In the United States Court of Federal Claims

No. 14-183L
(Filed: December 14, 2020)

IDEKER FARMS, INC., et al., Plaintiffs, v. THE UNITED STATES, Defendant.	)	Taking; Fifth Amendment; Flooding; *Arkansas Game & Fish*; Flowage Easement; Just Compensation; Before-and-After Valuation; Consequential Damages; Interest Rate

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Brent Allen, Environment and Natural Resources Division, U.S. Department of Justice, Washington, D.C., with whom was *Jean E. Williams*, Deputy Assistant Attorney General, for defendant. *Jacqueline C. Brown, Elizabeth McGurk*, *Brad Leneis*, *Terry Petrie*, and *Frank Singer*, Washington, D.C., of counsel.

TRIAL OPINION

FIRESTONE, *Senior Judge.*

Set forth below are the court's findings of fact and conclusions of law following the Phase II trial in *Ideker v. United States*. This takings action was brought by over four hundred farmers, landowners, and business owners from six states claiming that changes made by the United States Army Corps of Engineers ("Corps") to its operations on the Missouri River ("River") after 2004 under the Missouri River Recovery Program ("MRRP") in order to comply with the Endangered Species Act ("ESA") have resulted in

the taking of flowage easements across their properties without just compensation in violation of the Fifth Amendment to the United States Constitution.

In the Phase I trial, the court examined the claims of 44 representative plaintiffs to determine whether they met some of the threshold requirements for establishing a taking by intermittent flooding set forth by the Supreme Court in *Arkansas Game & Fish Commission v. United States*, 568 U.S. 23, 34 (2012) ("*Arkansas Game & Fish*"). The court in Phase I focused on whether the 44 representative plaintiffs could prove that some or all of the flooding of their properties was caused by the Corps' actions under the MRRP to comply with the ESA and, if so, whether that flooding was a foreseeable consequence of the Corps' actions.[1] The court also examined in Phase I whether any of the flooding caused by the Corps was sufficiently severe to give rise to a potential taking. Causation, foreseeability, and severity are three of the *Arkansas Game & Fish* factors the court must consider in determining whether the government has taken a flowage easement. 568 U.S. at 34, 39.

In the Phase I trial opinion, the court described the history of this case and made extensive findings and conclusions regarding the Corps' changes to the River under the

[1] In Phase I, the court rejected the claims of all representative plaintiffs who sought compensation for a taking based only on the extraordinary flooding that occurred along the River in 2011. *Ideker v. United States*, 136 Fed. Cl. 654, 691 (2018). The court found that this flooding had nothing to do with ESA compliance; instead, it was caused by extraordinary flows into the Missouri River Mainstem Reservoir System's reservoirs at levels beyond the System's design. *Id.* As a consequence, the Corps was forced to release huge volumes of water from the System's dams in order to protect the integrity of the System itself. *Id.* at 691-93. The court determined that the flooding in 2011 was necessary to save the System and did not give rise to a taking. *Id.* at 693. Many of the Phase I representative plaintiffs had a takings claim based only on flooding in 2011 and were accordingly not eligible to proceed to Phase II. *See id.* at 762-63.

MRRP. The court will not repeat in detail that history or those findings and conclusions here. In brief, after considering all of the evidence presented in Phase I, the court determined that 28 of the 44 representative plaintiffs had established that the changes made by the Corps to the Missouri River Mainstem Reservoir System[2] ("System Changes") and the River itself ("River Changes") under the MRRP[3] had foreseeably caused increased and repeated flooding on their respective properties. *Ideker Farms, Inc. v. United States*, 136 Fed. Cl. 654 (2018) ("*Ideker I*"); *Ideker Farms, Inc. v. United States*, 142 Fed. Cl. 222 (2019) ("*Ideker II*"). More specifically, the court held that the actions taken by the Corps when (1) releasing water from the Gavins Point Dam[4] to protect certain species during periods of high flows, and (2) undoing actions previously taken by the Corps to make the River straighter and faster[5] (and thus less flood prone) resulted in more flooding[6] than would have occurred on the properties of 28

[2] The Missouri River Mainstem Reservoir System is the system of dams and reservoirs constructed by the Corps on the Missouri River under the Flood Control Act of 1944. *Id.* at 661-62.

[3] In its Phase I opinion, the court, as a shorthand, referred to the Corps' River and System Changes as the MRRP. *Id.* at 665 (The MRRP "is the Corps' umbrella program for returning the Missouri River to a more natural state to aid in the recovery of the Missouri River Basin ecosystem."). In this opinion, the court continues to use the MRRP as the shorthand for these River and System Changes.

[4] The Gavins Point Dam is one of six mainstem dams operated by the Corps on the River. *Id.* at 661.

[5] The program that sought to make the river straighter, deeper, and faster is known as the Missouri River Bank Stabilization and Navigation Project ("BSNP"). *Id.* at 663 (describing the channelization and stabilization effect of the BSNP).

[6] The court used the word "flooding" in the Phase I opinion as a shorthand for four different types of flooding: "overbank, levee overtopping, blocked drainage, and seepage." *Id.* at 700.

representative plaintiffs without the System and River Changes for some or all of the following years: 2007, 2008, 2010, 2013, and 2014. *See Ideker I*, 136 Fed. Cl. at 761-63. The court further determined that 14 of the 28 had established that the increased flooding attributable to the MRRP had occurred more than three times and was "severe." *Id.* The court relied primarily on the testimony of plaintiffs' experts: Dr. Ronald Christensen (regarding raised water surface elevations ("WSEs")), Dr. Theodore Hromadka II (regarding increased and more severe flooding based on raised WSEs), and Mr. Glenn Tofani (regarding the effect of WSEs on levees and levee failure). *See id.* at 680-81, 761-63.

In Phase II, the court asked the parties to identify a smaller number of representative parties for the purpose of determining whether these plaintiffs could establish the remaining *Arkansas Game & Fish* factors, and, if so, to provide evidence regarding just compensation. The parties selected the tracts of three representative plaintiffs for the Phase II trial. These are the Adkins property (Property 17), the Ideker Farms, Inc. property (Property 33), and the Buffalo Hollow Farms, Inc. property (Property 41). These properties are referred to as "representative," "bellwether" or "Phase II" properties by the witnesses in Phase II and throughout this opinion. In Phase I, the court concluded that these three plaintiffs had already "established causation, foreseeability, and severity" for the flooding of their properties in 2007, 2008, and 2010 for the Adkins property, in 2007, 2008, 2010, 2013, and 2014 for the Ideker property, and

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The differences are explained in the Phase I opinion. *See id.* The court uses the term "flooding" the same way in this opinion.

in 2007, 2008, 2010, 2013, and 2014 for the Buffalo Hollow property. *Ideker I*, 136 Fed. Cl. at 761-62.

The Phase II trial concerning these three representative tracts was held remotely over three weeks beginning on July 20, 2020. The court heard testimony from 19 witnesses during the trial and received 1080 exhibits into evidence. Closing argument for the Phase II trial was heard on September 22, 2020.

This opinion is divided into four sections: (1) causation for post-2014 flooding, (2) takings liability for a permanent flowage easement under *Arkansas Game & Fish*, (3) the date of the taking, and (4) just compensation. The court's findings of fact and legal conclusions are set forth in each section separately. As described in more detail below, the court has concluded that the three representative plaintiffs have established that the government has taken a permanent flowage easement across their representative tracts and has determined the just compensation due to these three plaintiffs.

I. Causation for Post-2014 Flooding

The Supreme Court in *Arkansas Game & Fish*, 568 U.S. at 38-39, set forth the standard for when government-induced intermittent flooding may give rise to a claim for the taking of a flowage easement. Under *Arkansas Game & Fish,* the court must undertake a multi-factor, "situation-specific factual inquiry," *id.* at 31-32, considering whether (1) the flooding was caused by the government, *see id.* at 38; *see also Ridge Line, Inc. v. United States*, 346 F.3d 1346, 1356 (Fed. Cir. 2003) (holding the court must determine "whether the [flooding] on the claimants['] property was the predictable result of the government action"); (2) "the degree to which the invasion is intended or is the

foreseeable result of the authorized government action," *Ark. Game & Fish*, 568 U.S. at 39, (3) the "[s]everity of the interference," *id.*, (4) "time" and the duration of the flooding, *id.* at 38, (5) "the character of the land at issue," *id.* at 39, and (6) interference with "the owner's 'reasonable investment-backed expectations' regarding the land's use," *id.* (quoting *Palazzolo v. Rhode Island*, 533 U.S. 606, 618 (2001)).

This first part of the Phase II trial opinion addresses whether the representative plaintiffs have established causation for flooding that occurred on their respective properties post-2014. In the Phase I trial, the court limited the evidence of flooding to December 2014 so that the parties had a closing date for discovery. *See Ideker I*, 136 Fed. Cl. at 670. In the Phase II trial, the court allowed the three representative plaintiffs to present evidence of any continued flooding post-2014, setting a cut-off date of December 2018, again for trial preparation purposes. As discussed below, the three representative plaintiffs contend that flooding on their properties is continuing post-2018 and, as permitted, presented evidence in support of that contention.

A. Scope of the Court's Previous Findings on Causation and the Relevant Time Period

Before turning to the court's causation findings regarding flooding on the three representative plaintiffs' properties post-2014, the court will address two threshold issues raised in the parties' Phase II post-trial briefs regarding the scope of the court's holdings during and after the Phase I trial. First, the parties disagree as to whether the court previously determined that the Corps' actions caused *all* of the flooding on the representative properties for the years where the court found causation in Phase I, as the

representative plaintiffs contend, Pls.' Br. at 59-90, 130-33, ECF No. 678, or whether the Corps' actions caused only additional flooding beyond what would have otherwise occurred, as the government argues, Def.'s Br. at 12-20, 132-33, ECF No. 679.

The representative plaintiffs' argument that the government caused *all* of the flooding on their properties for the years where the court found causation is incorrect. It is true that the court found that any flooding attributable to natural causes, as opposed to the Corps' actions, did not break the "chain of causation" between the MRRP and the flooding on the representative plaintiffs' properties. Pls.' Br. at 133; *Ideker I*, 136 Fed. Cl. at 670. However, the court did not go on to hold that all of the flooding on the representative plaintiffs' tracts was attributable solely to the MRRP. Rather, the court concluded in Phase I that the Corps' MRRP actions in certain instances made the flooding more severe than it would have been had the MRRP not been in place.

Specifically, the court held that the "Corps' River Changes have, together with the Corps' System Changes, caused WSEs to rise higher than they would have risen without these Changes and that this rise in WSEs has led to more flooding or more severe or longer flooding than would have occurred had these Changes not been made by the Corps." *Id.* at 696-97. Relying on the testimony of the Phase I plaintiffs and their experts, for every year in which it found causation, the court concluded that the Corps' actions under the MRRP caused "*more severe* flooding than would have occurred without" the Corps' actions. *Ideker I*, 136 Fed. Cl. at 729-30 (Adkins) (emphasis added); *id.* at 747-49 (Ideker); *id.* at 757-58 (Buffalo Hollow). The only exception to this finding was where the evidence established that certain levees would not have failed but for the

higher WSEs attributable to the MRRP. *See, e.g.*, *id.* at 748 (for the Ideker property in 2010, "[t]he court finds, based on Mr. Tofani's testimony, that flooding was due to levee overtopping that would not have occurred without the System and River Changes"). Apart from these exceptions, the court did not hold that the MRRP was the but-for cause of *all* flooding on the representative plaintiffs' properties, but only that it caused additional or more severe flooding than would have occurred without the MRRP.

The representative plaintiffs' reliance on their experts' testimony from Phase I to argue that the court found that the Corps was responsible for all flooding is not supported. The representative plaintiffs first contend that Dr. Christensen and Dr. Hromadka opined in Phase I that the MRRP was the cause of all of the flooding on the Phase I plaintiffs' properties. Pls.' Br. at 60-62. The court did not interpret the evidence in that way or make such a finding. Rather, the court relied on Dr. Christensen, Dr. Hromadka, and Mr. Tofani to hold that, generally, the MRRP caused more severe flooding in certain years. *Ideker I*, 136 Fed. Cl. at 729-30 (Adkins); *id.* at 747-49 (Ideker); *id.* at 757-58 (Buffalo Hollow).

The representative plaintiffs also appear to suggest that the WSEs presented by Dr. Christensen in Phase I underestimate the extent of the flooding at the Adkins, Ideker, and Buffalo Hollow properties, meaning that the MRRP could have caused all of the flooding on the three representative plaintiffs' properties. *See* Pls.' Br. at 62-64. While Dr. Christensen opined that the WSEs on plaintiffs' individual properties could have been greater than he estimated in his model, Dr. Christensen's statement alone is not enough to prove that the MRRP was responsible for *all* of the flooding on plaintiffs' representative

tracts for the years in question. The court therefore agrees with the government that, when examining the *Arkansas Game & Fish* factors as well as just compensation, the court is tasked with determining whether the *additional* flooding caused by the MRRP is sufficient to meet the standards for the taking of a flowage easement and, if so, the value of the property interest it has taken.

However, the court disagrees with the government's argument that "[b]ecause Plaintiffs failed to present any evidence of the amount of incremental flooding, Plaintiffs failed [to] prove either liability or just compensation for their claims." Def.'s Br. at 133. As explained below, the court finds that the representative plaintiffs have demonstrated liability under the *Arkansas Game & Fish* factors here, building on the court's Phase I opinion that the MRRP caused more severe flooding on their properties. In fact, the government's own crop loss expert's opinions demonstrate that the representative plaintiffs' properties experienced considerable crop losses based on the incremental effects of MRRP flooding. *See infra* Part II. With respect to just compensation, the court finds that the representative plaintiffs' method of calculating the diminution in the fair market value of their respective properties supplies a reasonable approximation of what was taken as a result of the Corps' actions under the MRRP. *See infra* Part IV.

Second, the parties disagree as to the court's prior opinion regarding the relevant time period over which to analyze the *Arkansas Game & Fish* factors. The government presented evidence describing the flooding on the representative plaintiffs' tracts that occurred before the Mainstem System and BSNP (the program that made the river straighter and faster, see *infra* n.5) were in place to argue that the character of the

representative plaintiffs' land has not meaningfully changed with the introduction of the MRRP. *See* Def.'s Br. at 134 ("In this case, Plaintiffs' properties are located next to the Missouri River and have been subject to flooding (and, at times, major flooding) at unpredictable intervals throughout recorded history."). The representative plaintiffs argue that the proper time periods to compare are "the time period *without* the MRRP but *with* the System and BSNP (not the beginning of time)" and "the time period *with* the MRRP *and* the System and BSNP (the current period)." Pls.' Resp. at 13, ECF No. 681.

The court agrees with the representative plaintiffs that in determining whether the government can be liable for any increased flooding, the relevant time period begins after the Mainstem System and BSNP were in place. This court has already determined in its prior ruling denying the government's motion to amend its answer that "the flood protection provided by the Mainstem System and the BSNP is the baseline of flood protection against which the additional flooding caused by the MRRP should be judged for purposes of deciding both causation and government liability for any taking in this case." *Ideker Farms, Inc. v. United States*, 146 Fed. Cl. 413, 416 (2020) ("*Ideker III*").

It is against this backdrop of its prior rulings that the court now turns to the claims of the representative plaintiffs.

B. Phase I Findings of Fact on Causation and Foreseeability for the Three Representative Tracts

Before turning to the court's Phase II findings on post-2014 causation for the representative plaintiffs, the court will first review its Phase I findings for each representative property.

1. The Adkins Property

The representative Adkins property is located along the Missouri River at River mile markers 608-611 in Council Bluffs, Iowa. Tr. 46:23-47:2. The Adkins plaintiffs own the property in fee simple. *Ideker I*, 136 Fed. Cl. at 729. The property is protected on three sides by federal levees. *Id.*; *see also* Tr. 47:3-7 ("The Phase II tract is surrounded on three sides, the west, south and east side, by Federal Levee L-627, and the tie-back levee on Indian Creek.").

The court determined in Phase I that the MRRP caused foreseeable and more severe flooding on the Adkins representative tract in 2007, 2008, and 2010, but rejected flooding claims for 2011, 2013, and 2014. *Ideker I*, 136 Fed. Cl. at 730-31.

The court found that, in 2007, flooding occurred in April and May during the planting seasons. The Adkins claimed that 400 of their 1,044 acres flooded. About 50 to 60 percent of the property inside the levees was flooded for about three weeks. The court found that flooding in 2008 was similar to 2007 in severity, duration, and damage. The 2008 flooding occurred in June and crops were lost. The court found that, in 2010, flooding was similar to 2007 and 2008 but the water was higher and stayed longer. Flooding again occurred in late June and crops were lost. *Id.* at 729-31.

Based on Dr. Hromadka's testimony, the WSEs prepared and testified to by Dr. Christensen, and the testimony of Mr. Tofani regarding water levels on the levees, the court concluded in Phase I that the 2007, 2008, and 2010 flooding "was the result of higher WSEs," and that "the higher WSEs were caused by and were a foreseeable result

of the Corps' System and River Changes which resulted in more severe flooding than would have occurred without these Changes." *Id.* at 729-30.

2. The Ideker Property

The Ideker representative property is located in Holt County, Missouri, at River mile markers 510-12. Tr. 218:1-8; *Ideker I*, 136 Fed. Cl. at 747. The property is owned in fee simple. *Ideker I*, 136 Fed. Cl. at 747. The Corps' MRRP activities in the area surrounding the Ideker property include (1) dike construction and notching near the property; (2) dike alteration at River mile 512; and (3) the Corps' operations at the Thurnau Wildlife Refuge directly south of the property. *Id.* The Corning Levee District levee separates the Thurnau Wildlife Refuge and the Ideker property. *Id.* The property is also protected by a private levee built by the plaintiff. *Id.*

The court determined in Phase I that the Corps had caused foreseeable and more severe flooding on the Ideker property for 2007, 2008, 2010, 2013, and 2014. *Id.* at 748-49. The court rejected the Ideker flooding claims for 2011. *Id.* at 749.

The court found that in 2007, the entire Ideker farm flooded for 30 to 60 days beginning in May. Floodwaters entered the farm from the south and east, coming from the Thurnau Wildlife Refuge. The private levees held, but at that time there was no levee on the east side of the farm. The floodwaters entering the farm from the Thurnau Wildlife Refuge were estimated to be two to ten feet deep. Equipment was destroyed and some land reclamation was necessary. The 55 acres riverward of the mainline levee were flooded. The river cabin outside the levee flooded for the first time and required extensive renovation. *Id.* at 747.

The court found that in 2008, flooding began in mid-June and lasted 30 to 45 days. The Ideker levees held. Like in 2007, water entered from the Thurnau Wildlife Refuge. A portion of the farm sustained flood damage due to seepage and blockage of the drainage ditches. The drainage ditches on the property filled and flowed over onto some crops, sustaining water from one inch to one foot deep. Some crops died but were re-planted. Grain bins and irrigation equipment sustained damage. The 55 acres riverward of the Ideker mainline levee flooded. The cabin on the property adjacent to the River was flooded and required renovation. *Id.* at 747-48.

The court found that the flooding in 2010 was worse than in 2007 and 2008. Once again, the high waters entered from the Thurnau Wildlife Refuge. Sandbagging occurred to block the Thurnau waters from entering the farm. The efforts were successful until the mainline levee breached on the northwest corner of the farm, leaving a 90-foot scour hole destroying farmland. The entire farm was flooded for approximately 90 days with floodwaters on the north side of the property reaching three feet deep and 11 to 13 feet deep on the south end of the farm. The farm, home, structures, and equipment sustained extensive damage. Up to five feet of sand was left on the 60- to 70-acre area in the northwest of the farm. Grading equipment was used to remove sand and relocate and rebuild the mainline levee on the west and south areas, widening it two to three feet and raising it two feet. Additionally, levees were built on the east side of the farm to negate floodwaters emptying into the farm from the east in the future. *Id.* at 748.

The court found that in 2013, flooding on the property began in May and lasted 30 to 45 days. Fifty-five acres on the riverward side of the mainline levee again flooded.

There were no levee breaches. The water was estimated at seven to eight feet on the mainline levee on the west side and two to three feet over the riverbank. *Id.* at 749.

