilated data into their hydrologic modeling and forecast operations. In interacting with NWC, RFCs are responsible for: (1) requesting specific basins where satellite snow cover mapping is needed, (2) requesting establishment of new flight lines, and (3) providing requirements for airborne snow measurements to be taken for existing flight lines. RFCs work with their supported WFOs to ensure that all ground-based snow data collected by WFOs (e.g., snow water equivalent, snow depth, and snow density) are encoded in Standard Hydrometeorological Exchange Format (SHEF) and distributed over AWIPS for use by the OWP snow data assimilation program and incorporation into SNODAS. NWC interacts with RFCs to provide IHABBS software and database support upon request.

RFCs may request emergency or non-scheduled airborne snow surveys in coordination with their supported WFOs and RHQ. When possible, these requests should be submitted to NWC seven

to ten days before the required survey date. Meeting requests with shorter lead-time may cause schedule conflicts with other airborne surveys. In evaluating conflicting requests involving two or more areas, the criticality of airborne data to the hydrologic forecasting effort for each area should be evaluated in coordination with the affected offices and RHQ.

3.6.4.2 WFOs

Through their supporting RFCs, WFOs request: (1) specific basins where satellite snow cover mapping is needed, (2) establishment of new flight lines, and (3) emergency snow surveys on existing flight lines. Additionally, WFOs encode all available ground-based snow data (e.g., snow water equivalent, snow depth, and snow density) in SHEF products which are distributed via AWIPS and used in OWP's SNODAS model. WFOs incorporate OWP data into products disseminated to the public, mass media, partners, and other users.

3.6.4.3 RHQs

Before the onset of cold weather each year, NWC holds planning meetings at the regional level to lay out schedules for airborne data collection during the snow accumulation season and to coordinate SNODAS-related activities. NWC provides RHQ with information of concern to WFOs and RFCs regarding NWC status and products. RHQ, or the RFCs as delegated by RHQ, provide requirements to NWC for model-, airborne-, satellite-, and GIS-based products within the regions. Cancellations of scheduled airborne survey missions are coordinated with RHQ as well as affected RFCs and WFOs. Water Resources program managers across the RHQs relay information on NWC status and products to their regional directors and resolve conflicting requests for airborne surveys from field offices located in the same region. Conflicting schedule requests between regions should be resolved through coordination and if necessary, are resolved by the OWP Director.

3.6.4.4 NOAA Aircraft Operations Center

NWC coordinates with the NOAA Aircraft Operations Center to ensure that suitable, reliable, snow survey aircraft and NOAA Corps pilots are available to support the airborne snow survey program.

3.6.4.5 Local, State, Federal, and International Agencies and Commissions

NWC maintains contacts with key local, state, and Federal agencies and organizations across the U.S. and Canada. Periodic contacts are required to ensure the appropriate exchange of data, products, and technology between NWC and these external interests. NWC represents the NWS and NOAA at various local, state, Federal, and international agencies and commissions on issues associated with the generation and use of satellite and airborne remotely sensed data, the simulation of snow pack properties for the U.S. using an energy-and-mass-balance snow model, and operational products used in the NWS WRS Program.

NWC serves as a liaison between the NWS and Natural Resources Conservation Service (NRCS). NWC maintains a database of reference information on NRCS SNOTEL and snow course observation locations. This reference information is made available to WFOs and RFCs upon request.

3.6.4.6 Commercial and Private Sectors

NWC distributes gridded snow pack products to interested commercial and private sector stakeholders via a public-facing website (<http://www.nohrsc.noaa.gov/>) and an FTP-based data subscription service.

3.7 Outreach and Flood Safety Program

WFOs routinely conduct local outreach and education to heighten public and partner awareness of flood risks and NWS water resources services. On average, floods cause about 90 deaths per year and over 8 billion dollars in damage. Destructive flooding can affect any area of the U.S. and its territories. To help Americans guard against the dangers of flooding, the NWS has a Flood Safety Program aimed at arming America's communities with the safety skills necessary to save lives and property.

3.7.1 Office Roles

The NWS supports flood safety activities at several organizational levels to increase the American public's awareness of the dangers of flooding.

