WATER OPERATION AND MAINTENANCE

BULLETIN NO. 171

March 1995

IN THIS ISSUE. . .

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of water supply system operators. Its principal purpose is to serve as a medium to exchange information for use by Reclamation personnel and water user groups for operating and maintaining project facilities.

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Technical editing and graphics were provided by Sharon Leffel and Jim Whitfield.

Cover photograph: A rehabilitated, remotely-controlled, solar-powered, inflatable-gate check structure.

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

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SYSTEM SCHEDULING USING EFFICIENCY BLOCK TECHNOLOGY

by Doug Dockter[1]

INTRODUCTION

As the Western United States has become more urbanized, the increasing competition among urban and agricultural interests for a limited water supply has become more pronounced than ever. In the wake of this situation, agricultural water districts have found themselves being challenged to make costly investments in instrumentation and structural features in order to maximize the efficiency of their operations. Needless to say, with the low profit margins and the limited available capital currently associated with agricultural economics, many such investments have become prohibitive. Another avenue for optimizing irrigation operations is through the application of irrigation system scheduling computer software. Numerous water management software packages are available. The Bureau of Reclamation (Reclamation) is currently involved in the development, evaluation, and application of several such packages. Because of the breadth of this topic, this article will focus on the background and application concepts of one of these models.

Beginning in 1990, Reclamation conducted a 3-year research project for the purpose of determining operational responses to changes in irrigation water supply and demand through its Global Climate Change Response Program. The program was carried out in cooperation with the Medford, Rogue River Valley, and Talent Irrigation Districts in southwestern Oregon. As a result of the research, a group of fully integrated system scheduling programs was developed. These programs consisted of:

- A demand model
- An operations simulations model
- Efficiency block software
- Software for ditchriders to enter distribution system data on lap top computers
- Three data bases
- Billing software

This integrated software package is termed **Efficiency Block Technology** (EBT). System scheduling using EBT provides a nonstructural alternative that an agricultural water district can use regardless of their present level of water measurement and accounting.

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[1] Doug Dockter is a conservation program specialist in the Bureau of Reclamation's Pacific Northwest Regional Office Water Conservation Center in Boise, Idaho.

THE EFFICIENCY BLOCK CONCEPT

An **efficiency block** is defined as "an area of irrigated lands whose acreage and types of crops are known and that lies downstream from a flow measurement point within a delivery or conveyance system" (Buchheim, 1994). As such, an agricultural water district can be divided into any number of efficiency blocks. An efficiency block can range in size from as large as an entire irrigation district to as small as an individual field.

Daily operation of the EBT model involves obtaining near-real-time data via a telephone MODEM to the Pacific Northwest Region's AgriMet/HydroMet network. These data, consisting of evapo-ranspiration (ET) and precipitation data for the local area, daily average flows at various diversion points, and reservoir contents, are entered into the data base portion of the program. The user may then evaluate the district operations based on current conditions. Ditchriders and office personnel turn on and off deliveries to water users in the data base according to actual conditions in the field, a 14-day rotation schedule, and user requests.

The objective of EBT is to maximize operational efficiency of the entire distribution system through active "demand-based" management. To further explain this concept, the difference between what is meant by irrigation scheduling and system scheduling must be explained. The idea of scientifically determining when and how much to irrigate a particular crop has been termed "irrigation scheduling." It is the practice of managing *onfarm* irrigation systems so that the irrigation applications (supply) match the actual needs (demand) of the crop. The term "system scheduling," as used by an agricultural water supplier, is the active management of a water supply and *off-farm* distribution system based on the actual collective demand of the *onfarm* agricultural crops being grown.

Two prerequisites to demand-based management are: (1) knowing the required demand at points of use and (2) having the ability to control and adequately measure and account for the supply being delivered.

The ability to systematically and scientifically monitor agricultural demand has greatly improved over the years. Near-real-time agricultural weather networks, such as AgriMet in the Pacific Northwest, combined with improved crop water use modeling techniques, have provided agricultural water districts with the ability to track agricultural water demand on a daily basis.

Scheduling the supply requires the ability of an agricultural water district to provide timely operational control as well as adequacy in water measurement and delivery accounting throughout the physical distribution system. Flow and storage data acquisition are available to many Reclamation irrigation projects through Reclamation's HydroMet system. The extent of water measurement networking required to provide "adequacy" in measurement and accounting is often debated. Measurement networking that targets every diversion and return could become economically prohibitive to many districts, especially to those that are undergoing extensive subdivision into smaller service units. EBT provides flexibility in this situation because the flow into and out of an efficiency block are the only points that require measurement in order to begin applying demand-based management to the system. A district needs only to define its efficiency blocks according to the level of measurement they have in use.

Evaluation is accomplished through graphs (figures 1 and 2) that allow the user to view the season-to-date daily irrigation demands, diversions to the efficiency block, precipitation, effective precipitation,

