RECLAMATION
Managing Water in the West

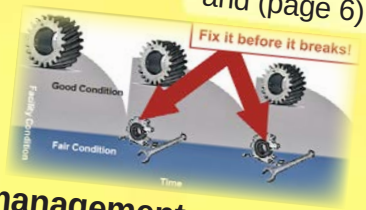
Issue No. 245–Spring 2018

Water Operation and Maintenance Bulletin

Use effective maintenance records. . .

with a computerized maintenance management system. . .

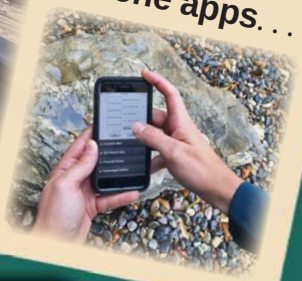
. . .(page 3) and (page 6)



Measure with WinFlume. . .

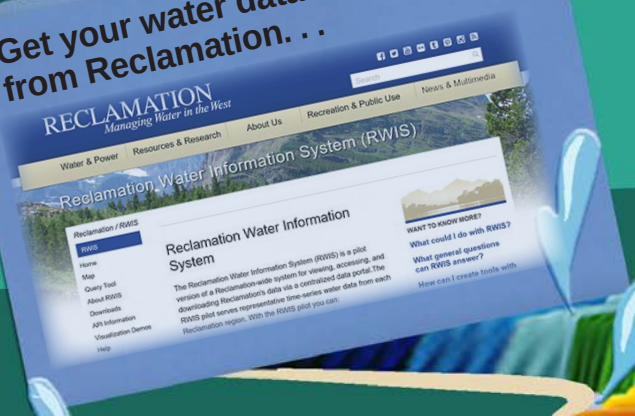
. . .(page 10) and (page 12)

Measure flow with phone apps. . .



Get your water data from Reclamation. . .

. . .(page 15)



Data Flow Canal

In this issue:

Issue No. 245–Spring 2018

About this Bulletin

Get the Water Operation and Maintenance Bulletin and subject index at:

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Denver, Colorado 80225-0007
303-445-2491
cvick@usbr.gov**

Thank you.

On the Covers:

Front: *Focusing on maintenance data, tracking, and measurements.*

Back: *Get the best value for your money—plan your maintenance!.*

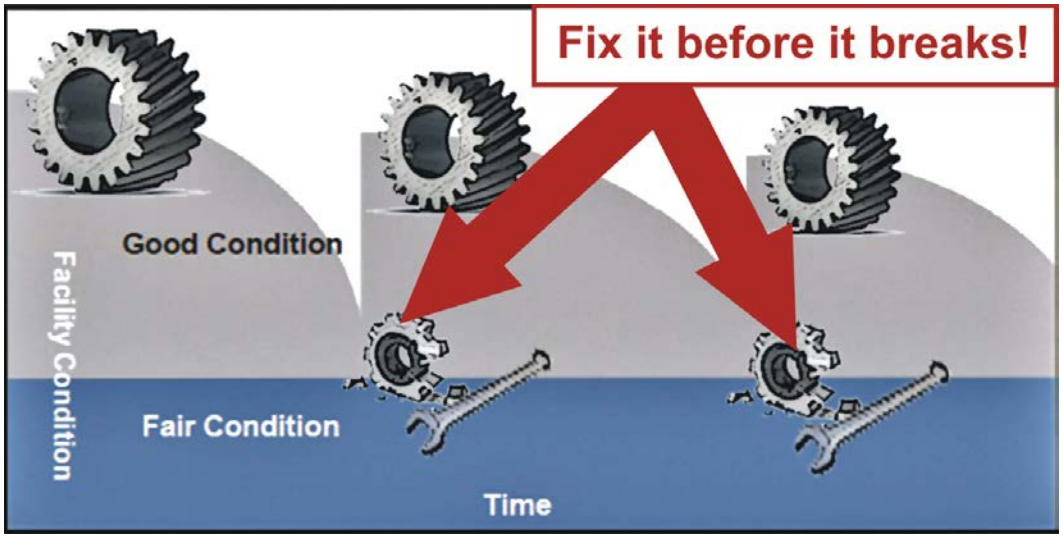
CONTENT

Creating Effective Maintenance Tracking Programs

Make the software fit your already-working processes, rather than changing your process just to fit the software

Tracking the equipment maintenance in a canal system is just like tracking your checkbook or the maintenance on your car—only at a larger scale. Think about all the records you have for each piece of equipment. Just one pump has manufacturer's operating instructions, preventative maintenance procedures, work orders, performance history. Whew! It's enough to make you want to dive under a desk to dodge the incoming paperwork! Yet maintaining records for equipment and keeping your pulse on canal conditions is really the crux of effective operations. Just where do you get the brain power to track all of that data? Big or small, your operating entity needs a tracking system to:

- Maintain standard records (original specifications, design and as-built drawings, photos, work orders, procedures, and other manuals, etc.)
- Ensure everyone can access and use the most recent version of those records
- Pinpoint problem areas where preventative maintenance can save time and money and keep you running
- Track inventory, work orders, outages, and conditions
- Budget effectively for repairs, replacements, and other expenses



"Computer systems get rid of paper and pencil and make it easy to query data that you can act upon." notes Dan O'Connor, who helped develop the Central Arizona Project's (CAP) computerized maintenance management system (CMMS). "There are many data and maintenance tracking management systems, inventory and work tracking systems, asset management systems, and on and on. Most commercial off the shelf systems give you a vanilla package, and you can customize this to meet your needs."

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How do you determine what will best suit your needs? Big or small, every operating entity needs to examine how they work and then develop business rules for your system to support those processes.

Know your processes. How do you track operations, photos, equipment information, and everything else in your district? What slips through the cracks now?

Get a naming convention. Everything you track needs to have a unique identifier, so get a naming convention for each piece of equipment.

Understand how you share information. Who needs to know what when? Does everyone have access to the correct, updated versions?

Stop reinventing the wheel. What parts of your work would benefit from templates and consistent information (e.g., a standard scope of work for contractors, standard reports)? Who should access those and how could they be used?

Work with your end users. Get their input every step of the way on what features make their lives easier. If they are involved, they are much more likely to understand how the system works and to commit to making it work.

Check what others have done. You may have unique circumstances, but chances are that others have already created a process that can be modified for your needs. If you go rogue, you may be missing the reason that most others went in a different direction.

