STATE OF COLORADO

Colorado Water Conservation Board
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TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler, Deputy Section Chief
Stream and Lake Protection Section

DATE: November 8, 2013

SUBJECT: **Agenda Item 28a, November 19-20, 2013 Board Meeting**
Finance – Construction Fund Non-Reimbursable Investment – Referred Satellite-linked Monitoring System and Stream Gage Refurbishment Program

Introduction

The Division of Water Resources (DWR) is requesting from the CWCB Non-Reimbursable Investment Program an appropriation of $330,000 for the continued operational viability of the state Satellite-linked Monitoring System (SMS) and Stream Gage Refurbishment Program. Each year, funding for this program has been reviewed and approved by both the Finance Committee and the Board. It has been 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.

Staff Recommendation

Staff recommends that the Board approve this request for the General Assembly to authorize this project and appropriate $330,000 from the Construction Fund to the Department of Natural Resources for allocation to the Division of Water Resources to replace out-dated Data Collection Platforms and associated satellite telemetry equipment in the existing satellite monitoring system, and to refurbish existing stream gages.

Discussion
The $330,000 request for FY 2014-2015 will support the continued, long-term operational viability of 520 satellite-linked water resources monitoring sites. These funds will be allocated as follows:

1. $275,000 for replacement of out-dated Data Collection Platforms (DCP) and associated satellite telemetry equipment and upgrading of satellite transmission components. The rate of replacement of DCPs is based on a life expectancy from normal wear, tear and software life cycle issues of 10 years. Replacement of out of date DCPs may also be required to accommodate technology upgrades and changes which are mandated by NOAA, the Federal Agency managing the GOES satellite resource.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 is a recurring annual request to cover refurbishment and repair costs which arise due to deterioration of the physical stream gage infrastructure.

The requested funding amount of $330,000 is $30,000 more than the past several years, but still below historical requests of $350,000 to $400,000. The $30,000 increase represents the revised estimates of the funding required to address the estimated 10 year life span of electronic telemetry equipment. (Further details of the DWR Satellite Monitoring System funding request are explained in the attached memo from Scott Cuthbertson to James Eklund dated July 29, 2013.)

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

John W. Hickenlooper
Governor

Mike King
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

MEMORANDUM

To: James Eklund**,** Director, Colorado Water Conservation Board

From: Scott C. Cuthbertson, Deputy State Engineer

Cc: Jeff Baessler

Date: July 29, 2013

RE: Division of Water Resources Satellite-linked Monitoring System and Stream Gage Refurbishment Funding Request for FY2014-15

Summary

The Colorado Division of Water Resources (DWR) requests a total of **$330,000** from the CWCB Construction Fund for FY2014-15. The requested funds will support the continued, long-term operational viability of over 520 satellite-linked water resources monitoring sites, including replacement of out-dated data collection platforms and satellite telemetry transmission components and refurbishment/renovation of gaging stations. The specific distribution of the funds requested is as follows:

1. The sum of $275,000 will be used to replace out-dated Data Collection Platforms (DCP) and associated satellite telemetry equipment and upgrading satellite transmission components. The rate of replacement of DCPs is based on a life expectancy from normal wear, tear and software life cycle issues of 10 years.
2. The remainder of $55,000 will refurbish existing stream gages as needed to maintain operational reliability of stream flow data collection. This is a recurring annual request to cover refurbishment and repair costs which arise due to deterioration of the physical stream gage infrastructure.

Introduction

The Division of Water Resources and CWCB, consistent with Section 37-60-121 and Section 37-80-102 C.R.S., maintain 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 electronic equipment in satellite-linked data collection stations;
- refurbish deteriorating gage station infrastructure and non-electronic station hardware;
- refurbish/replace cableways used for high flow measurements or implement alternate means of high flow measurement (for calibration of the upper end of stage-discharge relationships);
- rebuild gage sections damaged by high flows;
- flood harden, when possible, critical gages; and,
- continue, as necessary, the operation of vital gages operated by the United States Geological Survey (USGS) when that program can no longer provide the required support.