The court found that, in 2014, the 55 acres on the riverward side again flooded much like 2013. Flooding began in June with the peak water in late June but drainage was impacted periodically from June to October. Water reached the base of the mainline levee on the west side and was estimated at one to two feet over the riverbank. Floodwaters were not as deep as in 2013. Farming the acreage riverward of the levee was determined to be no longer sustainable in light of the flood-prone River. *Id.*

Based on Dr. Hromadka's testimony, Dr. Christensen's WSE chart, and Mr. Tofani's testimony, the court found for 2007, 2008, 2013, and 2014 that the flooding "was the result of higher WSEs," and that "the higher WSEs were caused by and were a foreseeable result of the Corps' System and River Changes which resulted in more severe flooding than would have occurred without these Changes." *Id.* at 747-49. For 2010, the court found based on Mr. Tofani's testimony that "flooding was due to levee overtopping that would not have occurred without the System and River Changes." *Id.* at 748. Based on Dr. Hromadka's testimony and Dr. Christensen's WSE chart, the court held that for 2010 "the higher WSEs were caused by and were a foreseeable result of the Corps' System and River Changes which resulted in more severe flooding than would have occurred without these Changes." *Id.*

3. The Buffalo Hollow Farms Property

The Buffalo Hollow property is located in Doniphan County, Kansas, adjacent to River mile markers 475-78. Tr. 142:12-15; *Ideker I*, 136 Fed. Cl. at 757. The property is

owned in fee simple and is protected by a private levee. *Ideker I*, 136 Fed. Cl. at 757. Corps construction activities near the property include the Wolf Creek Bend channel widening at River mile 481 in 2006 and dike notching at River miles 492, 490, and 487. *Id.* The court determined in Phase I that the Corps had caused foreseeable and more severe flooding on the subject property for 2007, 2008, 2010, 2013, and 2014. *Id.* at 758. The court rejected the Buffalo Hollow flooding claims for 2011. *Id.*

The court found that, in 2007, the flooding occurred in May, covering approximately 25 percent of the property inside the levee and all but two or three acres outside the levee. The River was three to four feet high against the levee and the water depths inside the levee ranged from "spongy" soil to two feet. Crops were lost, there were reduced crop yields, and pumping expenses were incurred. *Id.* at 757.

The court found that, in 2008, flooding occurred from May 30 to June 21. The flooding covered approximately 50 percent of the property inside the levee and all but two to three acres outside the levee. The River was four to five feet high against the levee and the water depths inside the levee ranged from saturated soil to one to two feet deep. Crops were lost, yields were reduced, and plaintiffs incurred pumping expenses and clean-up costs. *Id.*

The court found that, in 2010, flooding occurred from June 11 to August 20. Flooding covered about 75 percent of the property inside the levee and the entire property that was outside the levee. The River was four to five feet against the levee and the water depths inside the levee ranged from saturated soils to three feet deep. Crops were lost, yields were reduced, pumping expenses and debris clean-up costs were incurred. *Id.*

The court found that in 2013, flooding occurred from late May to early June. Almost all of the acres outside the levee were flooded with overbank flooding, and seepage and/or blocked drainage occurred inside the levee. Crops were lost. The River was about one to two feet high against the levee. The court found that flooding in 2014 was similar to 2013. *Id.* at 758.

For all of these years, the court found, based on Dr. Hromadka's testimony, Dr. Christensen's WSE chart, and Mr. Tofani's testimony, that the flooding "was the result of higher WSEs," and that "the higher WSEs were caused by and were a foreseeable result of the Corps' System and River Changes which resulted in more severe flooding than would have occurred without these Changes." *Id.* at 757-58.

C. Post-2014 Causation for the Phase II Representative Tracts

The court now turns to the post-2014 flooding on the three representative properties. Based on the evidence discussed below, the court finds (1) that the Corps' continued operation of the MRRP without change has caused more severe flooding in the years 2016, 2017, and 2018 on the Adkins representative tract; 2015, 2016, 2017, and 2018 on the Ideker representative tract; and 2015, 2016, 2017, and 2018 on the Buffalo Hollow representative tract than would have occurred without the MRRP and (2) that because of the MRRP there is a new and increased flooding pattern on these representative tracts and this new pattern of flooding is continuing into the future.

1. The Representative Plaintiffs' Accounts of Increased Flooding and a Changed Flooding Pattern

The court begins with its review of the representative plaintiffs' eyewitness accounts of the increased magnitude and duration of flooding post-2014 and the changed flooding patterns at their properties following implementation of the MRRP.

a. The Adkins property

Before the MRRP but after the Mainstem System and BSNP were in place, Mr. Adkins testified that his property experienced some degree of flooding from seepage and/or blocked drainage in 1967, 1984, 1993, and 1995. Tr. 57:8-16. However, Mr. Adkins testified that "the flooding in the 1980s and 1990s" was "much different" from the "MRRP flooding post-2004." Tr. 58:11-15. According to Mr. Adkins, the "MRRP flooding is different in how often it happens, its frequency, its severity, and just how long it lasts . . . ." *Id.*

Regarding flooding on the property after 2014, Mr. Adkins testified that in 2016 a high Missouri River in June and July caused blocked drainage and seepage on the representative tract, and water backed up into the ditches causing wet fields and blocked drainage. Crops were lost and yields were adversely impacted. Tr. 59:2-6. Mr. Adkins further testified that flooding on the tract in 2017 was very similar to 2016. Tr. 59:7.

Mr. Adkins then testified that in 2018, crops were planted and looked good up until the middle of June when, because of a high River, there was blocked drainage and seepage, and all the crops outside the levee and within a half-mile inside the levee were

lost. He observed that the floodwaters remained on the property from June 2018 through "Thanksgiving or so." Tr. 59:8-60:5.

Mr. Adkins testified that the new pattern of flooding caused by the MRRP beginning in 2007 has continued. Tr. 60:12-16; Tr. 86:25-87:4 ("The MRRP has cause[d] the river to change. It has changed from the standpoint that its flooding patterns have changed resulting in an increase in the frequency, severity and duration of the flooding."). He explained that the changes to the River from the MRRP are evidenced by a change in the observed WSEs that now block the drainage ditches so that water cannot runoff the property. Tr. 80:2-21. He also testified that before the MRRP the levee flood gates and pressure relief wells on the property required little to no maintenance because they were seldom used or needed. Tr. 80:22-81:1; Tr. 81:18-22. He stated that this is no longer the case and that the flooding post-MRRP is very different from what it had been before. Tr. 81:18-24; Tr. 82:5-6.

Based on his "personal observations of the river on a daily basis," Mr. Adkins testified "with confidence that we have a changed river since 2004." Tr. 85:21-24. Mr. Adkins stated that it is his "belief that the MRRP has altered the river's flooding patterns which will not go back to the way they were before unless the MRRP is terminated and time passes." Tr. 88:1-5. Because of this, Mr. Adkins "believe[s] the Phase II tract will continue to be subjected under the MRRP flooding pattern of the river to inevitably recurring and intermittent flooding on par with the flooding of the river from 2004 through 2014." Tr. 88:12-18.

b. The Ideker property

Mr. Ideker testified that before the MRRP, his property flooded in 1952, 1962, and 1967 – prior to the Mainstem System becoming fully operational – and then in 1984 and 1993. Tr. 224:12-16; Tr. 261:8-13. However, Mr. Ideker stated that this flooding was "nothing whatsoever like the flooding we have experienced since 2007," after the implementation of the MRRP. Tr. 224:17-20.

Mr. Ideker also testified about flooding after 2014. Mr. Ideker stated that in 2015, overbank flooding was again experienced over the 55 acres on the west side of the farm outside the levee, with blocked drainage inside the levee which adversely impacted farm efforts. There were no crops planted on the 55 acres at the time. The new river home on the acreage, now setting at a rebuilt higher elevation, was not damaged. Water again reached the base of the levee and was estimated at one foot over bank. Six hundred to 700 acres of the interior farm was impacted by blocked drainage and seepage, and 50 to 60 percent of the farmable acreage flooded. Tr. 245:10-25.

Mr. Ideker stated that the flooding in 2016 was worse than in 2015. Overbank flooding was experienced over the 55 acres on the west side of the farm outside the levee in May through June. Due to blocked interior drainage and seepage, 200 acres of cropland inside the levee were not planted. No crops were planted on the 55 acres outside the levee next to the River. The interior farm was again impacted by blocked drainage and seepage. Over 800 acres of farmable acreage flooded, or about 60 percent of the farm. Tr. 246:1-16.

Mr. Ideker observed that in 2017 the flooding was similar to 2016. Overbank flooding occurred on the 55 acres without reaching the interior of the new river home. No crops were planted on the 55 acres. Blocked drainage and seepage again resulted, adversely impacting farm efforts. Again, over 800 acres of the farmable acreage flooded, or about 60 percent of the farm. Tr. 246:17-247:1.[7]

Regarding flooding in 2018, Mr. Ideker testified that there was a high River for most of the year which periodically caused overbank flooding on 55 acres and created severe problems inside the levee with blocked drainage and seepage. Planting was hampered and the harvest was delayed until late 2018. The Ideker drainage tubes were blocked over 300 days during 2018. Flooding interfered with efforts to farm the entire year. Tr. 247:13-25.

Mr. Ideker stated that the changed pattern of flooding caused by the MRRP from 2007 to 2014 has continued and that this pattern is different than before 2007. Tr. 259:13-17; Tr. 263:17-264:1. Mr. Ideker testified that the "river since 2007 is unpredictable," and that the "severity, duration and frequency of the flooding is worse." Tr. 263:8-16; *see also* Tr. 267:16-18 ("This was not the situation prior to 2007, nothing remotely close.").

[7] After experiencing repeated ongoing flooding in 2017, the ninth time in 11 years, the Idekers made the decision to terminate their efforts to farm the land themselves and leased the interior farm effective March 1, 2018, for $260 per acre. The 55 acres outside the levee, which includes the new river home, were not part of the lease. The property was under lease at the time of trial. Tr. 227:4-10; Tr. 247:2-12.

c. The Buffalo Hollow Farms property

Mr. Schneider[8] testified that the Buffalo Hollow Phase II tract significantly flooded in 1952 and 1967, prior to the Mainstem System becoming fully operational, and then in 1973, 1984, and 1993. The 1973 and 1984 flood events took place before the private levee on the tract was fully completed. Mr. Schneider testified that any other flooding on the property from 1967 to 2007 was not significant and that even the 1973, 1984, and 1993 floods were nothing like what they have experienced since 2007. Tr. 146:22-147:4; Tr. 167:3-15. According to Mr. Schneider, "before the MRRP, the river would raise slowly and drop quickly. Flooding was infrequent. Now, under the MRRP, the flooding rises fast and it drops slowly. As a result, the inundation is more severe." Tr. 167:23-168:3.

Regarding flooding post-2014, Mr. Schneider described how, in 2015, the flooding occurred on two separate occasions in June lasting up to 10 days. There was overbank flooding outside the levee, with one to two feet of water up against the levee. Seepage and blocked drainage occurred inside the levee. Crops were impaired or lost. On December 16, water was over bank up against their levee and the Schneiders used a skid loader to clean up the debris. Mr. Schneider stated that this event was very much like those that occurred in 2013 and 2014. Tr. 159:20-160:7.

In 2016, Mr. Schneider stated that flooding took place May 10 through 31. As before, seepage and blocked drainage resulted. There was standing water inside the

[8] Mr. Schneider is the authorized representative of Buffalo Hollow Farms, Inc. Tr. 141:19-24.

levee. Crops had to be replanted and planting was delayed. Mr. Schneider described the May flooding as "particularly significant," but noted that there were other instances of blocked drainage that took place in 2016. Tr. 160:8-16.

In 2017, Mr. Schneider stated that the River ran high, blocking drainage and causing seepage problems during most of the summer. This was longer-lasting than the previous two years, and extensive pumping efforts in May were undertaken and continued. There was overbank flooding outside the levee. Mr. Schneider testified that 50 percent of the crops outside the levee were lost. Mr. Schneider likened the flooding in 2017 to that of "past years' flooding," which he ascribed to "a routinely high river." Tr. 160:17-161:2.

Regarding flooding in 2018, Mr. Schneider testified that the River ran above normal most of the year, blocking drainage for over 100 days in the summer, fall, and into December. Harvest efforts were significantly impaired. Overbank flooding outside of the levee occurred. Blocked drainage and seepage occurred again inside the levee constantly for six months. Mr. Schneider testified that 70 percent of the crops outside the levee were lost. Tr. 161:3-16.

Mr. Schneider testified that, based on his observation of the River on a daily basis, the implementation of the MRRP has changed the flooding on his property, and that the changed pattern of flooding is ongoing. Tr. 165:16-20; Tr. 166:15-20 ("[T]he river runs higher than it did prior to 2004.").

2. The Court Accepts Plaintiffs' Accounts of Post-2014 Flooding

The court finds the representative plaintiffs' descriptions of flooding on their properties as described above to be reliable, and that the flooding as described by the plaintiffs occurred as stated. The court also finds that the representative plaintiffs' testimony regarding the change in flooding patterns on their properties post-2014 is credible and reliable.

The government introduced crop insurance records to undermine the representative plaintiffs' recollections of flooding on their properties and plaintiffs' testimony regarding the changed nature of the flooding. However, the court finds the crop insurance evidence does not undermine the representative plaintiffs' testimony.

To begin, crop insurance claims may be made for a number of reasons if productivity is not achieved at the level of coverage provided. For example, claims can be made for losses due to "excessive moisture," in addition to claims for "flooding." Tr. 2660:22-25 (Mr. Zanoni, a government witness who is a senior underwriter for the federal crop insurance program, describing codes for losses). The government, not the farmer, makes the decision on how to code a loss, and such codes do not describe the source of the water that harms the crops. Tr. 2726:1-13; Tr. 2728:6-2730:21. The government attempts to undermine the representative plaintiffs' testimony by pointing out that they made insurance claims for "excessive moisture" in years in which they did not testify about any flooding. Def.'s Br. at 38-40. By counting claims for excessive moisture as evidence of flooding events, the government also contends that the representative plaintiffs either made a similar amount of crop insurance claims before and

after the MRRP, *id.* at 74 (arguing the Adkins farm made seven claims for excess moisture prior to 2004 and eight claims for excess moisture between 2004 and 2018), or failed to make claims for years in which they described flooding, *id.* at 76 (noting that Mr. Ideker did not make a claim in 2013 through 2014).

The court finds, however, that crop insurance claims cannot be used to account for flooding on the representative plaintiffs' properties and thus do not undermine plaintiffs' recollection. First, many of the insurance claims the government relies on are coded as "excessive moisture," *see id.* at 38-40 (describing claims), which usually references severe rainfall onto the land and not flooding caused by a higher River. Tr. 168:9-14 (Schneider) ("A claim for excessive moisture, for example, can be due to rainfall and not a rising river leading to flooding."); Tr. 262:1-6 (Ideker) ("A crop insurance claim for excessive moisture does not necessarily mean there was flooding from the river; it can be due to rainfall."); Tr. 2728:6-2730:21 (Zanoni) (testifying that the crop insurance records "would not tell you" the source of the water that harmed the crops and that the "crop insurance records alone cannot be used to confirm or not confirm a flood event in any given year"). Because the crop insurance claims do not necessarily correlate to whether River flooding occurred on the representative plaintiffs' properties, the government's reliance on crop insurance records to undermine the credibility of plaintiffs' testimony is unpersuasive.

The government has not put forth any other evidence to undermine the representative plaintiffs' recollection. To the contrary, the government witnesses at the Phase II trial each stated that they had no reason to doubt plaintiffs' descriptions of

flooding on their properties. Tr. 1999:14-2000:3 (Jones); Tr. 1307:9-19, 1329:13-18 (Kelman); Tr. 1397:22-24 (Remus); Tr. 2268:23-2269:8 (Earles). In addition, the Corps' historic flooding records generally support the representative plaintiffs' description of flooding on their properties prior to the MRRP. According to those records, historic flooding occurred in 1952, 1973, 1978, 1984, and 1993. *See* Tr. 1531:7-1533:14 (testimony of Eric Shumate, Chief of the Hydrologic Engineering Branch in the Kansas City District, Army Corps of Engineers). The Corps' Omaha District Office post-flood reports also included 1984 and 1993. Tr. 1453:7-22 (testimony of Daniel Pridal, Chief of the River and Reservoir Engineering section of the Omaha District Corps of Engineers).

For all of these reasons, the court finds that the representative plaintiffs' descriptions of the flooding on their properties and how the flooding has changed from the period preceding the MRRP to after the MRRP was implemented are credible and reliable. Taking this testimony together with the expert testimony described below, the court finds that the MRRP has caused a pattern of increased flooding on the three representative properties that will continue into the future.

3. The Plaintiffs' Expert Dr. Mays Confirms a Finding of a Changed and Increased Flooding Pattern on the Representative Tracts post-MRRP

In support of the representative plaintiffs' claim that the MRRP has caused a changed flooding pattern resulting in more flooding than plaintiffs had experienced before the MRRP was implemented, the plaintiffs presented the expert testimony of Dr.

Larry Mays.[9] Dr. Mays is both a professional hydrologist and professional engineer. Dr. Mays' testimony corroborated the representative plaintiffs' accounts of the additional flooding they are experiencing beyond what would have been expected to happen on their properties without the MRRP.

Dr. Mays was tasked with investigating whether flooding on the three representative plaintiffs' properties from 2015 through 2018 is consistent with the changed flooding pattern demonstrated from 2007 through 2014 and is attributable to the MRRP, and whether there is a heightened risk of flooding at the representative properties due to the MRRP. Tr. 820:11-18. Before conducting an analysis of the post-2014 flooding, Dr. Mays examined the flooding that occurred from 2007 through 2014, and the court's findings regarding MRRP causation from the Phase I opinion. Tr. 820:20-821:1. Dr. Mays opined based on the court's findings that "[o]ne would logically expect that, unless and until the river changes [caused by the MRRP] are deconstructed and the" environmental priorities under the MRRP shifted, "any altered flooding pattern caused by the MRRP changes would continue." Tr. 836:12-17. In other words, because the MRRP

[9] Dr. Mays is a registered professional hydrologist, a registered professional engineer in California, Arizona, and Texas, and is recognized as a leading authority on hydrology. Tr. 813:1-5; PX3443 (Mays CV). Dr. Mays' extensive academic and professional experience spans 43 years, and he is currently a Professor Emeritus at Arizona State University, School of Sustainable Engineering and the Built Environment. Tr. 813:6-15. He is the author, co-author, or editor-in-chief of 24 books. Tr. 814:15-25. Dr. Mays has also consulted with many different government agencies and industries regarding flood control systems, which include the U.S. Army Corps of Engineers Waterways Experiment Station, the State of Texas Attorney General's Office, and the American Water Works Association. Tr. 815:7-21. In recognition of his contributions to the field of hydrology, he has received numerous high honors and distinctions in the profession. Tr. 818:16-819:22.

changes are still in place, the flooding pattern recognized by the court in Phase I should continue to persist. *See* Tr. 897:17-898:11 ("There has been no effort to deconstruct physical channel changes or reinstitute a flood control first priority for require operations, so a hydrologist would expect that new flooding pattern to persist."). In this connection, the court notes that the government admits that the MRRP is ongoing and has remained a viable and active program at all times since 2014. Tr. 33:12-15 (admissions that the MRRP "has continued and remained a viable and active program at all times since 2014"); *see also* Tr. 1400:11-13, 1402:16-17 (Remus); Tr. 1494:14-1495:14 (Pridal); Tr. 1538:9-11 (Shumate).

To determine whether the more severe flooding recognized by the court in the Phase I opinion for the representative properties persists, Dr. Mays conducted three quantitative studies and one qualitative study. Tr. 849:17-23; Tr. 891:16-892:1. First, Dr. Mays analyzed the recorded annual peak discharges and corresponding gage heights available at United States Geological Survey ("USGS") gaging stations near each of the representative properties. Tr. 850:12-22. This analysis allowed Dr. Mays to "illustrate the patterns of flooding for each of the bellwether properties before and after the MRRP, and demonstrate[] that the increased flooding of the properties is a continuance of the newer post-MRRP flooding pattern." *Id.*; *see* PX3413, PX3415, PX3419 (tables ranking peak discharges and noting approximate return periods). Dr. Mays explained that the available data would not allow him to measure the duration or depth of increased flooding attributable to the MRRP. Tr. 851:3-11; Tr. 979:17-23. However, he explained

that the data provides "highly useful information regarding flooding patterns." Tr. 851:10-11.

Specifically, Dr. Mays' examined the peak discharges at the USGS gages near the representative plaintiffs' properties from 1980 through 2018. *See* Tr. 851:16-25. Peak discharges "are the largest discharge that occurred in each of those respective years." Tr. 852:6-8. Dr. Mays then sorted these peak discharges by magnitude. Tr. 851:24-25. Dr. Mays noted whether each representative property experienced flooding in that year and determined that, starting in 2007, every representative property started flooding during years with peak flows at lower levels, where the properties had not historically flooded. *See* Tr. 853:7-21. A review of this data led Dr. Mays to conclude that the pattern of flooding in 2015 to 2018 is consistent with the post-MRRP flooding pattern after 2007. Tr. 864:18-865:10 (summarizing conclusion for all properties).

