

Technical Fact Sheet SJ2017-FS2

Data Summary: Rodman Reservoir Drawdown



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Executive Summary

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This technical fact sheet documents the hydrologic data collected by the St. Johns River Water Management District for the 2015–2016 drawdown of Rodman Reservoir. Rodman Reservoir is drawn down every three to four years for resource management purposes by the Florida Department of Environmental Protection and the data that are collected provide a better understanding of the relationship between surface and groundwater levels.

The most recent drawdown event was monitored for hydrologic effects, which included local declines of up to six feet for both the surficial and Upper Floridan aquifers and negligible regional effects for each of these aquifer systems. Water levels were measured for groundwater monitoring wells associated with both the surficial and Upper Floridan aquifers and for wells adjacent to and a few miles away from the reservoir.

- Hydrographs for wells located adjacent to Rodman Reservoir indicate declines in surficial aquifer water levels of up to six feet and Upper Floridan aquifer declines of three to six feet during the drawdown event. These effects indicate a hydraulic connection between the surficial and Upper Floridan aquifers and a connection between groundwater levels and the stage of the Rodman Reservoir.
- Hydrographs for well clusters located approximately two to five miles from the reservoir indicate no response in groundwater levels to reservoir drawdown.

Several springs located under or adjacent to the reservoir were measured for discharge, with measurements indicating that spring discharge during the drawdown is larger than during the “full reservoir” condition. Spring discharge is directly related to the hydraulic relationship between the water level of the Upper Floridan aquifer and that of the receiving surface water body.

- Spring discharge was measured for Sims, Tobacco Patch, Wells Landing, Fish Hook 1 and 2, Catfish, and Marion Blue Spring during the event.
- Measured discharge ranged between 0.6 cfs (cubic feet per second) for Sims Spring and 6.1 cfs for Marion Blue Spring.