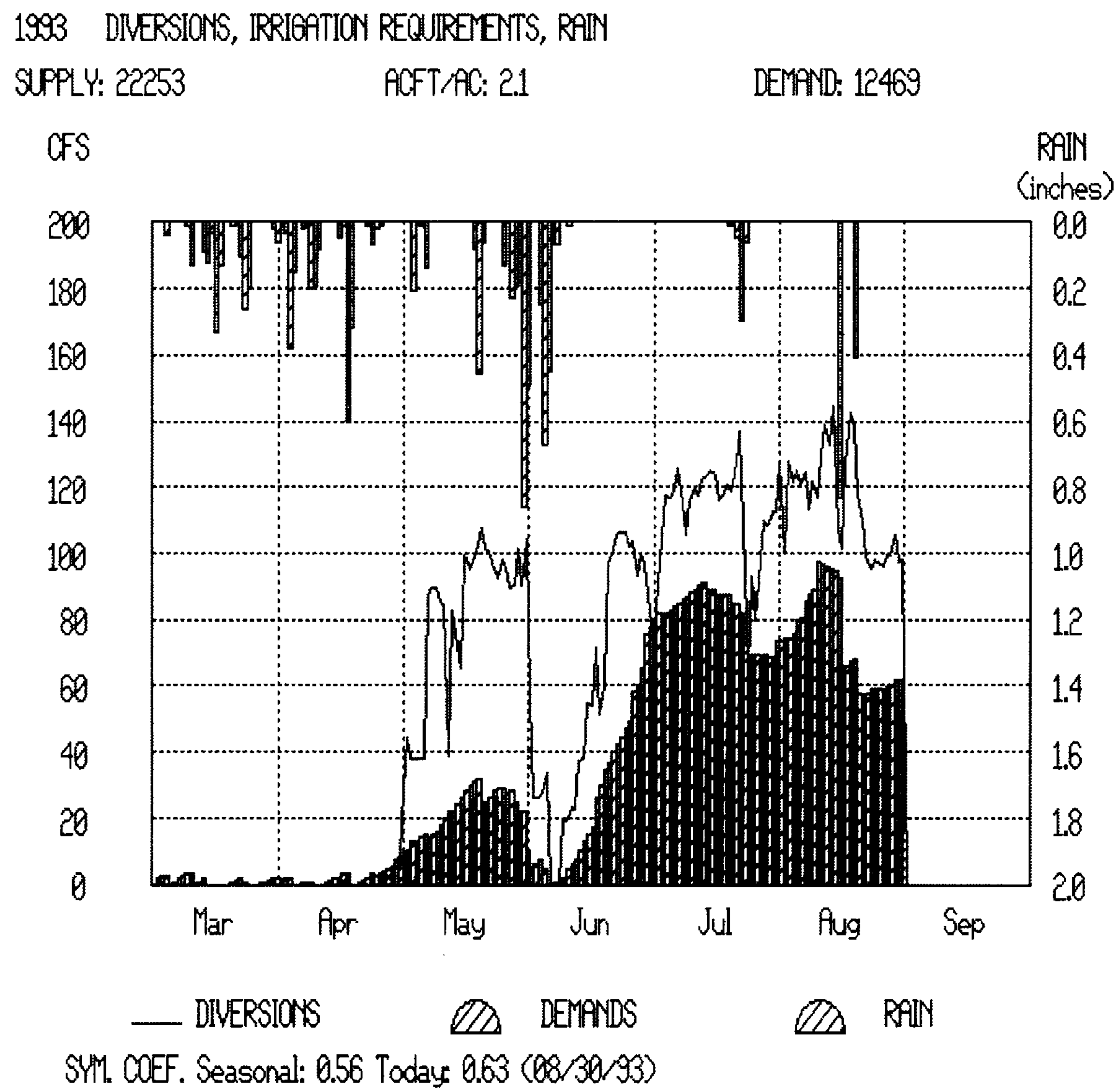

Figure 1.—Supply versus demand (efficiency block) with rainfall along the top. The supply and demand are plotted in cubic feet per second with the scale shown along the left side of the graph. Rainfall is plotted in inches based on the inverted scale on the right. The supply is the daily water deliveries determined by the formula entered above; the demand is the daily weighted average district-wide irrigation requirement multiplied by the acres in the area chosen to be graphed. The seasonal system coefficient is calculated by dividing the demand summed for the season by the supply summed for the season. The date used to calculate "today's" system coefficient is the most recent date with both weather (demand) and reading (supply) information.

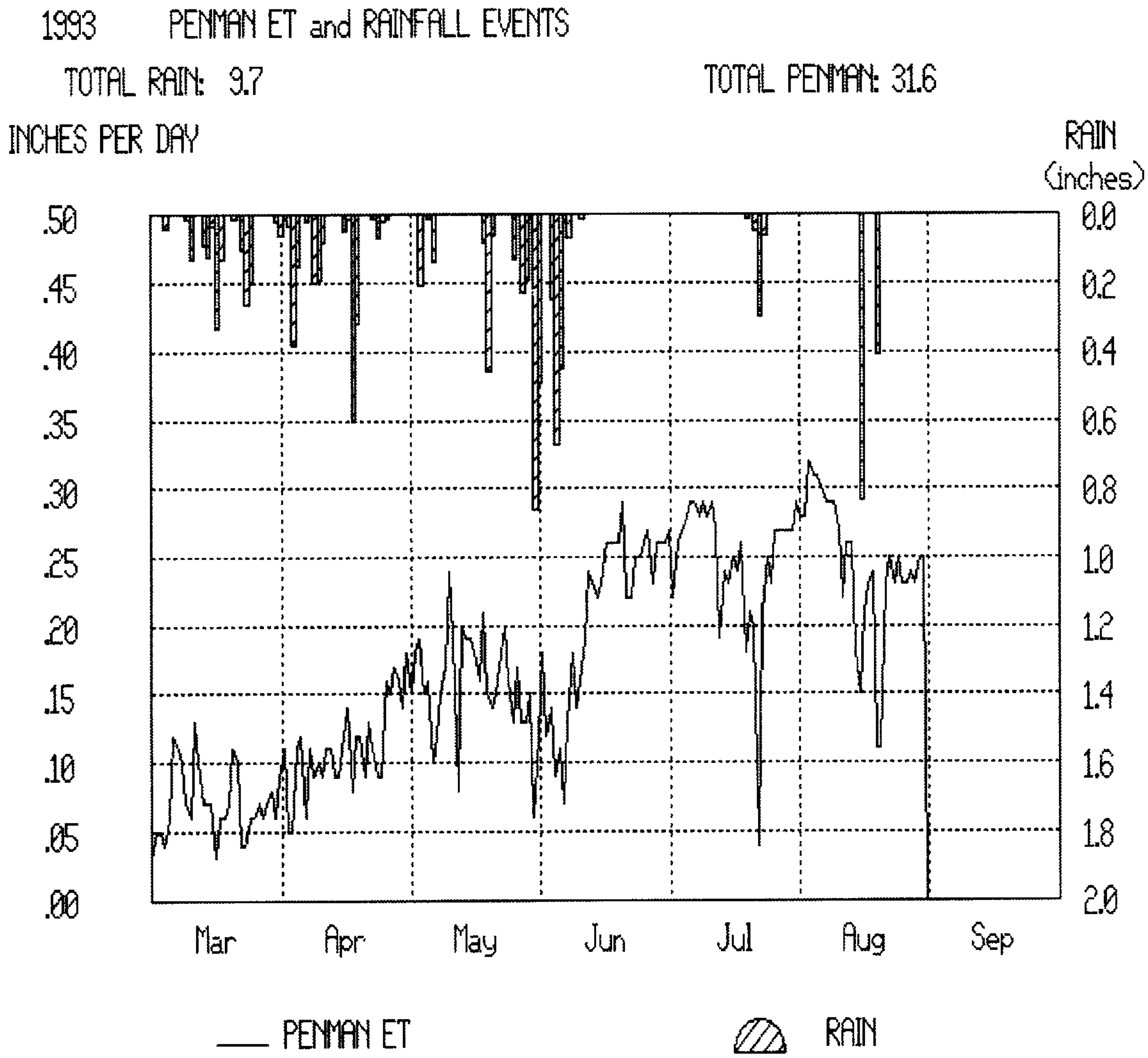

Figure 2.—Rain and Penman ET: selecting the "rain and ET (potential)" option of the "irrigation requirements" option displays a graph like the one above. Rainfall is plotted from the top of the graph downward, using the inverted scale to the right. The daily values of the modified Penman evapotranspiration, which were entered into the weather file, are plotted along the bottom. The daily Penman values represent the inches of water which would be used by a healthy, well-watered alfalfa crop 12 to 18 inches high. The total rain for the season, in inches, and the total inches of modified Penman evapotranspiration for the season are listed at the top of the graph.

total Penman ET, a weighted average Penman ET based on the various crops within the block, total supply and demand, total acreage in the block, total water use per acre, and an indicator called a **system coefficient**.