Second, Dr. Mays conducted a frequency analysis to determine "ranges of return periods for . . . USGS peak discharges" at the USGS gages closest to the three representative properties. Tr. 867:5-19. Return periods represent "how frequently a given flow is expected to occur or return at a particular location." Tr. 866:19-22. For example, Dr. Mays took the smallest peak discharges that resulted in flooding at the Ideker property. Using USGS peak discharge data from 1970 to 2018,[10] Tr. 868:19-21,

[10] Dr. Mays examined the flows post-1970 to reflect the completion of the Mainstem System and BSNP. Dr. Mays also considered other year ranges to determine any potential impact in wet or dry cycles and concluded that his results for return periods were not unduly influenced by wet or dry cycles. Tr. 3019:18-3020:10.

Dr. Mays then calculated a return period of 1.5 years for discharges with this smallest peak discharge range for the Ideker property. Tr. 870:16-22. In other words, discharges within this range can be expected to occur every 1.5 years on the Ideker property. Tr. 870:23-871:1. Conducting this analysis for all properties, based on the dataset of peak flows from 1970 to 2018, Dr. Mays determined that the return period for flooding tied to the Corps' MRRP actions at the Ideker, Buffalo Hollow, and Adkins representative tracts were 1.5, 2.0, and 1.5 years, respectively. Tr. 871:11-12 (Ideker); Tr. 873:6-11 (Buffalo Hollow); Tr. 874:20-25 (Adkins).

After a review of the peak discharge data, Dr. Mays concluded that "while the bellwether properties used to flood relatively infrequently," the "frequency of flooding has dramatically changed." Tr. 876:6-15. Now, "the MRRP-related flooding pattern that started in 2007 causes flooding to occur significantly more frequently on the bellwether properties compared to the pre-MRRP time period." Tr. 877:2-7. In support of his opinion, Dr. Mays noted that a 2003 Corps Flow Frequency Study,[11] *see* DX1097, DX1202 (appendices to the Flow Frequency Study), "obtain[ed] largely the same results," and that the 2003 Study "does not materially change" his conclusions. Tr. 877:16-22.

Third, Dr. Mays conducted a hydrologic risk analysis building off of his frequency analysis. Dr. Mays' hydrologic risk analysis was conducted to determine the likelihood

[11] This study updated the flow and stage frequency for the Missouri River from Gavins Point Dam to the mouth at St. Louis. The study was a continuation of previous Corps efforts to update flood risk within the basin. Tr. 1448:2-7 (Pridal).

that, given a particular return period, a flood will occur in any given year using a mathematical equation. Tr. 884:20-885:7; Tr. 886:2-20. Based on the frequency analysis, Dr. Mays reiterated that probabilities of flooding reflect that, in the post-MRRP flooding pattern, the "[b]ellwether properties cannot expect to go for even two years without flooding, a marked departure from pre-MRRP flooding pattern." Tr. 891:6-11. Applying those return periods, Dr. Mays opined that for the Adkins and Ideker properties, there was a 90 percent chance those properties would flood every two years, and a 75 percent chance the Buffalo Hollow property would flood every two years. Tr. 889:11-14 (Ideker); Tr. 890:6-9 (Buffalo Hollow); Tr. 890:20-23 (Adkins).

Finally, Dr. Mays conducted a qualitative risk analysis using a "generic risk matrix." Tr. 892:12-13. Dr. Mays opined that the representative properties were experiencing "tolerable" risk pre-MRRP but "intolerable" risk post-MRRP because of the frequent and more extensive flooding on the properties. Tr. 895:5-8.

The court finds that Dr. Mays' analyses described above all confirm the representative plaintiffs' account of increased flooding post-2014 attributable to the MRRP and establish that there has been a changed pattern of increased flooding following the Corps' implementation of the MRRP, as compared to the period of time before the implementation of the MRRP but after the completion of the Mainstem System and BSNP. Based on the plaintiffs' and Dr. Mays' opinion testimony, the court finds that the government, in implementing the MRRP, has increased the frequency of flooding on plaintiffs' representative tracts as compared to the pre-MRRP period.

4. The Government's Evidence Does Not Undermine, and at Times Supports, Plaintiffs' and Dr. Mays' Testimony

For the reasons that follow, the court finds that the government's evidence challenging Dr. Mays' conclusions does not undermine the court's finding that the MRRP has permanently increased the frequency of flooding from what plaintiffs would have experienced without the MRRP and that this increased flooding reflects a new and ongoing pattern of flooding attributable to the MRRP at the representative properties.

First, the court rejects the government's argument that to establish causation for post-2014 and continued flooding, Dr. Mays was bound to rely on the same analysis the plaintiffs used in Phase I, specifically, Dr. Christensen's data and opinions regarding changed WSEs. *See* Def.'s Br. at 65 ("Thus, to properly evaluate any 'consistency' with the incremental flooding caused by the Corps' actions from 2007 through 2014, Dr. Mays would have to have evaluated for 2015-2018 the same factors that experts evaluated in Phase I . . . ."); *id.* at 139 (arguing that plaintiffs "have not adduced competent evidence that could show that the United States caused flooding experienced in those years under the standard the Court laid out in Phase I"). Based on Dr. Christensen's modeling analysis, the court in Phase I had already determined that the MRRP resulted in increased and more severe flooding from 2007 to 2014 for these representative plaintiffs. The representative plaintiffs were not required to repeat this analysis in Phase II to prove that the MRRP caused increased and more severe flooding post-2014. Dr. Mays' testimony persuasively builds off Dr. Christensen's analysis and the court's related findings in Phase I. Dr. Mays explained that his opinion builds off of the court's findings in Phase I

by examining whether there is a continued, changed flooding pattern based on those findings. Tr. 819:25-823:18. As described above, he did this by demonstrating that flooding was occurring on plaintiffs' representative properties at lower peak discharges than previously associated with flooding on those properties pre-MRRP. Tr. 820:20-821:8. Having incorporated the court's findings from Phase I into his analysis, the court disagrees with the government that Dr. Mays' analysis did not properly evaluate the consistency of flooding from 2014 through 2018.

Second, the testimony of the government's experts Dr. Robert Holmes, Mr. Jonathan Jones, and Dr. Andrew Earles do not persuasively show that the MRRP has not caused a new and ongoing pattern of increased flooding. *See* Def.'s Br. at 49-63 (Holmes and Jones), 68-72 (Earles). The government first presented testimony from Dr. Holmes,[12] who modeled daily WSEs at the representative tracts between 1950 and 2018. Tr. 1592:13-1593:2. Dr. Holmes used an interpolation method similar to that used by Dr. Christensen in Phase I. Tr. 1592:13-1593:2 ("In assigning this task, [the] Department of Justice asked me to use the interpolation model, similar to the approach used by Dr. Christensen in Phase I . . . so I built an interpolation model similar to Dr. Christensen's but not exactly like Dr. Christensen's to provide a consistent methodology for estimates

[12] Dr. Holmes has spent his entire 33-year career with USGS, concentrating his efforts on the study of river hydrodynamics. Tr. 1583:3-7. Dr. Holmes currently serves as the Chief of the Branch of Hydrodynamics for the USGS. Tr. 1584:4-6. He previously served as the agency's National Flood Hazard Coordinator. Tr. 1584:16-17. Dr. Holmes earned a B.S. and M.S. from the University of Missouri-Rolla (now the Missouri University of Science and Technology, where he is on faculty) and a Ph.D. from the University of Illinois. Tr. 1586:14-22, 1587:25-1588:6; Tr. 1588:22-1589:4.

for that entire time period."); Tr. 1594:2-6 ("Although I was asked by DOJ to use an interpolation method similar to Christensen in Phase I, I did not use the exact manner or relationship that Dr. Christensen did. But, rather, I built my model from the ground up."); Tr. 1688:6-1690:11 (comparing Dr. Holmes' interpolation model with Dr. Christensen's interpolation model).[13]

Dr. Holmes modeled WSEs at the representative properties using historic daily WSEs at USGS gages, historic daily discharges at those gages, and water surface profiles from the Corps' 2003 Flow Frequency Study. Tr. 1594:7-24. A water surface profile is a measure of how WSEs change along a reach of river. Tr. 1595:2-4.

To measure WSEs at a point at the representative properties, Dr. Holmes interpolated between gages upstream and downstream of the properties using a "proration scheme." Tr. 1631:7-13; *see also* Tr. 1647:22-1654:9 (describing methodology behind "proration scheme"). This proration interpolation model was built using water surface profile data from the Corps' 2003 Flow Frequency Study. Tr. 1648:1-9. That 2003 Study in turn used bathymetric and terrain data from 1994 to 1999. *See* Tr. 1721:24-1722:10; PX3702 (excerpt of Phase I government witness expert rebuttal report stating

[13] The results of Dr. Holmes' analysis produced similar results to Dr. Christensen's analysis in Phase I. Tr. 1689:2-6. Dr. Holmes confirmed that the approach taken by Dr. Christensen to model the WSEs at the representative tracts in Phase I was sound. Tr. 1700:4-8 ("The interpolation model has its warts, it has periods of underprediction and overprediction, but, you know, I can't guarantee that I would do a lot better with the HEC-RAS model."); Tr. 1700:12-17 ("I find that the interpolation model used in this analysis provides overall reasonable estimates of daily water surface elevations at the representative Plaintiff properties from 1950 to 2018."). Dr. Christensen, however, did not have later Corps studies and thus explained that his modeling of WSEs at the representative properties was an underestimate. *See* Tr. 2252:23-2253:13 (discussing Phase I Tr. 4769:4-10).

that the Corps' profiles are "based on bathymetric and terrain data from 1994 to 1999 and calibrated to historical data from 2003 and earlier"). Using the 2003 Study, Dr. Holmes "back calculated what would be the proration value that would allow [him] to match" the Corps' data. Tr. 1648:18-24. Dr. Holmes also used historic water surface profile data from the Corps' records regarding historic floods to "back compute[] what the proration value of [the] model would have to be" to simulate the flood elevation at the plaintiffs' properties for these historic floods. Tr. 1650:19-1652:7. Dr. Holmes then used this proration model and the WSEs at the upstream and downstream bounding gages to compute the WSEs on the plaintiffs' properties on a given day. Tr. 1664:6-1666:9.

Dr. Holmes also conducted assessments of how his model performed at other stream gages on the River near the plaintiffs' representative properties to compare the model estimates against the real world observed data at those gages. Tr. 1674:21-1681:2; *see* DX6065, DX6066, DX6067 (plotting differences between modeled and actual data). At the Brownville gage closest to the Ideker property, for example, Dr. Holmes opined that the average difference between his model and the actual data at the Brownville gage was 0.9 feet, meaning that, on average, the model is underestimating the elevation by 0.9 feet. Tr. 1680:17-1681:9. Although acknowledging that the model was not perfect, based on his assessments of the model, Dr. Holmes opined that the model "provides overall reasonable estimates of daily water surface elevations at the representative Plaintiff properties from 1950 to 2018." Tr. 1700:12-17.

Using Dr. Holmes' WSEs and other data, Mr. Jones[14] was then tasked with determining whether the "high-water events that occurred at the representative properties from 2004 to 2018 were of comparable frequency, magnitude and duration to events experienced historically." Tr. 1838:17-21. To analyze frequency, Mr. Jones compared Dr. Holmes' modeled WSEs against key threshold elevations on the representative tracts, such as the top of the bank and the drain outlets on the properties. Tr. 1843:22-1845:4. With this comparison, Mr. Jones determined the number of days that the modeled WSEs exceeded the key threshold elevations from 1950 to 2018 on the representative tracts. Tr. 1849:23-1850:5, 1853:11-17 (Adkins); Tr. 1863:20-1864:12 (Ideker); Tr. 1866:24-1867:16 (Buffalo Hollow). Mr. Jones concluded that "before 2004, clusters of high-water events occurred during 15-year periods at every representative property . . . that were similar to the number of events experienced during the 2004 to 2018 period." Tr. 1872:11-17.

To analyze duration and magnitude, Mr. Jones used the same data to "rank all years between 1967 and 2018, in terms of the duration of time that each threshold elevation was exceeded in each year." Tr. 1909:17-1910:19. Mr. Jones also calculated "the percentage of days that each threshold elevation was exceeded for 1983 to [19]97,

[14] Mr. Jones is the CEO of Wright Water Engineers. DX4840-A (Jones CV). Mr. Jones holds B.S. and M.E. degrees from the University of Virginia. *Id.* He is a registered professional engineer in nineteen states. *Id.* He is also a registered professional hydrologist with the American Institute of Hydrology and a diplomate of water resources engineering with the American Academy of Water Resources Engineers. *Id.*

2004 to [20]18, and then 1967 to 2018."[15] *Id.* Mr. Jones concluded that the "1983 to [19]97 period saw high-water events of comparable magnitude and durations to the high-water events that occurred from 2014 to [20]18 at each representative property." Tr. 1927:12-17. In other words, according to Mr. Jones, "[n]o overarching trend has been identified at any of the representative properties for critical elevations that show one period to have consistently higher duration events than the other." Tr. 1927:18-22.

Based on Dr. Holmes' and Mr. Jones' analyses, the government argues that "high water events of similar frequency, duration, and magnitude" to the post-MRRP flooding "occurred at the representative properties between 1967 and 2004." Def.'s Br. at 49. For the following reasons, the court disagrees.

To begin, the court notes that neither Dr. Holmes nor Mr. Jones evaluated or tied their analyses to any actual flooding at the plaintiffs' representative properties. Dr. Holmes stated that his modeling was not for the purpose of predicting or determining when flooding occurred on the representative properties. Tr. 1766:22-1768:5. Mr. Jones also did not do any analysis to determine instances of actual flooding at the representative properties and testified that he was not offering any opinions on whether actual flooding occurred at any of the representative properties. Tr. 2007:20-2008:9; Tr. 2010:22-25; Tr. 2061:15-16; Tr. 3013:23-25 (Dr. Mays' rebuttal testimony noting that Mr. Jones' analysis

[15] Mr. Jones also compared "annual stage hydrographs for the relevant post-2004 years" against "historical stage hydrographs qualitatively," Tr. 1910:14-19, and found general "comparability," Tr. 1927:5-10, of WSE trends on plaintiffs' properties during select high water years pre- and post-MRRP.

"completely ignores the bellwether Plaintiffs' testimony about when they are actually flooding").

In addition, Dr. Holmes' modeled WSEs – relied on by Mr. Jones – were based on pre-MRRP data, even though more recent data was available. As noted above, to create his modeled WSEs, Dr. Holmes relied on water surface profiles sourced from the Corps' 2003 Flow Frequency Study, which Dr. Holmes stated are "the primary way that a model reflects channel geometry and morphology at localized spots within a river reach." Tr. 1705:25-1706:9. That 2003 Study used data from 1994 to 1999 to create water surface profiles. Tr. 1720:19-1722:23; *see also* 1714:2-1715:11 (use of data for Adkins); 1715:12-23 (use of data for Ideker); 1715:24-1716:13 (use of data for Buffalo Hollow). Because the Corps' actions on the MRRP began after 2004, the data from the 2003 Flow Frequency Study does not reflect any changes resulting from the implementation of the MRRP and does not paint an accurate picture of how the River has changed since then or how the MRRP has affected flooding at the representative properties.[16]

Moreover, Dr. Holmes' model relied on the 2003 Study data despite the fact that the Corps had prepared updated post-2004 water surface profiles that could have yielded

[16] The court notes that in Phase I, Dr. Christensen relied on the Corps' 2003 Flow Frequency Study to support his analysis of WSEs. Dr. Christensen, however, testified that he was underestimating flooding at individual properties precisely because he did not have more recent data on the River changes post-MRRP. *See* Tr. 1719:24-1721:11; *see also* Tr. 2552:23-2253:13 (discussing Phase I Tr. 4769:4-10). In Phase I, the court found that Dr. Christensen provided reliable estimates for purposes of the causation analysis, but explained that this model was conservative. *Ideker I*, 136 Fed. Cl. at 696 (noting that Dr. Christensen's "interpolation of water surface levels was probably conservative because it would not reflect higher WSEs at a particular property"). In other words, Dr. Christensen's interpolation model provided reliable minimum estimates of the effect of the MRRP.

a more accurate analysis. *See* PX3718 (comparing 2003 Study with later studies); PX3716 (Corps' updated May 2015 HEC-RAS Report, Appendix D). In Phase I, the government's expert Mr. Mark Woodbury opined in his rebuttal report that use of this more recent data would have produced more accurate results. *See* PX3702 (excerpts from Phase I Woodbury rebuttal report, noting "updated models" that "were built using bathymetry data from after the 2011 flood to best represent current state of the channel bed"); Tr. 1722:2-23. But Dr. Holmes testified that he was not given access to any of the updated hydraulic modeling that incorporates the modifications to the River channel made pursuant to the MRRP. Tr. 1722:2-23.

Dr. Mays persuasively explained that, by relying on the 2003 Study data in his proration scheme, Dr. Holmes' model predictably underestimated the WSEs in the post-MRRP world because it did not incorporate post-MRRP changes to the geometry and roughness of the river. Tr. 2992:12-2993:12. To show the model's tendency to underpredict, Dr. Mays separated out and analyzed how Dr. Holmes' model performed only during days where the representative properties experienced MRRP flooding. Tr. 2994:14-3000:15. Dr. Mays found that, of 50 data points at the Brownville gage, nearby Ideker, 49 showed under-predictions with an average under-prediction of almost two feet. Tr. 2997:9-11; *see also* PX3496 (plotting differences between modeled and observed WSEs for the range of MRRP flooding).

At the Oregon gage, which is across the River from Buffalo Hollow, Dr. Mays compared Dr. Holmes' modeled WSEs at Buffalo Hollow with actual recorded WSEs at the Oregon gage for the three years where data was available (2009, 2010, and part of

2011). Dr. Mays opined that Dr. Holmes' model "is consistently off by over three feet during high flow conditions." Tr. 3001:18-3002:3. Dr. Mays further testified that the mile distance between the Oregon gage and the Buffalo Hollow property would not explain this discrepancy. Tr. 3004:17-3005:2. These differences measured in feet between Dr. Holmes' model and the actual recorded data are troubling, where plaintiffs in Phase I testified that inches of water can be the difference between flooding and no flooding, for example, by blocking drainage pipes into the River. *See* PX3710 at 2873 (Mar. 2017 Phase I Tr.); PX3711 at 4164 (Apr. 2017 Phase I Tr.). Dr. Holmes did not disagree with this testimony. Tr. 1765:14-1766:11.

In addition, Dr. Holmes acknowledged that the gages he examined are not capable of picking up specific WSE changes associated with MRRP projects nearest to the plaintiffs' representative tracts. Tr. 1629:3-10 ("[W]hile the streamgages – or a streamgage may not sense the exact effect from a MRRP project miles downstream near a bellwether property, it does sense those MRRP projects nearest to the gage."). For reference, the Adkins tract is five miles downstream from the nearest gage, the Ideker tract is 10 miles downstream from the nearest gage, and the Buffalo Hollow tract is 20 miles downstream from the nearest gage. Tr. 846:3-8 (Mays, on Adkins); Tr. 841:10-16 (Mays, on Ideker); Tr. 843:24-844:1 (Mays, on Buffalo Hollow). And each tract is near multiple BSNP structures, MRRP sites, and dike notches that can impact flooding. *See* Tr. 847:2-11 (Mays, on Adkins); Tr. 842:16-20 (Mays, on Ideker); Tr. 845:9-23 (Mays, on Buffalo Hollow). While Dr. Holmes believed that the model's failure to pick up increases at the representative properties would be made up for by the gages picking up

different WSE increases from MRRP projects closer to the upstream and downstream gages, he did no study of how much WSE increases result from different MRRP projects or types of projects, nor did he study where MRRP projects are relative to the gages. Tr. 1751:10-1752:5. Dr. Mays persuasively testified in Phase II, and the court accepted Dr. Christensen's testimony in Phase I, that, for this reason, an interpolation model like Dr. Holmes' would likely underpredict WSEs at the representative tracts. Tr. 2983:1-10; *Ideker I*, 136 Fed. Cl. at 696 (citing Dr. Christensen's explanation that "his interpolation of water surface levels was probably conservative" because none of the MRRP projects are located at a specific gage location).

Because Mr. Jones relied on Dr. Holmes' analysis, which likely underpredicted WSEs at the representative properties, the court further finds that Mr. Jones' opinions are unpersuasive. For these reasons, the court finds that Mr. Jones' and Dr. Holmes' analyses do not call into question the court's findings based on the plaintiffs' testimony and Dr. Mays' opinion testimony.

The court also finds the opinions of Dr. Andrew Earles,[17] the government expert who challenged Dr. Mays' opinions, to be unpersuasive. Dr. Earles was tasked with providing a rebuttal to Dr. Mays' expert opinions. Tr. 2171:4-6. Dr. Earles did not perform his own frequency study. Tr. 2270:2-5.

[17] Dr. Earles is the vice-president of water resources for Wright Water Engineers. Tr. 2172:21-24. Dr. Earles holds a Bachelor's degree in civil engineering from Stanford University and Master's and Ph.D. degrees in civil and environmental engineering from the University of Virginia. Tr. 2172:11-15.