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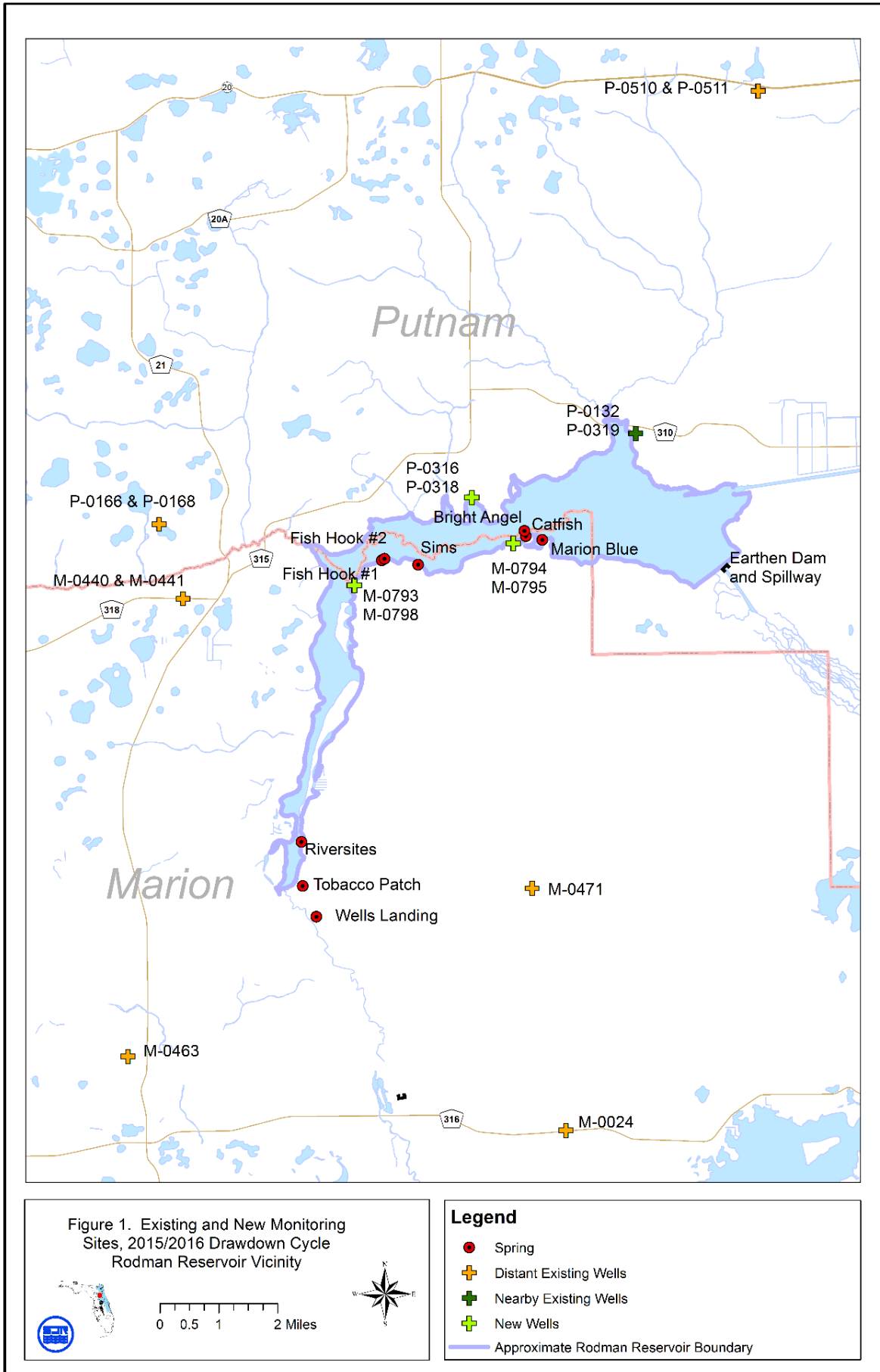
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Introduction. This technical fact sheet documents the hydrologic data collected by the St. Johns River Water Management District prior to and during the 2015–2016 drawdown of Rodman Reservoir. The reservoir is located in southern Putnam and northern Marion counties in north-central Florida (Figure 1). It was established in 1968 by constructing an earthen dam across the Ocklawaha River. Currently, a four-gate spillway (Kirkpatrick Dam) controls water levels in the reservoir. Drawdowns are conducted by the Florida Department of Environmental Protection every three to four years, primarily to control invasive aquatic vegetation; the drawdown procedure entails reducing the reservoir level for a period of six months. The most recent drawdown occurred between October 2015 and April 2016.

Several observation wells are available to illustrate groundwater levels in the underlying surficial and Upper Floridan aquifers (Figure 1). In addition, eight additional wells were either constructed or adopted for monitoring for the 2015–2016 drawdown (see Figure 1, “New Wells”).

Several subterranean springs exist along the perimeter of the Ocklawaha River (Figure 1), and discharge values at these springs are affected by changes in reservoir levels. These springs are submerged during full reservoir periods, but are accessible during drawdown events.