A system coefficient is defined as "the ratio of measured or computed irrigation demands (requirements) to the measured supply (deliveries) within an efficiency block" (Buchheim, 1994). The system coefficient is a tool that gives a measure of the efficiency of a block. A system coefficient is only relative to its individual district. A district could reach the point in which it is operating its system at maximum efficiency but its system coefficient is still low. This condition could be caused by physical limitations such as system losses and/or irrigation application inefficiencies.

Summary screens provide a look at the irrigation requirement for the date, acre-feet used in the block to date, inches per acre applied to date, number of users and acreage "on" and "off," users who are due "on" or "off," the irrigation requirement rate, the users required rate (based on orders and rotation), the supply rate, the acreage rotation rate, and the system coefficient.

The versatility of the EBT model is that it represents a demand-based methodology that can be initiated on the macro scale, such as an entire district, and then be progressively targeted toward a more micro scale, such as a lateral, sublateral, or farm. This process can occur as measurement, accounting, and control capabilities are appropriately phased in. EBT might be viewed in three levels of application. In the first level, a water district could consider itself as one large efficiency block. The system coefficient could be used here for relative comparisons of different time periods or years where changes in weather conditions, management methods, or various structural improvements have taken place. The effects of these changes can be evaluated and inefficiencies identified.

In the second level of application, a district would be gaging the efficiency of their system by monitoring the system coefficient. At this point, they could begin to use efficiency block system scheduling to implement changes in their operations. They would be adjusting deliveries through the system to match its limitations and thereby reducing fluctuations in the system. They would also be phasing in improved control, measurement, and accounting capabilities. As this improvement occurs, the district could be divided into several efficiency blocks. By doing this division, "problem" areas within the district could be identified and the efficiencies improved.

In the third level of application, a district would be in the ongoing process of educating its growers in onfarm scheduling based on the irrigation requirements of their crops. They would be dynamically performing optimum system scheduling based on the sum of the individual requirements. They would continue to monitor, evaluate, and adjust their water measurement and system control needs. It should be noted that this process does not necessarily mean that these capabilities are being increased, but rather that they are being applied in the most operationally and economically effective manner.

OUTREACH TO DISTRICTS

The Medford Irrigation District is currently using the EBT program at the third level of application. Many of the larger growers, representing about 10 percent of all users, have applied the *onfarm* portion of the software to their irrigation scheduling. Considering that 20 percent of the users in the district make up 80 percent of the acreage, 10 percent represents a large portion of the irrigated acreage in the district. The Talent and Rogue River Valley Irrigation Districts are also applying the EBT program to some degree. The Stanfield-Westland Irrigation District in northeastern Oregon will be using the program beginning in the spring of 1995 irrigation season.

Although EBT was developed with the intent that it would be generally applicable to other water districts, the fact that the demonstration was performed in the Rogue River Project required that some of the programming be unique to that area. A few of the calculations are based on the Oregon water right rate of 1 cubic foot per second per 80 acres for 180 days, which equals a maximum of 4.5 feet of water per acre. This calculation can be addressed in the software as the program is applied in other areas.

For more information on Efficiency Block Technology, please contact Doug Dockter of the Bureau of Reclamation Pacific Northwest Regional Office Water Conservation Center in Boise, Idaho, at (208) 378-5283.

REFERENCES

Buchheim, Jerry F., P.E., *Efficiency Block Technology*, Global Climate Change Response Program, United States Department of the Interior, Bureau of Reclamation, Denver Office, Denver, Colorado, May 1994, 53 pp.

SEISMIC MONITORING/STRONG MOTION PROGRAM AND NOTIFICATION SYSTEM

by Andy Viksne, Chris Wood, and David Copeland[2]

INTRODUCTION AND BACKGROUND

The Bureau of Reclamation Strong Motion Earthquake Instrumentation Program started in April 1937 when three of the "original U.S. Coast and Geodetic" strong motion accelerographs were installed in Hoover Dam (Arizona/Nevada). During the next 35 years, the program grew gradually, and strong motion instruments were installed at six new sites. A dramatically renewed interest in strong motion monitoring emerged in the early 1970's after the February 1971 San Fernando, California, earthquake (magnitude—6.6), which emphasized the need for improved methods for the analysis of the response of dams to earthquake loading. Thus, the Bureau of Reclamation initiated a program of upgrading existing instruments as well as adding new strong motion systems, especially on critical lifeline structures located in seismically active areas such as Seismic Zones 4 and 3 (figure 3).

The present Bureau of Reclamation Seismic Monitoring/Strong Motion Program incorporates 150 digital and analog systems located at 52 critical water resources lifeline structures such as dams, powerplants, pumping plants, and pipelines (figure 3). Fifteen structures are instrumented with digital accelerographs which function as Strong Motion Notification Systems.

STRONG MOTION NOTIFICATION SYSTEM

The purpose of installation and operation of Seismic Monitoring/Strong Motion Earthquake Systems (accelerographs) is to obtain input and response data at dams and other critical structures affected by shaking from earthquakes. The data obtained from the strong motion systems address two important needs: (1) as an enhancement to public safety to provide a Strong Motion Notification System and consequently a rational basis for inspection or remedial action at structures that have been subjected to earthquake loading and (2) to provide a record of ground motion parameters that can be used in the analysis and design of critical structures, existing or proposed.

Recent developments in earthquake instrumentation and automated seismic data acquisition afford the additional function of a Strong Motion Notification System, which provides immediate (within minutes) notification when a structure has experienced shaking and rapid information about the precise level of shaking, response spectra, and other critical information regarding the response of the structure. These timeframes are in contrast to the several-day to several-week response that is inherent in retrieving and processing records from existing analog strong motion instrumentation. The notification capability greatly enhances the original purpose of the Seismic Monitoring/Strong Motion Instrumentation by providing immediate, detailed information for inspection or other action.

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[2] Andy Viksne and Chris Wood are geophysicists, and David Copeland is an electronics technician. They are assigned to the Seismotectonics and Geophysics Group, Technical Service Center, Bureau of Reclamation, Denver, Colorado.

