

STATE OF COLORADO

Colorado Water Conservation Board

Department of Natural Resources

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TO: Colorado Water Conservation Board

FROM: Jeff Baessler
Tom Ley

DATE: November 6, 2009

SUBJECT: **Agenda Item 28.a, November 16-18, 2009 Board Meeting**
Water Supply Planning and Finance Section –
Satellite Linked Monitoring System & Flood Hardening Program

Bill Ritter, Jr.
Governor

Harris D. Sherman
DNR Executive Director

Jennifer L. Gimbel
CWCB Director

Dan McAuliffe
CWCB Deputy Director

Background

The Division of Water Resources (DWR) has requested an appropriation of \$250,000 for the continued operational viability of the state Satellite-linked Monitoring System (SMS). The Finance Committee and the Board have approved funding for this program annually. The Board has recognized that it is critical for both the State's water planning and water administrative agencies to support and maintain state-of-art stream gaging programs and continue to provide accurate water resources data to support multi-agency and water user needs. The DWR Satellite-linked Monitoring program is outlined in §37-60-121 and §37-80-102 C.R.S.

Discussion

In previous years, DWR requested approximately \$350,000 to operate and maintain the system as well as make infrastructure improvements at existing gage locations. This year's request was reduced by \$100,000 in recognition of the current budget crisis. In order to make up the shortfall, and to address other identified needs, DWR and CWCB are collaborating to identify the most critical streamgaging needs throughout the state and will combine resources as necessary to address those needs. In addition, CWCB and DWR will delay flood hardening and infrastructure improvements at a number of gages. CWCB is currently working on a hydrographic strategic plan that will address cooperative efforts with DWR and USGS and identify CWCB gaging needs throughout the state. CWCB staff will also be working closely with DWR over the next year to address cableway improvements which are needed at many gaging sites throughout the state. This year's reduced request will delay the replacement of some out-dated satellite data collection platforms; however, there will be no interruption in the collection of data at these gages.

It should be noted that in previous years, CWCB staff has requested approximately \$250,000 from the Construction Fund to address specific on-going CWCB stream gaging needs related to flood forecasting and warning, instream flow monitoring, compact protection, and Decision Support System data

collection efforts. In 2007, the legislature created a stream gage fund under §37-60-124 in the amount of \$250,000 to address the CWCB's gaging needs. Since this fund has been created, staff is no longer applying for annual non-reimbursable Construction Fund dollars. The fund is continuously refreshed up to the \$250,000 level.

Request for an exemption to Financial Policy 13

Since the Board's target growth rate will be unmet this fiscal year, it is understood that there would be no funding for non-reimbursable grants under Policy 13. However, staff is requesting an exemption from this policy and recommends that funds be provided for the DWR Satellite Monitoring System.

The requested exemption is due to the fact that stream gaging activities are critical to the mission of not only the State's water planning and water administrative agencies, but to all water users throughout the state. This, combined with the fact that Congress has failed to adequately fund the USGS stream gaging programs, has led to a crisis in Colorado where either gages are lost entirely or the cost of gages is passed on to cooperating entities who find it increasingly difficult if not impossible to pay the increased fees. On a number of occasions, CWCB and DWR have been able to step in and either take over critical gages or provide temporary operation and maintenance funds to keep gages running while other cooperators are pursued. Although Congress is well aware of the funding problems that the USGS is facing in both its Cooperative and National Streamflow Information Programs (CWP and NSIP), the current Federal budget does little to alleviate the problem. This year the Obama Administration has proposed a nominal \$5 million increase to the NSIP and a 1.5 million increase to the CWP. It has been estimated that a fully functioning NSIP would require an annual appropriation of \$110 million. In addition, the USGS would need another \$95 million to restore its 50:50 cost share match with state, tribal and other non-federal entities.

Recommendation

Staff recommends that the Board make an exemption to Policy 13 and appropriate \$250,000 from the Construction Fund to the Department of Natural Resources for allocation to the Division of Water Resources (DWR) to enhance, renovate, and replace the Data Collection Platforms in the existing satellite monitoring system (The details of the DWR Satellite Monitoring System funding request are explained in the attached memo from Scott Cuthbertson to Jennifer Gimbel dated August 11, 2009).