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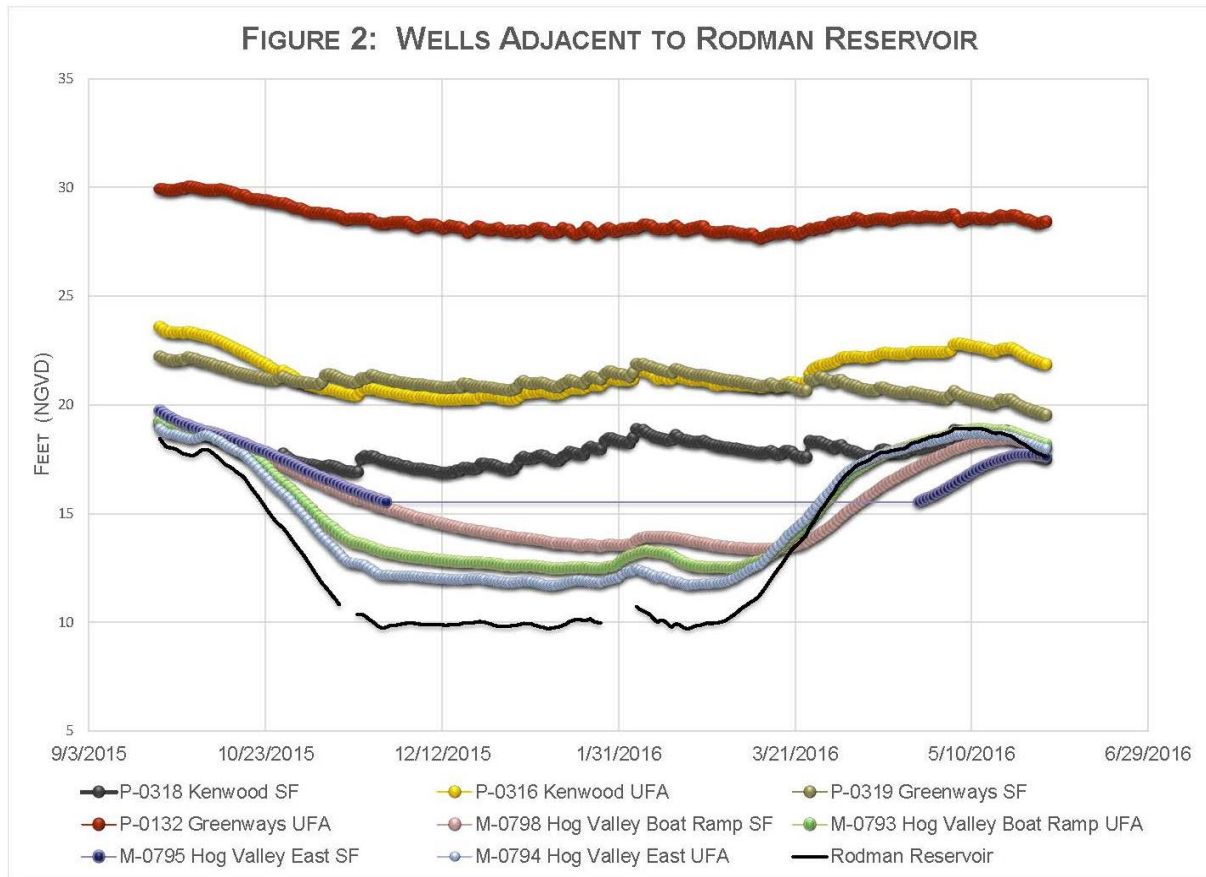
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Water Levels. Groundwater monitoring wells in the area surrounding Rodman Reservoir are categorized as either cluster well sites (i.e., with both an Upper Floridan and surficial aquifer well) or as individual Upper Floridan aquifer (UFA) wells (Table 1). Water levels for four well clusters that are adjacent to Rodman Reservoir (Figure 2) indicate surficial aquifer effects of up to six feet during the drawdown (M-0798) and Upper Floridan effects of three to six feet (M-0794). Water level changes at other nearby surficial aquifer (P-0319 and P-0318) and Upper Floridan aquifer wells (P-0132 and P-0316) are between one and three feet. The basis for the lower relative changes at these wells is most likely the proximity of the wells to the main channel of the reservoir (Figure 1). These changes indicate a hydraulic relationship between the responses for the surficial and Upper Floridan aquifers. They also indicate a connection between groundwater levels and the stage of Rodman Reservoir. Well clusters that are located up to several miles from the reservoir (Figure 3) suggest little to no relationship between the reservoir drawdown and respective groundwater levels. These hydrographs do indicate a gradual decline in water level that is attributable to relatively lower rainfall that occurs during the dry season. Groundwater level measurements for UFA wells (Figure 4) indicate a relationship for wells that are in close proximity to the reservoir (M-0793 and M-0794), but little to no connection for wells that are several miles from the reservoir.