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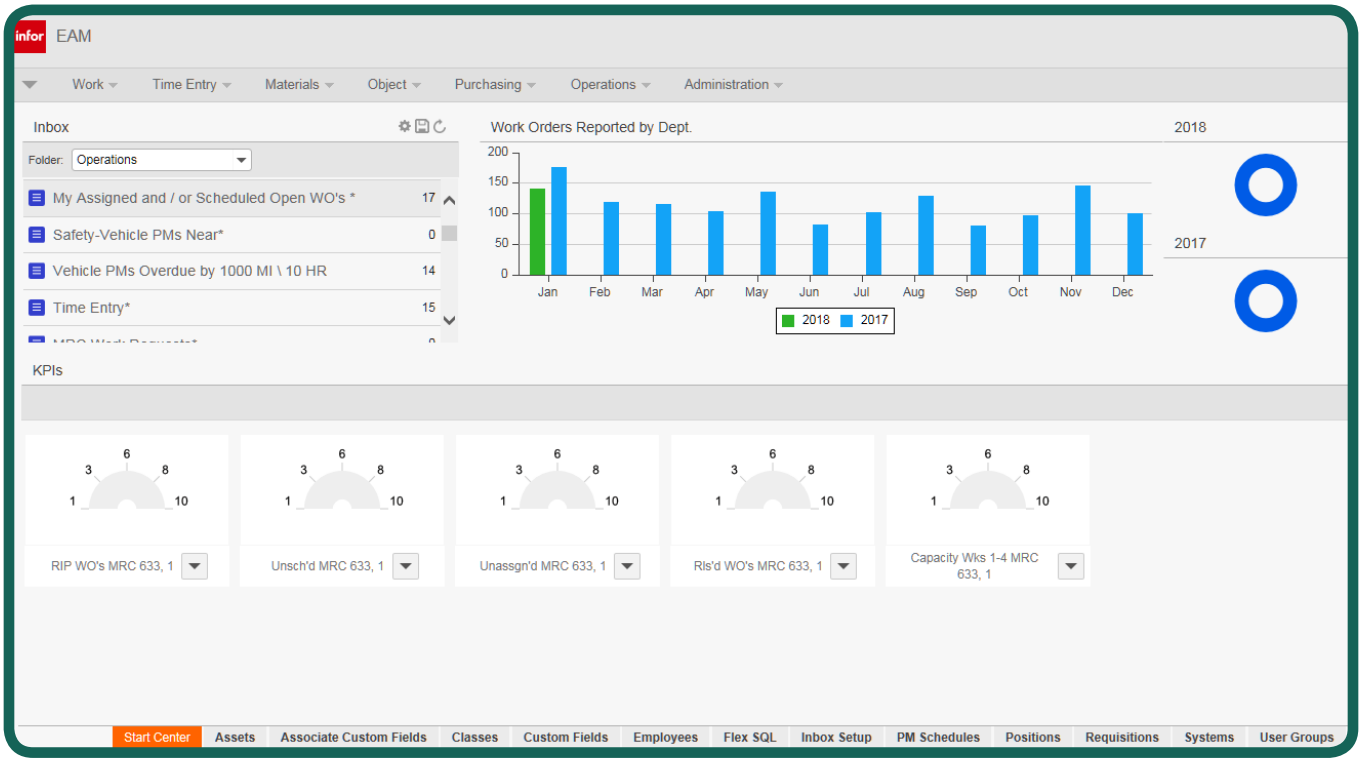

Home page for Infor EAM.

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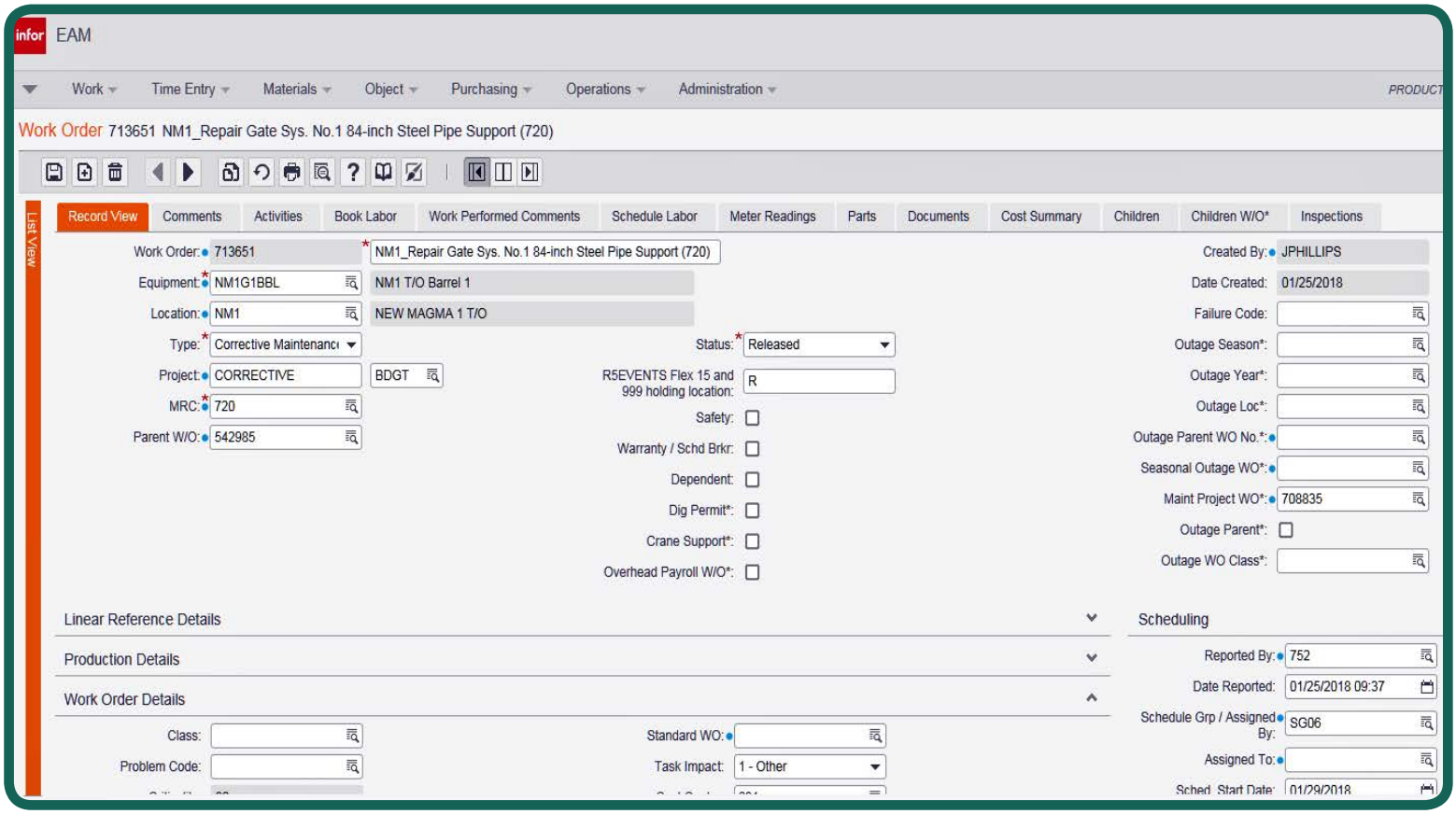
While you can track on paper, computerized systems let you analyze data to see overall O&M trends. For example, the CAP requires each work order to note how the failure occurred or why a repair is needed (a failure code). Using this information, CAP can address problems in a systematic way by examining the circumstances around the failures. If most pump failures are due to lubrication issues, for example, then a more effective lubrication program could save time and money. You can also balance maintenance needs with expenses—is it more cost-efficient to change the seven-year battery every three years on that emergency generator that can only be reached with a helicopter? And you can have a just-in-time repair system, where you have parts when you need them but do not have the expenses of storing the parts for a long time before you need them.