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Bill Ritter, Jr.
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Harris D. Sherman
Executive Director

Dick Wolfe, PE
Director/State Engineer

MEMORANDUM

To: Jennifer Gimbel, Director, Colorado Water Conservation Board

From: Scott Cuthbertson, Assistant State Engineer-- Public Safety

Cc: Tom Ley, Jeff Baessler, Dan McAuliffe

Date: August 11, 2009

RE: Division of Water Resources Satellite-linked Monitoring System
DWR and CWCB Flood Hardening of Existing Stream Gages

Summary

The Colorado Division of Water Resources (DWR) requests \$250,000 from the CWCB Construction Fund for FY2010-11. The requested funds support the continued, long-term operational viability of over 500 satellite-linked water monitoring sites: replacement of out-dated data collection platforms and satellite telemetry transmission components and renovation of existing gaging stations. The specific distribution of the funds requested is as follows:

1. \$195,000 for replacement of out-dated Data Collection Platforms (DCP) and associated satellite telemetry equipment and upgrading of satellite transmission components. Funds requested in this category allows the replacement of out of date DCPs at DWR satellite monitoring gaging stations as technology improvements become available or are mandated by NOAA, the Federal Agency managing the GOES satellite resource.
2. \$55,000 for refurbishing existing stream gages as needed to maintain operational reliability of stream flow data collection. This request is anticipated to be an annual cost due to deterioration and projected life expectancy of the physical and mechanical aspects of the stream gages.

Introduction

The Division of Water Resources and CWCB, consistent with Section 37-60-121 and Section 37-80-102 C.R.S., continue to improve the utility of the stream gaging program to support multi-agency and water user needs such as water rights administration, compact protection, flood forecasting and warning, and Decision Support System implementation and use. DWR must maintain the electronics in satellite-linked

data collection stations; refurbish gage station infrastructure and non-electronic hardware for stations that are deteriorating; harden certain key stations against flood events so that we can continue to collect critical, real-time stream flow data in times of flood; refurbish/replace cableways used for high flow measurements or implement alternate means of high flow measurement (for subsequent calibration of the upper end of stage-discharge relationships), and continue, as necessary, the operation of vital gages which are currently operated by the United States Geological Survey (USGS). The current request is part of a continuing annual request for funds to support this program.

Background

The Satellite-linked Monitoring System (SMS) has been operating since 1985, starting with 82 linked gaging stations. As the need for the data has increased, the SMS has expanded. Since inception, in excess of 7.5 million dollars has been spent to develop the infrastructure of the SMS. Currently, DWR operates and maintains over 500 data collection platforms (DCPs) on rivers, streams, reservoirs, ditches and canals to collect and transmit basic stream flow and water elevation data to support the Division's primary mission of water rights administration. Included is support of interstate compact administration, and flow alerts based on parameter thresholds (e.g., low flow alerts in support of CWCB ISF programs, high flow alerts in support of flood protection decision making and flood warning). Collectively, these platforms and the computer equipment in Denver are the Satellite-linked Monitoring System (SMS). The USGS and other entities operate an additional 300+ sites in Colorado. The USGS and DWR are working to improve data availability and reduce duplication through improved gaging station effectiveness. The SMS provides basic water flow data to the staffs of the Division of Water Resources and Colorado Water Conservation Board; to many public and private entities, such as the Cities of Colorado Springs and Aurora, the Denver Water Board, the Arkansas River Compact Commission, Emergency Coordinators for most Colorado counties; to water rights holders; and to many recreationists such as fishermen, rafters, etc. Many programs of the DWR, such as various river operations analysis spreadsheets used in each of the seven DWR Division offices for water administration, and the DWR Safety of Dams Program rely upon the real-time data acquired through the SMS. Water resources accounting programs utilizing the SMS include the Dolores Project, the Colorado-Big Thompson Project and the Fryingpan-Arkansas River Project. CWCB programs, such as Stream and Lake Protection, Flood Protection and Water Supply Protection also utilize the real-time data.