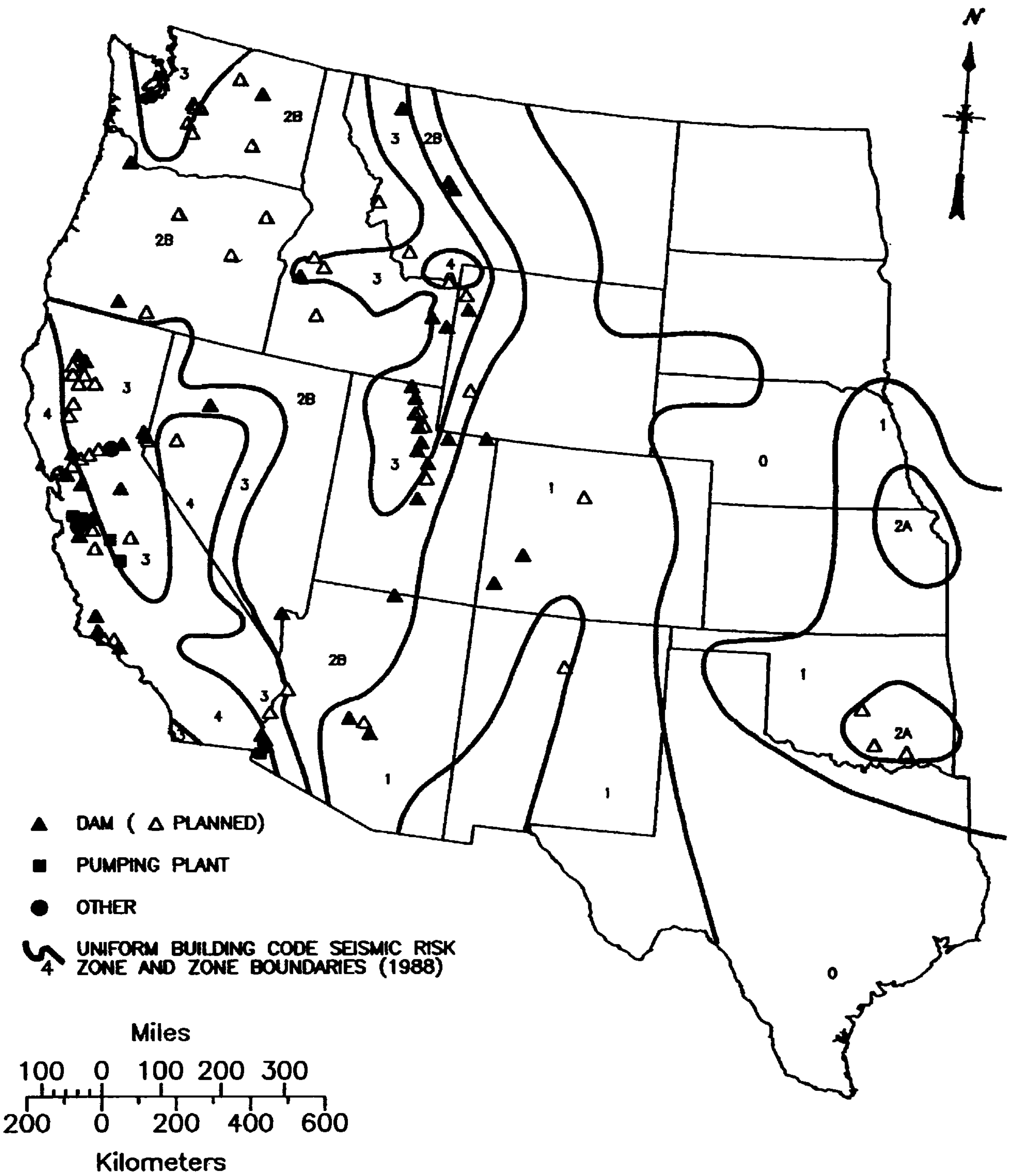

Figure 3.—Bureau of Reclamation seismic monitoring/strong motion program.

The implementation of the Strong Motion Notification System began in 1990 when two commercially available digital accelerographs were deployed—one at Casitas Dam, a 350-foot (107-meter) high earthfill structure located near Ventura, California, and one system at San Justo Dam, also an earth dam in California. Both systems were linked via telephone lines to a data retrieval and analysis system located at the Denver Technical Service Center. From 1991 through 1994, 13 more digital systems were added to the Strong Motion Program, bringing the total to 15 systems to date. Each Seismic Monitoring/Strong Motion Notification System consists of a commercially available digital accelerograph connected to the call-back microprocessor (triggered modem controller - TMC5) then to a telephone modem attached to a standard touch-tone telephone line (figure 4). When the digital instruments are triggered, the call-back microprocessor - TMC5, a "smart interface" between digital accelerographs and modems, uses the event-detected signal output to begin a scripted conversation with the "smart modem" connected to it. The conversation directs the modem to dial the Unix host computer system, located in the Denver Technical Service Center, and log in and download the recorded data. Decision and notification software assesses the importance of any recorded event. Then, routine processing tasks are automatically performed, with ground motion parameters and response spectra computed, and (if predetermined site-specific thresholds are exceeded) the Strong Motion Notification System automatically transmits a Seismic Event Alarm Message to the predetermined appropriate regional/area/water district office via voice message, fax, and/or LAN, providing all pertinent information.

The Strong Motion Notification System was implemented in September 1994 and was tested within a few days by several earthquakes. The ground motion generated by the earthquakes triggered digital accelerographs located on Bradbury, San Justo, San Luis, and O'Neill Forebay Dams in California. The ground motion data were received by the Denver Technical Service Center (Code D-8330), identified as earthquake generated, and processed; then a Seismic Event Alarm Message was transmitted to the designated Bureau of Reclamation Mid-Pacific Regional Office in Sacramento, California, by LAN, providing location, event time, peak acceleration, and response spectra intensity (figure 5). The whole process was performed automatically and within minutes of the triggering of the accelerographs.

Eventually, all critical Bureau of Reclamation structures (dams) in the Seismic Monitoring/Strong Motion Program will contain a minimum of two triaxial digital accelerographs—one located on the toe (foundation/bedrock) of the dam for recording input motion and the other on the crest of the dam to obtain the response motion/time history of the shaking—and, consequently, providing near-real-time strong motion seismic monitoring and the information for the Seismic Event Alarm Message.

CONCLUSIONS

The availability of reliable digital strong motion earthquake systems and automated seismic data acquisition not only has enhanced the standard Seismic Monitoring/Strong Motion Earthquake Instrumentation Program but also has provided the opportunity for the incorporation of the additional capability of the Strong Motion Notification System. The Strong Motion Notification System in the form of a Seismic Event Alarm Message provides immediate notification when a strong-motion-system-instrumented structure has experienced shaking and near-real-time information about the shaking, response spectra, and other critical information which provides a rational basis for inspection, remedial action, and/or any other required response.