A Corrective Work Order – Infor EAM.

For more information contact:

Dan O'Connor,
CMMS Administrator
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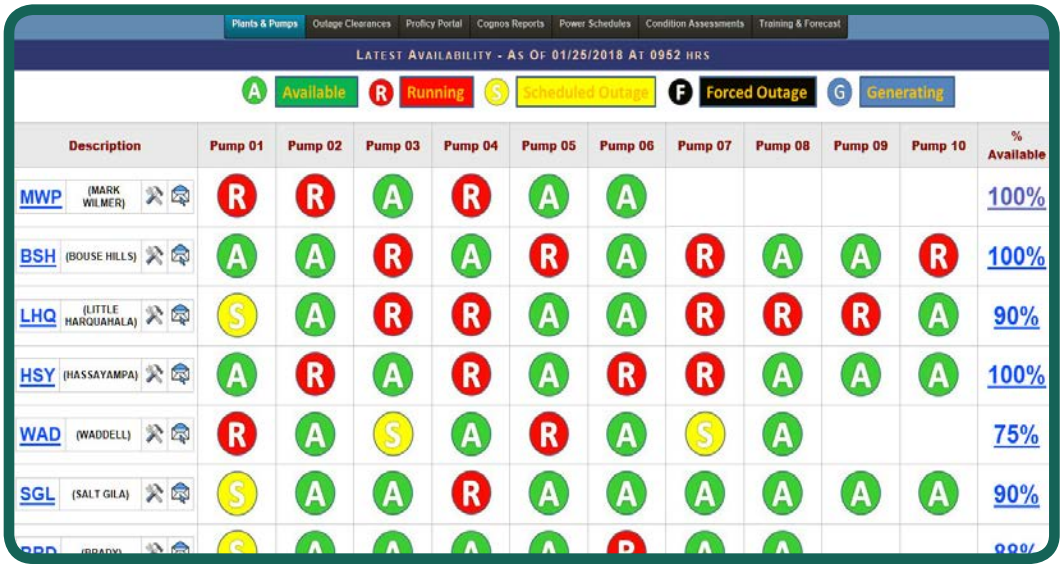
Using the Computerized Maintenance Management System from the Central Arizona Project

A planned job is a better, safer, cheaper job

The Central Arizona Project (CAP) is a 336-mile long system of aqueducts, tunnels, pumping plants, and pipelines and is one of the biggest and most complex water operating entity in the United States. Tracking every component of this system by hand and paper would be insane. As Tim Allen, Reliability & Maintenance Engineering Supervisor, put it: "Without a computerized maintenance management system (CMMS), we could not work at all. People could keep information on paper work orders and folders, but that would be a nightmare."

CAP's CMMS system is based on an asset inventory and tracks equipment status, schedules work orders, tracks parts and orders, costs, and accounting. It is organized by drilling down levels from plant to system to subsystem to individual assets to subcomponents. For example, each of the 15 pumping plants is broken into pumping systems and auxiliary systems such as ventilation system, elevator system, station service, and the AC/DC distribution system. Each pumping system is further broken down into components such as the discharge valve and controls, the motor, exciter, and pump controls. Each component is broken down even further into an asset such as guide bearings or a guide-bearing auxiliary pump (a lube-bearing pump). Everything is tracked by these asset numbers.



A custom grid to reflect real time status of the Pumps at CAP – More commonly refered to as the Maintenance Management Dashboard (MMD). This screen also has drill down capability.

Each asset has data about that asset and a work order history, including planned corrective work, who booked time, hours associated with work, parts replaced, and costs. For example, a pump has information on the commissioned date, pump size, pump flow, head, rpm, last overhaul date, corrective and preventative maintenance performed and scheduled, outage time, and repair and replacement costs. Combining this data with the SCADA system creates a maintenance management dashboard to display operations, unit availability, and other data.

The Planning and Scheduling Department use this system to track work requests, priority work, and the mean time between failure and restoration. They have been building customized reports to help budget and schedule preventative maintenance. They create Pareto charts to show where the money is going and what systems consume the most labor hours and material dollars and have the most breakdowns.

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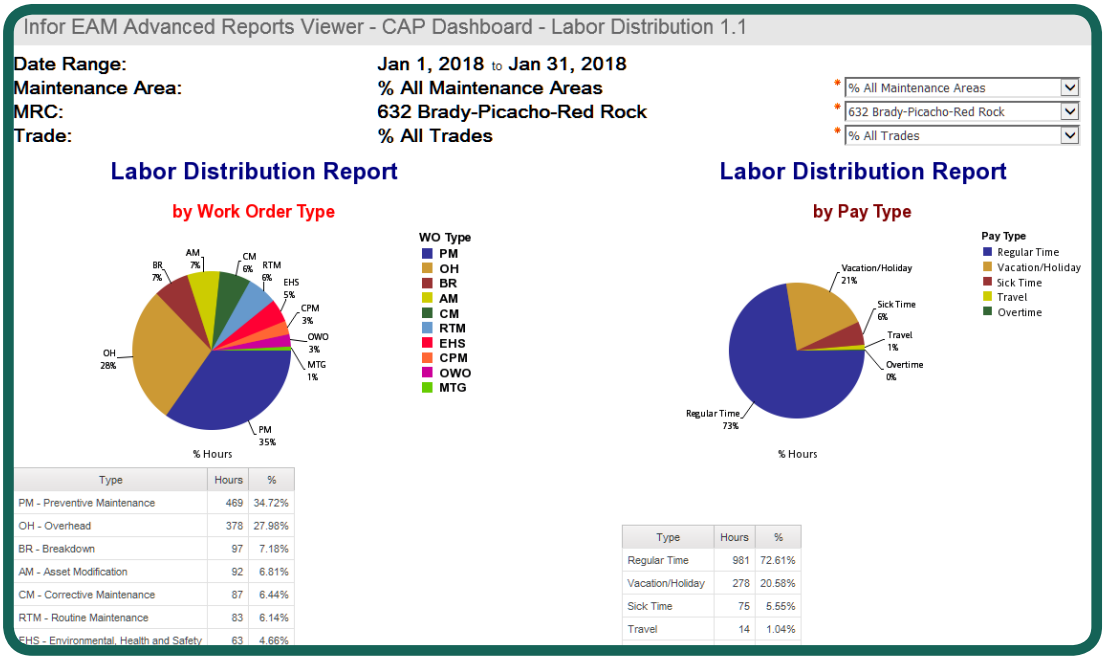
Tim Allen rhapsodizes, "The beauty of this system is that it allows you to research a work history to answer questions like average life spans of specific types of equipment. It can also keep track of corrective maintenance and identify failure modes and events surrounding that failure. So if things keep getting plugged in the impellor, for example, we can tell the type and frequency of failures and help determine the root cause. We can address problems as they come up and track priority work. If one of our main units is forced out, a black mark shows on the Maintenance Management Dashboard, so everyone can see that and prioritize work. We are barely scratching the surface of what this system can do for failure codes and we are working on finding ways to use this to pinpoint systemic problems."