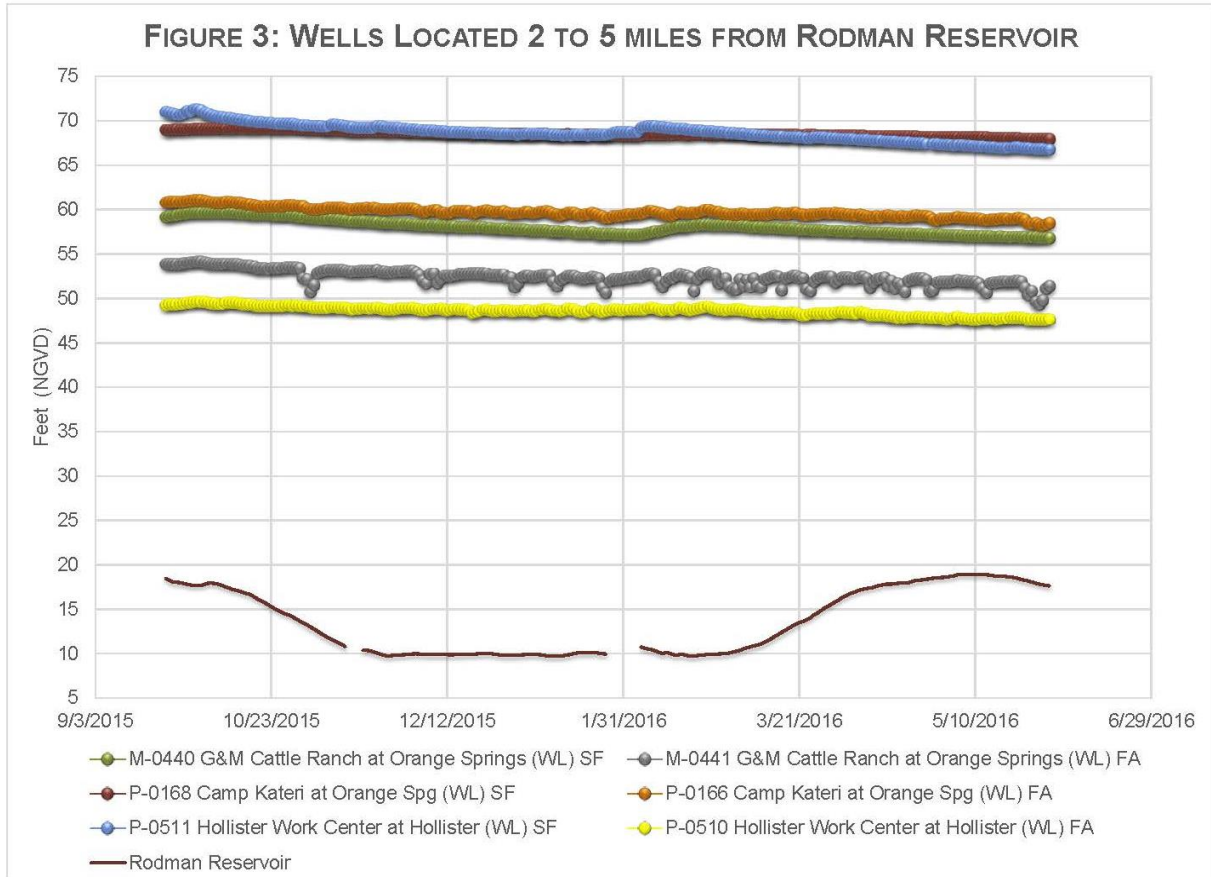
Table 1. Characteristics of Monitor Wells near Rodman Reservoir

Well	Site Location	Aquifer	Diameter (inches)	Casing Depth (feet)	Total Depth (feet)
M-0440	G&M Cattle Ranch	SA	4	33	43
M-0441	G&M Cattle Ranch	UFA	6	155	210
M-0798	Hog Valley Boat Ramp	SA	4	20	80
M-0793	Hog Valley Boat Ramp	UFA	4	125	162
M-0794	Hog Valley East	UFA	4	50	52
M-0795	Hog Valley East	SA	4	4	9
P-0319	Greenways and Trails off HWY 310	SA	2	30	40
P-0132	Greenways and Trails off HWY 310	UFA	6	155	210
P-0168	Camp Kateri	SA	4	36	46
P-0166	Camp Kateri	UFA	6	180	230
P-0318	Kenwood	SA	4	10	25
P-0316	Kenwood	UFA	4	170	190
P-0511	Hollister Work Center	SA	2	40	62
P-0510	Hollister Work Center	UFA	4	175	300
M-0024	Forest Rd 97 & CR316	UFA	6	53	90
M-0463	Ft. McCoy ES	UFA	6	135	180
M-0471	Forest Rd 75	UFA	6	317	380