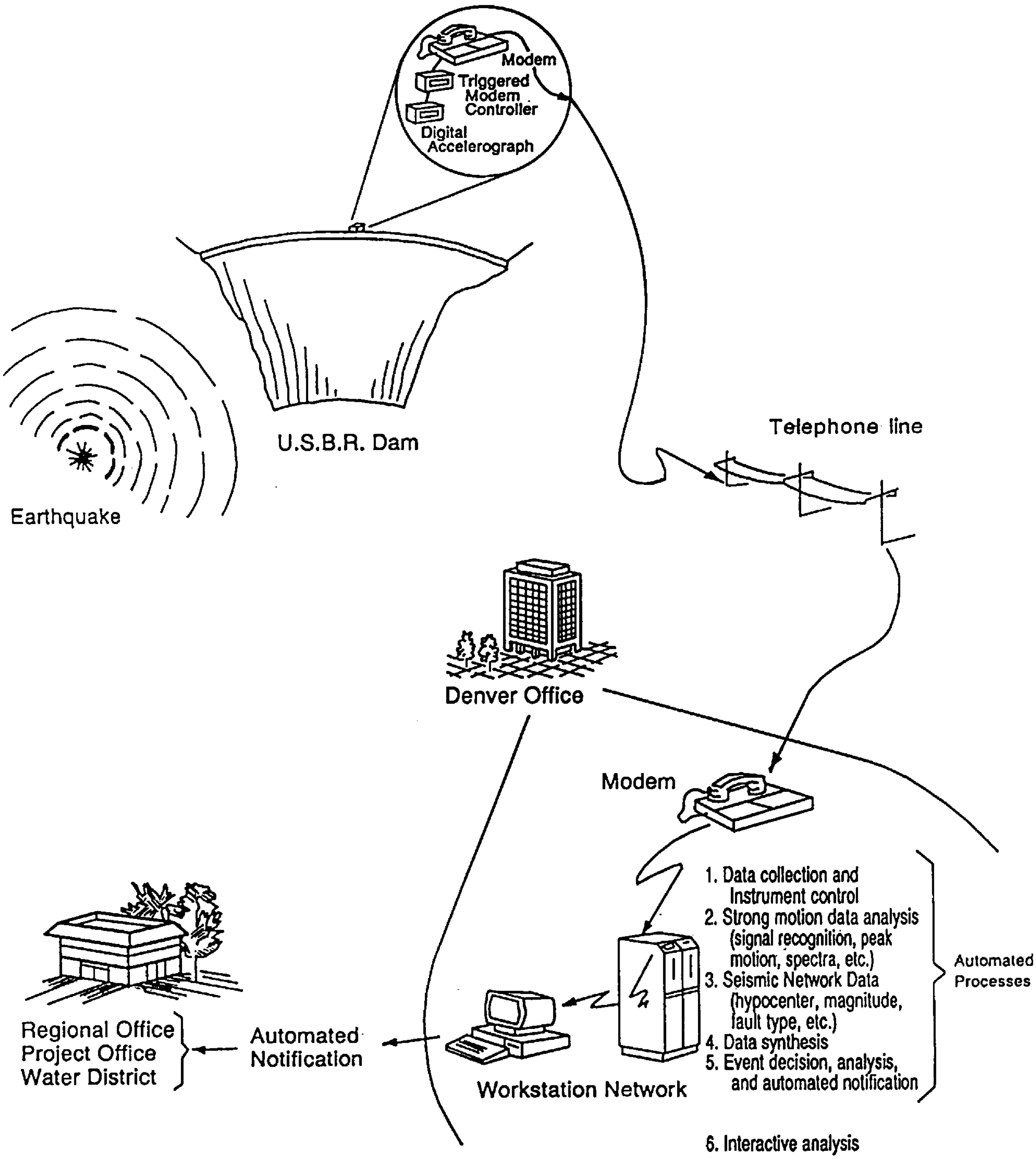

Figure 4.—Seismic monitoring/strong motion notification system.

```
From:     strong-motion instruments ("STRINST@SEISMO.DO.USBR.GOV
          ")
To:       dfrawley@ibr2mp400.mp.usbr.gov,
Date:     Tuesday, October 11, 1994  6:05 am
Subject:  Strong Motion Trigger: San Justo Dam  (SMTP Id#:
          47604)


=================================================================

                         Seismic Event Alarm Message

A seismic event has been detected at a Reclamation facility in
your
area.  Please follow the Standard Operating Procedure for a
seismic
alert at this facility, and the actions specified below.

-----------------------------------------------------------------

Facility:        San Justo Dam
Event Time:      Tue Oct 11 05:01:20 PDT 1994

Station:         Crest

Ground Motions: Peak acceleration: 0.014 g
          PSRV spectrum intensity: 0.5 cm
          PSAA spectrum intensity: 5.5 cm/s

SOP Threshold:   Peak acceleration: 0.010 g and above
          PSRV spectrum intensity: none applicable
          PSAA spectrum intensity: none applicable

Action:          Informational only - no action required

-----------------------------------------------------------------

This message was automatically generated by the Strong Motion
Notification
System.  For further information please contact the
Seismotectonics
and Geophysics Section at
       Voice          (303)236-4196        Office hours
       Fax            (303)236-9071
       WPO-LAN        ibr8smtp:"strinst@seismo.do.usbr.gov"
       Internet       strinst@seismo.do.usbr.gov
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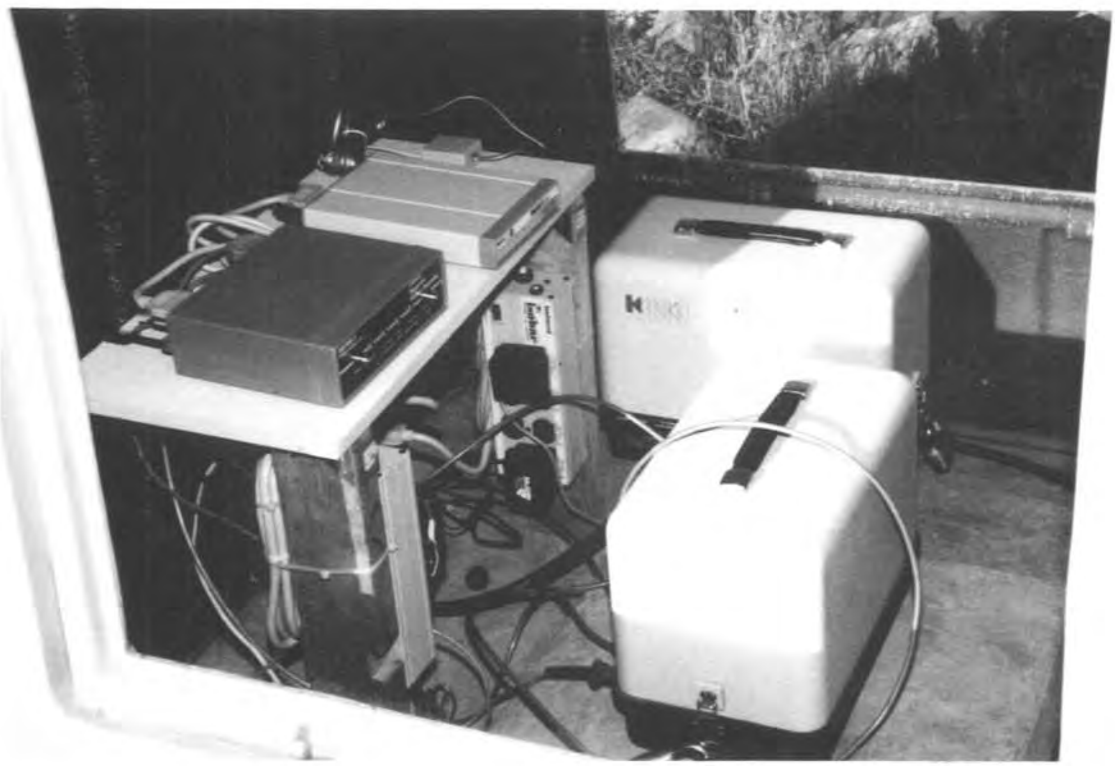
Figure 5.—Seismic event alarm message.



Photos 1 and 2.—Seismic monitoring/digital strong motion system (San Justo Dam, California).

REMOTE CONTROL OF A SOLAR-POWERED, INFLATABLE-GATE CHECK STRUCTURE

by Tony Wahl[3]

A canal check structure on the Strawberry Highline Canal near Payson, Utah, has recently been rehabilitated using a solar-powered inflatable gate. In addition, an upstream water level controller based on a proportional-integral-derivative (PID) algorithm was developed for the site to automatically maintain a constant water level upstream from the check structure. Canal operators can now remotely control and monitor the operation of the gate using a computer and a telephone/radio link to the site. The rehabilitated check structure was operated during the summer of 1994 with a minimum of manual intervention.

SITE DESCRIPTION

The check structure is located on the Strawberry Highline Canal on the outskirts of Payson, Utah. Maximum canal capacity at the structure is about 4.25 cubic meters per second (150 cubic feet per second). Three turnouts are located just upstream from the structure. The check structure was originally equipped with manually operated slide gates. Recently, the check has been operated primarily as a stoplog structure and has required frequent attention from the ditchrider. The ditchrider has operated the structure in the past to maintain constant water levels upstream from the gate to ensure consistent flows through the upstream turnouts.

The upgrade of the check structure consisted of improvements in four areas: the gate, a solar-powered gate operator, an upstream water level controller, and an integrated data collection and communication system.

INFLATABLE GATE

The inflatable gate chosen for the check structure upgrade is a new gate concept developed and patented by Obermeyer Hydro Accessories of Fort Collins, Colorado. The gate is a hybrid combination of an overshot gate and an inflatable rubber dam. The steel gate leaf is raised by a bladder, or pillow, located under the gate (photo 3). The gate used at this site is 1.524 meters (5 feet) wide and has a full-raised height of 1.524 meters (5 feet) when the gate leaf is at a 65-degree angle. The bladder is raised and lowered with compressed air and typically operates at pressures of 34 kilopascals (5 pounds per square inch) or less. This gate design has significant operational advantages over a rubber dam, including operability over a full range of bladder inflations and consistent gate crest elevation at partial inflation. The gate leaf also protects the bladder from debris damage. When the canal is dry, the gate can be fully lowered to protect the bladder from vandalism. The cost of the