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 8 million dollars has been invested in the development of the SMS infrastructure. Currently, DWR operates and maintains over 520 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 and compact administration. Additional benefits of the system include flow alerts based on parameter thresholds, such as: low flow alerts in support of CWCB ISF programs; high flow alerts in support of flood protection decision making and flood warning; and, rate of change alerts below dams and reservoirs.

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 and 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, water rights owners, recreationists such as fishermen and rafters, and conservation groups. 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.

FY2014-15 Funding Request

Satellite Telemetry Equipment. DWR requests $275,000 to replace out-dated DCPs and upgrade associated satellite telemetry equipment. This is $25,000 more than requested for the last several years and represents the basic funding required to replace equipment as it wears out or becomes out-dated.

In order to maintain the system, DWR projects that electronic equipment will be replaced, on average, every 10 years. DWR owns about 480 total sets of electronic (DCP and stage sensor) equipment out of the 520+ gages it operates. With an average life of 10 years, we project 45-50 replacements per year. At current equipment costs, the cost of DCP replacement with newest generation satellite transceivers as well as replacement of gage height sensors ranges from $3750 to $6000 per gage, depending on the type of gage height sensor needed (shaft encoder, constant flow bubbler or radar sensor). Using a mean of $4500 and life expectancy of 10 years, the total annual projected equipment cost to simply maintain operable equipment is approximately $216,000. The life of antennas, batteries, solar panels, wiring, and grounding equipment varies considerably. Based on the last several years, we project an average annual expense of this equipment is approximately $24,000. Travel (vehicle mileage, per diem, etc.) and overtime support to perform this work around the State is projected at $35,000. Total annual current cost is, therefore, approximately $275,000.

Existing Stream Gages. DWR requests $55,000 for refurbishing existing stream gages. The request in this category of funding is level and the same as the past several years. 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. Gaging station physical infrastructure (shelters, stream controls, independent reference gages, etc.) must be properly maintained and periodically refurbished in order to collect accurate data.

An important physical component of many DWR stream gages around the State is the ability to measure high flows so that the upper end of stage-discharge relationships can be improved and maintained 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 up- or downstream bridges. Cableways at DWR stream gages are given a detailed inspection each four 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 $1000 per cableway to as much as $20,000 per cableway, 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 $6000 to $9000 per site. As current funding allows, we have been addressing some of these needs.

FY2012-13 Accomplishments

The CWCB provided $300,000 in FY2012-13 for satellite telemetry equipment upgrade and replacement and stream gage refurbishment. An additional $12,826 in CWCB carryover funds was available from the previous fiscal year for a total FY2012-13 project budget of $312,826. In total, DWR expended and committed a total of $311,015, 99.5% of project funding.

Satellite Telemetry Upgrade Program. Of the $245,000 allocated, $245,123 were expended on the procurement and installation of new generation, high data rate, satellite-linked monitoring equipment and associated components. High data rate DCP upgrades have now been completed at all DWR gage stations. However, as discussed earlier, the normal wear, tear and software life cycle anticipates replacing all equipment every ten years, regardless of other system changes.

Streamgage Refurbishment. An allocation of $55,000 along with carryover funds from the previous fiscal year in the amount of $12,826 were used to refurbish existing stream gages throughout the State. Refurbishment projects and miscellaneous expenditures totaling $27,891 were completed at the stream gages listed in Table 1. An additional $38,000 committed toward the construction of four new gages to help manage flow alert systems in the West Fork Complex wild fire area were not expended in time to actually be included in FY2012-13, but will be included in the first quarter report for FY2013-14.