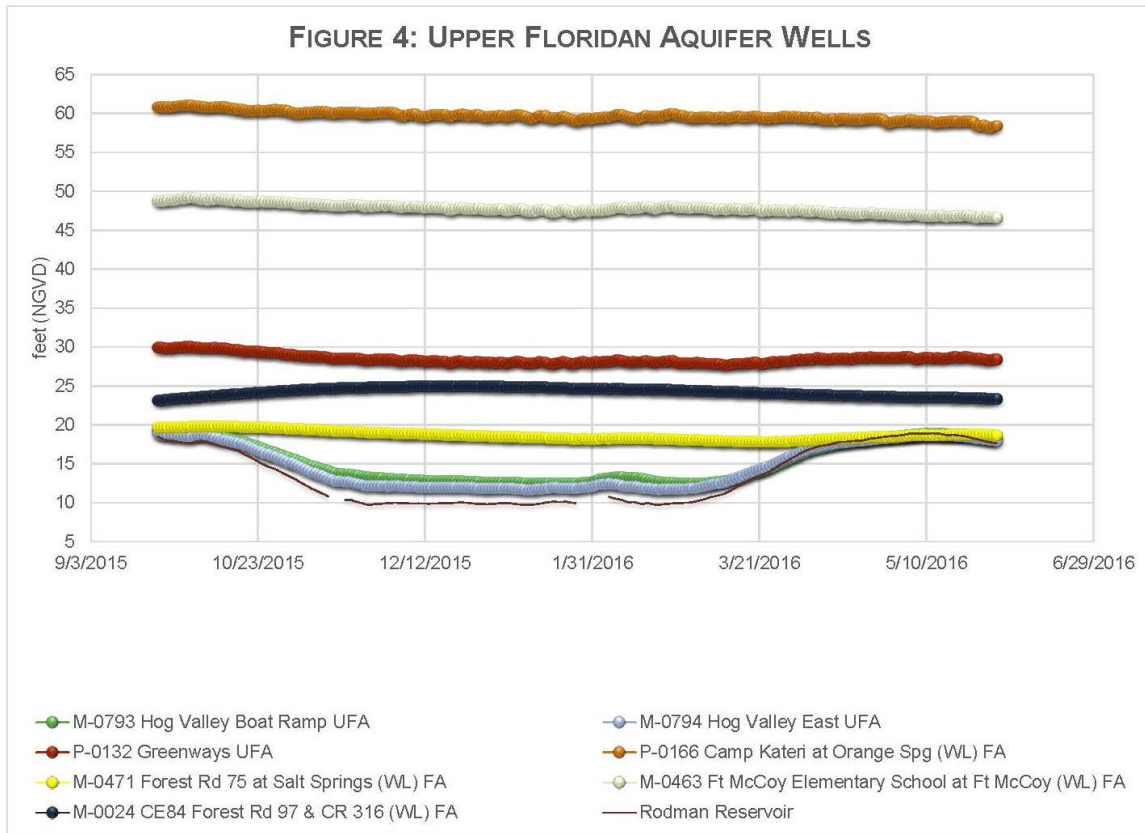
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Spring Discharge. The magnitude of spring discharge is a function of the difference between the hydraulic pressure of the spring source (i.e., the Upper Floridan aquifer), and the spring pool level (i.e., the receiving surface water body). The springs near Rodman Reservoir are measured infrequently due to the difficulty of measuring discharge from a submerged spring. For the 2015–2016 drawdown, measurements were conducted for Sims, Tobacco Patch, Wells Landing, Fish Hook 1 and 2, Catfish, and Marion Blue springs during the event (Figure 1). Measurements were conducted by either a district consultant (i.e., Karst Environmental Services) or district staff

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(Table 2). For Marion Blue Spring, discharge was measured by divers directly at the spring vent, utilizing a gridded measurement system that covers the entire spring vent.

