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Federal Efforts in Forecasting Snow Depth and Run-off Information. CED-78-43; B-114885. January 27, 1978. 5 pp.

Report to Sen. Frank Church; Sen. James A. McClure; by Henry Eschwege, Director, Community and Economic Development Div.

Issue Area: Water and Water Related Programs: Water Resources Programs to meet the competing demands for Water Uses (2503).
Contact: Community and Economic Development Div.
Budget Function: Natural Resources, Environment, and Energy: Water Resources and Power (301); Agriculture: Agricultural Research and Services (352).
Organization Concerned: Department of the Interior; Department of Agriculture; Department of Commerce; National Weather Service; Soil Conservation Service; Department of the Army: Corps of Engineers; Bonneville Power Administration; Bureau of Reclamation.
Congressional Relevance: Sen. Frank Church; Sen. James A. McClure.

The hydrometeorological data used in making water supply forecasts, including measurements of the snow water equivalent, precipitation, stream flow, and temperature, are collected by several Federal agencies. In only one instance were agencies duplicating data collection efforts. However, the Soil Conservation Service and the National Weather Service have been preparing duplicate water supply forecasts in the Western United States for 30 years. Several other agencies prepare water supply forecasts to meet their own operational requirements, including the Bonneville Power Administration, the Bureau of Reclamation, and the Corps of Engineers. The Soil Conservation Service is responsible for gathering snow data and providing it to the public and to other Government agencies. The Service planned to automate its snow survey program using SNOTEL, telemetered snowpack and related hydrometeorological data from mountainous regions of the West. The proposed SNOTEL system was not completed on time because of: late deliveries from suppliers, interference from nearby power lines at one station, insufficient air conditioning installed at base stations, and the inability of batteries at remote sites to supply sufficient power when temperatures were very low. (RRS)

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

B-114885

JAN 27 1978

The Honorable Frank Church
The Honorable James A. McClure
United States Senate

In response to your August 1, 1977, request, we have reviewed Federal efforts to measure snowpack and forecast water supply. As requested, we placed particular emphasis on determining whether Federal agencies were duplicating each others' efforts and whether they were effectively using their equipment and financial resources to measure snowpacks.

We contacted officials of the Soil Conservation Service, the Agricultural Research Service, the Corps of Engineers, the Bureau of Reclamation, the National Weather Service, the U.S. Geological Survey, the Bonneville Power Administration, the U.S. Forest Service, and the Environmental Protection Agency. We also contacted university professors, irrigation district managers, and officers of Idaho Industrial Instruments and Systems Consultants, Inc. As suggested by your office, we contacted former Congressman Ralph Harding.

We presented the following results of our review to your office and Ralph Harding on December 7, 197".

DATA COLLECTION

Most of the Federal agencies mentioned above collect the hydrometeorological data used in making water supply forecasts. This includes measurements of the snow water equivalent, precipitation, stream flow, and temperature. We found only one instance where two agencies were duplicating data collection efforts. In that instance, a Bureau of Reclamation official stated that the Bureau and the Soil Conservation Service had each installed a snow

pillow 1/ at similar altitudes within 1 mile of each other in 1958 and 1949, respectively. We found numerous instances in which Federal agencies cooperated with and assisted each other in collecting and disseminating meteorological data.

For example, in Idaho the U.S. Forest Service, the Bureau of Reclamation, the Agricultural Research Service, and the State of Idaho employees make snowpack measurements on their respective lands and provide this data to the Soil Conservation Service. The Service, in turn (1) provides this information and the data they collect to any party requesting it, (2) includes the information in monthly publications, and (3) uses this information to develop water supply forecasts. We found no instance in which one Federal agency was unable to obtain meteorological data from another Federal agency.

DUPLICATION OF FORECASTING

We found numerous instances of duplication in water supply forecasting in the Western United States. However, some action was taken to eliminate this duplication after our review began. The Soil Conservation Service and the National Weather Service have been preparing duplicate forecasts for 30 years in this western area of the United States. Each agency publishes its forecast monthly from January through May each year. There are about 214 common forecast points.

We discussed this duplication with the National Weather Service regional hydrologist in Salt Lake City and the Soil Conservation Service field representative at the Western Technical Service Center in Portland, Oregon, in early November 1977. A week after our discussion, officials of these agencies met and agreed to eliminate duplicate forecasts at 64 (74 percent) of the common forecast points in the Columbia Basin where one of the agencies felt the forecast was not required or was of secondary interest to its mission.

Agency officials also agreed on a schedule calling for elimination of (1) duplicate forecasts outside the Columbia Basin by January 1979, where one of the agencies felt the forecast was not required or of secondary interest, (2) all

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1/A liquid-filled device installed at ground surface that monitors the water content of the snowpack based on the amount of pressure from the snowpack.

remaining duplicate forecasts in the Columbia Basin by January 1980, and (3) all remaining duplicate forecasts outside the Columbia Basin and all duplicate forecast publications by January 1981. Agency officials told us that this time would be required to decide which agency would continue making the forecasts and to negotiate an acceptable formula for making such forecasts.