Dr. Earles focused much of his criticism of Dr. Mays' opinion regarding flow frequency on the ground that Dr. Mays had failed to follow all aspects of a USGS publication known as Bulletin 17C to develop his flood flow frequency curves and calculate his recurrence intervals. *See* Tr. 2199:1-4 (testifying that Dr. Mays "did not conduct any of the necessary procedures" for his analysis). Bulletin 17C "provides the standard guidelines for conducting flow frequency analysis in the United States." Tr. 2196:17-19. Dr. Earles opined that Dr. Mays' analysis "incorrectly applied Bulletin 17C methods to regulated data without making any adjustments," and that, as a result, Dr. Mays' calculations were unreliable. Tr. 2207:6-9.

On cross-examination, Dr. Earles admitted, however, that Bulletin 17C expressly states there is no national guidance on how to develop flood frequency curves for regulated rivers. Tr. 2324:24-2325:4; *see also* PX3749 at 35-36 (USGS Bulletin 17C). There is no dispute that the Missouri River is a regulated river. Tr. 2322:12-2324:21. Dr. Mays opined that Bulletin 17C need not be used to calculate reliable recurrence intervals and merely provides guidelines. Tr. 3015:20-3016:13.

Dr. Earles also challenged Dr. Mays' analysis because he did not follow the steps for developing flow frequency relationships used in the Corps' 2003 Study. Tr. 2218:12-2221:12. In its study, the Corps developed regulated and unregulated flow relationships to quantify the value of flood protection that the Mainstem System provides as well as to incorporate both regulated and unregulated historical data in its analysis. Tr. 2220:16-25. However, Dr. Mays opined that it was unnecessary to take these steps in this case, and that to do so would only add uncertainty to his analysis, which included exclusively

regulated river data. Tr. 3018:11-3019:12. Dr. Mays also noted that the Corps itself does not always rely on such regulated and unregulated flow relationships when it is analyzing exclusively regulated data. Tr. 3017:7-3018:7.

Dr. Earles also criticized Dr. Mays' recurrence intervals because they differed from the recurrence intervals outlined in the Corps' 2003 Study. Tr. 2238:5-2242:2. However, the Corps' 2003 Study used data from 1897 to 1997, while Dr. Mays used data from 1970 to 2018. Tr. 2291:25-2292:3. Dr. Earles stated that he had no knowledge of the effect of the use of the different datasets on the recurrence interval calculation. Tr. 2295:18-24 ("I have not had an opportunity to do a comparison of a dataset properly analyzed from 1970 to 2019 with the flow frequency study."); Tr. 2296:19-23 (Dr. Earles agreeing that he had "not done any analysis to see what the effect is on recurrence interval calculation if one includes water years subsequent to . . . 2011").

Dr. Earles further criticized Dr. Mays for using outdated and inappropriate "regional skew data" in his analysis, which produced a "less accurate fit of the data." Tr. 2213:12-20; Tr. 2218:5-10. But, again, Dr. Earles did not conduct his own flood frequency study and did not opine what the effect of using this outdated data would be. Dr. Mays persuasively concluded that, even if any of Dr. Earles' proposed extra steps were added to his methodology, it is impossible that the effect would have been sufficiently material to alter his conclusions about a changed flooding pattern along the River due to the MRRP. Tr. 3020:16-3021:9 (Dr. Mays stating that "[n]one of Dr. Earles' criticisms affect my confidence in my conclusions" and observing that Dr. Earles

did not "offer any analysis to quantify how my thresholds would have been affected had I incorporated into my analysis any of the changes he opined I should have made").

Dr. Earles also criticized Dr. Mays for not aligning his analysis with the representative plaintiffs' testimony regarding flooding. However, the only example Dr. Earles offered was Mr. Adkins' testimony regarding whether flooding occurred in 1995 or 1996. Tr. 2253:25-2254:17; *see also* Tr. 2304:14-2312:19 (discussing Dr. Mays' testimony regarding flooding on the Adkins property and affirming that the Adkins testimony is the only example of "improper reliance" on plaintiffs' testimony regarding historical flooding included). Dr. Mays addressed and corrected this issue in his opening testimony. *See* Tr. 2304:14-2312:19 (cross examination of Dr. Earles discussing Dr. Mays' opening testimony).

Finally, Dr. Earles criticized Dr. Mays' "calculations about the changes in flooding patterns and future flooding" for using small sample sizes and for failing to account for "wet and dry cycles in the Missouri Basin." Tr. 2258:5-10. However, Dr. Mays credibly testified that he performed separate analyses on multiple different time frames and was thus "able to test whether I was getting unreliable results that were unduly influenced by a wet or dry cycle or some other time-limited phenomenon." Tr. 3019:15-3020:14.

The court therefore finds that Dr. Earles' criticisms of Dr. Mays do not undermine Dr. Mays' opinions. The court agrees that Dr. Mays was not bound to follow all of the steps in Bulletin 17C or those taken by the Corps in the 2003 Study and, while offering criticisms of Dr. Mays' calculations, the court notes that Dr. Earles did not provide his

own flow frequency study and could not say whether his criticisms would have had a material effect on Dr. Mays' conclusions. Dr. Mays also provided reasoned responses to Dr. Earles' criticisms. The court finds Dr. Mays' opinions more persuasive.

Finally, the government's own hydrology expert Dr. Jeffery Bradley, an expert identified for trial but never called,[18] stated in his deposition testimony that flooding events have become more common and of longer duration in the post-MRRP timeframe, as the representative plaintiffs claim. *See* PX3740 at 78-83 (excerpt from June 19, 2020 Bradley Depo.); Tr. 2078:8-2084:7 (reading excerpts of Bradley deposition testimony into the record). Although Dr. Bradley characterized the increased recurrence intervals as "minor," Dr. Bradley's testimony is nonetheless consistent with Dr. Mays' opinions. PX3740 at 80. Dr. Bradley also opined that Dr. Holmes' use of outdated water surface profiles was not best practice, consistent with Dr. Mays' criticisms of Dr. Holmes and Mr. Jones. PX3738 at 30-34 (excerpt from June 19, 2020 Bradley Depo.); PX3739 at 36 (excerpt from June 19, 2020 Bradley Depo.).

Having found that the government's evidence challenging the representative plaintiffs' lay testimony and expert evidence of increased flooding post-2014 is not persuasive (and even, at times, supports plaintiffs' claims), the court concludes that the plaintiffs have met their burden of demonstrating that the MRRP has caused increased

[18] Although the government did not present Dr. Bradley as a trial witness, the court acknowledges that Dr. Bradley's deposition testimony constitutes an admission against the government and is admissible as such. *See* Tr. 2491:7-2492:13.

flooding for the years at issue in both Phase I and Phase II and has caused a changed pattern of increased flooding on the plaintiffs' representative properties.

II. Liability for a Permanent Flowage Easement Under the Remaining *Arkansas Game & Fish* Factors

Against the backdrop of the above findings on causation, the court now turns to whether the flooding described above satisfies the criteria for establishing a taking of a flowage easement under *Arkansas Game & Fish.* In that case, the Supreme Court identified the following factors that the court must consider in determining whether government action that causes intermittent flooding amounts to the taking of a flowage easement: severity, duration, intent or foreseeability, character of the land, and reasonable investment-backed expectations. *See Ark. Game & Fish*, 568 U.S. at 38-39; *see also Ridge Line*, 346 F.3d at 1355-56 (considering intent or foreseeability and "the nature and magnitude of the government action"). Although these factors are related, the court will examine them separately to determine whether the representative plaintiffs have established each.[19]

A. Severity

One factor that the court must consider in the liability determination under *Arkansas Game & Fish* is the "[s]everity of the interference." 568 U.S. at 39. This factor requires the court to assess whether the intermittent flooding at issue was "substantial" enough to rise to the level of a taking. *Ridge Line*, 346 F.3d at 1355. In doing so, the

[19] Although the government in closing argument suggested that plaintiffs need not establish each factor in order to show a taking occurred, Tr. 3452:18-3453:20, the court finds that the requisite showing for all six factors has been met and therefore does not reach that issue.

court must determine whether "after the [government action] began the flooding lasted for significantly longer periods of time and had much more serious consequences than the flooding" during the period before the government action. *Ark. Game & Fish v. United States*, 736 F.3d 1364, 1374 (Fed. Cir. 2013). In other words, the court must determine whether or not "the asserted intrusion was within a range that the property owner could have reasonably expected to experience in the natural course of things." *Id.* at 1375. Although "it may often be difficult to say, in the abstract, whether a particular intrusion is severe or only incremental in nature" the "consideration of the effects of the intrusion on the property owner will often make that distinction easier to draw." *Id.*

While the government acknowledges that the court found that flooding on the three representative properties caused by the MRRP was "severe," the government contends that "the severity of any additional incremental flooding" caused by the MRRP is "relatively small," and thus does not meet the "severity" prong of the *Arkansas Game & Fish* test. Def.'s Br. at 148. The court disagrees. Based on the testimony of the representative plaintiffs and Dr. Mays, the court concluded above that the Corps' ongoing implementation of the MRRP has caused a new pattern of increased flooding on the representative properties beginning in 2007. The court further finds that the Corps' actions have resulted in more severe flooding than plaintiffs experienced pre-MRRP. Following implementation of the MRRP, the return periods associated with flooding are now likely to occur every 2 years. Tr. 889:11-14 (Mays, on Ideker); Tr. 890:6-9 (Mays, on Buffalo Hollow); Tr. 890:20-23 (Mays, on Adkins); Tr. 891:6-9 ("The probabilities of flooding reflect that, in the new flooding pattern, the bellwether properties cannot expect

to go for even two years without flooding."). Moreover, the plaintiffs' testimony established that flooding on the plaintiffs' representative tracts is far more frequent and damaging than they had experienced before implementation of the MRRP*, see supra* Part I.B & I.C, and is outside the "range that [the representative plaintiffs] could have reasonably expected to experience," *Ark. Game & Fish*, 736 F.3d at 1375.

In addition, as discussed in more detail below, the post-MRRP flooding has had considerable effects on the plaintiffs' crop yields. *See infra* Part II.E. This is a "serious consequence[]" of the MRRP flooding, further evidencing that the flooding was "severe." *Ark. Game & Fish*, 736 F.3d at 1374. The court therefore concludes that the plaintiffs have met their burden of establishing that the increased and repeated flooding attributable to the MRRP is sufficiently severe for each representative plaintiff to demonstrate the *Arkansas Game & Fish* severity factor.

B. Duration

The time and duration of the government invasion is also an important consideration in takings cases based on intermittent flooding. *See Ark. Game & Fish*, 568 U.S. at 38-39. This factor is often relevant in the context of a temporary taking, as was the case in *Arkansas Game & Fish.* In this case, however, both parties agree that if the court finds that a taking occurred, that taking is permanent. Def.'s Br. at 158; Pls.' Br. at 119-20. This court has previously held that where the government action that causes intermittent flooding will continue into "the foreseeable future," the time and duration factor is not measured by the length of time that water inundates the plaintiffs' properties, but by the government's "permanent right to inundate the property." *In re*

Upstream Addicks and Barker (Texas) Flood-Control Reservoirs, 146 Fed. Cl. 219, 250 (2019). In other words, the permanent nature of the intermittent flooding means that the duration factor "weighs in favor of plaintiffs." *Id.* Nevertheless, in this case, the court will consider both the duration of the more severe flooding attributable to the MRRP each year, as well as the permanent nature of the MRRP itself.

As discussed above, the court heard undisputed testimony from the plaintiffs that the flooding attributable to the MRRP lasted of sufficient duration, each year, to impact their farming operations. *See supra* Part I.B & I.C. In addition, as discussed in more detail below, the increased flooding attributable to the MRRP caused the representative plaintiffs to lose crops that they would not have otherwise lost absent the incremental effects of the MRRP. *See infra* Part II.E. The court thus concludes that the flooding each year was of a duration substantial enough for the duration factor to weigh in plaintiffs' favor.

Moreover, these significant invasions of increased flooding are not temporary or isolated events. The representative plaintiffs have shown that more severe flooding will often recur for the foreseeable future. The government concedes that the MRRP is ongoing. *See, e.g.*, Tr. 34:7-16 (admitting that the government has not removed or closed any of the chutes constructed and/or opened in conjunction with the MRRP since 2014); Tr. 1400:11-13, 1402:16-17 (Remus, confirming that the MRRP "still exists"); *see also* Pls.' Br. at 55-56. The plaintiffs can now anticipate that they will experience more frequent flooding periods from increased WSEs than they would have experienced without the MRRP. *See infra* Part I.C. The permanent nature of the increased flooding

also indicates that the duration factor weighs in favor of finding a taking. *See In re Upstream Addicks and Barker*, 146 Fed. Cl. at 250.

C. Intent and Foreseeability

Arkansas Game & Fish also requires the court to evaluate "the degree to which the invasion is intended or is the foreseeable result of authorized government action." 568 U.S. at 39. An action is foreseeable if "the government should have predicted or foreseen the resulting injury." *Moden v. United States*, 404 F.3d 1335, 1343 (Fed. Cir. 2005). An injury "may not be foreseeable if an intervening cause breaks the chain of causation." *Id.* at 1344.

In Phase I, the court determined that the increased flooding on plaintiffs' properties was the foreseeable result of the System and River Changes made under the MRRP. *Ideker I*, 136 Fed. Cl. at 761-62 (listing plaintiffs that have "established causation, foreseeability and severity"); *id.* at 705 ("The rising WSEs described by Dr. Hromadka and Dr. Christensen are the result of known processes that change the hydrology and hydraulics of a river. When the Corps took combined actions to make the River shallower and slower, rising WSEs were a natural, direct, and probable consequence of the Corps' actions."); *see also id.* at 729-30 (Adkins), 747-49 (Ideker), 757-58 (Buffalo Hollow), 690 (finding that Dr. Christensen's testimony was sufficient to show foreseeability), 696-97 (concluding that, in light of Dr. Christensen's and Dr. Hromadka's testimonies, the System and River Changes have "caused WSEs to rise higher than they would have risen without these Changes and that this rise in WSEs has led to more flooding or more severe or longer flooding than would have occurred had

these Changes not been made by the Corps"). Dr. Mays' testimony regarding the predictable increase in flooding because of the MRRP confirms the court's Phase I finding. Tr. 835:12-21 (testifying that it "makes perfect sense from a hydrological perspective" that higher WSEs are the "predictable result" of the MRRP); Tr. 833:1-7 (testifying that "[t]he evidence has established that the river changes by the Corps . . . have had the effect of raising Missouri River's water surface elevations in periods of high flows"); Tr. 833:8-834:4 (testifying that "[w]hether the Corps took combined actions to make the river shallower and slower, arising water surface elevations were a natural, direct, and probable sequence of the Corps' actions").

While the government continues to dispute that the MRRP has caused any change in flooding, *see, e.g.*, Def.'s Br. at 139 ("The flooding that occurred between 2007 and 2014 did not significantly alter the character of the land" and "was consistent with the historical record"), the government did not present any specific evidence on foreseeability in Phase II to counter the court's Phase I finding that the flooding changes on plaintiffs' properties following implementation of the MRRP were a foreseeable consequence of the Corps' actions under the MRRP. As noted above, the government also concedes that it is continuing to implement the MRRP and will do so into the future. The court therefore concludes that the plaintiffs have shown that continued increased flooding on the plaintiffs' representative tracts is a foreseeable consequence of the Corps' implementation of the MRRP.

D. Character of the Land

The court must also determine in the takings analysis whether the increase in flooding "was great enough to change the character" of the land. *Ark. Game & Fish*, 736 F.3d at 1371. "The character of the land in government flooding cases is usually defined by whether, inherently, the property is 'especially susceptible to flooding.'" *In re Upstream Addicks and Barker*, 146 Fed. Cl. at 248 n.18.

The government argues that the Corps' actions under the MRRP did not significantly alter the "character" of the representative plaintiffs' land. Def.'s Br. at 139 ("The flooding that occurred between 2007 and 2014 did not significantly alter the character of the land" and "was consistent with the historical record"). A great deal of the evidence presented by the government in Phase II was centered on this factor. The government presented as its first witness Dr. Ari Kelman, an environmental historian. *See* Tr. 1246:18-1250:10. Dr. Kelman testified that properties next to the Missouri River have always been subject to extensive flooding. Tr. 1253:12-15. In support, Dr. Kelman presented evidence of flooding that occurred on the Missouri River beginning in July 1867 through the end of the twentieth century. *See generally* Tr. 1254:7-1266:20. Dr. Kelman's opinions were based solely on the review of documents concerning historical flood events identified in public records; he did not consult the plaintiffs regarding their experience of flooding on the representative tracts before and after the MRRP. Tr. 1312:24-1313:7.

The court finds that Dr. Kelman's testimony is largely irrelevant. The court has previously determined that, in evaluating whether the government is liable for a taking in

this case, the relevant time frame is from the period after the Mainstem System and BSNP were completed, in the 1970s, and then the period following implementation of the MRRP in 2004. *Ideker III*, 146 Fed. Cl. at 416. Given these bounds, the court finds evidence regarding the character of the land that predates the Mainstem System and BSNP to be of little value.

Moreover, the evidence presented by the representative plaintiffs in Phase II and described above establishes that the character of plaintiffs' land has changed. There is no dispute that the representative plaintiffs' land flooded prior to the MRRP; the plaintiffs' themselves so testified. However, the court has concluded that the changes implemented by the Corps under the MRRP caused more severe and frequent flooding than the representative plaintiffs have historically experienced. The court therefore concludes that the "character of the land" factor weighs in plaintiffs' favor. *See In re Upstream Addicks and Barker*, 146 Fed. Cl. at 286 n.18 ("That plaintiffs' properties may be susceptible to flooding during extreme weather events is of some relevance, but it is independent from the fact that plaintiffs' properties . . . only flooded in this case because of the government's construction of the" dams.).

The government's additional argument that the character of the land has not changed because the plaintiffs' representative tracts were in a FEMA designated flood hazard zone before the MRRP is without merit. *See* Def.'s Br. at 136. There is no dispute that the plaintiffs' properties are within a flood zone. The issue in this case is whether the changes made by the Corps to implement the MRRP for the purpose of protecting and promoting habitat for endangered species has increased the flooding on

plaintiffs' property such that it is now experiencing more frequent and more severe flooding post-MRRP. In *Arkansas Game & Fish*, the land at issue was also in a flood zone, but the Supreme Court recognized that a taking can nonetheless occur. *See* 568 U.S. at 26-29 (noting that, prior to the government action, the area at issue flooded approximately 65 days per year during the relevant period).

In sum, the court finds that the increased frequency, severity, and duration of flooding post-MRRP demonstrates that the MRRP changed the character of the representative tracts of land. It cannot be the case that land that experiences a new and ongoing pattern of increased flooding does not undergo a change in character. The court therefore finds that the plaintiffs have met their burden of demonstrating that the Corps' actions under the MRRP are "great enough to change the character" of the representative properties. *Ark. Game & Fish*, 736 F.3d at 1371.

E. Reasonable Investment-Backed Expectations

Finally, the court must consider a property owner's "reasonable investment-backed expectations regarding the land's use" in the takings inquiry. *Ark. Game & Fish*, 568 U.S. at 39. An objective standard applies. *Chancellor Manor v. United States*, 331 F.3d 891, 904 (Fed. Cir. 2003). The "burden is on the owner to establish a reasonable investment-backed expectation in the property at the time [the owner] made the investment." *Cienega Gardens v. United States*, 503 F.3d 1266, 1288 (Fed. Cir. 2007) (citing *Forest Props., Inc. v. United States*, 177 F.3d 1360, 1367 (Fed. Cir. 1999)). The court considers whether a plaintiff had expectations that were backed by investments, whether those expectations were reasonable, and whether the government action

interfered with those expectations. *Cienega Gardens*, 503 F.3d at 1288-89; *Palazzolo*, 533 U.S. at 618.

The court notes that the concept of "reasonable investment-backed expectations" is traditionally considered in a regulatory, not physical, takings analysis. *Love Terminal Partners, L.P. v. United States*, 889 F.3d 1331, 1345 (Fed. Cir. 2018) ("The reasonable, investment-backed expectation analysis is designed to account for property owners' expectation that the regulatory regime in existence at the time of their acquisition will remain in place, and that new, more restrictive legislation or regulations will not be adopted."). However, the Supreme Court in *Arkansas Game & Fish* recognized that "reasonable investment-backed expectations" is also an appropriate factor to consider in a flooding takings case. 568 U.S. at 39. The Supreme Court applied this factor to the flooding before it, explaining that the flooded area at issue in *Arkansas Game & Fish* had flooded previously, but that the flooding involved in the takings claim was of a different kind than the plaintiffs had previously encountered. *Id.* Likewise, the question in this case is whether plaintiffs had a reasonable expectation that the flooding pattern on their properties after the Mainstem System and BSNP were in place would continue, whether that expectation was backed by investment in plaintiffs' properties, and whether that expectation was interfered with by the Corps' actions under the MRRP.