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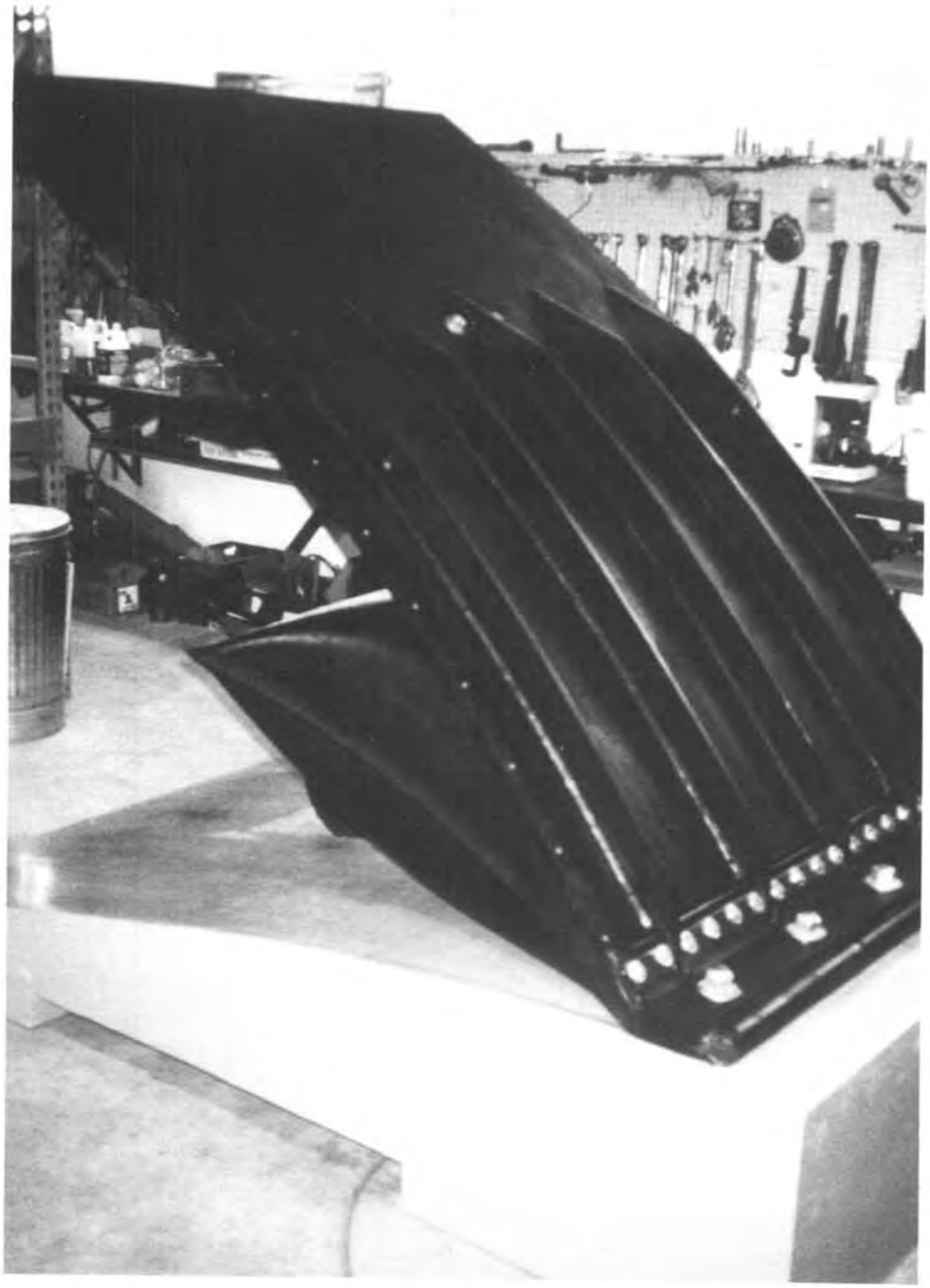

Photo 3.—A typical inflatable gate assembled in the shop. This gate is similar to the gate installed at the check structure on the Strawberry Highline Canal.

gate for this site was about $6,000. Photo 4 shows the check structure in operation following the installation of the inflatable gate. The gate is installed in the left bay of the check structure (looking downstream).

Photo 4.—The rehabilitated check structure with flow over the inflatable gate. The control system hardware is installed in the vault on the far side of the canal.

SOLAR-POWERED GATE OPERATOR

Electric power was not available at the check structure site, so the system was designed for solar-powered operation. A 12-volt d-c, 7-ampere (1/16-horsepower) compressor supplies air to the bladder. Compressed air is stored in a 114-liter (30-gallon) pressure tank. A 40-watt solar panel, 12-volt charger system, and a deep-cycle marine battery completes the solar-powered gate operator. In addition, a 10-watt panel and charger with a second storage battery provides power for the data collection and control system that regulates airflow in and out of the bladder. The data collection and control system includes a Campbell Scientific CR-10 Remote Terminal Unit (RTU), a Leupold-Stevens water level transmitter, a radio, a radio frequency (RF) modem, and two solenoid valves used to control airflow to and from the gate. The water level transmitter consists of a 0- to 34-kilopascal (0- to 5-pounds per square inch) pressure transducer mounted in a polyvinyl chloride pipe attached to the upstream side of the check structure.

UPSTREAM WATER LEVEL CONTROLLER

Initially, the control system for the site was built around a self-tuning PID control module purchased specifically for this site. For a given flow rate over the gate, the bladder pressure can be correlated to the gate position. The module functioned by measuring the upstream water level, determining whether the gate should be raised or lowered, and then raising or lowering the bladder pressure (adding or releasing air) to move the gate. This control system did a good job of maintaining the desired upstream water level. However, a deadband could not be set in the module to prevent hunting. This weakness was inherent in the design of the control module. Thus, the control module was constantly adding or releasing air in an attempt to fine-tune the water level far beyond the water district's needs. This fine-tuning led to excessive operation of the compressor and quickly drained the reserves from the storage battery. To keep the system operational, project personnel were manually recharging the battery or replacing it every few days.

To solve this problem, the control module was replaced, and a control algorithm was developed that could be programmed into the CR-10. This method allowed the inclusion of appropriate deadbands and safeguards against operating the gate based on erroneous water level readings. This approach also integrated the control system into the data collection and monitoring capabilities of the CR-10.