Sims Spring had the lowest measured flow, 0.6 cubic feet per second (cfs), while Marion Blue Spring had the largest flow, 6.1 cfs (note: discharge is rounded to the nearest 0.1 cfs). For comparison, previous measurements at these springs and others are include in Appendix 1.

Table 2. Summary of Spring Discharge Data

Spring	Date	Discharge (cfs)*	Source	Reservoir Status
Marion Blue	12/11/2015	6.1	Karst Environmental Services	Drawdown
	2/29/2016	5.5	Karst Environmental Services	Drawdown
Catfish	9/3/2015	1.3	Karst Environmental Services	Full
Sims	2/26/2016	0.6	SJRWMD database	Drawdown
Fish Hook #1	9/22/2015	0.1	Karst Environmental Services	Full
	12/1/2015	1.2	Karst Environmental Services	Drawdown
	2/26/2016	1.0	Karst Environmental Services	Drawdown
Fish Hook #2	12/1/2015	1.1	Karst Environmental Services	Drawdown
	2/26/2016	1.2	Karst Environmental Services	Drawdown
Tobacco Patch Landing	12/2/2015	3.6	SJRWMD database	Drawdown
	2/29/2016	3.8	SJRWMD database	Drawdown
Wells Landing	12/2/2015	8.9	SJRWMD database	Drawdown
	2/29/2016	5.0	SJRWMD database	Drawdown

* cfs: cubic feet per second

Summary. Rodman Reservoir is periodically drawn down for resource management purposes. The drawdown event takes about six months and occurs every three to four years. The most recent event was monitored for hydrologic effects. The effects associated with the drawdown event include localized impacts of two to six feet and a wider effect of one to two feet of decline in the surficial and Upper Floridan aquifers. Several springs that exist near the reservoir are exposed during the event and were measured for discharge. Measured discharge data generally indicates that spring discharge during a drawdown event is greater than that during the “full reservoir” condition.

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Appendix 1. Listing of all spring discharge data