The representative plaintiffs argue that based on the pre-MRRP flooding patterns of the River, the plaintiffs had reasonable expectations of being free from the increased flooding caused by the MRRP. Pls.' Br. at 146-52. Plaintiffs contend that "no reasonable River Basin stakeholder, including the Plaintiffs, would have ever predicted

that the Corps, after decades of honoring a pre-emptive priority of flood control and after spending billions of dollars to tame the River in order to induce people and businesses to settle and invest in the Basin, would suddenly change cause and intentionally alter the existing flooding patterns of the River to benefit the ecosystem and fish and wildlife." *Id.* at 150. Plaintiffs further argue that "there is also evidence in the record establishing that each of the Phase II Plaintiffs invested in their property interests relying on their reasonable expectations of flooding based upon the *pre*-MRRP flooding patterns." *Id.* at 152.

The government contends that the representative plaintiffs have not carried their burden of demonstrating reasonable investment-backed expectations because "it is not clear" from the plaintiffs' testimony "what specific expectations" the plaintiffs had about the government's actions or whether any investments were actually made based on those expectations. Def.'s Br. at 141. The government also argues that because the representative plaintiffs' "land has always been subject to flooding, any investment-backed expectations were not interfered with" by the Corps' actions. *Id.* The government contends that the representative plaintiffs could not have reasonably expected that the Corps to continue its pre-2004 operations of the Mainstem System and BSNP without change when the Corps had changed its operations in the past. *Id.* at 144. The government points out that the Corps under federal law has been authorized since the 1980s to complete projects to mitigate BSNP habitat losses, and that these federal laws were publicly available and widely known within the Missouri River Basin. *Id.* at 147.

For the reasons that follow, the court concludes that the plaintiffs have established that they had reasonable investment-backed expectations that the pre-MRRP flooding pattern would continue, and that the Corps' actions under the MRRP interfered with those expectations.

1. The Government's State Law Arguments are Waived and Fail for Lack of Proof

As an initial matter, the court rejects the government's argument, raised for the first time in the government's Phase II post-trial brief, that the plaintiffs' reasonable investment-backed expectations should be framed by the Corps' rights as an upstream riparian landowner under state law. *See* Def.'s Br. at 138-39 (in the context of the character of the land factor), 143 (reasonable investment-backed expectations factor). The government briefly argues in its post-trial brief that under the state law of Kansas, Missouri, and Iowa, "those owning land along a river must anticipate that other landowners will make reasonable use of their properties and the benefits and burdens of riparian ownership will be shared with their neighbors." Def.'s Br. at 139. The plaintiffs contend, and the court agrees, that to the extent the government's argument is a defense to any takings liability for flooding plaintiffs' properties, that defense has been waived. Pls.' Resp. at 41-43; *see also* RCFC 12(h)(2); *Kontrick v. Ryan*, 540 U.S. 443, 459 (2004) ("A defense or objection that is not raised by motion or in the responsive pleading is waived unless it is protected by Rules 12(h)(2) or 12(h)(3) or by the successful invocation of the liberal amendment policy of Rule 15." (quotation omitted)).

But even if not waived, the court finds that this argument fails for lack of proof. Whether the Corps' actions in implementing the MRRP even qualify as rights of a riparian landowner under state law is unclear. Even if the government could make a claim based on its rights as a riparian landowner, the government presented no evidence and scant argument on this issue. For example, some of the footnoted cases cited by the government in support of this argument apply a "reasonable use" rule in determining whether an upstream landowner may take actions on that landowner's own property even though those actions may result in flooding damages to a neighboring property. *See Bettinger v. City of Springfield*, 158 S.W.3d 814, 818 (Mo. Ct. App. 2005). The government did not present any evidence describing what riparian rights it was exercising and whether its actions met this "reasonableness" standard. The court has no basis for determining whether the government's actions would qualify under state riparian laws or how these laws apply to the facts in this case.

The court will now turn to the evidence presented regarding reasonable investment-backed expectations and the extent to which the government has interfered with those expectations.

2. The Plaintiffs Made Substantial Investments in Farming Their Representative Properties in Reliance on the Flood Protection Provided by the Mainstem System and BSNP

a. The Adkins property

Mr. Adkins testified that he grew up and has spent his life at or near the Phase II tract. Tr. 48:14-17. Over time, the Adkins family invested in acquiring additional tracts of land for farming. Tr. 76:6-7. Robert and Betty Adkins, Sr. settled on the Phase II tract

in 1948. Tr. 76:4-5. Mr. Adkins, his brother, and his parents all built homes next to each other on the northern portion of the tract. Tr. 48:16-27. Mr. Adkins explained that after the Mainstem dams were built, the Adkins family proceeded to invest millions of dollars in the development and farming of the Phase II tract and the other land they own near the River. Tr. 78:11-79:14. He testified that but for the government's assurances that the Mainstem System and the BSNP would provide enhanced flood protection, the Adkins family would not have made these investments. *Id.* He testified that the Adkins family relied on the government's representations about flood protection. *Id.*

b. The Ideker property

Although Mr. Ideker conceded that the Ideker representative tract when acquired was prone to flooding, he testified that the Ideker family acquired the property with the expectation that the flood protection the government promised to provide with the Mainstem System, the levees, and the BSNP would allow the property to be productive. Tr. 221:19-222:19. He testified that the Idekers relied upon many government publications and representations that flooding would be substantially reduced. *Id.* Mr. Ideker further explained that the government encouraged citizens to invest in the farmland that the Corps' actions made possible. Tr. 220:20-24; Tr. 223:17-24; *see also* PX1 (cross-section photo of Ideker property comparing September 1934 with March 1977). In reliance, the Ideker family began investing heavily to develop the land for farming. Tr. 223:17-24.

Mr. Ideker testified that his family built private levees to protect their investment from flooding. Tr. 225:10-226:14. He stated that the levees represent an investment of

millions of dollars. *Id.* Additionally, he testified that Ideker Farms has invested hundreds of thousands of dollars in equipment, including irrigation equipment, in planting beans and corn, and harvesting crops. *Id.* He explained that drainage ditches and two drainage conduits were constructed at significant cost. *Id.* He also testified as to the wells dug to irrigate the farm. *Id.* He testified that these investments in the farm were prompted by the belief that the land would be suitable and productive for farming, as well as for their recreational use and enjoyment without repetitive, atypical flooding they are now experiencing due to changes in River management by the Corps. *Id.*

Mr. Ideker testified that it costs the Idekers about $750 per acre to plant a crop of corn, and $550 per acre to plant a crop of beans. Tr. 226:15-24. The Idekers planted an average of 645 acres of corn and 733 acres of beans each year for an average total planted acreage of 1,378 acres. *Id.* Their total investment for planting each year averaged $483,750 for corn and $403,150 for beans, for a total of $886,900. *Id.* Mr. Ideker stated that this represents a substantial business investment. *Id.*

After the MRRP flooding began in 2007, Mr. Ideker testified as to the steps the farm has taken to prevent the flooding and protect their property. Tr. 227:11-228:10. These efforts included the rocking of the riverbank to abate erosion and preserve the levee and river cabin situated close to the river. Tr. 228:1-10. It also included the repair of the existing levees breached or damaged as a result of the flooding, as well as the building of new levees on the east side of the property, all at substantial expense. Tr. 227:11-25.

c. The Buffalo Hollow Farms property

Mr. Schneider testified that his family originally acquired the Phase II tract in 1962, believing that the new publicized flood protection to be provided by the government through new dams and reservoirs and the BSNP would allow the ground adjacent to the river to be productive and otherwise free from the frequent flooding that had been experienced up until that time. Tr. 145:8-20.

Title to the representative property was transferred to the Schneider's family-owned Buffalo Hollow Farms in July 2009. Tr. 171:20-172:4. Buffalo Hollow Farms absorbed Buffalo Hollow Ranch. *Id.* No money was exchanged for the transfer of title. JX8 (Jan. 27, 2020 Schneider Depo. at 19:13-21, 20:18-21:14).[20]

Mr. Schneider testified that his family has invested millions of dollars in the land since acquisition. Tr. 146:6-12. He explained that but for the many public assurances by the government regarding flood control and enhanced flood protection beginning during the last century, the Schneiders and Buffalo Hollow Farms would not have invested in the property as they have done. *Id.* Based upon the Schneiders' experience with the Phase II tract prior to 2007, they expected the farm to be productive each year and experience wet years approximately once per decade. Tr. 147:12-18.

Mr. Schneider testified that it costs Buffalo Hollow Farms $670 per acre to plant a crop of corn on 579 acres, and $450 per acre to plant a crop of beans on 248 acres,

[20] The government argued that there cannot be any reasonable investment-backed expectations regarding property that is "inherited." Def.'s Br. at 40. The court disagrees. As discussed above, Mr. Schneider continues to farm the subject property and his undisputed testimony states that he and his family have invested millions in the farm.

exclusive of labor costs. Tr. 149:11-150:4. The Schneiders' total investment for crops per year, exclusive of labor costs, is approximately $500,000. *Id.* Mr. Schneider stated that this investment was made in reliance on the flood control Buffalo Hollow experienced prior to 2007. *Id.* Mr. Schneider further explained that the substantial investment of millions of dollars the Schneiders have put in the land for farming since acquisition makes it economically difficult to simply quit trying to farm the ground. *Id.* The Schneiders' expectations for their Phase II tract remained the same until at least 2011. Tr. 151:14-19. He testified that the flooding impacts of the MRRP and the deprioritization of flood control came as a surprise to them. *Id.*

Based on the testimony of the representative plaintiffs summarized above, the court finds that each of the plaintiffs has shown that they had an investment-backed expectation that they would continue to farm their properties under the pre-MRRP flood pattern. The representative plaintiffs own their farmland, invest yearly in crop production to make use of the land, have an interest in the land gaining value, spend money to prevent flooding, and remediate their land after flooding. The representative plaintiffs made these investments to make their farms productive with the expectation that the pre-MRRP flood patterns would continue.

3. Plaintiffs' Expectation that the Representative Properties Would Not Be Subject to Increased Flooding is Reasonable

The court further finds that the representative plaintiffs' expectations are supported by evidence and this court's prior opinions and are therefore reasonable. The plaintiffs in both Phase I and Phase II presented government publications that

demonstrate that the United States expected people to be protected from flooding along the River following the construction of the Mainstem System and BSNP. *See* Pls.' Br. at 35-38; *see, e.g.*, *Ideker I*, 136 Fed. Cl. at 661 (noting that the federal government determined it was in the national interest for the Missouri River "to be controlled for purposes of human settlement and as a resource to support economic development" (citing PX16 at PLTF-00003157, PLTF-00003098)). For example, a U.S. Department of Interior Overview Report dated March 2005 states that after "closing of the dams, the vast lands were cleared for agricultural production . . . As time passed, the idea that these lands were flood-free caused developers to move in, thus supplementing the demands for bank stabilization projects." PX18 at PLTF00005755; *see also* PX16 at PLTF-00003229 (2002 National Resource Council publication stating "[h]owever, the land between federal levees and the river has been farmed, and expectations consequently arose to protect this land, as well as those lands behind the levees . . . ."). The Phase II representative plaintiffs testified that they relied on the government's assurances about flood protection when investing in their properties. *See* Tr. 78:17-79:14 (Adkins); Tr. 221:19-222:19 (Ideker); Tr. 146:6-12 (Buffalo Hollow).

It was reasonable for the plaintiffs to expect the prioritization of flood protection to continue, and for the prioritization of habitat protection under the ESA to come as a surprise to the plaintiffs. As this court has previously held, "the changes made to the Corps' River and Mainstem [S]ystem after the court order requiring the Corps' compliance with the ESA increased flooding *to a degree that would not have been contemplated* when the River and Mainstem System structures were planned." *Ideker II*,

142 Fed. Cl. at 232 (emphasis added). Separately, the court has explained that the actions taken by the Corps to comply with the ESA represent a "significant change in the focus of the work the Corps was doing in managing the River—from flood control to River restoration work." *Ideker I*, 136 Fed. Cl. at 668. It is true, as the government argues, that the Corps must comply with federal laws like the ESA and that the Corps was free to change its operations of the Mainstem System and BSNP, and has in fact done so in the past. Def.'s Br. at 46; *see also, e.g.*, Tr. 1362:20-1363:16 (Remus) (citing PX6 ¶ 5-23) (noting that as early as 1960, the Corps explained in its master manual that its operation of the mainstem system could not "be expected to remain entirely fixed in the future"). But it was nonetheless reasonable for the representative plaintiffs to view the post-MRRP flooding as "unexpected" given the Corps' significant priority change from flood protection to species protection after 2004. *Cf. In re Upstream Addicks and Barker*, 146 Fed. Cl. at 261 ("[I]t is not the case that a takings claim must fail simply because a property owner acquired land while on notice that a taking . . . had the potential to occur." (quotation and internal alterations omitted)).

The government also argues that Dr. Kelman's and Mr. Jones' testimony, along with government documents introduced by other government witnesses, establish that the representative plaintiffs' expectations regarding flooding on their properties was not reasonable because plaintiffs' land has always been subject flooding risk. Def.'s Br. at 43-49 (discussing Dr. Kelman's testimony and documents), 59-62 (discussing Mr. Jones' review of other documents); *see also id.* at 144 ("Plaintiffs' land was subject to flooding before and after [the] Mainstem System, and before and after 2004-2006 changes.").

However, as stated above, the court gives Dr. Kelman's testimony little weight. Dr. Kelman conducted no interviews with the representative plaintiffs regarding their expectations or what information they had available when forming their expectations, despite acknowledging that such information is relevant to his opinions. Tr. 1312:24-1313:7. On cross-examination, Dr. Kelman admitted that the representative plaintiffs' personal observations for the period of time they lived on the river and how that was managed are relevant and important considerations. Tr. 1310:21-1311:8.

Mr. Jones also performed a literature review of historical documents on government communications regarding flood risk, but has no training as a historian or in any social sciences. Tr. 2092:14-2093:6. The government contends that this literature review supports the proposition that plaintiffs should have known that their land "has always been subject to flooding." Def.'s Br. at 141; *see also id.* at 59-60 (discussing Mr. Jones' literature review). As an initial matter, the court has already rejected the government's argument that the nature of the flooding on representative plaintiffs' properties has not changed. *See infra* Part I.C. Notwithstanding that, the court concludes that Mr. Jones' testimony does not show that the representative plaintiffs' expectations were unreasonable. Mr. Jones acknowledged during cross examination that after the BSNP was constructed, farm development investment followed, and that reasonable investment-backed expectations can arise from enhanced flood control. Tr. 2100:1-2101:13. Mr. Jones also acknowledged that an "important part" of his conclusions about plaintiffs' expectations was his belief that those expectations would have been formed based in part on flooding patterns that predated completion of the dams, which is not the

relevant time period. Tr. 2067:7-2071:1. For these reasons, plaintiffs' expectations that there would not be increased flooding after the BSNP and Mainstem System was in place are reasonable.

4. The Corps' MRRP Actions Interfered with the Representative Plaintiffs' Reasonable Investment-Backed Expectations

Finally, the court finds that the Corps' MRRP actions have interfered with the representative plaintiffs' reasonable investment-backed expectations to be able to farm and invest in their property. The government argues that the "productivity" and "value" of the representative plaintiffs' land has not "changed considerably as a result of the MRRP changes." Def.'s Br. at 146. However, this assertion is undermined by the government's expert on crop losses. The court finds that the testimony of the government's crop loss expert, Dr. Robert Evans, confirms that the MRRP has resulted in increased flooding which in turn has led to lower crop yields and therefore a drop in productivity and value.[21]

Specifically, Dr. Evans calculated for years 2007, 2008, 2010, 2013, and 2014 the but-for or incremental impacts of the MRRP on the three representative plaintiffs' corn and soybean crop yields. *See* Tr. 2524:13-2529:11; *see also* DX7007-223, DX7007-224, DX7007-225 (demonstrative summaries of opinions on yield impact for claim years). These lost yields were then valued by the government's expert Dr. David Sunding[22] at

[21] Dr. Evans' qualifications and opinions are discussed in more detail in Part IV, *infra*.

[22] Dr. Sunding's qualifications and opinions are discussed in more detail in Part IV, *infra*.

$1.3 million dollars. Tr. 2854:9-18; *see also* DX6033-0030 (table of crop loss calculations using Dr. Evans' report). Dr. Sunding also testified that Dr. Evans' analysis demonstrated a 12 percent average drop in crop yield across the three representative properties for the crops Dr. Evans considered. Tr. 2879:12-19. While the plaintiffs argue that Dr. Evans' study undervalues the impact of the MRRP on crop yields, *see* Pls.' Br. at 81, Dr. Evans' work nonetheless establishes that but for the MRRP the representative plaintiffs would have seen greater crop yields. The losses described by Dr. Evans and Dr. Sunding are significant, and with more frequent flooding, the losses are continuing. Accordingly, the court finds that the representative plaintiffs' have met their burden of establishing that the MRRP interfered with their reasonable investment-backed expectations.

In sum, for the reasons discussed above, the three representative plaintiffs have established all of the factors set forth by the Supreme Court in *Arkansas Game & Fish* for proving the taking of a flowage easement. Both parties agree that if the court finds a taking here, that taking is of a permanent flowage easement,[23] given the ongoing nature of the MRRP. *See* Def.'s Br. at 158; Pls.' Br. at 119-20. The court now turns to the issue of just compensation.

[23] *Arkansas Game & Fish* involved a temporary taking by intermittent flooding. As discussed in Part III, *infra*, the court concludes (and the parties agree) that it is appropriate to apply the *Arkansas Game & Fish* factors for the taking of a permanent flowage easement by intermittent flooding as well. *See* Tr. 3390:8-14; Tr. 3424:13-3425:5 (closing arguments).

III. Date of Taking

Having determined that the United States is liable for a taking of a permanent flowage easement for the three representative plaintiffs under the *Arkansas Game & Fish* factors, the court now turns to the question of just compensation. As an initial matter, the parties disagree as to the appropriate date of taking, which implicates not only how just compensation is valued but whether plaintiffs' claims are time-barred. The court therefore addresses this issue first.

The representative plaintiffs argue that to determine the date of taking, the court must apply the stabilization doctrine in *United States v. Dickinson*, 331 U.S. 745 (1947) and the doctrine approved by the Federal Circuit in *Arkansas Game & Fish*, which allows the court to group multiple years of flooding together so long as they are sufficiently related. According to the representative plaintiffs, the period of taking is one that begins in 2007 but stabilizes for accrual and valuation purposes on December 31, 2014. Pls.' Br. at 157-64. The representative plaintiffs point out that the permanent nature of the flowage easement was not confirmed until 2020, when the government admitted that the MRRP was not going to be terminated. Pls.' Br. at 162-63. However, the representative plaintiffs contend that the accrual and valuation date under the unique facts and circumstances of this case is December 31, 2014, when the effects of the MRRP were sufficiently stabilized as shown by the evidence. *Id.*

December 31, 2014 is also the date this court set as a "cut-off" date as to what flooding would be considered in addressing the representative plaintiffs' claims for just compensation. *See Ideker I*, 136 Fed. Cl. at 670 ("The year 2014 was selected as the cut-

off year for purposes of proving flooding by the Corps' System and River Changes; however, some plaintiffs have continued to experience flooding."). The representative plaintiffs therefore chose December 31, 2014 as the date of taking "to be conservative with their demand and consistent with the court's approach to trial." Pls.' Br. at 163.

The government contends that for the representative plaintiffs, the appropriate date of taking is 2007, the first year that atypical flooding at the three representative properties occurred. Def.'s Br. at 151. Based on this date, the government argues that the representative plaintiffs' claims are time-barred under the six year statute of limitations because they filed their complaint on March 5, 2014. Def.'s Br. at 152-53 (citing 28 U.S.C. § 2501). Alternatively, the government argues that the representative plaintiffs have failed to meet their burden to provide any evidence of a credible date of taking. Def.'s Br. at 153-54.

A. The Stabilization Doctrine

In general, where the United States permanently takes an interest in real property, the date of a taking is the date the United States enters into possession of the property. *United States v. Dow*, 357 U.S. 20, 22 (1958). This date is generally also "the date as of which the land is to be valued." *Id.* However, where flooding results from a "continuing process of physical events" set in motion by the United States, the date of taking is set when the property has experienced flooding and the situation has "stabilized." *Barnes v. United States*, 538 F.2d 865, 873 (Ct. Cl. 1976) (discussing *Dickinson*, 331 U.S. at 748-49).