Labor distribution report by work order type and pay type

CAP also integrates a Content Server document management system to track changes in documents, such as the Communications Directory, emergency plans, Standing Operating Procedures, maintenance procedures, drawings, memos, and organization charts. All revisions and updates to documents are online. This searchable system is interlinked with the CMMS, so that each piece of equipment is automatically linked to its Preventive Maintenance Procedures. The file structure mirrors locations in the CMMS, so a Pumping Plant has a main folder, with multiple subfolders for each piece of equipment. Before this system, everyone sent documents from their own drives, which often led to people missing out on the latest and greatest version and working off of inconsistent reports. Now, everyone can simply send a link to the most updated version and be on the same page—or at least the same screen. Earlier versions are still on the drive so people can investigate the history when needed for investigations or to compare practices. All departments have the same information and thus can coordinate. So the purchasing department can order the correct part and ensure that the vendor has the current drawing by simply sending the link to the latest drawing.

Sounds great—but of course, nothing is perfect. Staff in the field complain that they can't find what they are looking for, and training is important to know the best way to use the system and retrieve information. CAP found that it is best to have "gurus"—planners or engineers or supervisors that everyone goes to for that information.

For more information contact:

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tallen@cap-az.com

Soaring Above to Find Water Below

Airborne geophysical measurements can help detect groundwater

Groundwater can be an additional source of water and it can also be a threat to canal and structural foundations. Groundwater constantly moves—much like an underground river. Irrigation and water districts need to know not only where the groundwater is, but the quality of groundwater.

The airborne time-domain electromagnetic survey, during Yuma flights in early September 2016. (Photo courtesy of Jared Abraham - Aqua Geo Frameworks)

As part of its primary mission, Reclamation's Yuma Area Office (YAO) monitors and manages the depth and water quality of groundwater in the Yuma, Arizona area. Groundwater levels are close to the surface, so that groundwater must be pumped to ensure farmers can farm. Without this, the water table would be too high in many instances, and crops would not be sustainable.

YAO contracted with Southern Helicopters, Inc. to use low-level helicopter flights in areas with existing drainage infrastructure (i.e., well fields) that pump groundwater to sustain agricultural purposes. The helicopter towed a large hexagonal frame over the Yuma agricultural production areas near the Colorado River during August and September 2016.

The instrumentation mounted below the helicopter collected data to form a real-time airborne electromagnetic geophysical survey with flow imagery to determine the amount, location, relative quality, and breadth of groundwater existing in aquifers in the area. "Electromagnetic resistivity changes as it hits different materials," Carrie Scott, Chief of YAO's Technical Support Office, explains, "So where you have a change in resistivity — that could indicate a change of material like a clay or a sand or it could also indicate changing water quality."

The area covered by the flights is operated by four water districts and one tribe in the area around Yuma, where most of the groundwater in the area is very saline and not suitable for agricultural applications. These flights helped determine where there is better quality water—indicating where there may be opportunities to augment Colorado River irrigation and deliveries with pumped groundwater. Additionally, we found some potentially promising pockets of deep water that are worth exploring for the same reasons.

Flights confirmed that, overall, the groundwater that is readily available to be pumped in the shallow aquifer is generally saline. We also have a good visual of general salinity trends in the area. Where we used to just have point information from well samples, we now have a more continuous 3D model of water quality trends below the ground surface.

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Two photos showing the SkyTem-304M AEM system, with a detailed view of the transmitter coil frame (green frame) and the receiver coil (white stand-up frame) (top), and the system slung beneath a helicopter during data collection (bottom).

Other water districts and Reclamation offices could use this technology. It is commonly used in Denmark for water applications, and is used all over the world for mining and petroleum applications. Carrie Scott offers districts some advice: "Get a geophysicist on board! The raw data that is collected shows resistivity, but it is another step to be able to compare the response from the helicopter to interpret what is going on underground. The raw data can show either a change in geology or a change in water quality, or both, so it's important to have technical experts that can look at the big picture of subsurface water and lithology to be able to parse out the water you are looking for."

For more information contact:

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Reclamation, Yuma Area Office
928-343-8317, cmscott@usbr.gov

Temporary plywood structures can demonstrate how well the structure measures water and can help determine where permanent structures should be placed.

Less head is needed for broad-crested weirs and long-throated flumes.

Measure Canal Flows with WinFlume

You can't manage what you can't measure

You need accurate flow measurements in canals, laterals, and farm ditches to manage irrigation water delivery systems. But how can you get a measurement in an existing canal? Adding new measurement structures typically raises water levels in the canal and reduces freeboard. However, long-throated flumes and broad-crested weirs (two common names for a large family of measurement devices that all behave similarly from a hydraulic perspective) require very little head—a few inches rather than the couple of feet needed by older measurement devices such as sharp-crested weirs. These weirs and flumes are stable, easy-to-build structures that operate without moving parts or electronics, so maintenance is minimal.

Long-throated flumes and broad-crested weirs typically have an upstream ramp, a raised sill within the canal, and sometimes a downstream ramp. This arrangement allows the flow to drop so that it can be measured. A calibrated gauge shows the flow rate at each water depth.

Calibrating and designing these structures takes precise calculations. WinFlume is a Windows-based software that helps irrigation districts to design new flow measurement structures and calibrate existing structures without costly physical testing in a lab. Reclamation worked with the Agricultural Research Service and the International Institute for Land Reclamation & Improvement to develop this software.

With WinFlume, structures can be custom-designed and calibrated to meet site-specific needs. WinFlume can also develop calibrations for existing structures based on as-built dimensions. Structures calibrated with WinFlume do not need to be tested in a hydraulic laboratory, since the ratings produced by WinFlume rely on basic hydraulic theory developed from previous laboratory testing. To use WinFlume, a designer provides information about the site, the range of flows to be measured, and design requirements such as freeboard limits and flow measurement accuracy objectives. The software guides the designer to a solution that meets all of the site conditions and design requirements.