A PID algorithm was developed to operate the gate, and two solenoid valves were installed that regulate airflow into and out of the gate. The algorithm operates on a continuous 20-second cycle, calculating the amount of time to either raise or lower the gate during each cycle. Measurement of the bladder pressure is not needed for the control system. If the calculated movement is less than 2 seconds, the algorithm simply holds the gate in place. This deadband was very effective at reducing the unnecessary hunting that discharged the batteries in the first control system. The software also includes a manual operating mode in which the gate can be raised or lowered with commands transmitted to the CR-10 over the radio link from the water district office. Commands can also be transmitted to the CR-10 by personnel at the gate site using a lap top computer or the Campbell Scientific keyboard display unit.

Important aspects of the control system were protection against making gate movements based on erroneous water level readings and ensuring that the system would fail safe in the event of problems. Water level readings are checked against minimum and maximum limits and unreasonable readings are ignored. Preventing gate operation following very rapid changes in the water level reading also proved helpful. This technique eliminated unnecessary gate movements in response to noisy input data. One improvement still planned will disable the compressor operation if the battery voltage drops below a preset limit. This refinement will prevent the system from fully discharging the battery.

One weakness of the current system is the absence of any indication of the actual gate position. The original control system did provide an indication of bladder pressure, which can be correlated with gate position, but only if both the upstream water level and the discharge over the gate are known. Not knowing the gate position leads to the possibility that the control system could attempt to raise the gate past its fully raised position (65 degrees), especially when the canal flow becomes very small. An inclinometer will be added to the gate in the future that will provide a direct measurement of the gate angle; knowing the gate angle will also allow computation of the flow rate over the inflatable gate.

DATA COLLECTION AND COMMUNICATIONS

The primary method of communicating with the site is through a telephone and RF modem link. A radio and RF modem are installed at the site, and a second RF modem is installed at the water district office several miles from the site. A computer at the water district office can make a connection to the site through the RF modems. The user can monitor the current water level, battery voltages, and other relevant parameters, make operational changes (e.g., change the desired water level or make manual changes in gate position), download data from the RTU, and even edit the control software running in the RTU. Similarly, other interested parties can place a phone call from their computer through the water district phone system and then through the RF modems to the site. These users can have similar or more restricted access to the data and programs in the RTU, depending on their needs.

Historical data are stored in a limited memory space in the RTU by the control software every 10 minutes for use in long-term monitoring of gate operation. The data are stored in a cyclic fashion; the oldest data are overwritten by the newest data. This interval can be adjusted in the software from as short as 1 second to as long as several days. Users must connect to the site every few days to retrieve the newest data. With the 10-minute recording interval used at this site, users must call the site every 5 to 6 days to prevent overwriting of data before it is retrieved.

RESULTS

The control system was upgraded in late July to the PID algorithm running in the CR-10. Figure 6 shows the results of gate operation during the month of August. With the deadband properly implemented in the algorithm, the batteries began to gain ground immediately, and they reached full charge within about 20 days from system startup. Air usage was measured in terms of the accumulated number of seconds that the solenoid valves were open to admit air to the bladder or release air from the bladder. Air input to the bladder was typically in the range of 100 to 200 seconds per day. The driving pressure into the bladder (the tank pressure minus the bladder pressure) was greater than the driving pressure to release air from the bladder (bladder pressure minus atmospheric pressure). Thus, more overall time was spent releasing air than adding air. This time difference explains why the cumulative net air (raise time minus lowering time) is negative.