The Supreme Court held in *Dickinson v. United States* that where the "source of the entire [takings] claim . . . is not a single event[, but] is continuous," such as a series of floods, a claim does not arise "until the situation becomes stabilized." 331 U.S. at 748-49. This is because "when the Government chooses not to condemn land but to bring about a taking by a continuing process of physical events, the owner is not required to resort either to piecemeal or to premature litigation to ascertain the just compensation for what is really 'taken.'" *Id.* at 749. Under *Dickinson*, a claim becomes "stabilized" where the "consequences of inundation have so manifested themselves that a final account may be struck." *Id.*

The Court of Claims applied *Dickinson* in *Barnes*, 538 F.2d at 873, where the United States' actions at the Gavins Point and Fort Randall Dams caused farmland flooding from 1969 to 1975. The *Barnes* court set the date of taking not at the approximate date of the first flood, but at November 30, 1973, reasoning that by then, "the permanent character of intermittent flooding could fairly be perceived." 538 F.2d at 873.

Likewise, in *Cooper v. United States*, the Federal Circuit applied *Dickinson* in a temporary takings case to determine when the government's taking of timber by intermittent flooding occurred. 827 F.2d 762, 764 (Fed. Cir. 1987). The Federal Circuit explained that "the critical question is: when did the destruction of trees become sufficiently stabilized so that the owner could determine the amount of timber taken?" *Id.* The Federal Circuit stated that, although trees began to die on the plaintiff's property

in 1979, "the extent of the destruction was not ascertainable until 1984," when the plaintiff filed suit. *Id.*

More recently, the Federal Circuit held in an erosion case that a situation becomes stabilized when the physical process caused by government action has "substantially encroached the parcels at issue and the damages [are] reasonably foreseeable." *Banks v. United States*, 741 F.3d 1268, 1272-73 (Fed. Cir. 2014) (quoting *Boling v. United States*, 220 F.3d 1365, 1373 (Fed. Cir. 2000)). The Federal Circuit has also applied *Dickinson* to hold, in a case alleging that the government's actions in draining a lake caused uncontrolled vegetation growth, that a taking accrues when all the events which fix the United States' alleged liability have occurred and the harmed party knows or should have known their existence. *Nw. La. Fish & Game Pres. Comm'n v. United States*, 446 F.3d 1285, 1290 (Fed. Cir. 2006). In that case, the Federal Circuit held that the proper accrual date occurred when the damages from the vegetation overgrowth became "quantifiable and present," even where the plaintiff had estimated damages years earlier. *Id.* at 1291.

Where stabilization is an issue, "it is the uncertainty surrounding the permanent nature of the taking, and not the uncertainty surrounding the ultimate extent of the[] damage, that is critical in determining whether the situation has stabilized." *Boling*, 220 F.3d at 1372. Stabilization occurs where "environmental forces have substantially and permanently invaded the private property such that the permanent nature of the taking is evident and the extent of the damage is reasonably foreseeable." *Id.* at 1371. Selecting the date of taking under *Dickinson* and its progeny is a question of fact that is dependent on the unique circumstances of a particular case. *Dickinson*, 331 U.S. at 748-49; *Barnes*,

538 F.2d at 873. Determining the date is "a practical matter and not a technical rule of law." *Dickinson*, 331 U.S. at 749.

Applying these standards, the question in this case is therefore: when did the flooding consequences of the MRRP claimed by the representative plaintiffs become sufficiently stabilized? In answering this question, the court considers when the nature of the flooding caused by the MRRP could be reasonably perceived, the foreseeability of the damages from this flooding, when the plaintiffs were or should have been aware of the MRRP-caused flooding on their properties, and the practicalities presented by the circumstances of this case.

B. The Taking Did Not Accrue in 2007

Applying the *Dickinson* stabilization doctrine to this case, the court first rejects the government's contention that the taking accrued in late 2007, when the atypical flooding on the representative plaintiffs' properties first became apparent. *See* Def.'s Br. at 151. The MRRP's effect on the River had not "stabilized" as of 2007, and it is unreasonable to expect the representative plaintiffs to have known of the MRRP's ongoing effect on their property after the first atypical flooding event.

To begin, *Dickinson* and the cases that follow reject the idea that the date of taking is the first flooding event because, at that time, the nature and the extent of the flooding at issue is still unknown. *Dickinson*, 331 U.S. at 769 (holding that a claim does not accrue "as soon as [the property owner's] land is invaded" because of the "uncertainty of the damage"); *see also Cooper*, 827 F.2d at 764 (holding that the taking did not accrue when the timber in question was first damaged by flooding in 1979, but in 1984 when the

extent of the injuries was "ascertainable"); *Barnes*, 538 F.2d at 873 (setting the date of taking after five years of flooding). Likewise, here, at the time of the first atypical flood in 2007, there was no reason to know whether that flooding would continue in a way that would be so substantial and frequent as to constitute a taking. *Boling*, 220 F.3d at 1372 ("[R]equiring the plaintiffs to sue immediately upon the initial encroachment of their land is too rigid an application of the stabilization principle.").

Rather, not until the plaintiffs had experienced multiple years of intermittent flooding would a taking have accrued. For example, in *Barnes*, the Court of Claims held that government-caused intermittent flooding did not amount to a taking of a permanent flowage easement until after years of flooding that was expected to continue into the future. *See* 538 F.2d at 872. The Court of Claims therefore did not set the date of taking at the date of the first flood in 1969, but five years later in 1973, when the "permanent character of intermittent flooding could fairly be perceived." *Id.* at 873. A similar finding is warranted here, where the representative plaintiffs have presented evidence of years of intermittent flooding that began in 2007 and is expected to continue.

Moreover, as discussed in the Phase I decision, the Corps' projects under the MRRP continued past 2007, into 2014. *See Ideker I*, 136 Fed. Cl. at 669 ("Corps studies explain that as of 2014, the Corps had undertaken 1,697 dike notching actions, 354 major modification actions, 63 dike lowering actions, 36 dike extension actions, 39 side-channel chute actions, 20 revetment chute actions, 14 backwater actions, and 3 channel widening actions."). The continued construction projects under the MRRP years after 2007 undermine the government's argument that the situation had "stabilized" by then.

Evidence in the Phase II record also supports the representative plaintiffs' contention that the River continued to change between 2003 and 2015 near the representative plaintiffs' tracts. PX3718 (comparing "roughness" values in the Corps' 2003 Flow Frequency Study and May 2015 Missouri River Unsteady HEC-RAS Model Calibration Report); PX3716 (Corps' May 2015 HEC-RAS Report Appendix D). These studies show increased "roughness" in the River adjacent to the Adkins and Ideker properties. *See* PX3716 at USACE2571084 (roughness values); PX3718 at USACE0231783 (roughness values); Tr. 1729:10-1734:20 (Dr. Holmes, discussing these documents). Although these studies use two different modeling methods, *see* Def.'s Resp. at 31 n.28, the studies nonetheless recognize changes in the River post-2007, *see* PX3716 at USACE2571059.

In addition, it is unreasonable to expect the representative plaintiffs to have known of the cause of the increased flooding by 2007 given the complex nature of the hydrology of the River. *See Ideker I*, 136 Fed. Cl. at 702-05 (describing Dr. Hromadka's testimony). As the representative plaintiffs have testified, and many, if not all, of the Phase I plaintiffs testified, the cause of the flooding beginning in 2007 was not known until later. *See* Pls.' Resp. at 30. The representative plaintiffs specifically explained that they were "not aware until sometime later [of] the MRRP, the deprioritization of flood control and the changes that had been made to the river and river management in 2004. The ongoing flooding was much different than before." Tr. 82:2-6 (Adkins). And, although they "beg[a]n questioning the cause of flooding in our region" during "the 2010 flood event," the representative plaintiffs did not until March 2014 file suit "after getting confirmation from our expert in the latter half of 2013, the Government's actions in

conjunction with the MRRP were causing the flooding we were experiencing." Tr. 150:22-151:13 (Schneider).

The court rejects the government's contention that the evidence demonstrates that the representative plaintiffs should have known of the cause of the increased flooding in 2007. The government points to testimony by plaintiffs regarding observed changes in the River at various dates before the plaintiffs' chosen date of 2014. *See* Def.'s Br. at 152 (citing, for example, testimony by Mr. Adkins that the 2007 flooding was atypical), 154 (citing testimony from the Phase II and Phase I plaintiffs regarding changes in the River since 2004). While changes in the River may have occurred earlier, the representative plaintiffs reasonably did not know the cause or character of the River changes and the foreseeable extent of the damages during those earlier times. *See Nw. La. Fish & Game*, 446 F.3d at 1291-92 (holding that the fact that the plaintiffs estimated damages before the extent of potential harms became known did not set accrual at an earlier date than when the potential harms actually occurred and subsequently "stabilized").

The government further argues that this court has already held that the 2007 flooding at issue on the representative plaintiffs' properties was the foreseeable result of the MRRP, a required element of plaintiffs' takings claims. Def.'s Br. at 152. Yet, this does not mean that the impact of the MRRP had stabilized by 2007, or that the nature of the takings claims had become known by the first atypical flood. *See Barnes*, 538 F.2d at 873 (setting the date of taking as November 30, 1973, but noting that the relevant flooding "stretch[ed] back to 1969," when the first flood occurred).

For all of these reasons, the court disagrees with the government's proposed 2007 date of taking.

C. The Accrual and Valuation Date is December 31, 2014

The court instead agrees with the plaintiffs that, under the unique facts and circumstances of this case, the accrual and valuation date for a permanent flowage easement is December 31, 2014. First, as noted above, the MRRP construction activities relied on by the representative plaintiffs continued through 2014. *See Ideker I*, 136 Fed. Cl. at 669. This suggests that the full effect of the MRRP would not have "stabilized" until these construction activities were completed – in other words, when the events fixing the United States' liability occurred – supporting plaintiffs' December 31, 2014 accrual date.[24] *See Nw. La. Fish & Game*, 446 F.3d at 1291-92.

Second, although they were aware of atypical flooding earlier, it is the combined effect of the years of intermittent flooding between 2007 and 2014 that supports the taking of a permanent flowage easement for the three representative plaintiffs. "Adopting a date of taking must often be done in a somewhat imprecise manner," and the court is satisfied that based on the facts of this case for these three plaintiffs, "the permanent character of intermittent flooding could fairly be perceived" by the end of

[24] Although the Corps plans to continue to construct new projects under the MRRP, *see, e.g.*, Tr. 1469:6-1471:22 (regarding minor modifications and yet-to-be-completed spawning habitat); Def.'s Br. at 73 (noting that the planned future MRRP construction will take place downstream of the three representative properties), plaintiffs do not base their takings claims on this new construction, except, as discussed above, to demonstrate that the MRRP is ongoing.

2014. *Barnes*, 538 F.2d at 873 (finding a date of taking for a permanent flowage easement after five years of intermittent flooding).

Third, the representative plaintiffs testified that while they began to notice changes in the river before 2014 and began to question those changes in 2010, they could not reasonably have known that the MRRP caused those changes before consulting with their experts and ultimately filing suit. This, combined with the unique circumstances and "practical[ities]" of the case, further supports a date of taking of December 31, 2014. *Dickinson*, 331 U.S. at 749. As discussed above, the changes to the river caused by the MRRP are complex. *See Ideker I*, 136 Fed. Cl. at 702-05 (describing Dr. Hromadka's testimony). As the Federal Circuit has held, a taking does not accrue until all the events which fix the United States' alleged liability have occurred and the harmed party was aware of or should have been aware of their existence. *Nw. La. Fish & Game*, 446 F.3d at 1290. It is reasonable for the representative plaintiffs not to have known the cause of the flooding on their properties until consulting an expert. Although the plaintiffs consulted their expert in late 2013 and filed their lawsuit on March 5, 2014, the court concludes that it is appropriate to use December 31, 2014, the court's original "cut-off" date for plaintiffs' flooding claims, as the date of taking.

In sum, the court concludes that the end of 2014 best represents when all of the events fixing the United States liability occurred, when the intermittent flooding on the representative plaintiffs' properties became sufficiently permanent in nature, and when the plaintiffs knew or should have been aware of the nature and extent of the MRRP-

caused flooding. The court therefore agrees with the representative plaintiffs that December 31, 2014 is the appropriate date of accrual and valuation in this case.

D. The Taking Began in 2007

Finally, the court agrees with the representative plaintiffs that it is appropriate to continue to treat the increased flooding attributable to the Corps' MRRP actions prior to 2014 as a continuous flood as it did in Phase I in determining when the taking began, based on the Federal Circuit's remand decision in *Arkansas Game & Fish*. *See* Pls.' Br. at 158-64. In that case the Federal Circuit, on remand from the Supreme Court, found that where the Corps' yearly actions between 1993 and 2000 causing intermittent flooding on the land in question "were directed to a single purpose," it was appropriate to analyze the intermittent flooding "as having lasted for seven years." 736 F.3d at 1370. In other words, it was appropriate in that circumstance to treat the intermittent flooding as a single flood for purposes of the takings analysis, rather than treating each flood as an individual, separate action. *Id.*

Pursuant to the Federal Circuit's remand decision, in Phase I the court found here that "(1) the Corps' System and River Changes were made for a single purpose; (2) the cumulative and combined effects of the System and River Changes made for that single purpose led to higher WSEs than would have existed without the System and River Changes; and (3) the higher WSEs led to flooding, or more severe flooding on the property owned or farmed by that individual plaintiff than the flooding the plaintiff would have experienced without the Corps' System and River Changes." *Ideker I*, 136 Fed. Cl. at 674. Applying these facts to the reasoning in the *Arkansas Game & Fish*

remand decision, the court held that "it is proper to consider the *series* of changes made by the Corps for a single purpose" in the causation analysis, *id.* at 674, rather than isolate each individual Corps action under the MRRP and connect that action to each flooding event on each plaintiffs' individual property, as the government sought, *id.* at 673.

The court now finds that this same reasoning extends to determining the period of the taking. The atypical flooding caused by the MRRP began in 2007, as part of a series of floods caused by the Corps' actions under the MRRP that is continuing today. Under the Federal Circuit's remand decision in *Arkansas Game & Fish*, the court treats this series of intermittent floods collectively in determining the period and nature of the taking and in evaluating just compensation. *See* 736 F.3d at 1370.

The government suggests that, where the court has determined an accrual date in 2014, treating the taking as beginning in 2007 is inconsistent with *Barnes*, where the Court of Claims held that any flooding damages "sustained prior to the date of taking are the product of tortious invasions" and are thus unrecoverable. 538 F.2d at 874; Def.'s Br. at 154, 159. The *Barnes* court reasoned that "not until the date of taking," when it became clear that prior flooding would continue and that the government therefore had taken a permanent flowage easement, "did these several tortious invasions ripen to the extent necessary to confer on the defendant a flowage easement." *Id.* at 874. According to the government, any damages claimed by the plaintiffs prior to the 2014 accrual date are tort damages beyond this court's jurisdiction. Def.'s Br. at 154, 159.

It is well-settled that tortious flood damages claims are not within the court's jurisdiction. *Ridge Line*, 346 F.3d at 1355. However, since *Barnes*, the Supreme Court

has held that government-induced intermittent flooding could constitute a taking, rather than a tort, even where the flooding is temporary in nature. *Ark. Game & Fish*, 568 U.S. at 27. In doing so, the Supreme Court reversed the Federal Circuit's decision, which relied in part on *Barnes*, that the government's actions "at most created tort liability." *Ark. Game & Fish Comm'n v. United States*, 637 F.3d 1366, 1378, 1379 (Fed. Cir. 2011). On remand from the Supreme Court, the Federal Circuit held that the seven years of intermittent flooding caused by the government in that case could be treated as one flood in the takings analysis. 736 F.3d at 1370. The Federal Circuit upheld the trial court's determination that this intermittent flooding (which had a single purpose of providing water to farmers), taken together, constituted a taking. *Id.* at 1381.

In this case, there has been a permanent, rather than a temporary, taking, based on intermittent flooding related to the single purpose of the MRRP. The parties agree that the Supreme Court's decision in *Arkansas Game & Fish* is applicable not only to a temporary taking due to intermittent flooding, but to the taking of a permanent flowage easement due to intermittent and continuing flooding. *See supra* n.23. The court finds no reason not to apply the rationale of *Arkansas Game & Fish* in this case, even though the intermittent flooding here – unlike the intermittent flooding in *Arkansas Game & Fish* – will continue into the future. Applying *Arkansas Game & Fish*, the court finds it appropriate to hold that the accrual date of intermittent flooding resulting in a permanent flowage easement may be later than the date that the taking began. The court therefore treats the taking here as beginning in 2007, when flooding attributable to the MRRP

began, and rejects the government's argument that any floods prior to the 2014 accrual date were tortious invasions outside this court's jurisdiction.

Based on the foregoing, the court determines that, while the taking began in 2007, the representative plaintiffs' claims did not accrue until December 31, 2014. The representative plaintiffs have therefore brought their claims within the six-year statute of limitations applicable to this case. In addition, as discussed below, December 31, 2014 is the appropriate date for valuing just compensation for the permanent flowage easement taken.

IV. Just Compensation

Having determined that the taking began in 2007 and accrued in 2014, the court next turns to just compensation. Where there is a physical taking under the Fifth Amendment, the court must award just compensation. *See Yee v. City of Escondido*, 503 U.S. 519, 527 (1992) (holding that the government must pay just compensation when it "requires [a] landowner to submit to the physical occupation of his land"); *see also Banks v. United States*, 721 F. App'x 928, 940 (Fed. Cir. 2017) ("It cannot be the case that acres of property are lost due to erosion and the value of that total property is not affected."). Just compensation must be paid in an amount that puts the property owner in "as good a position pecuniarily as he would have occupied if payment had coincided with the appropriation." *Kirby Forest Indus., Inc. v. United States*, 467 U.S. 1, 10 (1984). The court does not require proof of the "precise amount" of just compensation due, but only a "reasonable approximation," *Ark. Game & Fish*, 736 F.3d at 1379, which "requires more than a guess, but less than absolute exactness," *Precision Pine & Timber Inc. v. United*

States, 596 F.3d 817, 833 (Fed. Cir. 2003). "[J]ust compensation must be measured by an objective standard that disregards subjective values which are only of significance to an individual owner." *United States v. 50 Acres of Land*, 469 U.S. 24, 35 (1984).

The representative plaintiffs' claims for just compensation in this case involve valuing the permanent flowage easement based on the diminution in land value due to the increased flooding pattern on the representative tracts as measured on the date of accrual in 2014, as well as the crop and other losses, including land and levee restoration, sustained from 2007 to 2014. The court first addresses the valuation of the permanent flowage easement, and then turns to whether plaintiffs are entitled to lost crop and other damages prior to the 2014 date of accrual. Finally, the court addresses the proper interest rate.

A. Valuation of Just Compensation for the Taking of the Permanent Flowage Easement

In this case, the United States has taken a flowage easement across the representative plaintiffs' properties. Where the United States takes less than an entire parcel, the "before-and-after" valuation method is generally the simplest and perhaps the most widely-used approach that "serves to lessen the pitfalls and problems that arise when a series of factors affecting value are added together to arrive at a total severance damage determination." *Ga. Pac. Corp. v. United States*, 640 F.2d 328, 336 (Ct. Cl. 1980). Under the before-and-after method, "just compensation" is the difference between the fair market value of the whole parcel immediately before the taking and the remainder after the taking. *United States v. Miller*, 317 U.S. 369, 376 (1943); *see also Otay Mesa*

Prop., L.P. v. United States, 670 F.3d 1358, 1363-64 (Fed. Cir. 2012) ("Where the property interest permanently taken is an easement, the 'conventional' method of valuation is the 'before-and-after' method, i.e., 'the difference between the value of the property before and after the Government's easement was imposed.'" (quoting *United States v. Va. Elec. & Power Co.*, 365 U.S. 624, 632 (1961)).

However, there is no one approved approach for determining what injuries and losses are compensable; rather, the determination must be based on the particular facts of each case. *Hendricks v. United States*, 14 Cl. Ct. 143, 149 (1987) (holding "the concept of just compensation cannot be reduced to formula nor can it be confined to inexorable rules") (internal citation and quotation marks omitted); *Ridge Line*, 346 F.3d at 1354-55 (holding that the trial court erred in finding that damages could not be demonstrated simply because the plaintiff did not provide appraisals of its land value before and after the taking). The trial court has considerable discretion in determining the methodology to be used in calculating just compensation. *Innovair Aviation, Ltd. v. United States*, 82 Fed. Cl. 567, 568 (2007). Regardless of the valuation method used, "a judge may award damages, even if [the judge] does not fully credit that party's methodology." *Banks*, 721 F. App'x at 940 (quotation omitted).

Ultimately, the court must determine whether the damages were shown "to a reasonable approximation" of the value of what was taken from the plaintiffs. *Ark. Game & Fish*, 736 F.3d at 1379. For the reasons set forth below, the court finds that the representative plaintiffs' damages calculations meet that standard.