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WinFlume has been used to design and calibrate tens of thousands of water measurement structures worldwide. Applications have ranged from the 3000 cfs Arizona Canal to tiny flumes that measure flows in alpine headwaters and individual farm furrows. Larger flumes are commonly constructed on site, but for small ditches, commercial off-the-shelf flumes are available.

Permanent weirs and flumes are generally constructed from reinforced concrete. Structures in concrete canals form the control section from the existing concrete sidewalls, whereas structures in earthen canals are constructed within new vertical sidewalls.

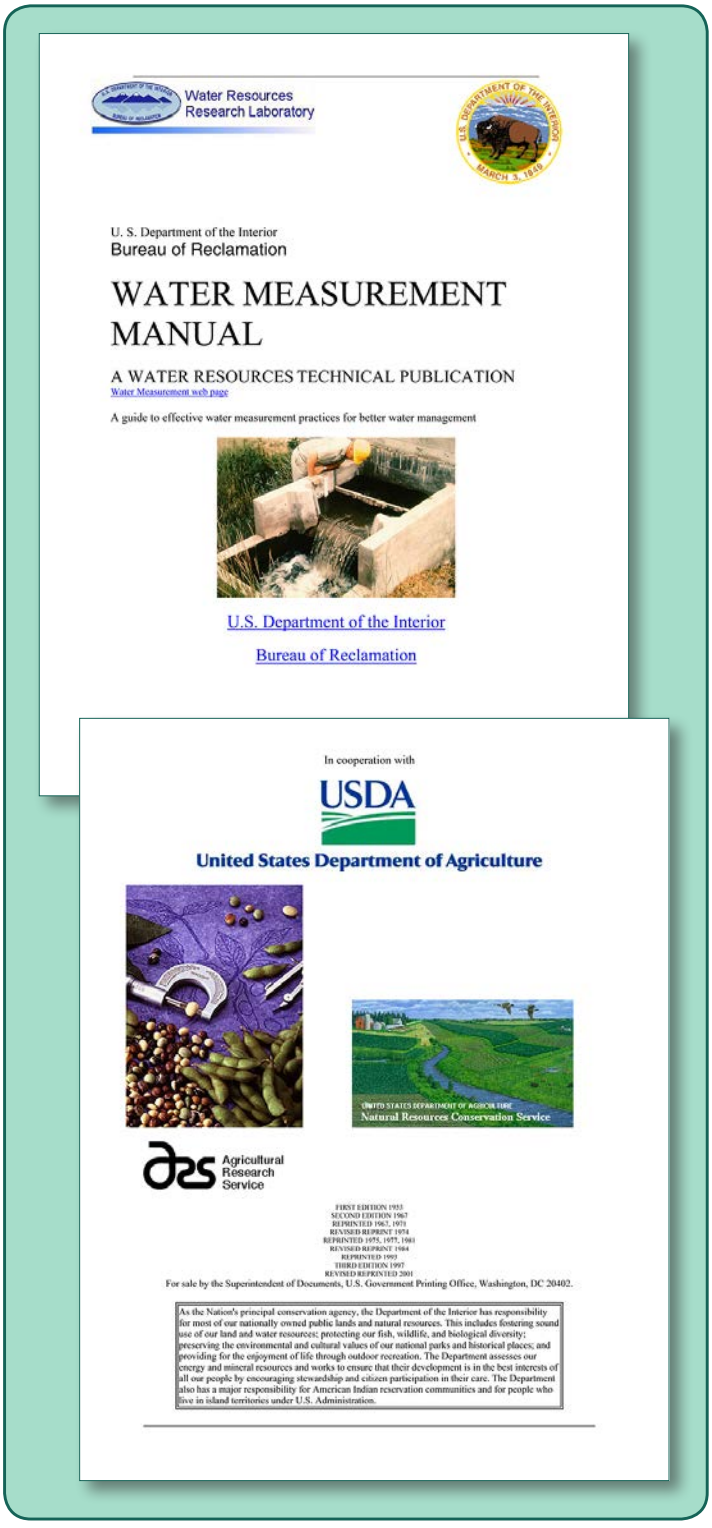
Calibrated gauges show flow amounts at various water levels.

The WinFlume software, links to publications, and other supporting resources are available at www.usbr.gov/tsc/techreferences/computersoftware/software/winflume/index.html. Reclamation also presents a hands-on workshop in to provide training on using WinFlume. Using WinFlume can be part of an overall water management program, and it is best to consult with Reclamation on the most effective uses.

For more information contact:
Tony Wahl, Hydraulic Investigations & Laboratory Services
Technical Service Center
303-445-2155, twahl@usbr.gov

Measure Flows from Your Phone with Measure H2O

As water managers know, accurate water metrics are an essential component of sound water management. To promote the accurate computation of flows, Reclamation has produced water measurement documents for over 100 years. Reclamation's water measurement manual is at www.usbr.gov/tsc/techreferences/mands/wmm.html.



In 2015, Reclamation took the first step toward digitizing these documents by releasing Measure H2O, a mobile application capable of performing various water measurement calculations.

Measure H2O allows water managers to measure water flow and delivery more efficiently—and more accurately—than by using a look-up table or book. The app eliminates the need to perform manual calculations, instead allowing water managers to input readings directly from water measurement devices.

To generate the measurement of flow into common unit of measurement, specific data points are required. Users must:

1. Identify the type of structure constructed to measure the water

2. Gauge the height of the water moving through the structure

3. Measure the width of the structure

Measure H2O was initially conceptualized by Ed Vidmar, the former Division Manager of the Provo Area Office's Resource Management Group. Mr. Vidmar noticed that performing water measurement calculations and using lookup tables was often time consuming and cumbersome for water managers. John Strongo, now a UC Regional Information System Security Officer, shepherded the app's development, contracting with local software developer Trent Staheli to develop an app that could accomplish these tasks digitally. Just three months later, Measure H2O was available from the Apple Store. The app is now free to use and is available to any member of the public. The Android version is available upon request (John Strongo) and requires some additional steps for installation.