The upstream water level was held nearly constant at 5.0 ± 0.07 feet throughout the 2-month operating period. The system also responded quickly to two severe changes in canal flow during early July. The site required minimal maintenance through the end of the irrigation season in late September.

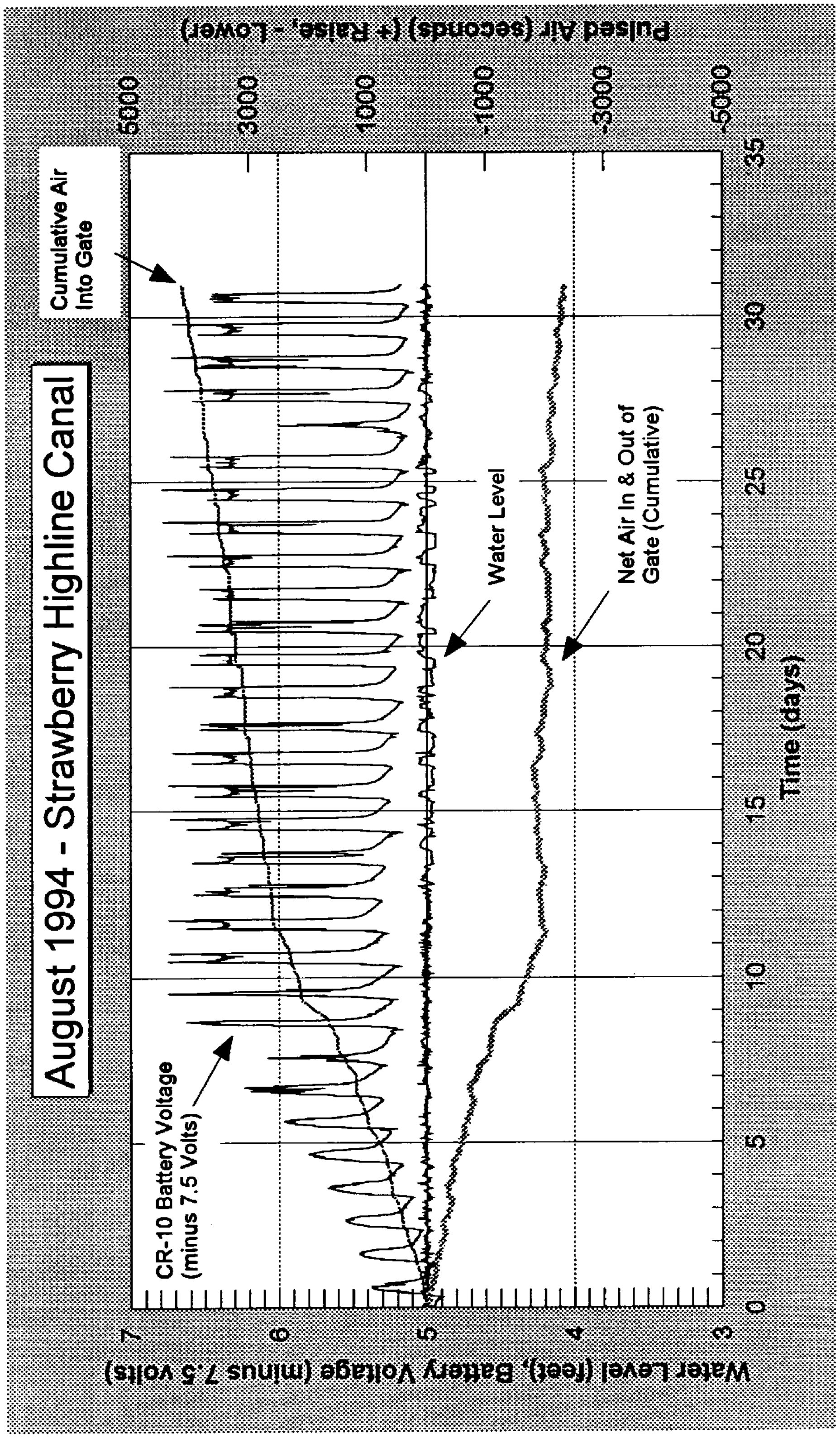

Figure 6.—Performance of the check structure following the installation of the inflatable gate and improved control system.

PROJECT INNOVATIONS

Protecting Pushbutton Controls At Granby Dam

Granby Dam is located near the southwest corner of Rocky Mountain National Park. The reservoir receives a lot of visitation throughout the year. Some of these visitors have strange ways of passing their recreational time. To discourage vandalism, better protection has been provided for the pushbutton controls for the spillway gates which are more secluded from the dam and local thoroughfares.

The Northern Colorado Conservancy District uses a system of locking devices to prevent damage to their pushbutton controls. When gate operations are completed (photo 5), a small box (photo 6) is attached and locked over the pushbutton area. Finally, a larger canister (photo 7) is locked in place over the entire assembly.

Photo 5.—Spillway gate pushbutton control.

Photo 6.—Small box attached over pushbuttons.

Photo 7.—Canister locked in place over entire assembly.

PROJECT INNOVATIONS

Oil-Absorbent Socks

During a recent Review of Operation and Maintenance examination at Unity Dam in Oregon, the examination team noted the neatness of the outlet works control house and gate chamber. To absorb oil leakage, Jerry Franke of the Burnt River Irrigation District had placed Pig Absorbents under the hydraulic controls and around the high-pressure slide gate bonnets. Jerry has used the absorbents for 2 years and says that they provide a clean, easy method of absorbing oil leakage.

The Pig Absorbents absorb oil and contain leaks in a cleaner and safer manner than sawdust, clay, or rags. The product brochure shows a variety of sizes, shapes, and applications. The absorbents come in different levels of absorbency and are flexible to fit around corners. Absorbed oil can be wrung out and recycled, reducing disposal costs. Most of the Pig Absorbents meet nonbiodegradable standards for landfilling.

Jerry may be contacted at (503) 446-3313 for further information.

Photo 8.—Square pig absorbents placed beneath hydraulic controls in Unity Dam outlet works control house.

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Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

The purpose of this bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends upon your help in obtaining and submitting new and useful operation and maintenance ideas.

Advertise your district's or project's resourcefulness by having an article published in the bulletin—let us hear from you soon!

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Vickie Hoffman, Pacific Northwest Region, ATTN: PN-3234, 1150 North Curtis Road, Boise, Idaho 83706-1234; (208) 378-5335, FAX (208) 378-5305.

Dena Koyama, Mid-Pacific Region, ATTN: MP-430, 2800 Cottage Way, Sacramento, California 95825-1898; (916) 978-5078, FAX (916) 978-5284.

Ron Smith, Lower Colorado Region, ATTN: LC-4842, PO Box 61470, Boulder City, Nevada 89006-1470; (702) 293-8436, FAX (702) 293-8042.

Don Wintch, Upper Colorado Region, ATTN: UC-434, PO Box 11568, Salt Lake City, Utah 84147-0568; (801) 524-3307, FAX (801) 524-3034.

Tim Flanagan, Great Plains Region, ATTN: GP-433, PO Box 36900, Billings, Montana 59107-6900; (406) 657-6243, FAX (406) 657-6418.