Site Name	SR Station/Hydon Number	Date	Discharge (cfs)	Rodman Pool Stage at Dam (ft NAVD 88)	River/Reservoir Condition	Source / Hydrate Notes
Marion Blue Spg Run*	37335452	1/24/2008	27.5	10.43	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate: First ADCP measurement by SIRWMD - R.Davis 2/28/2008 RP set in Spring Pool, measurement taken 300 feet downstream of the spring vent.
		2/21/2008	20.0	10.10	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate: Second ADCP measurement by SIRWMD - R.Davis 2/28/2008, measurement taken 300 feet downstream of the spring vent.
		1/11/2012	11.5	9.97	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate: No adjustment required, ADCP Measurement, JMW 02/08/2012, Meas #5, measurement taken 300 feet downstream of the spring vent.
		2/7/2012	13.7	9.97	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate: No adjustment required, Used GPS reference due to large bottom track error over 20%, Meas #6, measurement taken 300 feet downstream of the spring vent.
		3/1/2012	30.6	10.74	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate: Manual measurement recorded by DCS on discharge form M Latin 3/5/2012, wind from the west, same as flow, measurement taken 300 feet downstream of the spring vent.
Marion Blue Spg*	28495015	10/8/1935	10.6	N/A	Historic Free Flowing	Ferguson G.E., Ungerham C.W., Love S.K. and Vernon R.O. 1947: Springs of Florida Geological Bulletin No. 31, Florida Geological Survey, Tallahassee, Florida; this is a pre-reservoir measurement.
		5/18/1999	0.5	17.85	Reservoir Filling, Almost Back to Pool	Scott T.M., Means G.H., Meagan R.P., Means R.C., Upchurch S. B., Copeland R. E., Jones J., Roberts T. and Miller A. 2004, Springs of Florida Bulletin No. 66, Florida Geological Survey, Tallahassee Florida, Note: USGS Shows 0.5 cfs on 5/11/1999 http://waterdata.usgs.gov/nwis/measuments/?site_no=02243550 .
		9/27/2007	0.8	19.05	Reservoir Full	Karst Environmental Services, Inc. 2007, Submerged Springs Site Documentation: August and September 2007 St. Johns River Water Management District Special Publication SJ2008-SP7: Hydrate: no adjustment required, Underwater Karst measurement with additional head from Rodman Pool, JMW 02/08/2012.
		3/6/2008	4.0	11.83	Reservoir Drawdown	SIRWMD WRI/HDS: Hydrate
		9/1/2015	0.0	18.81	Reservoir Full	No discharge per KES, personal communication Pete Butt.
Catfish	28485011	12/11/2015	6.1	9.89	Reservoir Drawdown	SIRWMD WRI/HDS (Karst Environmental Services): Hydrate: Karst Underwater Discharge Measurement: DHUMBERT 13.57.09_04/07/2016 Reviewed By: MWANWRI 13.36.52_04/07/2016
		2/29/2016	5.5	10.02	Reservoir Drawdown	SIRWMD WRI/HDS (Karst Environmental Services)
		3/6/2008	4.2	11.83	Reservoir Drawdown	SIRWMD WRI/HDS
		9/3/2015	1.3	18.58	Reservoir Full	Karst Environmental Services, Inc.2015, Discharge Measurement: Catfish Spring, Rodman Reservoir/Ocklawaha River, Marion County, Florida: September 3, 2015
		9/27/2007	0.5	19.05	Reservoir Full	Karst Environmental Services, Inc. 2007, Submerged Springs Site Documentation: August and September 2007 St. Johns River Water Management District Special Publication SJ2008-SP7.
Bright Angel	28545102	3/6/2008	1.7	11.83	Reservoir Drawdown	SIRWMD WRI/HDS
		12/27/2007	0.7	10.31	Reservoir Drawdown	SIRWMD WRI/HDS
		2/21/2008	0.5	10.10	Reservoir Drawdown	SIRWMD WRI/HDS
		2/13/2009	1.4	16.81	Reservoir Drawdown	In Wycoff Report - Not in Hydrate - Doesn't fit with other measurements
		1/10/2012	0.9	9.95	Reservoir Drawdown	SIRWMD WRI/HDS
Slins Spring	2855024	2/7/2012	0.7	9.97	Reservoir Drawdown	SIRWMD WRI/HDS
		2/29/2012	0.5	10.30	Reservoir Drawdown	SIRWMD WRI/HDS
		2/26/2016	0.6	9.69	Reservoir Drawdown	SIRWMD WRI/HDS
		9/27/2007	0.1	19.05	Reservoir Full	Karst Environmental Services, Inc. 2007, Submerged Springs Site Documentation: August and September 2007 St. Johns River Water Management District Special Publication SJ2008-SP7.
		1/24/2008	0.8	10.43	Reservoir Drawdown	SIRWMD WRI/HDS
Fish Hook #1	2855023	2/21/2008	1.6	10.10	Reservoir Drawdown	SIRWMD WRI/HDS
		1/11/2012	1.7	9.97	Reservoir Drawdown	SIRWMD WRI/HDS
		2/7/2012	1.4	9.97	Reservoir Drawdown	SIRWMD WRI/HDS
		2/28/2012	1.0	10.30	Reservoir Drawdown	SIRWMD WRI/HDS
		9/22/2015	0.1	18.60	Reservoir Full	Karst Environmental Services, Inc. 2015, Discharge Measurement: Fish Hook Spring #1, Rodman Reservoir/Ocklawaha River, Marion County, Florida: September 22, 2015
		12/1/2015	1.2	9.96	Reservoir Drawdown	SIRWMD WRI/HDS (Karst Environmental Services)
		2/26/2016	1.0	9.95	Reservoir Drawdown	SIRWMD WRI/HDS (Karst Environmental Services)