1. The Representative Plaintiffs' Method of Before-and-After Valuation Offers a Reasonable Approximation of the Diminution in Fair Market Value of Their Properties

The representative plaintiffs relied on three experts, Mr. Leo Smith, Mr. Tim Keller, and Dr. Bruce Babcock, to determine the diminution in the fair market value of their tracts due to the imposition of the permanent flowage easement. As discussed below, the plaintiffs did not use the traditional "before-and-after" appraisal method to determine just compensation. However, the court finds the plaintiffs experts' opinions credible and persuasive, and that the representative plaintiffs' method, under the unique circumstances of this case, provides a reasonable approximation of the diminution in fair market value of the representative plaintiffs' tracts.

a. The court finds the testimony of plaintiffs' appraisers credible and reliable

First, the representative plaintiffs relied on the testimony of local appraisers, Mr. Leo Smith and Mr. Tim Keller. Mr. Smith and Mr. Keller were not tasked with performing before-and-after property appraisals. Rather, Mr. Smith and Mr. Keller were tasked with valuing the representative plaintiffs' tracts as of the December 31, 2014 date of taking; in other words, to appraise the plaintiffs' property after the imposition of the permanent flowage easement. Tr. 316:10-317:2 (Smith); Tr. 453:15-454:2 (Keller). Mr. Smith and Mr. Keller were also tasked with providing Dr. Babcock additional appraisal data needed to perform his analysis (described below). Tr. 319:5-8 (Smith); Tr. 454:10-15 (Keller). Although the government had originally planned to call its own appraisal

witness, that witness was withdrawn before trial, and the government did not offer its own appraisals of the plaintiffs' properties.

The court finds the appraisals of Mr. Smith and Mr. Keller credible and reliable. Both Mr. Smith and Mr. Keller are local, experienced appraisers. Mr. Smith has been a licensed real estate appraiser for over 21 years and is a licensed certified general real property appraiser in Iowa and Nebraska. Tr. 320:3-17; *see also* PX3031 (Smith CV). Mr. Keller has been a licensed real estate appraiser for over 27 years, in Kansas, Missouri, Nebraska, and Colorado. Tr. 455:15-456:19. Both Mr. Smith and Mr. Keller previously completed appraisals for the federal government, including for the U.S. Army Corps of Engineers. Tr. 321:22-322:13 (Smith); Tr. 545:7-546:9 (Keller). Mr. Smith and Mr. Keller are familiar with Missouri River bottom farmland, the type of property which they were asked to appraise. Tr. 323:3-7 (Smith); Tr. 460:4-10 (Keller). The appraisals were developed in conformity with the Uniform Standards of Professional Appraisal Practice. Tr. 320:19-24 (Smith); Tr. 457:1-14 (Keller). Both appraisers testified that they complied with "all applicable ethical and professional standards in conducting" the appraisals. Tr. 321:19-21 (Smith); Tr. 457:23-25 (Keller).

Mr. Smith appraised the Adkins representative tract using the comparable sales approach. This approach uses sales considered to have been made in the most similar market areas and with the most similar land characteristics as the Adkins tract, near the December 31, 2014 valuation date. Tr. 323:13-324:1. Mr. Smith split the Adkins property into four appraisals after considering the highest and best use of the property. Tr. 317:19-318:11. Only the two Adkins farmland tracts, referred to as the farmland

inside and outside the levee, are relevant here. Tr. 1013:1-8 (Babcock). Mr. Smith also verified these two appraisals using an income approach and a cost approach. Tr. 324:16-24. In conducting his appraisals, Mr. Smith received information including the Adkins tract profile, visited with Mr. Adkins, and visited the Adkins representative tract. Tr. 323:7-12.

The Adkins representative tract inside the levee is approximately 754.52 acres of improved farmland of which 698.03 acres are tillable and 47.92 are timberland. Tr. 325:13-16. The appraised market value using the sales comparison approach of the Adkins representative tract inside the levee was $6,700 per acre or $5,055,000 as of December 31, 2014. Tr. 331:5-10; *see also* PX3037 (opinion of value document using different approaches). In performing the comparable sales appraisal, Mr. Smith made adjustments for characteristics including building improvements and soil quality differences and noted that several of the comparable sales had slow drainage issues like the Adkins farmland inside the levee. Tr. 330:19-331:3.

The Adkins representative tract outside the levee is 221.57 acres of unimproved farmland with 98.08 tillable acres and 72.28 acres enrolled in the Forest Reserve. Tr. 335:17-22. The appraised fair market value of the Adkins representative tract outside the levee, using the sales comparison approach, was $2,300 per acre or $510,000 as of December 31, 2014. Tr. 340:16-19; *see also* PX3055 (opinion of value document using different approaches). In conducting the appraisal using the comparable sales approach, Mr. Smith made adjustments for the timing of the sales and land mix. Tr. 339:24-340:4.

Mr. Keller appraised the Ideker and Buffalo Hollow tracts using a sales comparison approach, as verified by an income approach. Tr. 460:4-461:22. The comparable sales analysis focused on comparable sales of properties with similar characteristics that occurred near the time of the December 31, 2014 valuation date. Tr. 461:2-4. Mr. Keller "received information including the tract profiles, met and visited with" the Schneiders and Mr. Ideker, and "visited each of the representative tracts on several occasions . . . ." Tr. 460:11-16. In conducting the appraisals, Mr. Keller researched, among other things, flood zone status, tax data, crop history, soil data, comparable sales data, and the plaintiffs' summary of the River's flooding history. Tr. 459:22-460:3.

Mr. Keller appraised the Ideker representative tract at $8,250 per acre, or $12,330,000 as of December 31, 2014. Tr. 478:19-23; Tr. 480:3-13; Tr. 483:8-12; *see also* PX3273 (Ideker sales comparison conclusions). Mr. Keller appraised the Buffalo Hollow representative tract at $8,000 per acre or $6,230,000 for the bottomland, $2,500 per acre or $1,240,000 for the upland, for a total value of $7,470,000. Tr. 470:2-14; Tr. 483:1-7; *see also* PX3266 **(**Buffalo Hollow sales comparison conclusions). Both of these values fell within the range in prices for Missouri River bottomland in Northeast Kansas and Northwest Missouri of $6,500 per acre to $8,250 per acre. Tr. 483:14-17.

Based on their qualifications and testimony, the court finds Mr. Smith and Mr. Keller's appraisals of the representative plaintiffs' tracts persuasive and adopts those valuations.

b. The court finds the representative plaintiffs' diminution in value analysis a credible method of measuring just compensation

Next, the plaintiffs relied on the econometric analysis of Dr. Bruce Babcock, an agricultural economist,[25] who, using farmland sales data obtained from Mr. Smith and Mr. Keller and interviews of the representative plaintiffs, estimated the diminution in the fair market value of the representative plaintiffs' properties due to the MRRP. Tr. 1001:3-1002:3. To do so, Dr. Babcock measured "the extent to which the fair market values of the Phase II tracts in the actual world . . . that . . . includes the MRRP permanent flowage easements . . . are less than the hypothetical fair market values of those Phase II tracts . . . in the but-for world (without the MRRP permanent flowage easement)." Tr. 1016:19-1017:6.

Dr. Babcock's approach used actual farmland sales data in the Missouri River Basin, both before and after the MRRP, to determine how the MRRP on average affected farmland price. Tr. 1026:2-6. Farmland price data was obtained from Mr. Smith and Mr. Keller, plaintiffs' appraisers. Tr. 1039:14-19 (referencing Mr. Smith); Tr. 1048:3-8 (referencing Mr. Smith and Mr. Keller). Mr. Smith compiled 20 years of arms-length land sales of Missouri River bottomland in Nebraska and Iowa. Tr. 358:2-7 (Smith). He

[25] Dr. Babcock is an agricultural economist and is currently a Professor of Public Policy at the University of California at Riverside. Tr. 1002:9-15. Dr. Babcock received his Bachelor's degree from the University of California at Davis in 1980, a Master's degree from the University of California at Davis in 1981, and his Ph.D. in Agricultural and Resource Economics from the University of California at Berkeley in 1987. Tr. 1003:19-1004:4. For most of his career, Dr. Babcock held various roles at Iowa State University; most notably, he was the director of a public policy research center called The Center for Agricultural and Rural Development, for which he was the director from 1998 to 2011. Tr. 1002:16-22; *see generally* PX3350 (Babcock CV).

also gathered twenty years of land sales data for both the East and West Nishnabotna River Basins, a tributary of the Missouri River. Tr. 359:21-360:3 (Smith). Mr. Keller collected data from Kansas, Missouri, and Nebraska. Tr. 3204:19-3205:22 (Babcock). Dr. Babcock limited the data to arms-length, commercial agricultural transactions, and ruled out land sales where the price was inflated by developmental value. Tr. 1048:3-19. Dr. Babcock also limited the farmland data along the Missouri River Basin to the state of Iowa. Tr. 1143:8-1144:9; Tr. 1148:21-1149:1. Dr. Babcock excluded data from other states because of the small number of observations and because the other states would have impeded his ability to use the Iowa soil quality index as an explanatory variable in his analysis. Tr. 3205:3-3207:16.

Using this data, Dr. Babcock conducted a regression analysis that allowed for a change in farmland prices to occur in 2011. Tr. 1027:8-16. Dr. Babcock used this 2011 "switch point" or "intercept" variable to measure the effect of the MRRP, reasoning that by 2010, the effects of the MRRP would have been reflected in farmland prices. Tr. 1061:5-1062:4. Dr. Babcock's regression analysis also controlled for other variables that determine farmland prices, such as technology costs, soil quality, and the amount of tillable acreage. Tr. 1033:5-12; Tr. 1036:22-1037:23.

To control for whether some factor other than the MRRP may have impacted farmland value, Dr. Babcock's model also incorporated farmland data from the Nishnabotna River Basin. Tr. 1039:14-1040:9. The Nishnabotna is a tributary of the Missouri River. Tr. 359:23-360:1 (Smith). The farmland along the Nishnabotna is unaffected by the MRRP but otherwise similar to the farmland along the Missouri River

Basin. Tr. 1027:17-3 ("I also got additional farmland sales data from a nearby river basin that's not impacted by the MRRP, and I used that data . . . as a check."); Tr. 1046:14-1047:24 (description of regression equation). Although Dr. Babcock did not initially label it as such, this type of regression model is known as a "difference-in-difference" model. Tr. 3168:21-3170:15 (Dr. Babcock equating his model with a "difference-in-difference" model). The first "difference" in the model measures the change in farmland prices in 2011 along the River, which Dr. Babcock uses to measure the impact of the MRRP. The second "difference" measures the change in 2011 on the Nishnabotna River. *See* Tr. 1050:17-1053:17. The difference between these farm price changes measures the impact of the MRRP. *See* Tr. 1055:8-1060:13.

The results of Dr. Babcock's initial regression analysis indicated that if the MRRP had not affected farmland prices, the Missouri River Basin farmland prices would have been, on average, 25.7 percent higher. Tr. 1055:13-16; *see also* PX3389 (demonstrative sales data plots); PX3356 (model results chart); PX3390, PX3391, PX3392 (demonstrative graphs visualizing the regression results). After discovering that he erroneously included three land sales, Dr. Babcock re-ran the analysis, which increased the average diminution in value to 26.9 percent. Tr. 1059:20-1060:10. Dr. Babcock opined that this change was statistically significant, meaning that he could be confident that the change was not zero. Tr. 1057:19-1058:3. In contrast, Nishnabotna River Basin farm prices would have been 9 percent lower had there been no change in 2011. Tr. 1055:16-18. However, this change in farmland prices in the Nishnabotna River Basin

was not statistically significant. Tr. 1058:9-1059:6. Dr. Babcock therefore treated this shift – the second "difference" – as if it had not occurred. Tr. 1059:3-6.

Dr. Babcock also performed a check on the robustness of the model to determine whether allowing the change in farmland prices to occur in 2011, rather than some other year, was appropriate. Tr. 1060:14-1064:6. Dr. Babcock determined that the highest diminution in value occurred in 2010, and opined that that was the correct year of the diminution in value for his statistical model. Tr. 1063:24-1064:6. Dr. Babcock further testified that his result aligned with his interviews with the representative plaintiffs and Dr. Mays' analysis. Tr. 1061:17-25. He testified that flooding through the late 2010 time period would have increased the knowledge that something had changed among local farmers and outside buyers. Tr. 1061:13-16. When he first talked to the representative plaintiffs, they told him that they first became aware that something had changed on the river in the first decade in the late 2000s. Tr. 1061:18-25. And they all said they were aware of the changed river by 2011. Tr. 1062:1-4.

Dr. Babcock then took that average diminution in value of 26.9 percent and translated it into a tract-specific diminution in value. Tr. 1065:13-1069:9. Based on a review of the Phase I opinion, his conversations with the representative plaintiffs, and Dr. Mays' analysis, Dr. Babcock concluded that the representative plaintiffs had greater-than-average increased flood losses. *Id*. Dr. Babcock then incrementally increased the diminution in value of the Adkins tract to 27.5 percent, and of the Buffalo Hollow and Ideker tracts to 30 percent, which he believed to be a "conservative" estimate of the diminishment in their respective fair market values. Tr. 1069:10-23. Based on its review

of Dr. Babcock's approach and Dr. Babcock's qualifications, the court finds Dr. Babcock's method of just compensation persuasive and reliable.

c. The government's arguments do not undermine plaintiffs' method

The government contends that the representative plaintiffs' method of valuing the diminution in the fair market value of their properties should be rejected on three general grounds: (1) Mr. Jones and Mr. Keller's appraisals of plaintiffs' properties are unreliable; (2) Dr. Babcock's method of calculating the before-and-after valuation of the plaintiffs' properties is improper; and (3) assorted additional criticisms of Dr. Babcock's model. Def.'s Br. at 83-100, 158-59. The court determines that the government's objections and criticisms do not undermine Dr. Babcock's approach.

First, the government raises several issues with Mr. Smith and Mr. Keller's appraisals of the representative plaintiffs' tracts as of December 31, 2014. However, the issues raised by the government do not undermine the reliability of the appraisals. For example, the government raises issues with the appraisal of development and residential tracts on the Adkins property. Def.'s Br. at 84-85 (criticizing Mr. Smith's reliance on the city of Council Bluff's 2030 development plan). But this criticism is irrelevant, as Dr. Babcock's ultimate opinions regarding diminution in value apply to only two of the appraisals Mr. Smith provided, both of which are for farmland (inside and outside the levee). Tr. 1013:1-8; Tr. 1014:3-8.

As another example, the government argues that Mr. Smith and Mr. Keller did not appropriately adjust the comparable sales for flood frequency or size. Def.'s Br. at 86-88.

However, in determining just compensation, mathematical certainty is not required. *See, e.g.*, *Otay Mesa Prop., L.P. v. United States*, 779 F.3d 1315, 1323 (Fed. Cir. 2015) (requiring "more than a guess, but less than absolute exactness" (quoting *Precision Pine*, 596 F.3d at 833)). The government did not offer its own appraisals of the properties or provide the proper method of doing so, nor did the government provide a sense of whether these adjustments would have made a large or small difference in the appraisals. While it could be true that Mr. Smith and Mr. Keller could have made certain adjustments to their appraisals, the court finds that none of the issues raised by the government fatally undermine the credibility and reliability of Mr. Smith and Mr. Keller's opinions. Even if the appraisals lack perfection, they are the best evidence available. For these reasons, the court rejects the government's arguments regarding the reliability of the appraisals of plaintiffs' properties.

Second, the government argues that because the plaintiffs did not conduct a standard before-and-after valuation as called for by the Yellow Book,[26] the representative plaintiffs' method of measuring diminution in value is improper. Def.'s Br. at 83, 87. As an initial matter, the Yellow Book applies to only those appraisals being conducted at the request of the government. *See Hardy v. United States*, 141 Fed. Cl. 1, 32 (2018) ("[A]s a matter of law, [Plaintiffs' appraiser] was not bound by the Yellow Book. The Yellow Book applies only to appraisers hired by the federal government for condemnation

[26] The Yellow Book is shorthand for the Uniform Appraisal Standards for Federal Land Acquisitions, developed and adopted by the Interagency Land Acquisition Conference and published by the Appraisal Institute to guide appraisals associated with federal land acquisitions. *See Tech. College of the Low Country v. United States*, 145 Fed. Cl. 408, 426 (2019).

purposes; it is not mandatory with respect to appraisers not hired by the government."). The plaintiffs' appraisers, therefore, were not bound by the Yellow Book.

In addition, the court disagrees with the government's argument to the extent that the government suggests that a standard before-and-after valuation method by an appraiser must be used in determining just compensation. Def.'s Resp. at 35, ECF No. 682 ("The correct way of determining just compensation in a takings case is through a straightforward before-and-after analysis of fair market value, where an appraiser uses comparable properties and other techniques to determine the subject property's value immediately before and immediately after the date-of-taking."). The Federal Circuit has stated that in assessing just compensation, the court has the flexibility to consider alternative approaches from the standard before-and-after method using comparable sales. *See, e.g.*, *Banks*, 721 F. App'x at 940. As the government itself acknowledges, "courts are willing to employ non-traditional valuation methods when necessary." Def.'s Resp. at 35. The court does not fault plaintiffs for seeking the expert opinion of a qualified agricultural economist, rather than an appraiser, to evaluate the effects of the MRRP on plaintiffs' properties.

Moreover, the model by Dr. Babcock is not a wholesale departure from the before-and-after valuation method. Evidence was presented showing that farmland prices were generally increasing in the Missouri River Basin from the 1990s through 2013, meaning that the value of the flowage easement taken by the government may not have been reflected in a standard before-and-after appraisal. *See* Tr. 1028:25-1030:1; *see also* PX3386 (demonstrative plotting farmland price data on the Missouri River). In light of

that, the court finds Dr. Babcock's method proper. As Dr. Babcock opines in his rebuttal testimony, his model measures the average before-and-after effect of the MRRP on properties along the Missouri River Basin, which he then adjusts to plaintiffs' respective properties. Tr. 3212:4-3215:18. While criticizing certain aspects of Dr. Babcock's model, the government's rebuttal expert, Dr. Sunding, did not testify that the "difference-in-difference" model could not be used for this purpose.

Third, the court finds that none of the problems the government raises with Dr. Babcock's model through the testimony of its rebuttal expert, Dr. Sunding,[27] are persuasive. Def.'s Br. at 89-100. For example, the government argues that Dr. Babcock did not perform a difference-in-difference analysis and offered "flaw[ed], nonstandard" work product as a result. *Id.* at 89, 95; *see also* Tr. 2759:4-6 (Dr. Sunding testifying that "Dr. Babcock uses a nonstandard statistical framework and misinterprets his results"). In particular, Dr. Sunding criticizes Dr. Babcock for not using the "second difference" in forming his opinion. *See* Tr. 2763:22-24 ("[T]he way economists would describe what Dr. Babcock is doing is he's estimating a first difference."); Tr. 2764:17-24 ("Observations from the Nishnabotna . . . don't directly influence [Dr. Babcock's] estimated treatment effect, because . . . Dr. Babcock is only estimating a first difference

[27] Dr. Sunding is a professor of agricultural and resource economics at the University of California at Berkeley. He has been on the faculty there since 1992, specializing in agricultural economics, applied econometrics, natural resource economics, and law and economics. Tr. 2736:12-19. He also has been a visiting professor at Stanford in the Woods Institute of the Environment. He has won a number of research awards over the course of his career. In 2009, he was named the inaugural Thomas J. Graff Professor in the College of Natural Resources at Berkeley in the area of natural resource economics, with an emphasis in the economics of water resource. He has served two terms as chair of Berkeley's Department of Agricultural and Resource Economics. Tr. 2737:7-2739:10; DX6033-0031 (Sunding CV).

for the Missouri Basin parcels, which is why I say that Dr. Babcock didn't use a difference-in-difference framework."); *see also* Tr. 2769:19-2770:6 (summarizing the difference-in-difference analysis). However, Dr. Babcock explained that he dropped this "second difference" as statistically insignificant, which resulted in a more conservative estimate of diminution in value. Tr. 3179:24-3181:16.

Dr. Sunding also criticizes Dr. Babcock for relying on plaintiffs' appraisers and for failing to include certain explanatory variables and data points from other states in the model. *See* Tr. 2755:6-2756:3 (criticizing Dr. Babcock for not using a "random sample" of data); Tr. 2752:20-2754:9 (criticizing Dr. Babcock for not collecting his own data and not including the "entire population of sales in his dataset" as he claims to have done); Tr. 2814:22-2815:13 (criticizing Dr. Babcock for not using all of the information he was armed with in his analysis); Tr. 2824:9-2825:17 (criticizing Dr. Babcock for basing his analysis on four Iowa-based counties that do not contain any of the representative properties and are distanced from the representative properties). Yet, the court has already determined plaintiffs' appraisers to be reliable and credible. In addition, Dr. Babcock persuasively opined that the additional variables added by Dr. Sunding are themselves statistically insignificant and added no explanatory power to the model. *See* Tr. 3195:10-3197:24. Dr. Babcock also persuasively testified as to why he excluded certain data points, including the fact that other states had small and unbalanced datasets for purposes of the before-and-after valuation, and that limiting the dataset to relevant Iowa sales was appropriate in light of the superior explanatory variables that were limited to Iowa, such as the Iowa soil quality measure. Tr. 3205:18-3210:14.