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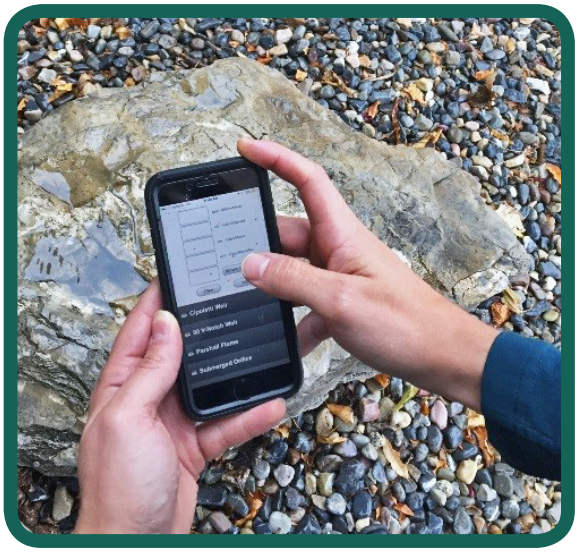
The application can help water managers and "ditch riders" quickly determine the amount of flow passing through a constructed water structure at any time. "Measure H2O is capable of providing very accurate calculations while saving time and reducing human error in the calculation process," says Strongo, "we tested this app against look-up tables and found very few discrepancies." Mr. Strongo also noted that he is interested in hearing feedback from users about the app's performance or whether users would like to see additional features.

"This app is a good example of how Reclamation strives to support local water managers by developing and supporting technological improvements," says Wayne Pullan, Area Manager of the Provo Area Office.

Using Measure H2O can provide several benefits for water managers. The app can facilitate:

- More equitable allocation and distribution of water shares
- Improved operational efficiencies and irrigation practices
- More accurate metering and seepage loss evaluation data
- Support for automation improvements
- More accurate datasets for siting and prioritizing canal and ditch improvements
- Enhanced conservation and ability to mitigate excess runoff
- Mitigation of environmental impacts through conservation



"Measure H2O provides accurate calculations of flow and avoids errors that can sometimes be made when using look-up tables in the field."

"This app is a good example of how Reclamation strives to support local water managers by developing and supporting technological improvements," says Wayne Pullan, Area Manager of the Provo Area Office.

Those interested in learning more about Measure H2O or providing feedback on features or performance should contact John Strongo. IPhone and iPad users can download the Measure H2O through the Apple App Store. Android users should contact John Strongo for a copy of the app and installation instructions.

For more information contact:

For support:

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For future development:

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For questions:

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akirby@usbr.gov

Connections

Welcome Brenda Burman

The new Reclamation Commissioner, Brenda Burman, has been profiled in the January 2018 issue of the Irrigation Leader "Bureau of Reclamation Commissioner Brenda Burman is exceptionally capable and well prepared for her new job. Her résumé reads like a many-years-long western water training program to be commissioner. . . "

www.waterstrategies.com/assets/il-jan-18.pdf

Canal Operations and Flow Measurement Course

Reclamation's Hydraulics Laboratory provides training on canal operations (5-day course at the end of January) and flow measurement (3-day course in mid-February). The canal operations class uses a lab model of a canal system to present modern methods for upgrading the operations of existing canals, including canal automation techniques and equipment. The flow measurement class covers typical structures and equipment used to measure water flow in irrigation delivery systems, with special emphasis on the WinFlume computer program. These classes are great for canal operators, district managers, water masters, and engineers involved in canal design and control.

Both classes are filled for this year, but contact Tony Wahl in Reclamation's Technical Service Hydraulics Laboratory to be notified about future classes.

For more information contact:
Tony Wahl, Hydraulic Investigations & Laboratory Services
Technical Service Center
303-445-2155, twahl@usbr.gov

Get Your Water Data from Reclamation

Reclamation now provides access to water data from all of Reclamation's regions in a central data portal at https://water.usbr.gov. You can use a map to obtain information by location, a query tool to select precisely the sites and parameters that you are interested in, and a web service/API to automatically transfer data to your own tools, apps, and models.

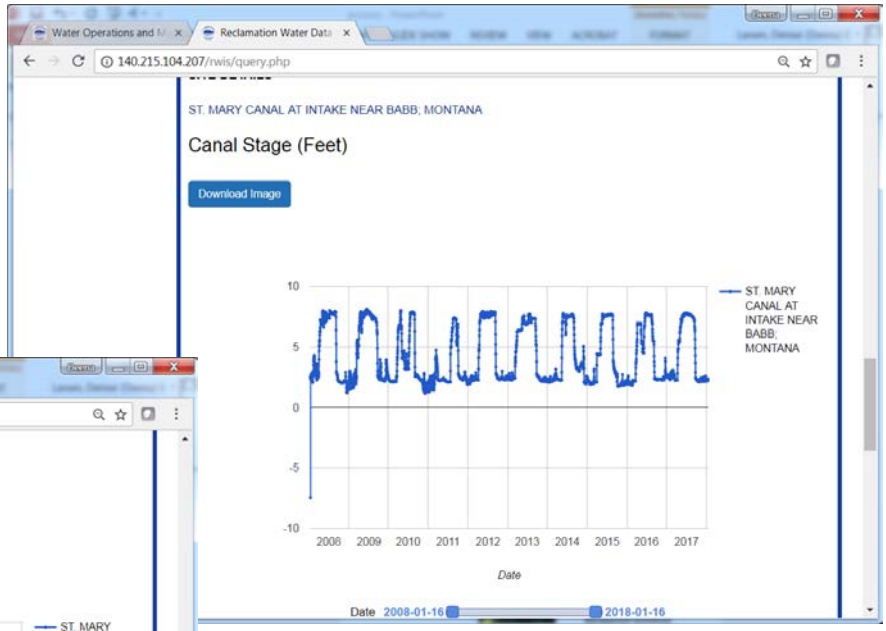
RWIS Release 2.0 expands the data available to the full period of record for many sites, adds the ability to bookmark a query, and lets you download all of the RWIS data in one file. We also have a visualizations demo page, featuring teacup diagrams for some Colorado River Basin reservoirs.

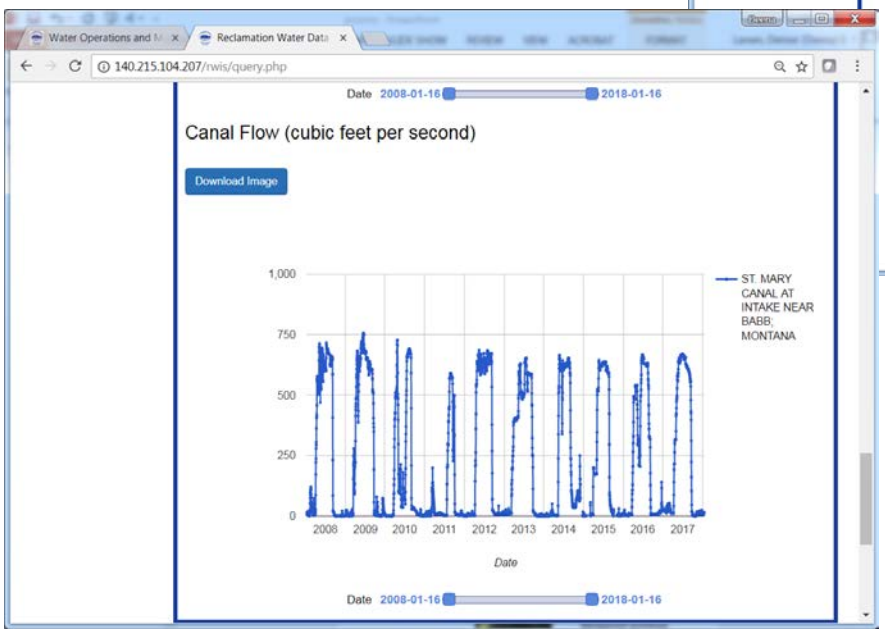
Please visit the site and tell us what you think.