FY2010-11 Funding Request

Replacement of Satellite Telemetry Equipment

DWR requests \$195,000 in FY2010-11 for the replacement of out-dated DCPs and associated satellite telemetry equipment and upgrade of associated satellite transmission components. The National Oceanic and Atmospheric Administration (NOAA) operates the GOES satellite via which stream stage and water body surface elevation data are telemetered from remote sites to the central computer in Denver. The use of this satellite and all the ancillary hardware and software, including staffing, is valued at over \$500 million dollars. The State of Colorado has been able to utilize this system at no charge. By 2001, the use of the GOES satellite system had increased to the point where demand had begun to exceed satellite channel capacity. NOAA, therefore, mandated that all DCPs using the GOES satellites for data transmission be upgraded by 2013 to transmit data at 300 baud as compared to the 100 baud rate of first generation DCPs. It is projected that the upgrade to high data rate DCPs throughout the DWR satellite monitoring system will be completed in FY2010-11. An important benefit of the high data rate upgrade program has been the more frequent (from once per four hours to once per hour) transmission of data from remote sites to the central computer. This has resulted in near 'real-time' data on the system. The current equipment costs of a high data rate DCP upgrade with the new GOES transceivers, antennas, batteries, gage height sensors, solar panels, wiring, and grounding equipment for a standard stilling well type stream gage station is about \$5000.

In addition, NOAA, through the Satellite Telemetry Interagency Working Group (of which the State of Colorado is a non-voting member) continues to explore means of increasing the capacity of the GOES satellite system. NOAA is currently planning the next technology upgrade: implementation of narrow band transmission protocols. This improvement will cut the band width of each telemetry assignment from 300 kHz to 150 kHz, effectively doubling the satellite transmission capacity. Most GOES transmitter manufacturers have agreed this will be a firmware upgrade to their equipment, as opposed to the wholesale

replacement required with the high data rate DCP upgrade program. However, early high data rate DCPs procured and installed by DWR beginning in 2001 are not compatible with the narrow band protocol and will require replacement. Records show that 139 of these units were purchased and installed. These DCPs are approaching their useful life of 8-10 years, and, indeed, a number of these early high data rate DCPs have already failed. NOAA has not set a firm timetable for implementation of the narrow band protocol.

Useful DCP life is sometimes shorter in the humid and/or harsh cold environments in which the equipment is housed. In order to continue using the present system to collect and transmit basic stream flow and water body elevation data, DWR projects that electronic equipment will be replaced, on average, every 10 years. Since DWR owns about 460 total sets of DCP equipment out of the 500+ gages it operates, an average of about 45 replacements per year should be planned.

The current funding request for FY2010-11 in this category recognizes difficult budget times, and is therefore at an amount less than what is needed to perform 45 replacements per year. This funding request supports approximately 30 replacements. Hopefully, DWR will be able to ramp the rate of DCP replacement back up to 10% per year by FY2011-12.

Refurbishment of Existing Stream Gages

DWR requests \$55,000 for refurbishing existing stream gages in FY2010-11. Approximately 60% of Colorado's satellite-linked gaging stations are located in the rivers and streams of the state. The others are located in reservoirs, ditches, and canals. The electronic equipment is attached to mechanical equipment in and along the stream channel, and electronically relays the data gathered by the mechanical measuring devices. If the mechanical equipment and associated stream gage structures (shelters, stream controls, independent reference gages, etc.) are not properly maintained, protected against flood conditions and periodically refurbished, data quality and accuracy diminishes.

Flood Hardening/Improvement of Infrastructure for High Flow Measurement Capability and Safety

DWR and CWCB have jointly requested \$50,000 to continue flood hardening and to improve infrastructure at existing stream gages for safe high flow measurement capability during the past several years. No funds are requested in this category for FY2010-11 due to the recognition of current budget concerns as discussed above.

An important goal of flood hardening of stream gages is improvement of stage-discharge relationships to yield accurate high/flood flow data. High flow measurement capability varies from gage to gage. High flows at stream gages are measured from cableways near the gage or from nearby upstream or downstream bridges. Cableways at DWR stream gages are given a detailed inspection every four years. During the past 4 years many cableways, primarily because of age, have been found to need replacement of key components of the cableway system. High flow measurement sustainability projects address such identified cableway design/safe use issues. These may include replacement of cable, improvements to the cable anchorage system, replacement of A-frame components, replacement of cable cars, etc. Costs can run from as little as \$1,000 per cableway to as much as \$20,000 per cableway, obviously depending on what components need replacement before a cableway can be returned to safe service. Alternatively, existing cableways found to have design or safe use deficiencies are, under certain site conditions, being replaced with bank-operated cableways. Costs of installing bank-operated cableways range from \$5000 to \$7000 per site. After FY2010-11, DWR proposes annual funding for cableway improvements of \$70,000 to \$80,000 per year, until critical needs are addressed. Cableway improvements are expected to require 4 to 5 years at that level of funding to completely address the known concerns.

FY08-09 Accomplishments

The CWCB provided \$350,000 in FY2008-09 for satellite telemetry equipment upgrade and replacement, flood hardening of stream gages, and stream gage refurbishment.