Dr. Sunding further criticizes Dr. Babcock of "data mining" in choosing the 2011 date as the "switch point" in his model, purportedly to cherry pick the year that yielded "the largest diminution in property value." Tr. 2798:21-2799:6. Dr. Sunding argues that in determining the "switch point," Dr. Babcock should have conducted local media searches to determine when market participants would have been made aware of the MRRP or flooding. Tr. 2797:12-2798:10; Def.'s Br. at 96. But, as explained above, Dr. Babcock persuasively opines that the 2011 date is based on both a robustness check and his interviews with the plaintiffs, which highlighted their overall understanding of the flooding. Tr. 3190:1-3191:11. While more limited than a local media search, the court finds Dr. Babcock's method behind selecting 2011 as his "switch point" reliable.

Finally, as Dr. Babcock points out, the government's own expert on crop damages, Dr. Evans, confirms the plausibility of Dr. Babcock's diminution in value. As discussed in the liability section of this opinion, the government relied on the testimony of Dr. Robert Evans[28] to provide an alternative valuation of crop loss, should the court award damages for lost crops. In brief, Dr. Evans, relying on WSEs from plaintiffs' Phase I expert, Dr. Christensen, and the government's Phase II expert, Dr. Holmes, used

[28] Dr. Robert Evans is the United States' expert witness in agricultural engineering. He has over thirty-five years of experience conducting agricultural water table management research and advising farmers about strategies to manage on-farm water to optimize agricultural production. Tr. 2337:9-14. Dr. Evans has over 50 years of first-hand experience managing excess water on his family farm, a farm comprised of inherently wet, poorly drained soils. Tr. 2337:21-23; Tr. 2343:25-2443:3. He has Ph.D., M.S., and B.S. in Biological and Agricultural Engineering from North Carolina State University. Tr. 2338:20-23. Dr. Evans has served as a Professor Emeritus at North Carolina State University since 2017 and head of the Department of Biological and Agricultural Engineering from 2006 until 2014. Tr. 2339:7-12. He has taught or co-taught courses on DRAINMOD to engineers and other professionals across the United States, including the mid-west. Tr. 2342:15-19.

DRAINMOD, a water management simulation model, to isolate and measure the incremental impact of the MRRP on plaintiffs' crop yields from 2004 to 2015. Tr. 2356:15-22; Tr. 2378:5-8; Tr. 2344:12-19; Tr. 2345:23-2346:3; Tr. 2428:7-13. As recounted by Dr. Sunding, Dr. Evans estimated an average 12 percent drop in production for corn and soybeans on the representative plaintiffs' properties. Tr. 3181:21-3182:3 (Dr. Babcock summarizing Dr. Sunding's testimony). As opined by Dr. Babcock, this drop in production translates roughly into a 27 percent decrease in fair market value, which is in line with Dr. Babcock's estimated 26.9 percent average decrease attributable to the MRRP. Tr. 3186:16-24.

For these reasons, the court finds that Dr. Babcock's method in determining the before-and-after effect of the MRRP reasonably approximates the diminution in value of the representative properties. Notably, the government has not offered an alternative method of calculating the diminution in value, only criticisms of the plaintiffs' method. This was not enough, particularly in light of Dr. Babcock's reasoned responses to Dr. Sunding's criticisms.

2. The Court Adopts Dr. Babcock's Diminution in Value Calculations for the Plaintiffs' Representative Tracts

Having concluded that Dr. Babcock's method in determining the average effect of the MRRP on Missouri River Basin properties is appropriate, the court now turns to the diminution in value of plaintiffs' representative properties. To determine the diminution in fair market value of plaintiffs' representative properties, Dr. Babcock increased his "conservative" estimate of diminution in value to 27.5 percent for Adkins, and 30 percent

for Buffalo Hollow and Ideker. Tr. 1069:10-20. Dr. Babcock based his increases on the court's opinion in Phase I that the representative plaintiffs had greater than average increased flood losses, his discussion with plaintiffs, and Dr. Mays' analysis. *Id.* Although the government through the testimony of Dr. Sunding argues that Dr. Babcock's analysis is "subjective and unscientific," Tr. 2835:12-16, the court agrees with the plaintiffs that Dr. Babcock's approach represents a reasonable approximation of the representative plaintiffs' losses.

Just compensation "should be carefully tailored to the circumstances of each particular case" and "should be based on an assessment of precisely what the government takes from a landowner." *Otay Mesa*, 670 F.3d at 1368. It was therefore entirely appropriate for Dr. Babcock to translate his average diminution in value to the plaintiffs' representative properties. While not precise, Dr. Babcock's approach amounts to "more than a guess," which is all that is called for in evaluating just compensation. *Precision Pine*, 596 F.3d at 833.

Moreover, Dr. Babcock's analysis of the government's expert on crop loss, Dr. Evans, supports a higher diminution in value for the plaintiffs' representative tracts. As noted above and persuasively explained by Dr. Babcock in rebuttal, Dr. Evans testified that plaintiffs' properties experienced decreased crop yields during the relevant flooding years. *See* Tr. 3186:16-21 (Dr. Babcock noting that Dr. Evans estimated a 12 percent drop in crop yields during the relevant period). After looking at this data "more careful[ly]," Tr. 3186:25-3187:3, Dr. Babcock opined, using Dr. Evans' data, that "the fair market value would be 37 percent higher but-for the MRRP using my rebuttal report

estimates and using Dr. Evans' estimate." Tr. 3188:4-16. The court is therefore satisfied that Dr. Babcock's more conservative estimates are appropriate for plaintiffs' representative properties.

Finally, the court rejects the government's assertion that the representative plaintiffs have failed to carry their burden of proof regarding diminution in value, and that, therefore, the plaintiffs' should be awarded no damages. Tr. 3513:1-3 (government arguing that the court should award "either zero or nominal damages"). Here, the government's expert Dr. Evans acknowledges that the MRRP caused a reduction in crop yields across plaintiffs' properties. It cannot be the case that this reduction in crop yields did not negatively affect the value of the representative properties, which are utilized as farmlands. The government did not provide its own estimate of the diminution in fair market value. And the plaintiffs have presented a credible methodology for calculating damages to a reasonable approximation. In these circumstances, the court will award damages. *See Banks*, 721 F. App'x at 940-41 ("It cannot be the case that acres of property are lost to erosion and the value of that total property is not affected.").

For these reasons, the court holds, based on its review of the evidence, that the diminution in value of the plaintiffs' representative tracts are as follows: Adkins, 27.5 percent; Ideker, 30 percent; Buffalo Hollow, 30 percent. Translated into dollar values, the court values just compensation for the taking of a permanent flowage easement across the representative plaintiffs' properties as follows: Adkins, $1,530,268; Ideker, $3,698,887; Buffalo Hollow, $1,868,928. Tr. 1012:5-10 (Ideker), 1012:20-25 (Buffalo Hollow), 1013:13-15 (Adkins).

B. Compensation for Lost Crops and Other Costs

Having determined the value of the permanent flowage easements, the court next turns to the question of what, if any, other damages plaintiffs are entitled to due to the flooding of their properties caused by the MRRP. As discussed below, the court concludes – with one exception – that all other damages the plaintiffs seek are consequential damages and are therefore not compensable.

The Fifth Amendment provides the right to just compensation for property taken, not "damages" that are the "proximate result" of the government's action. *Yuba Nat. Res., Inc. v. United States*, 904 F.2d 1577, 1581 (Fed. Cir. 1990) ("It is a well settled principle of Fifth Amendment taking law . . . that the measure of just compensation is the fair value of what was taken, and not the consequential damages the owner suffers as a result of the taking."); *see also Kirby Forest*, 467 U.S. at 15 (just compensation is "the fair market value of the property on the date it is appropriated" and "[u]nder this standard, the owner is entitled to 'what a willing buyer would pay in cash to a willing seller' at the time of the taking." (internal citations omitted)); *United States v. General Motors*, 323 U.S. 373, 380 (1945) ("[T]hat which is taken or damaged is the group of rights which the so-called owner exercises in his dominion of the physical thing, and that damage to those rights of ownership does not include losses to his business or other consequential damage." (footnote omitted)). Thus, "not all losses suffered by the owner are compensable under the Fifth Amendment." *U.S. ex rel. Tennessee Valley Auth. v. Powelson*, 319 U.S. 266, 281 (1943).

In the case of a partial taking, compensation may include the diminished value to the remaining portion of land, called "severance damages," as well as the value of the portion of land taken. *Miller*, 317 U.S. at 375-76; *Ga. Pac. Corp.*, 640 F.2d at 336. "The cost to cure – or the cost of mitigating damages caused by the taking – provides an alternative means of quantifying severance damages." *Childers v. United States*, 116 Fed. Cl. 486, 497 (2013).

As discussed above, there exist alternative ways to assess and calculate the compensation owed to a landowner for governmental interference with the use of property. *See Otay Mesa*, 670 F.3d at 1369 (holding "there can in principle be an appropriate alternative valuation measure to the 'before-and-after' method in a given takings case"); *Ridge Line*, 346 F.3d at 1359 ("damages may be assessed based on Ridge Line's cost in constructing prudent flood control measures"); *Vaizburd v. United States*, 67 Fed. Cl. 499, 501-02 (2005) ("the 'cost of cure' approach to recovery in a takings case is an alternative to computing damages through diminished market value"). But those alternatives should not be used to award damages above and beyond what was taken.

Here, plaintiffs are alleging damages above and beyond the value of the flowage easement that the government has taken. In particular, the plaintiffs allege through the testimony of their damages expert, Dr. Bateman,[29] crop losses and lost profits based on reduced yields, damage to structures, damages to equipment, flood prevention expenses,

[29] Dr. Bateman received his B.S. in economics from the University of Utah in 1960, and his Ph.D. in economics from MIT in 1965 with a special emphasis on price theory as applied to financial and agricultural commodity markets, econometrics. Tr. 563:19-564:2; PX3214 (Dr. Bateman's CV).

and flood reclamation expenses. Tr. 577:3-578:8; Tr. 610:25-614:4; Tr. 573:23-574:2; Tr. 728:4-21. However, these are consequential damages that are an indirect result of the taking of the flowage easement. It is improper to both claim compensation for diminution in value and claim compensation for these consequential damages. *See Yuba Nat. Res., Inc.*, 904 F.2d at 1581-82 ("[Plaintiff's] claim for the difference in the value of the gold during the taking period and after the taking is precisely the kind of claim for consequential damages—here, lost profit—that is not an appropriate element of just compensation for the temporary taking of the property."); *Childers*, 116 Fed. Cl. at 600 (noting consequential damages include "loss of business, relocation expenses, and the like"); *R.J. Widen Co. v. United States*, 357 F.2d 988, 993-94 (Ct. Cl. 1966) (holding that there was no Fifth Amendment taking for "incidental spoliation of the plaintiff's inventory and equipment, the reduction or loss of its good will and profits, and the expenses incurred in having to readjust its manufacturing operations").

Relying on *Dickinson*, the plaintiffs argue that the government is liable for both "the land which it permanently floods as well as that which inevitably washes away as a result of that flooding." Pls.' Resp. at 29 (quoting *Dickinson*, 331 U.S. at 750). However, plaintiffs quote *Dickinson* out of context. In discussing "that which inevitably washes away as a result" of flooding, the Court in *Dickinson* was addressing additional *land* that had eroded as a consequence of government-induced flooding, not crops, structures, or equipment incidentally damaged by the flooding. Plaintiffs reliance on *Dickinson* is thus misplaced.

Plaintiffs also cite *Ridge Line* for the proposition that the court must award "all damages, past, present, and prospective." Pls.' Br. at 119 (quoting *Ridge Line*, 346 F.3d at 1359); Pls.' Resp. at 29. However, *Ridge Line* does not discuss consequential damages, but instead affirms that flood control measures may be used as an alternative method of calculating just compensation. 346 F.3d at 1358-59. This selective quote in *Ridge Line* does not support plaintiffs' claim for lost crops and other incidental damages.[30] For these reasons, the court will not award the damages claimed by plaintiffs above and beyond the diminution in value of their property.[31]

The court will, however, award severance damages for the repair of the Ideker levee in 2010. *See* Tr. 238:3-13 (Mr. Ideker describing levee repair efforts). In the Phase I opinion, the court held that in 2010, the flooding on the Ideker property was "due to levee overtopping that would not have occurred without the System and River Changes." *Ideker I*, 136 Fed. Cl. at 748 (citing PX2554). In other words, the destruction of this

[30] Moreover, even if the court were to consider these additional damages, just compensation would only include an amount "proportionate to the government's quantitative contributions" to the damage incurred. *Ridge Line*, 346 F.3d at 1359. Unlike the government's expert Dr. Evans, plaintiffs have not apportioned crop losses (or other costs) to the increment of flooding caused by the Corps' actions under the MRRP. *See* Tr. 3283:18-24. The Court of Claims in *Barnes* also recognized that the plaintiffs there could possibly be compensated for the value of "mature" crops destroyed on the date of taking, but not "immature" crops. 538 F.2d at 874. The representative plaintiffs have not presented any evidence with specificity regarding this distinction between immature and ready-to-harvest crops that would allow the court to make an award.

[31] The government argues that even if the plaintiffs are entitled to just compensation for crop losses, just compensation requires offsetting those losses by payments received by the plaintiffs based on various federal-backed crop insurance programs. Def.'s Br. at 165-67. Because the court has declined to award the plaintiffs damages for crop loss, the court does not address this argument.

levee is entirely attributable to the government's actions. In addition, the court finds that the repair of the levee is properly considered as a severance damage assumed to protect the remainder of the property. *See Ideker I*, 136 Fed. Cl. at 747 ("The property is protected by a private levee built by plaintiff."). Compensation for this damage may be measured by the mitigation cost of rebuilding the levee. *See Childers*, 116 Fed. Cl. at 497; *Miller*, 317 U.S. at 375-76. This levee repair occurred during the period of taking, which, as discussed above, the court finds began in 2007. The court therefore holds that the Ideker plaintiffs are entitled to the cost of levee repair in 2010 in the amount of $1,032,338 without interest. Tr. 238:3-13 (Ideker); Tr. 661:4-13 (Bateman) (describing $823,123 to rebuild the levee and $209,225 in fuel costs, which together add to $1,032,338).

C. Interest Rates

Finally, the court must determine the appropriate interest rate to apply to the just compensation award described above. In doing so, "the court is to choose an interest rate that puts the property owner in as good a financial position as if the compensation were given concurrently with the taking." *Textainer Equip. Mgmt. Ltd. v. United States*, 115 Fed. Cl. 708, 719 (2014) (citing *Kirby Forest*, 467 U.S. at 10); *see also NRG Co. v. United States*, 31 Fed. Cl. 659, 670 n.8 (1994) (observing that "the point" of determining interest rates "is not which approach yields a higher or lower payment, but rather which approach is the more accurate measure of the economic harm to property owners").

The "guiding principle" used to determine the appropriate interest rate to apply to takings claims is the "Prudent Investor Rule," which examines "how a reasonably

prudent person would have invested the funds owed by the government to produce a reasonable return while maintaining safety of principal." *Sears v. United States*, 124 Fed. Cl. 730, 734-35 (2016) (internal quotation marks and alterations removed). Notably, prior courts have recognized that the Prudent Investor Rule contemplates investments with "minimal risk," and have rejected proposed rates based on volatile investments. *Sears*, 124 Fed. Cl. at 735 (rejecting rate premised on a diversified mutual fund with volatility of 7.4 percent for failing to comport sufficiently with the "minimal risk" criterion).

Here, the parties disagree on the proper marker for investments that comply with the Prudent Investor Rule. The representative plaintiffs present two options for the court's consideration. Plaintiffs first argue that a mix of stocks and bonds evinces the appropriate interest rate. In support, plaintiffs offered testimony from plaintiffs' damages expert, Dr. Bateman, who recommended a bond equity combination utilizing the iShares Core U.S. Aggregate Bond Exchange Traded Funds (the "ETF") by Blackrock and the SPY Fund, which was created in 1993 by State Street Corporation in cooperation with the American Stock Exchange and provides a rate of return of 3.5 to 4 percent. Tr. 629:19-24. Dr. Bateman argued that the ETF best adheres to the Prudent Investor Rule as its mixture of bonds and stocks speaks to "the principles of diversity and balance" which are "key to managing risk." Tr. 627:23-628:3. As an alternative, the representative plaintiffs propose using the Moody's Composite Index of Yields on Aaa Long-Term Corporate Bonds (the "Moody's rate"), which provides a rate of return of 1.7 percent. Tr. 618:13-619:17. Dr. Bateman acknowledges that the Moody's rate "has been recognized by the

Court of Federal Claims as an appropriate index for satisfying the [Prudent Investor Rule]." Tr. 624:23-625:1.

The government disagrees with both of plaintiffs' proposed rates, maintaining instead that government bonds provide the appropriate measure of interest. In support, the government offered the testimony of Dr. Sunding, who opined that, from an economics perspective, the proper interest rate to apply is the yield on one-year Treasury bonds (described as the "T-bond rate"), a "risk-free rate of return." Tr. 2842:12-15. Dr. Sunding maintains that using a risk-free rate of return to calculate interest is appropriate here because "[t]he conversion of past losses into current period damages doesn't require the Plaintiffs to take on any additional risk." Tr. 2843:4-9. Indeed, Dr. Sunding states that doing otherwise would be "inappropriate as a matter of economics." *Id.*

While the court acknowledges that others have tied the interest rate to the T-bond rate in other takings cases, "the prudent-investor rule does not require that a reference be made only to a rate of interest on Treasury securities where the United States is the defendant." *Indep. Park Apartments v. United States*, 61 Fed. Cl. 692, 717 (2004), *rev'd on other grounds*, 449 F.3d 1235 (Fed. Cir. 2006). Indeed, other courts have recognized a recent "consensus" reached among the Court of Federal Claims "that the Moody's rate is the appropriate benchmark by which to award delay damages" for takings claims. *Tech. College of the Low Country v. United States*, 147 Fed. Cl. 364, 370 (2020) (quoting *Hardy v. United States*, 138 Fed. Cl. 344, 356 (2018)); *see also Adkins v. United States*, Nos. 09-503L, 02-241L, 09-158L, 2014 WL 448428, at *2 (Fed. Cl. Feb. 4, 2014) (applying the Moody's rate to delay damages arising from a 2003 taking); *Biery v. United*

States, Nos. 07-693L, 07-675L, 2012 WL 5914521, at *4 (Fed. Cl. Nov. 27, 2012) (applying the Moody's rate to delay damages arising from a 2007 taking); *Sears*, 124 Fed. Cl. at 736-37 (applying the Moody's rate to delay damages arising from a taking that occurred after February 2016). The court sees no reason to stray here. Accordingly, the court concludes that the Moody's rate is the appropriate measure of interest. *See Pitcairn v. United States*, 547 F.2d 1106, 1124 (1976) ("[L]ong-term corporate bond yields are an indicator of broad trends and relative levels of interest rates. They cover the broadest segment of the interest rate segment.").

The court further finds that it is appropriate to compound interest annually. As repeatedly acknowledged by this court and others, "[p]rudent investment practices compel the compounding of interest" as "no prudent, commercially reasonable investor would invest at simple interest." *Tech. College of the Low Country*, 147 Fed. Cl. at 370 (quoting *Brunswick Corp. v. United States*, 36 Fed. Cl. 204, 219 (1996)). But, the parties dispute the timeline on which interest should be compounded. The representative plaintiffs maintain that interest should be compounded quarterly; the government maintains that interest should be compounded annually. Neither presents substantive arguments to support its approach. Without meaningful guidance, the court elects to follow its prior decisions in *Textainer*, 115 Fed. Cl. at 719, *Adkins*, 2014 WL 448428 at *2, and *Biery*, 2012 WL 5914521 at *5, and concludes that interest in this case should be compounded annually.

The interest rates adopted by the court should be applied for the Ideker levee as of the date that those costs were incurred and for the diminution in fair market value as of

December 31, 2014, the accrual and valuation date. *See Tech. College of the Low Country*, 147 Fed. Cl. at 367 ("Any delay in payment of . . . just compensation entitles the property owner 'to interest thereon sufficient to ensure that he is placed in as good a position pecuniarily as he would have occupied if the payment had coincided with the appropriation.'" (quoting *Kirby Forest*, 467 U.S. at 10)).

V. CONCLUSION

Based on the foregoing, the court finds that the government's actions under the MRRP and the flooding of the three representative plaintiffs' properties constitutes the taking of a permanent flowage easement under the Fifth Amendment, and that the plaintiffs are entitled to just compensation for that taking. The parties are directed to file a joint status report with a proposed judgment consistent with this opinion, to include the amount of just compensation due to plaintiffs with interest, by **January 15, 2021.**

IT IS SO ORDERED.

s/Nancy B. Firestone
NANCY B. FIRESTONE
Senior Judge