The project team is also working on expanding the system into the Reclamation Information Sharing Environment (RISE). RISE will add data types (e.g., spatial data sets, modeling, and analytic results, and reports), new portal features, and data from the infrastructure/assets, hydropower, and environmental domains.

We need you to tell us how RWIS/RISE can help you:

- What data do you use and what data would be useful for you?
- What data collection processes and analyses do you follow and how could RISE improve those processes?





For more information:
Reclamation's Water Information System (RWIS) at:
https://water.usbr.gov
and https://water.usbr.gov/docs/general-use.pdf
or email to rwis@usbr.gov

Connections (continued)

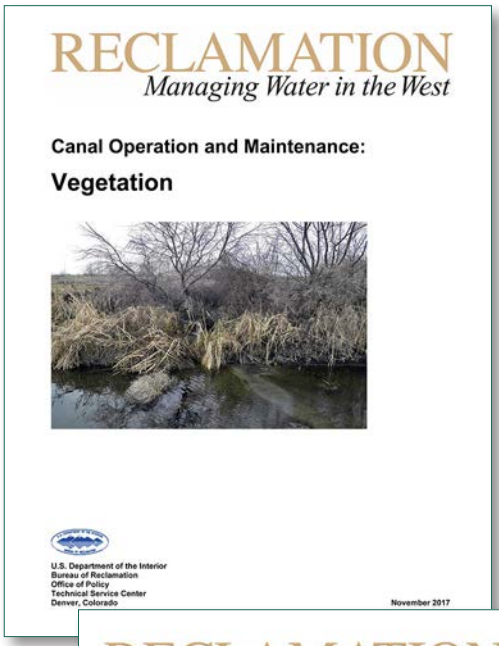
Canal Operations and Maintenance Manuals are now online!

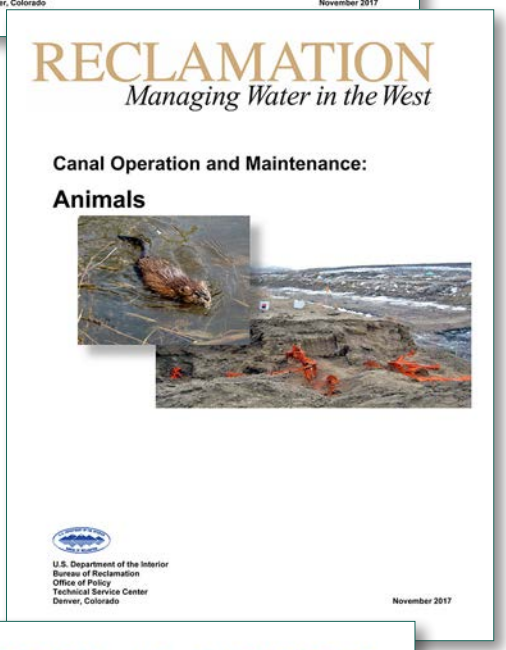
Reclamation has released a series of Operation, Maintenance, and Repair/ Replacement manuals for water districts who operate Reclamation canals: Vegetation Control, Burrowing Animal Control, Concrete, and Mechanical Equipment. These manuals are based on Reclamation and districts' experience and expertise, and research into successful strategies.

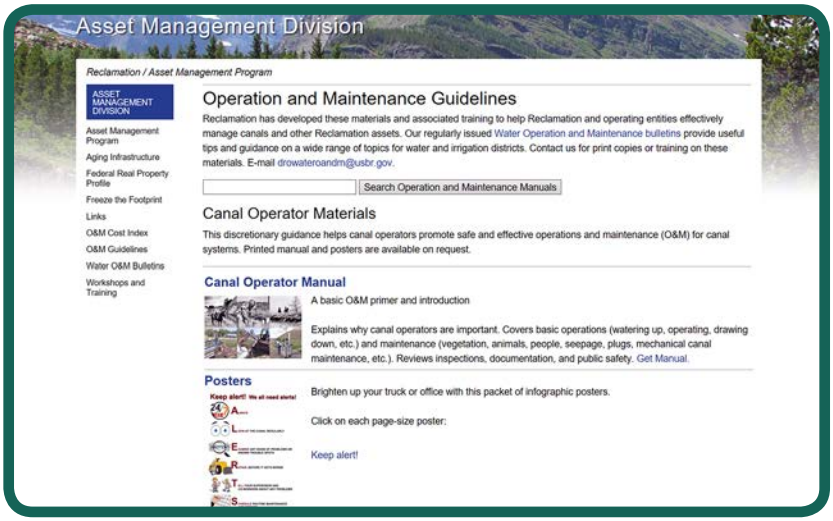
These manuals can help irrigation and water districts identify issues within their respective systems, and to plan, budget, and prioritize actions to address these issues. The manuals contain pictures identifying problems, helpful techniques to prevent these problems, and guidance on solving problems.

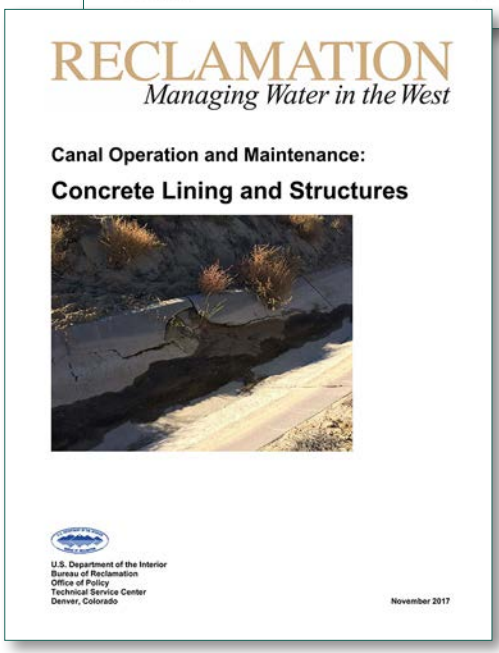
These manuals, along with a basic Canal Operators Manual and posters made from the infographics at the end of each Water O&M bulletin, are now available at:

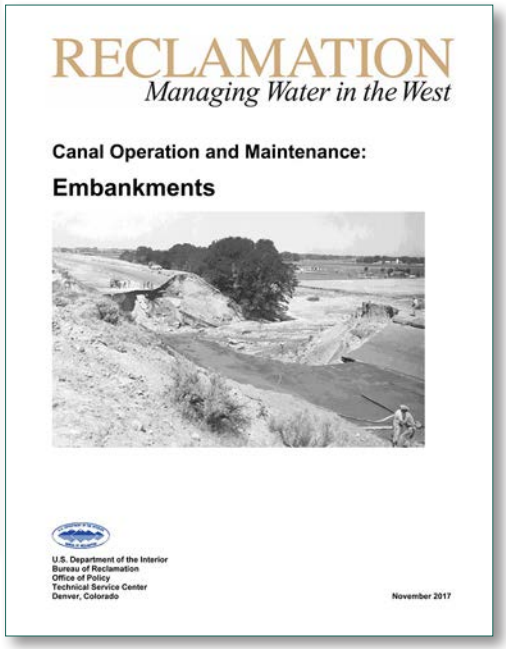
www.usbr.gov/assetmanagement/canalOamM.html.

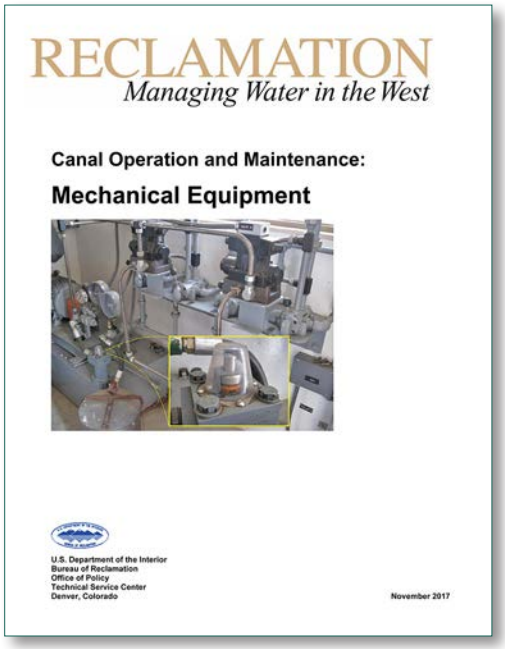










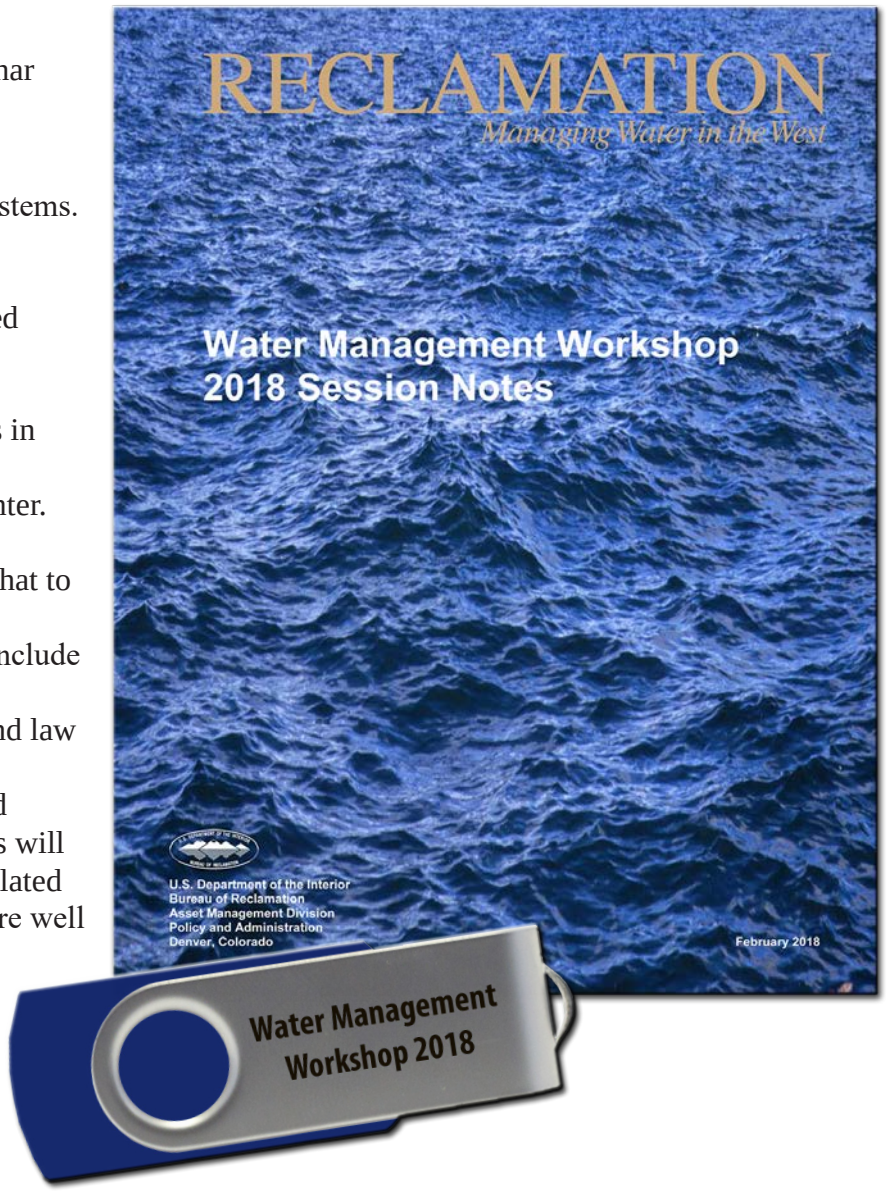


Water Management Workshop Training

The Water Management Workshop is a seminar for supervisors, managers, water masters, and others responsible for or associated with the operation and maintenance (O&M) of water systems. The workshop is held when field activities are generally at a minimum for the convenience of operating personnel. Reclamation has conducted these workshops since 1961.

Participants spend their time attending sessions in either a classroom setting or at Reclamation's research laboratories at the Denver Federal Center.

The focus of the workshop has evolved somewhat to include Reclamation's increased emphasis on efficient water management activities. Topics include irrigation system efficiency, planning O&M and managing water systems, security and law enforcement, environmental considerations, construction practices, and human relations and working with water users. Many of the sessions will address these topics as well as current issues related to other Reclamation programs. Leaders who are well qualified in their particular field will be in charge of each session. They will present a summary of the material to be covered, with an emphasis on discussion and exchange of information by all participants in the session.



For more information about upcoming workshops visit: www.usbr.gov/assetmanagement/Workshops.html

For more information contact:

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