In addition to published water supply forecasts made by the Soil Conservation Service and National Weather Service, there are several other agencies which prepare forecasts to meet their own operational requirements. For example, the Bonneville Power Administration prepares forecasts at six of the dams whose hydropower it markets. The Bureau of Reclamation and the Corps of Engineers make forecasts for the dams each agency operates.

Officials of the U.S. Geological Survey stated that they make water supply forecasts only in western Washington and only at the request of individual power companies which partially reimburse the agency for these forecasts.

In October 1977 the Director of the National Weather Service wrote to the Commissioner of the Bureau of Reclamation to explore the possibility of closer cooperation between the agencies in the preparation of water supply and river forecasts. The Commissioner replied in November 1977 that he was very much interested in developing closer cooperation and would provide a full response as soon as he received comments from Bureau of Reclamation regional offices.

The initial efforts made by some agencies to eliminate forecast duplication and develop a cooperative forecasting program should be diligently pursued so the efficiency of Federal water supply forecasting efforts will be increased.

SELECTION OF SNOW SENSORS

The Soil Conservation Service is responsible for gathering snow data and providing it to the public and other government agencies. In 1972 the Congress authorized the Service to upgrade and automate its snow survey program. The plans called for locating sensors at about 500 snow courses in the west. Also, rainfall, temperature, and related information, as well as snowpack data were scheduled to be telemetered to a central location, according to the plans. The acronym "SNOTEL" evolved from the project's description, meaning to telemeter snowpack and related hydrometeorological data from mountainous regions of the west.

The Soil Conservation Service initiated purchase of remote snow sensors and other hardware in February 1975. Stainless steel snow pillows were purchased for 160 phase I SNOTEL sites. Soil Conservation Service officials informed us that stainless steel snow pillows were purchased because (1) the Service had considerable experience with snow pillows in the field and at their Mt. Hood, Oregon, test site, (2) they were the best snow pillows available and were next in the evolutionary sequence of snow pillow development, and (3) they were less expensive than isotopic snow sensors.

Because of your questions and those raised by private citizens concerning the selection of snow pillows, Soil Conservation Service officials agreed in February 1977 to make comprehensive accuracy and cost comparison studies of the isotopic gauges and stainless steel snow pillows before purchasing a second round of snow sensors.

We held discussions with many knowledgeable people on various types of snow sensors, particularly stainless steel snow pillows and isotopic gauges. There was general agreement that the snow pillows were less expensive than isotopic gauges and were preferable, if their accuracy was proven comparable to that of the isotopic gauge. Several parties stated, however, that snow pillows experienced problems in areas where severe ice bridging 1/ was prevalent or when installed on steep slopes, and that isotopic gauges may be preferable at such locations. We reviewed a draft of the Soil Conservation Service report which reached these same conclusions. The report stated that the future selection of snow sensor types, installed at each site where these conditions exist, would be made on a case-by-case basis.

Selection of SNOTEL telemetry

The selection of a meteor burst telemetry system for SNOTEL was the result of a long and detailed analysis.

On June 14, 1974, the Soil Conservation Service awarded a contract to System Consultants, Inc. (SCI) for a study of an automated system to collect snow and other hydrometeorological data. SCI evaluated alternative telemetry methods, including VHF line of sight, forward scatter meteor burst, and orbiting satellites. The October 4, 1974, SCI report

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1/Ice bridging occurs when the snowpack is not measured properly because a layer of compacted snow or ice forms over the snow pillow.

recommended a meteor burst system as ideally suited to the task of remote data acquisition. The report stated that the forward scattering meteor burst method (1) was sound and proven, (2) required little power, (3) was almost impervious to man-made or natural disturbances that affect most other means of communication, and (4) was the most cost effective of the candidate systems. Testing of a meteor burst telemetry system in Alaska in 1974 and 1975 also supported its feasibility.

In January 1976 the General Services Administration approved the Department of Agriculture's solicitation for the SNOTEL telemetry system on the condition that (1) vendors be allowed to propose any or all methods and/or types of data transmission and (2) the award of a contract be based on the lowest overall cost, price, and other factors delineated in the solicitation. In May 1976 the contract was awarded to the Western Union Telegraph Company, as lowest of the technically acceptable bidders.

The Western Union telemetry system was not completed on schedule because of (1) late deliveries from suppliers, (2) interference from nearby power lines at one base station, (3) insufficient air-conditioning installed at base stations, and (4) the inability of batteries at remote sites to supply sufficient power when temperatures were very low. Although the Western Union telemetry system for SNOTEL completion date was January 1, 1977, they were allowed to extend the contract to July 1 with a penalty of $81,093. According to a Soil Conservation Service procurement officer, additional penalties of about $530 a day have been assessed against the contractor since July 1, 1977. A Soil Conservation Service official informed us on December 14, 1977, that although the meteor burst telemetry system had proven its feasibility, Western Union would have to correct the hardware problems it was experiencing and successfully test the system before the Soil Conservation Service would accept it.

As agreed with your office, we will gladly discuss details of any topics covered in this letter with Rod Morrison of Idaho Industrial Instruments. We are sending copies of this report to the agencies we contacted during the review and to Mr. Ralph Harding.

Henry Eschwege

Henry Eschwege
Director