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Fish Hook #2	28595028	2/21/2008	1.0	10.10	Reservoir Drawdown	S/RWMD WRI/HDS
		1/11/2012	1.4	9.97	Reservoir Drawdown	S/RWMD WRI/HDS
		2/7/2012	0.7	9.97	Reservoir Drawdown	S/RWMD WRI/HDS
		2/28/2012	1.3	10.30	Reservoir Drawdown	S/RWMD WRI/HDS
		12/1/2015	1.1	9.96	Reservoir Drawdown	S/RWMD WRI/HDS (Karl Environmental Services)
Riversites	28464991	2/26/2016	1.2	9.69	Reservoir Drawdown	S/RWMD WRI/HDS (Karl Environmental Services)
		1/31/2008	3.3	9.91	Reservoir Drawdown	S/RWMD WRI/HDS
		2/20/2008	2.8	10.04	Reservoir Drawdown	S/RWMD WRI/HDS
		1/12/2012	2.8	9.99	Reservoir Drawdown	S/RWMD WRI/HDS
		2/6/2012	2.2	9.96	Reservoir Drawdown	S/RWMD WRI/HDS
Tobacco Patch Landling	10943293	2/29/2012	2.3	10.52	Reservoir Drawdown	S/RWMD WRI/HDS
		3/3/1999	2.1	10.07	Reservoir Drawdown	Scott T.M., Means G.H., Megan R.P., Means R.C., Upchurch S. B., Copeland R. E., Jones J., Roberts T., and Willie A. 2004. Springs of Florida bulletin No. 66, Florida Geological Survey, Tallahassee Florida.
		2/6/2002	5.0	9.66	Reservoir Drawdown	S/RWMD WRI/HDS
		1/31/2008	4.1	9.91	Reservoir Drawdown	S/RWMD WRI/HDS
		2/20/2008	3.8	10.04	Reservoir Drawdown	S/RWMD WRI/HDS
Wells Landling	16843294	1/12/2012	3.8	9.99	Reservoir Drawdown	S/RWMD WRI/HDS
		2/6/2012	3.1	9.96	Reservoir Drawdown	S/RWMD WRI/HDS
		2/29/2012	2.7	10.52	Reservoir Drawdown	S/RWMD WRI/HDS
		12/2/2015	3.6	9.96	Reservoir Drawdown	S/RWMD WRI/HDS
		2/29/2016	3.6	10.02	Reservoir Drawdown	S/RWMD WRI/HDS
Wells Landling	16843294	3/3/1999	9.9	10.07	Reservoir Drawdown	Scott T.M., Means G.H., Megan R.P., Means R.C., Upchurch S. B., Copeland R. E., Jones J., Roberts T., and Willie A. 2004. Springs of Florida bulletin No. 66, Florida Geological Survey, Tallahassee Florida.
		2/6/2002	8.3	9.66	Reservoir Drawdown	S/RWMD WRI/HDS
		1/31/2008	7.8	9.91	Reservoir Drawdown	S/RWMD WRI/HDS
		2/20/2008	7.8	10.04	Reservoir Drawdown	S/RWMD WRI/HDS
		1/12/2012	7.8	9.99	Reservoir Drawdown	S/RWMD WRI/HDS
		2/6/2012	7.8	9.96	Reservoir Drawdown	S/RWMD WRI/HDS
		2/29/2012	6.2	10.52	Reservoir Drawdown	S/RWMD WRI/HDS
		12/2/2015	8.9	9.96	Reservoir Drawdown	S/RWMD WRI/HDS
		2/29/2016	5.0	10.02	Reservoir Drawdown	S/RWMD WRI/HDS
					Reservoir Drawdown	S/RWMD WRI/HDS

* Previous reports of discharge at Blue Spring Marion included measurements taken by divers at the spring vent as well as those taken in the spring run at a location 300 feet downstream of the vent. In this and future reports, we are separating these into two distinct stations. For the latter spring run data collection, District staff conducted the surface flow measurements in accordance with standard methods at a location where the surface flow was sufficiently constricted to obtain a consistent and reliable measurement. During these times, there was no observable connection between water levels at the reservoir pool and at the spring run. However, due to uncertainties regarding the equivalence between the surface flow measurements and measurements taken at the spring vent, we are splitting the measurements into two separate stations, both in this report and in the District's time series database (Hydstra). Further clarification on the equivalence or relationship of these two measurement sites will require additional investigation. For future reservoir drawdowns, we propose that concurrent measurements be taken at the spring vent and at the downstream run location, as well as just above the spring vent, to more clearly quantify the relationships between the historical measurements at the two locations.