



## 2018 Annual Presumptive Stream Depletion Factor (PDF) Evaluation Report Hydrologic Institutional (H-I) Model Area, Arkansas River Basin August, 2018

### Introduction and Summary

Presumptive depletion factors, or PDFs, are used by the Colorado Division of Water Resources Division 2 in the administration of water replacement plans in the Arkansas River Basin to relate amounts of groundwater pumping from a well to amounts of stream depletions. Colorado’s 1996 Use Rules define groundwater-only PDFs for flood and sprinkler irrigation. However, Amended Appendix A.4 of the Kansas v. Colorado decree directs the state of Colorado to conduct an annual evaluation of the PDF for supplemental flood/furrow irrigation following the annual update of the Hydrologic Institutional Model (H-I Model).

For the 2018 Annual PDF Evaluation, Colorado concludes that a supplemental flood/furrow irrigation PDF of **36.0%** is most appropriate and should be used by Division 2 for replacement plans in year 2019. PDFs for supplemental flood/furrow irrigation for recent water replacement plan years are shown in the following table.

**Presumptive Depletion Factors for Water Replacement Plan Years**

Replacement Plan Year	PDF for Supplemental Flood/Furrow Irrigation
2012	39.0%
2013	38.1%
2014	36.5%
2015	36.0%
2016	35.5%
2017	36.0%
2018	36.0%
2019	<b>36.0%</b>

*Note: Other PDFs are 50% for sole-source flood/furrow, 75% for sprinkler, and 100% for drip irrigation*

### Methods and Results

Amended Appendix A.4 provides a methodology framework for the annual PDF evaluations, but the methodology is updated and more fully described in a report titled “Annual Presumptive Stream Depletion Factor (PDF) Evaluation Methodology for the Hydrologic Institutional Model Area, Arkansas River Basin, Colorado” (PDF Evaluation Methodology Document, 2015). The methodology incorporates updates to the H-I Model; primarily those acknowledging higher groundwater irrigation application efficiencies from sprinkler and drip systems.



The process described in the PDF Evaluation Methodology Document was followed to complete the 2018 PDF Evaluation. The GWAM model was used to determine idealized reach replacements given these PDF values which were provided to a modified version of the HI model with a revised update file. Annual depletions and accretions to usable stateline flow were estimated from historic (with actual pumping and ideal replacements represented) and compact (without pumping or replacements) runs of the modified HI model. Supplemental irrigation PDFs were tested until the minimum PDF was found which produced no cumulative shortfall to usable stateline flows over any 10-year period. Annual and ten-year sums of accretions and depletions for the limiting PDF values are shown in the following table.

### 2018 PDF Evaluation Results

Year of Review Period	Calendar Year	Annual Usable Stateline Depletions (+)/ Accretions (-) (acre-feet)		10-Year Period	10-year Sum of Usable Stateline Depletions (+) / Accretions (-) (acre-feet)	
		SF.PDF: 35.0%	SF.PDF: 36.0%		SF.PDF: 35.0%	SF.PDF: 36.0%
1	1998	-869	-955			
2	1999	-915	-1005			
3	2000	-692	-323			
4	2001	-525	-787			
5	2002	-808	-1004			
6	2003	1391	1215			
7	2004	-138	-217			
8	2005	-373	-457			
9	2006	-430	-546			
10	2007	-539	-615	1998-2007	-3898	-4694
11	2008	-1715	-1827	1999-2008	-4744	-5566
12	2009	-1511	-1646	2000-2009	-5340	-6207
13	2010	-78	-29	2001-2010	-4726	-5913
14	2011	264	166	2002-2011	-3937	-4960
15	2012	2205	2125	2003-2012	-924	-1831
16	2013	1161	1098	2004-2013	-1154	-1948
17	2014	1120	1058	2005-2014	<b>104</b>	-673
18	2015	-236	-280	2006-2015	<b>241</b>	-496
19	2016	-3059	-3224	2007-2016	-2388	-3174
20	2017	-14394	-14743	2008-2017	-16243	-17302

*Note: indicated PDF is for supplemental flood/furrow irrigation  
PDF of 50% sole-source flood/furrow, 75% for sprinkler, and 100% for drip irrigation used  
PDF of 35.0% indicates shortfall in bold and is insufficient while PDF of 36.0% is sufficient*