High Data Rate DCP Upgrade Program. Of the funds allocated, \$245,000 were expended on the procurement and installation of new generation, high data rate, satellite-linked monitoring equipment. The high data rate upgrade program began in 2001. To date, over 400 DWR satellite monitoring gages throughout Colorado have been upgraded from 100 baud to 300 baud transmission speed. Upgrades also include new generation data collection platforms with on-board data logging, new stage measurement equipment, ancillary telemetry support equipment, and gage station grounding equipment. DWR anticipates being able to complete this initial phase of the high data rate DCP upgrade program by the end of FY2010-11. As discussed above, additional upgrades will be required to meet the band with limitations placed on the system.

Streamgage Refurbishment. Of the FY08-09 funds, \$55,000 along with carryover funds from the previous fiscal year were used on refurbishment of existing stream gages throughout the State. Refurbishment projects were completed at the following stream gages in FY 2008-09.

Boulder Creek near Orodell	\$84.48
South Platte River near Balzac	\$215.10
Huerfano R near Redwing	\$4,750.00
Arkansas River at Nepesta Bridge near Nepesta	\$215.10
Arkansas River at Salida	\$110.85
Crooked Arroyo	\$600.00
Horse Creek at Hwy 194	\$250.00
North Clear Creek bel Continental Reservoir	\$7,306.71
Goose Creek at Wagonwheel Gap	\$1,620.71
Railings on wooden A-frame platforms--Div 3	\$696.71
Big and Little Spring Creeks	\$891.96
Roubideau Creek at the Mouth near Delta	\$2,688.00
Uncompahgre River at Olathe	\$5,460.00
Cow Creek near Ridgway Reservoir	\$2,846.35
Muddy Creek bel Paonia Reservoir	\$870.98
Walton Creek near Steamboat Springs	\$1,996.17
Morrison Creek bel Silver Creek near Stagecoach	\$1,525.66
LAPBRECO ramp flume stabilization	\$7,480.00
LAPCHECO ramp flume stabilization	\$7,120.00
La Plata at Hesperus	\$8,960.00
New door handsets and locks all keyed alike-Div 7	\$812.90
La Plata River Ditch gages (3)	\$662.06

Flood Hardening. An allocation of \$50,000 was used to flood harden several critical stream gaging sites. The following table is a summary of the flood hardening projects initiated or completed in FY08-09.

South Boulder Creek at Eldorado Springs	\$4,522.00
St. Vrain Creek at Lyons	\$5,848.82
Arkansas R. at Canon City	\$7,985.57
Arkansas R. at Granite	\$2,500.03
Arkansas R. near Granada	\$3,587.88
Cucharas River at Boyd Ranch	\$7,250.00
Huerfano River at Redwing	\$4,522.00
San Antonio River at Ortiz	\$17.76
Conejos River below Platoro Reservoir	\$2,611.19
Trinchera Creek above Turner's Ranch	\$178.01
Big Thompson River at the Canyon Mouth	\$4,522.00
SP-ADCP transducer wit 3 m cable	\$6,000.00

Water Project Construction Program – Project Data

Applicant: Division of Water Resources and Colorado Water Conservation Board

Project Name: Satellite-linked Monitoring System and Flood Hardening Program

Project Type: DWR Stream Gaging

County: Statewide **Drainage Basin:**
Statewide Drainage Basins

Water Source: N/A

Total Study Cost: \$250,000

Funding Sources: Construction Fund

CWCB Investment: **Interest Rate:** N/A
\$250,000

Term: N/A

This project entails the continued, long-term operational viability of the State Satellite Linked Monitoring System, which is administered by the Division of Water Resources (DWR). It also involves the continued implementation of the joint DWR/CWCB Flood Hardening Program. The Satellite-linked monitoring system, which is comprised of over 500 satellite-gaging stations, requires continued renovation and flood hardening of existing gages, replacement of outdated data collection platforms and upgrades to transmission components. In addition, many existing gaging stations need to be modified to provide critical stream flow data for flood warning and

low flow monitoring. Changes in technology, which will ultimately increase reliability and real time data transmission rates, will require the DWR to continue to upgrade the system in the future. The costs associated with the continued refurbishment and operational viability of the system is approximately \$350,000 per year. This year's request is being temporarily reduced to \$250,000 as a result of state budget constraints.



Crystal River DWR/CWCB Satellite Gage