SWSI Automation Project Phase II

CWCB and DWR September 21, 2015





COLORADO Colorado Water Conservation Board

Department of Natural Resources



COLORADO Division of Water Resources Department of Natural Resources

* What is SWSI?

Time Period	Components
January - June	Forecasted Runoff + Reservoir Storage
July - September	Previous Month's Streamflow + Reservoir Storage
October - December	Reservoir Storage
SWSI Value	
Hydrologic l Code (HUC8	

* Example Step 1:

Year	Volume* of water in HUC	NEP
May 1999	460,388	
May 1996	453,066	
May 1974	440,361	
May 1979	411,037	
May 1998	396,116	
May 1993	394,651	

Rank the volume available to a HUC over all the Mays in the last 40 years.

* Example Step 1:

Year	Volume* of water in HUC	NEP
May 1999	460,388	76.12
May 1996	453,066	73.63
May 1974	440,361	71.14
May 1979	411,037	68.66
May 1998	396,116	66.17
May 1993	394,651	63.68

- * Rank the volume available to a HUC over all the Mays in the last 40 years.
- * Use ranking to calculate the non-exceedance probability.

* Example Step 2:

Year	Volume* of water in HUC	NEP
May 1999	460,388	76.12
May 1996	453,066	73.63
May 1974	440,361	71.14
May 1979	411,037	68.66
May 1998	396,116	66.17
May 1993	394,651	63.68

- * Calculate the volume available to the HUC this May
- * Insert into ranking by volume



* Example Step 3:

Year	Volume* of water in HUC	NEP	 Interp value
1999	460,388	76.12	* Use N
1996	453,066	73.63	SWSI
1974	440,361	71.14	<u>,</u>
2015	429,100	Interpolation: 70.19	
1979	411,037	68.66	$SWSI = \frac{NEP - 50}{1}$
1998	396,116	66.17	12
1993	394,651	63.68	

nterpolate to get the NEP value for this May

Jse NEP value to calculate SWSI

SWSI = + 1.47

* Example Step 4:



- * Repeat! 41 HUCs and 7 river basins.
- * Analyze results
- * Distribute
 - Colorado Water Supply
 Conditions Update (DWR)
 - Governor's Water
 Availability Task Force

A brief history



-3.42

-3.6

Platoro Reservoir Improving but 51% of Average -1.23



SWSI Automation Project

- * Goal: Utilize TSTool to run SWSI calculations for Colorado through a transparent, automated process
- * Phase I: Completed Summer 2014
 - * TSTool program that closely mirrored existing excel spreadsheets
 - * Lessons learned: Need greater ability to handle input data issues
- * Phase II: Completed Summer 2015
 - * Evaluated alternative river forecasting options
 - * Tools to address data input issues
 - * User-friendly operating environment
 - * Enhanced program verifications/checks
 - Enhanced output files

SWSI Automation Tool

* Takes advantage of new TSTool-Excel integration features.
* User sets up Excel workbook, then runs TSTool steps.

TSTool Configuration Property Name		Property Value	Property Value (Text)	Property Description
CurrentMonthDate	=	2015-09	2015-09	Current month (as date) for which SWSI is being computed. The
CurrentMonth	=	9	09	Current month (as month number 1-12, where 1=January).
PreviousMonthDate	=	2015-08	2015-08	Previous month (as date). The date format YYYY-MM is consiste
PreviousYearMonthDate	=	2014-09	2014-09	Previous year (as date). This date is used in the SWSI output re

F	G	Н	Ι	J	K	L	М
						Datastore	Datastore Data
Data Type 📼	ID 💌	Station Name	🔻 State 💌	Datastore	Datastore ID	Source 💌	Туре 💌
ForecastedNaturalFlow	06707500	SOUTH PLATTE RIVER AT SOUTH PLATTE	CO	NrcsAwdb	CO-06707500	USGS	SRVO
ForecastedNaturalFlow	06710385	BEAR CREEK ABV EVERGREEN	CO	NrcsAwdb	CO-06710385	USGS	SRVO
ForecastedNaturalFlow	06719505	CLEAR CREEK AT GOLDEN	CO	NrcsAwdb	CO-06719505	USGS	SRVO
ForecastedNaturalFlow	06724000	SAINT VRAIN CREEK AT LYONS	CO	NrcsAwdb	CO-06724000	USGS	SRVO
ForecastedNaturalFlow	06727000	BOULDER CREEK NEAR ORODELL	CO	NrcsAwdb	CO-06727000	USGS	SRVO
ForecastedNaturalFlow	06729500	SOUTH BOULDER CK NR ELDORADO SPRINGS, CO	CO	NrcsAwdb	CO-06729500	USGS	SRVO
ForecastedNaturalFlow	06738000	BIG THOMPSON R AT MOUTH, NR DRAKE, CO	CO	NrcsAwdb	CO-06738000	USGS	SRVO
ForecastedNaturalFlow	06752000	CACHE LA POUDRE R AT CANYON MOUTH	CO	NrcsAwdb	CO-06752000	USGS	SRVO