TABLE 1 - FY2012-13 Gage Projects

Div. I	Project Name	Description of Work	TOTAL
	South Platte River nr Kersey	Install radar unit	$ 355.77
	Big Thompson near La Salle	Repair gage shelter roof	$ 118.69
	South Platte River nr Balzac	Build sand dam to direct flow to gage	$ 330.00
	Denver Metro Excel Energy	Connect to Excel DCP	$ 224.23
Div. II			
	Arkansas River above Pueblo Reservoir	Staff gage - new inflow location	$ 100.00
	Muddy Creek near Toonerville	Install wire weight gage	$ 1,150.00
	Lake Creek above Twin Lakes	Repair gage	$ 39.84
	LAWMA Aug Stn gage	Retrofit new intakes on stilling wells	$ 113.70
	Verhoeff Flumes	Retrofit new intakes on stilling wells	$ 156.39
Div. III			
	Rio Grande River nr Del Norte	Replaced cableway w/ new A frames	$ 8,498.64
	Rio Grande River at 30-mile Bridge	Retaining wall and outside staff gage.	$ 2,159.30
	Rio Grande River above Trinchera Creek	Retaining wall and outside staff gage.	$ 147.71
	Conejos nr LaSauses (South Channel)	Installed outside staff gage.	$ 147.71
	Spanish Creek nr Crestone	Clean gage pool, inlet work	$ 370.22
	San Isabel Creek nr Crestone	Built V-notch weir and relocated gage.	$ 1,093.78
	Paint and float supplies for Div 3 gages	Various locations	$ 1,479.90
	Ventilation fans for 5 gages	Various locations	$ 301.27
	New steps for RIOMONCO & TRIMTNCO	Built new steps to gage house	$ 127.28
	Rio Grande Reservoir	Relocated staff gage	$ 220.71
	Temporary labor to assist with projects above		$ 2,731.13
Div. IV			
	Kannah Creek nr Grand Junction	Replaced inlet	$ 28.99
	Leroux Creek above Carl Smith Reservoir	Refurbished control	$ 271.70
	Uncompahgre River upstream of South Canal	Installed cantilever gage	$ 127.98
	South Canal	Installed bubbler and extended line	$ 187.08
	Redlands Canal	ADVM platform repair	$ 88.92
	Uncompahgre River at UNCOLACO	Bank stabilization	
Div. V			
	Tenmile Creek below Copper Mtn	Staff gage	$ 141.96
	Fryingpan River near Thomasville	CFB line extension	$ 119.95
	Cableway for ORCHIDCO	New cableway	$ 366.62
Div. VI			
	Michigan River at Walden	New staff gage	$ 32.34
	White River below N Elk Creek near Buford	New radar sensor	$ 1,806.02
Div. VII			
	Animas River near Howardsville	Installation of a bank operated cableway.	$ 563.05
	Old Indian Gage bel Red Mesa Reservoir	Fix a broken pipe.	$ 42.88
	Little Navajo River below Little Oso Diversion	Refurbish gage house.	$ 139.42
	Outside horizontal cantilever gages	JACCUPCO, RIOMOUCO	$ 707.21
Miscellaneous			
	Misc. supplies and equipment		$ 1,404.58
	Moving expense, shelving and new office supplies		$ 1,919.17
		TOTAL	**$ 27,891.49**

CWCB Water Project Non-Reimbursable Investment Program
Project Data Sheet

Sponsor: Colorado Water Conservation Board

Location: Statewide

Project Name: Satellite-linked Monitoring System and Stream Gage Refurbishment Program

Project Type: DWR Streamgaging

Drainage Basin: Statewide Drainage Basins

Water Source: Various

Total Project Cost: $330,000

Funding Source: Construction Fund

CWCB NRI: $330,000

Type of Grantee: State Agency

This project entails the continued, long-term operational viability of the State Satellite Linked Monitoring System and Stream Gage Refurbishment Program, which is administered by the Division of Water Resources (DWR). This program currently encompasses 520 satellite stream gaging stations which require continued replacement of outdated data collection platforms, upgrades to transmission components, and refurbishment of the associated infrastructure. In addition, many existing gaging stations need to be modified to provide critical stream flow data for both flood 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 currently approximately $330,000 per year.

Crystal River DWR/CWCB Satellite Gage

Purgatoire River @ Fishers Crossing
DWR/CWCB Compact Gage