3.7.1.1 WFOs

WFO HPMs, with the support of Warning Coordination Meteorologists (WCM) and RFC Service Coordination Hydrologists (SCH), perform the vital flood safety outreach activities at the local level. Key flood safety outreach activities of warning coordination meteorologists and hydrology program managers include:

- a. Establishing and maintaining the necessary flood coordination and information sharing mechanisms between the WFO and local, county, and state emergency managers and other government officials.
- b. Leading flood safety activities at schools and community/city/county events.
- c. Working with news media outlets in the WFO area to help them disseminate the most useful flood safety information.
- d. Developing flood safety programs and materials tailored to the pressing hydrologic issues faced in the local WFO area. For example, the phrase "Turn Around Don't Drown®" was originated by a WFO as part of a new outreach effort.

3.7.1.2 RFCs

RFC outreach primarily involves partners and other users operating on the large river basin scale. RFC SCHs serve as the lead to support and partner with WFOs in outreach and safety activities. SCHs develop a network of partners and users to coordinate outreach and flood awareness to a broad set of partners and stakeholders.

3.7.1.3 RHQs

Managers of water resources services programs at RHQ provide leadership, expertise, and financial support for WFO flood safety efforts. They document best practices to ensure that highly effective flood safety efforts developed by individual WFOs are known and available to all of their field offices.

3.7.1.4 NWC

NWC supports flood safety outreach activities, particularly focused on large-scale flooding events and targeted towards national partners. Activities include:

- a. Establishing and maintaining the necessary coordination and information sharing mechanisms between NWC and national-level federal partners.
- b. Working with national media outlets to help them disseminate the most useful flood safety information.

3.7.1.5 NCEP / WPC

WPC supports flood safety outreach activities, particularly focused on extreme rainfall and targeted towards national partners. Activities include:

- a. Establishing and maintaining the necessary coordination and information sharing mechanisms between WPC and national-level federal partners.
- b. Working with national new media outlets to help them disseminate the most useful flood safety information.

3.7.1.6 National Headquarters

National outreach focuses primarily on enhancing relationships with National Headquarters of other Federal agencies and supporting outreach efforts of RHQ and field offices. National outreach is led by the Communications Division and WRSB. Flood safety activities include:

- a. Ensuring NWS water resources services outreach activities and information meet the changing needs of our diverse partners and other users.
- b. Planning and participating in training, education, and outreach activities such as user forums, workshops, and conferences and/or webinars.
- c. Developing, disseminating, and maintaining outreach information such as brochures briefings, user guides, videos, and web-based resources.

3.7.2 Outreach Materials

Nationally developed water resources outreach brochures are stored in the National Logistics and Supply Center (NLSC) in Kansas City, MO. Requests for outreach materials should be made directly to NLSC by calling (816) 926-7794. Two internet web sites ([Flood Safety](#) and the [TADD Toolbox](#)) also contain water resources outreach resources. These include Fact Sheets, online versions of DVDs, printable brochures and flyers, educational links, magazine articles, and publications.

3.7.3 Seasonal Safety Campaign and Flood Safety Awareness Week

The [Seasonal Safety Campaign](#) is a nationally supported campaign seeking to inform the public about seasonal weather, water, and climate hazards during the time they are most common. Regions and WFOs may supplement the seasonal safety campaign with a Flood Safety Awareness Week which occurs each year, typically during March. This local campaign is aimed at raising the awareness to the dangers of flooding and ways to protect property. In the past, typical themes have been:

- AHPS
- Turn Around Don't Drown®
- Floods, Droughts, and other Related Phenomena

- Flood Insurance

3.7.4 Flood Safety - Turn Around Don't Drown

The flood safety phrase “Turn Around Don't Drown®” is a registered trademark of NOAA, U.S. Department of Commerce (Trademark Registration Numbers: 2,853,276 and 2,853,277). This phrase is used in many outreach efforts aimed at reducing the number of vehicle-related drownings, injuries, and water rescues during flood events. NWS employees may use this phrase in any official flood safety activity. Policies and procedures on use of the phrase “Turn Around Don't Drown®” by internal (i.e., NOAA/NWS employees) and external entities (i.e., non-NOAA/NWS employees and NOAA/NWS employees working in an unofficial capacity) are provided in a separate document which can be found in the [TADD Toolbox](#) under the “Policy on Use of Turn Around, Don't Drown Phrase” Section.