SWSI TSTool Process

- Download data using web services: NRCS AWDB, ColoradoWaterSMS, ColoradoWaterHBGuest
- * Fill data and propagate flags
- * Calculate SWSI values based on 2010 Drought Plan
- * Create output files that can be used for reports and integration into Hydrobase, CIM, and CDSS Map Viewer

Time Period	Components
January - June	Forecasted Runoff + Reservoir Storage
July - September	Previous Month's Streamflow + Reservoir Storage
October - December	Reservoir Storage

Results

Basin Summary

Basin	Date	SWSI	NEP	SWSI_Prev_Mo	Chg_SWSI_Prev_Mo	SWSI_Prev_Yr	Chg_SWSI_Prev_Yr
Arkansas	2015-08	3.48	91.79	3.77	-0.28	0.05	3.43
Colorado	2015-08	0.30	53.66	2.12	-1.82	0.61	-0.30
Gunnison	2015-08	1.94	73.25	2.55	-0.61	-0.59	2.53
Rio Grande	2015-08	1.33	65.94	1.60	-0.27	-0.32	1.65
San Juan-Dolores	2015-08	2.52	80.26	2.54	-0.02	-1.58	4.10
South Platte	2015-08	3.66	93.95	3.95	-0.29	3.65	0.01
Yampa-White	2015-08	0.27	53.21	-0.67	0.94	0.45	-0.18

HUC Summary

Basin	HUC_ID	HUC_Name	Date	SWSI	NEP	SWSI_Prev_Yr	Chg_SWSI_Prev_Yr	ReservoirStorageNEP	PrevMoStreamflowNEP	ForecastedRunoffNEP
Arkansas	11020001	Arkansas Headwaters	2015-08	3.04	86.43	-0.78	3.81	73.03	79.85	
Arkansas	11020002	Upper Arkansas	2015-08	3.09	87.03	1.70	1.39	81.89	83.19	
Arkansas	11020005	Upper Arkansas-Lake Meredith	2015-08	3.30	89.63	0.41	2.89	98.51	82.82	

Component Summary

Basin	HUC_ID	HUC_Name	Date	Component Type	Component ID	Component Name	Component Volume	Component NEP by Month
Arkansas	11020001	Arkansas Headwaters	2015-08	PrevMoStreamflow	07091500	ARKANSAS RIVER AT SALIDA	88305.92	79.85
Arkansas	11020001	Arkansas Headwaters	2015-08	ReservoirStorage	07007020	CLEAR CREEK RESERVOIR	9000.00	63.68
Arkansas	11020001	Arkansas Headwaters	2015-08	ReservoirStorage	07007110	TURQUOISE LAKE	120300.00	57.27
Arkansas	11020001	Arkansas Headwaters	2015-08	ReservoirStorage	07007120	TWIN LAKES RESERVOIR	70100.00	66.49
Arkansas	11020001	Arkansas Headwaters	2015-08	ReservoirStorage	09009040	HOMESTAKE RESERVOIR	42500.00	78.61
Arkansas	11020002	Upper Arkansas	2015-08	PrevMoStreamflow	07099400	PUEBLO RESERVOIR INFLOW	136126.69	83.19

















Program Verification



Automated SWSI Tool Highlights



SWSI Integration

* Laserfiche

- * Water Supply Update Reports
 - * All reports now stored in Laserfiche
- * SWSI documentation
 - * Transparent, accessible
- * SWSI monthly modeling files:
 - * Ensures transparent, repeatable process
 - * No output files/pictures saved, only save input files needed to reproduce outputs
 - * No need to store SWSIs on shared drive

SWSI Integration

* Hydrobase

- * SWSI Summary output file brought in automatically
- Sends data sets to the Colorado Information Marketplace for viewing of tabular data by the public
- * Sends data needed for MapViewer (CDSS) update

* MapViewer (CDSS)

- * Each HUC will have its SWSI and its SWSI components
- * Link to CIM to obtain component details
- * Link to DWR's Water Supply Update, which has graphs

Website & Report

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	L				October 1 - Dece	mber 1	Reservoir Storage			

Next Steps

- * Finish SWSI Integration
- * Coordinate publication of SWSI with NRCS
- * Continue vetting data, developing native flow calculations, and developing internal documentation
- * Open Water Foundation's recommendations



Questions?

Special thanks to:
Open Water Foundation
CWCB
Riverside Technology, Inc
NRCS Snow Survey Colorado
NRCS National Water and Climate Center
Northern Water

Denver Water